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): California Department of Transportation - Caltrans

2. Name and Title: Bruce Rymer, Senior Engineer

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Innovation Description (10 points)

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

3. Name of the innovation:

Quieter Pavements to Lower Traffic Noise Levels

4. Please describe the innovation.

Use quieter pavements to lower traffic noise levels

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

Noise barriers are expensive, at a cost of about $2M/mile, only work on one side of the highway, and reduce noise only for the narrow band directly behind the wall in the “acoustic shadow”. Quieter pavements turn down traffic noise at the source, work on BOTH sides of the road, and reduce noise levels for a much larger area.

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

Traffic noise is ubiquitous and is always a top community issue. Noise-mitigation design options are limited primarily to noise barriers and quieter pavement strategies add another, sometimes very effective, design tool which can be used to lower traffic noise levels and address noise complaints.

7. Briefly describe the history of its development.

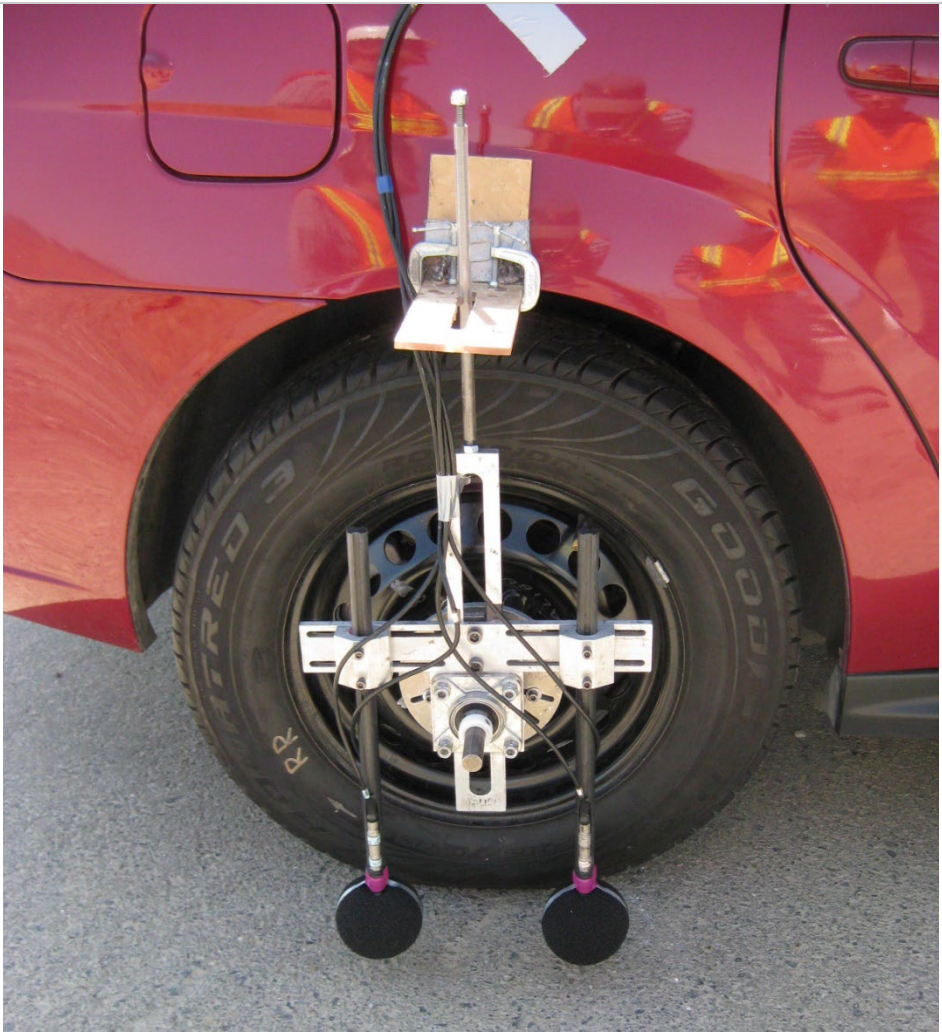
Motivated by constant concerns and complaints over traffic noise levels, Caltrans began exploring approaches to lower noise generated by certain highway infrastructure elements. Pavement is a primary product, and anecdotally it was observed that certain pavements were significantly louder or quieter than others. Caltrans conducted several detailed and controlled noise studies which determined pavement does impact roadside noise levels significantly and at large distances from the roadway. Roadside noise measurements can be imprecise and resource intensive, so Caltrans modified a process which General Motors originally used to measure noise of many different tires on a standard test-track pavement. Caltrans switched the GM process and measured many different pavements with a standard tire, and this allowed different pavement acoustics to be quickly and inexpensively measured and compared. Caltrans determined there is a large variation between old/young and flexible/rigid pavements. The difference between replacing a loud pavement with a quieter pavement can be equal or better than the reduction a sound wall can provide! Caltrans shared the measurement technology with other SDOTs, academic pavement/transportation research centers, and industry. FHWA Pavement & Materials Team supported the development of this process which eventually became AASHTO Standard T-360-16.

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.

The AASHTO Standard T-360-16 establishes the measurement process. Transportation Pooled Fund Study 5-135 (https://pooledfund.org/Details/Study/364) reduced the cost of measurement hardware by 66% by using lower-cost off-the-shelf components and also developed a desktop calibration system/process so researchers can verify/calibrate their equipment and know they can confidently compare their results with others. Several SDOTS have developed policy and specifications for constructing or implementing quieter pavements. The AASHTO Standard T-360-16 has been researched and verified under NCHRP 630 (http://www.trb.org/Publications/Blurbs/160668.aspx) and much of the

overall pavement acoustic research is documented in this Caltrans Reference: Quieter Pavement Acoustic Measurement and Performance (PDF) . International Grooving and Grinding Association developed the quietest rigid pavement surface called the Next-Generation-Concrete-Surface by using the AASHTO Standard: https://www.igga.net/resources/next-generation-concrete-surface-ngcs/

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.

☐Technology has been deployed multiple times in an operational environment **YES**

☐ Technology is ready for full-scale implementation **YES**

Caltrans, other SDOTs, and academic research centers routinely use AASHTO T-360-16 to measure, compare, and monitor pavement acoustics.

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

About six SDOTS are using AASHTOT-360-16 and experimenting with quieter pavements. Many SDOTs are not aware of the potential quieter pavements may have in helping them address infrastructure noise levels.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? ☐ Yes

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

Source: All listed contacts worked with Caltrans team.

Organization	Name	Phone	Email
FHWA Resource Center- Pavement & Materials Team	Robert Orthmeyer	708–283–3533	obert.orthmeyer@dot.gov
University of California Pavement Research Center	Dr John T. Harvey	530 – 754-6409	jtharvey@ucdavis.edu
International Grooving & Grinding Association	Larry Scofield	480-220-7144	lscofield@pavement.com

University of Texas Center for Transportation Research	Dr Manuel Trevino	512-232-3133	manuel.trevino@mail.utexas.edu

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?

Quieter Pavement has proven it can lower traffic noise levels and it adds another 'tool' to the noise mitigation toolbox. It is a very effective and practical tool for addressing noise complaints and noise concerns over new projects. When quiet pavement is paired with sound walls even greater noise reductions can achieved. Noise levels on bridge decks have been cut in half in California.

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:
Can significantly reduce roadside noise levels.	Quieter Pavements can reduce noise anywhere from 1 to 10 dBA, depending on existing pavement noise levels. A tall expensive sound wall costs $2M/mile, only reduces noise 5-7 dBA, and only works on one side of the road.
Concrete bridge-deck noise can be lowered by half.	Changing the bridge-deck surface texture specification can reduce noise by 8 to 10 dBA. This is heard as being half as loud. Older bridges can be rehab-ed and made quieter.
Noise levels from projects can be more accurately estimated and controlled using AASHTO T-360-16 and quieter pavement strategies	Having a database of pavement acoustics gives SDOTs a very important design tool for addressing concerns over new project noise levels and tool for addressing noise complaints.

Provide any additional description, if necessary:

Refer to attached TRB paper explaining a Pavement Acoustics Mapping demonstration using the AASHTO T-360-16 and quieter pavement strategies to address noise complaints on a 24 mile corridor in the Silicon Valley.

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)?

See above TRB paper.

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	Click or tap here to enter text.
☐	Communicating benefits	Click or tap here to enter text.
☐	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	Pavement wears out and becomes louder. FHWA-(Environmental) doesn't view quieter pavement as a permanent noise mitigation solution like noise barriers. But there are established FHWA funded pavement rehab programs. Click or tap here to enter text.
☐	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: About $1,000,000

Level of Effort: Many stakeholders involved over the years: General Motors, FHWA Resource Center, other SDOTs, academia, industry. See attached poster.

Time: 15- 20 years

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.

It's a relatively mature concept. It requires knowledge in acoustics and pavement engineering. The acoustic measurement equipment costs about $25,000 and requires special training to operate