AASHTO
AASHTO INNOVATION INITIATIVE

AASHTO Innovation Initiative

[Proposed] Nomination of Innovation Ready for Implementation

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): Ohio DOT

2. Name and Title: Noel Alcala, Noise and Air Quality Coordinator

Organization: Ohio DOT, Office of Environmental Services (OES)

Street Address: 1980 W Broad Street, Mail Stop 4170

City: Columbus

State: OH

Zip Code: 43223

Email: noel.alcala@dot.ohio.gov

Phone: 614-466-5222

Fax: Click or tap here to enter text.

Innovation Description (10 points)

The term "innovation" may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

81" Tall Noise Abatement Solid Safety Barrier (SSB)

4. Please describe the innovation.

The innovation involves constructing 81" tall solid safety barriers (SSBs) for noise abatement in lieu of standard taller post and panel design noise walls. National research has documented that the FHWA

Traffic Noise Model (TNM) significantly underestimates and overlooks the noise attenuation of 81" tall solid safety barriers (SSBs) because TNM distributes a large amount of noise energy tall in the heavy truck vehicle profile at the 12-foot position above the pavement. TNM places 63% of the noise energy of every heavy truck (HT) at 12'. In Ohio and adjacent states, 65% of all HTs don't even have a vertical stack, hence, no 12' noise source. This is the main reason why taller noise walls are unnecessarily being built nationally. Tall sound walls cost $400/LF and are currently acoustically over- designed. An 81" tall SSB can cost as low as $180/LF. With the current version of FHWA TNM, 81" SSBs are currently being rejected because of internally inaccurate and outdated computational assumptions and algorithms which are about 25 years old. SSBs are already an established design component of highway infrastructure and provide two functions: safety and noise attenuation. Ohio DOT has collected measured data that shows 81" tall SSBs provide 7-10 decibel reductions adjacent to freeways. These reductions meet noise abatement criteria that are expected of taller and more expensive standard noise walls. This provides DOTs with a much less-expensive option to abate noise impacts. Successfully utilizing 81" SSBs would result in significant annual cost savings for noise barrier construction and noise barrier maintenance. These savings will compound over time as 81" tall SSBs are constructed in place of taller structural noise walls.

5. What is the existing baseline practice that the innovation intends to replace/improve?

The existing baseline practice in Ohio is constructing taller post and panel designed concrete and fiberglass noise walls.

6. What problems associated with the baseline practice does the innovation propose to solve?

Below is a comprehensive list of the benefits of 81" SSBs over Standard Noise Walls. This is mostly a list of issues/problems with standard noise walls that 81" SSBs would solve/avoid.
Substantial construction cost savings ($160/LF-$200/LF for the 81" SSB vs $400/LF-$550/LF for a standard noise wall!! ~60% cost savings!!); Substantial maintenance cost savings; Design cost and time savings; Review time savings. No shop drawings required to be prepared or reviewed; Substantial Geotech cost and time savings; No deep foundations required; non-intrusive construction; Easier and quicker to construct; 81" SSB uses slip forming technology; Similar acoustic benefit to taller standard walls at the EOS; SSB is closer to the source and a solid seal from top to bottom; avoids possible slits in joints between posts and panels and horizontal joints from standard noise walls where noise would seep through; Noise modeling is inaccurate because of the 12' noise position in HTs and HT stack noise is rare; tire pavement noise is the dominant source; Avoids gaps with structure mounted walls where noise will seep through; Avoids clearing of heavy vegetation; Avoids disturbance or replacement of existing ROW fencing; Less seeding and mulching needed; Avoids signage issues (blocking, relocation, etc); Avoids

expensive clear walls; Avoids fiberglass noise wall panels popping out of place; Avoids costly standard noise wall bump outs for sign truss posts; Avoids costly overhead and underground utility issues; Avoids costs for noise wall doors for tower lighting access and noise wall holes for fire access; Avoids ecological impacts/issues; wetlands, streams; Avoids common noise wall overlaps that add substantial cost and have received negative feedback from the homes behind them; Avoids contractor/supplier issues, panel or post cracking or chipping during construction, issues with shipping and handling posts and panels, peeling sealer issues on panel and panel coping over time; Avoids common issues with control bays; Avoids unacceptable repairs on new concrete panels or posts; Avoids fitting issues between posts and panels; Avoids unacceptably worn form liners being used by suppliers; Avoids typical pre-bid questions from standard noise walls; Avoids contractor/supplier disputes; Avoids possible sawing off panel edges to allow fit into posts; Avoids added trucking and crane costs; Avoids special post spacings; Avoids foam backer rod, concrete step blocks, etc.; Avoids potential efflorescence from concrete noise walls; Avoids common ugly rust stains on panels; Avoids concrete panel tolerance issues; Preserves color desires (not texture); Avoids the need to survey color and texture for the resident side of a standard wall; saves time and money; Avoids icons and logos that add cost; Avoids issues with different shades of standard panels or blotchy sealer ion panels; Avoids common drainage issues on residential homes' yards from standard noise walls at ROW; Avoids resident complaints on their flower beds from ROW walls; Avoids complaint of the sun being blocked by a standard noise wall; Allows snow and ice to melt off of roadway better from the sun; Avoids complaints to plant trees to replace the ones cleared to construct a ROW wall; Avoids complaints of standard noise walls discoloring, looking dirty; Avoids different shades of newly produced panels; Avoids fading colored sealer of icons and name plates; Avoids no man's land relative to ROW walls; Avoids weed complaints from the public behind standard ROW wall; Avoids redundant required EOS noise wall behind safety barrier and avoids guardrail requirement for an EOS noise wall; Avoids graffiti issues from standard noise walls Avoids trapped wildlife in back yards due to noise walls at the ROW; Avoids mowing, weed, trash, and debris issues between guardrail or safety barrier and EOS noise wall; Avoids possible erosion issues from EOS walls behind guardrail; Avoids gaps that occur under standard noise walls over time (i.e., erosion) where noise would seep through; Increased safety since SSBs separate live traffic and maintenance workers; Avoids the possibility of a vehicle strike of a standard concrete noise wall causing a post or panel to fall onto a vehicle causing a fatality; May avoid complaints opposite freeway of noise reflections from tall noise walls; A standard noise wall located at the edge of shoulder must be set back 8'-10' from the edge of shoulder due to the design requirement to do so. An SSB would start precisely at the edge of the paved shoulder which is a better placement for reducing noise due to being closer to the noise source (i.e. edge of paved shoulder); Allows ability to provide Type II noise abatement for more locations due to the cost savings vs standard noise walls. Type II funding is limited to $5 million/year. More funding would be available to help more communities.

Avoids the sustainability issue with traditional noise walls. 81” SSBs are much more sustainable than traditional noise walls. 81” SSBs have a better capacity to be maintained or improve the state and availability of desirable materials or conditions over the long-term vs standard noise walls. 81” SSBs will better meet DOT needs now without compromising the ability of future generations to meet their own needs (i.e. future costly maintenance of standard noise walls). The manufacturing and construction of 81” SSBs reduces GHGs relative to the manufacturing and construction standard noise walls.

7. Briefly describe the history of its development.

ODOT commenced a research study on measuring reductions from 32”-42” SSBs in 2020; Reductions were 3.0-5.5 decibels (db). 5 db is considered “substantial” in accordance with FHWA Highway Traffic Noise Guidance. There are no known stand-alone national studies on noise reductions from tall SSBs, only short SSBs. Based on the results of the 2020 study, OES began field testing 45”-57” SSBs in 2022. Reductions were 4.5-6.0 db. OES identified a 60” SSB as a retaining wall which triggered the identification and testing of 60”-66” Edge of Shoulder (EOS) SSBs in the state in the Fall 2022. Reductions were 6-7 db. OES was made aware of ODOT Standard Drawing RM4.3 which is the design of an 81” SSB on one side of a bifurcated freeway. OES tested bifurcated median 81” SSBs in late 2022 and early 2023. Reductions were 7-10 db which is what is expected of tall standard noise walls. A 10 db reduction is equivalent to halving the noise. OES consulted with structural and roadway engineers regarding the feasibility and design of a stand-alone 81” SSB. It was determined to be feasible to construct. The ODOT District 4 Office in Akron will be using 81” SSB in lieu of standard noise walls on elevated roadways and further consulted with structural, roadway, and geotechnical engineers on the design and constructability. Other ODOT Districts are now designing and considering 81” SSB in lieu of taller standard noise walls at the EOS.

8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

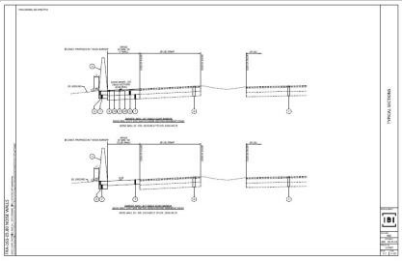
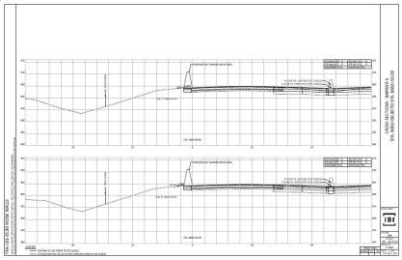
A draft design specification is already currently developed. An ODOT approved standard design specification for a stand-alone 81” SSB is anticipated in 2024.

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.







State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The AII selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☒ Prototype is fully functional and yet to be piloted

☐ Prototype has been piloted successfully in an operational environment

☐ Technology has been deployed multiple times in an operational environment

☐ Technology is ready for full-scale implementation

81” SSBs have already been constructed on several bifurcated freeways in Ohio (i.e., 81” on one side and 42” on the other) and these sites were used for acoustic testing by ODOT which determined that 81” SSBs were providing 7-10 db reductions in the field. A stand-alone 81” SSB on the ground has never been constructed anywhere in the country to our knowledge.

10. What additional development is necessary to enable implementation of the innovation for routine use?

None. 81” SSB designs for noise abatement are underway on several projects and expected to be constructed in 2024, 2025, and beyond.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? ☒ Yes ☐ No

If so, please list organization names and contacts. Please identify the source of this information.

Organization	Name	Phone	Email
Caltrans	Bruce Rymer	916-956-3272	Bruce Rymer <bruce.rymer@dot.ca.gov>
NVDOT	Jessica Goza-Tyner	775-888-7693	Goza-Tyner, Jessica <JGoza-Tyner@dot.nv.gov>
PADOT	Jim Spatz	717.787.5306	Spatz, James <jspatz@pa.gov>

Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice .

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

The 81” SSB provides Ohio DOT with a much less-expensive option to abate noise impacts. Ohio DOT has measured data that shows 81” tall SSBs provide 7-10 decibel reductions adjacent to freeways. These reductions meet noise abatement criteria that are expected of expensive taller standard noise walls. The 81” SSB also provides the need to minimize future noise wall maintenance costs. Maintenance of standard noise walls is a significant cost in Ohio. The 81” SSB also provides the opportunity to build more Type II noise abatement for more communities due to the cost savings over standard taller noise

walls. Ohio's Type II noise wall budget is only $5 million/year and, in most cases, this amount only provides noise walls for only 1 or 2 communities.

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Cost Savings	Substantial construction cost savings ($160/LF-$200/LF for the 81" SSB vs $400/LF-$550/LF for a standard noise wall) (~60% cost savings) would be realized. Substantial cost savings would be realized in design and geotechnical work as well. Substantial cost savings would be realized in maintenance as well. It is expected there would be little to no maintenance required for 81" SSBs. Maintenance is a frequent issue for standard noise walls in Ohio (i.e. graffiti, panels damaged by vehicles, resealing issues, etc)
Shorter Schedule	The design and construction schedules would be significantly shorter as opposed to the standard noise wall schedule. The 81" SSB design is simpler to design as well as review. The 81" SSB construction would be much quicker due to the slip forming technology typical of SSB construction.
Environmental Benefits	The environmental benefits include the following: • No deep foundations required (non-intrusive construction) • Avoids clearing of heavy vegetation • Avoids ecological impacts/issues; wetlands, streams • Avoids added trucking and crane costs • Avoids complaint of the sun being blocked by a standard noise wall • Allows snow and ice to melt off of roadway better from the sun

Provide any additional description, if necessary:

Click or tap here to enter text.

14 How broadly might this innovation be deployed for other applications. in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

This innovation can be deployed by local transportation agencies where traffic noise is a public concern. This innovation can be deployed by the FRA, FTA, and railroad companies where rail noise is a public concern or when communities are impacted by rail noise based on a required rail noise analysis.

Market Readiness (20 points)

The AII selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
☒	Gaining executive leadership support	The 81" SSB has already gained support from ODOT executive leadership. The same would need to occur with any other interested DOT.
☒	Communicating benefits	Ohio DOT has already developed a comprehensive list of benefits of the 81" SSB over standard noise walls. This list would simply need to be shared with other interested DOTs.
☐	Overcoming funding constraints	Click or tap here to enter text.
☐	Acquiring in-house capabilities	Click or tap here to enter text.
☐	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	Click or tap here to enter text.
☒	Resolving conflicts with existing national/state regulations and standards	The FHWA Traffic Noise Model (TNM) significantly underestimates and overlooks the noise attenuation of 81" tall solid safety barriers (SSBs) because TNM distributes a large amount of noise energy tall in the heavy truck vehicle profile at the 12-foot position above the pavement. TNM places 63% of the noise energy of an HT at 12'. In Ohio and adjacent states, 65% of all HTs don't even have a vertical stack, hence, no

		12’ noise source. This is why taller noise walls are unnecessarily being built nationally. With the current version of FHWA TNM, 81” SSBs are currently being rejected because of internally inaccurate and outdated computational assumptions and algorithms which are about 25 years old. SSBs are already an established design component of highway infrastructure and provide two functions: safety and noise attenuation. Ohio DOT has collected measured data that shows 81” tall SSBs provide 7-10 decibel reductions adjacent to freeways. These reductions meet noise abatement criteria that are expected of taller and more expensive standard noise walls. This provides DOTs with a much less-expensive option to abate noise impacts.
☐	Other challenges	Click or tap here to enter text.

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: The estimated cost of the 81” SSB is $160/LF-$200/LF. The estimated cost of a standard noise wall in Ohio is $400/LF-$550/LF. This equates to approximately a 60% cost savings.

Level of Effort: The level of effort to deploy is low and simple. 81” SSB designs for noise abatement are underway on several projects in Ohio and expected to be constructed in 2024, 2025, and beyond. A draft design specification is already currently developed. An ODOT approved standard design specification is anticipated in 2024.

Time: The effort is minimum and simple. Design and construction are simple activities. Design and design review would be about 75% quicker than a standard noise wall. The 81” SSB can use standard slip forming technology for construction.

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

Highway design consultants would be designing the 81” Noise Abatement SSB. Concrete producers would be supplying the material for the 81” Noise Abatement SSB. Highway contractors would be constructing the 81” Noise Abatement SSB using standard slip forming technology.