# 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): Delaware

2. Name and Title: Peter Haag, P.E., PTOE, Chief of Traffic Engineering

Organization: Delaware Department of Transportation (DelDOT)

Street Address: 169 Brick Store Landing Road

City: Smyrna

State: Delaware

Zip Code: 19977

Email: peter.haag@delaware.gov

Phone: 302.659.4084

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:

“Clankers”

4. Please describe the innovation.

Overhead physical deterrent for overheight vehicles used in conjunction with a dynamic warning system (stop beacons/flashers) set at the low-clearance bridge/tunnel height (8'-7") along a commuter route, Casho Mill Road in Newark, Delaware, as a "last resort" downstream of vehicle turnouts/diversion routes

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

Conventional MUTCD-compliant Low Clearance warning signs/beacons and "sacrifice beams" (e.g., parking garages, drive thrus, etc.)

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

Provides a relatively safe obstacle (arranged with high density/frequency) for overheight vehicles to detect visually and then strike with relatively "safe" results – e.g., minimal overheight vehicle/load damage and reduced likelihood of flying projectiles injuring nearby pedestrians, bicyclists, residential properties, public infrastructure, etc.

7. Briefly describe the history of its development.

In **May 2014**, the City of Newark's police department and public works officials approached DelDOT about a relatively sharp uptick in overheight vehicle railroad bridge/tunnel strikes along two high-volume, state-maintained roadways within the city limits – Casho Mill Road (8'-7" clearance) and North Chapel Street (12'-0" clearance). At that time, the most common overheight vehicle striking the lower CSXT railroad bridge/tunnel along Casho Mill Road was rental box (moving) trucks. Members of the surrounding Newark communities also took notice of the overheight collisions – jokingly referring to the infamous railroad bridge/tunnel as "Crasho Mill" and "Smasho Mill." Additionally, a satirical social media account with over 1,600 followers launched in **July 2014** under the guise of Casho Mill River and Bay Authority (a local spin on the much more recognizable multimodal toll agency, Delaware River and Bay Authority). In **late 2016/early 2017**, DelDOT installed over two dozen emphatic warning signs/plaques on surrounding roadways and approaches to Casho Mill Road, upgraded the existing overhead warning beacons, and worked with city officials on public outreach/education materials generally targeting rental truck companies and the FMCSA. Unfortunately, these step-wise improvements resulted in relatively little change and vehicle strikes continued to plague the CSXT railroad bridge/tunnel. Consequently, on **July 3, 2019**, CSXT transmitted a letter to DelDOT requesting to barricade then fill the railroad underpass and effectively cul-de-sacking the Casho Mill Road thoroughfare. DelDOT, City of Newark leadership, and state/local elected officials all adamantly opposed the closure and obtained CSXT's concurrence to commence an "all-out design" to mitigate and reduce the number of low-clearance strikes in the short-term while also evaluating long-term solutions such as raising the railroad tracks, constructing an off-alignment, taller railroad bridge, lowering the roadway profile of Casho Mill Road, etc. To further support DelDOT's short-term mitigation strategies, Delaware's General Assembly issued a directive to DelDOT on **July 23, 2019** to pursue the design and installation of an overhead physical deterrent system along Casho Mill Road, citing the Holland Tunnel's system in the directive. On **October 13, 2021**, as DelDOT's

"all-out design" for the low-clearance bridge/tunnel "clankers" and supporting dynamic warning system was being finalized, the City of Newark and DelDOT entered into a maintenance and ownership agreement for the initial capital expenditures (DelDOT) and long-term, local maintenance responsibilities (City of Newark). In **late January 2022**, DelDOT's local electrical contractor, Byers Industrial, was issued notice-to-proceed, and heavy construction commenced in **early March 2022**, while unfortunately facing constraints with both electrical material availability and labor shortages. Ironically, even while construction was proceeding relatively slowly along Casho Mill Road, 3 reported bridge/tunnel strikes occurred on **June 22, June 29, and July 2, 2022**! In response to the continued and unfortunate events, DelDOT and Byers Industrial prioritized the installation of the supporting steel mast arms and "clankers" even though other supplemental infrastructure and traffic control device elements still faced material supply and construction delays. On **July 11, 2022**, the steel was erected and the drop-down chains plus 7 "clankers" (marine-grade boat fenders/bumpers) were installed with 8'-7" clearance along each side of the Casho Mill Road railroad bridge/tunnel. In the month and a half that followed, local residents and commuters expressed their overwhelming interest in "clanker balls" (resulting in over 10,000 media posts, comments, tweets, likes, etc!), and DelDOT further field-refined the installation with several important upgrades – e.g., No Trespassing signs (due to an individual photographed climbing on, and swinging from, the "clankers"), lateral chain supports and chain sleeves (to reduce the tethering/wrapping effect from strikes or manual "vandalism"), and retroreflective bands and strips to enhance nighttime conspicuity. As of **August 31, 2022**, DelDOT, the City of Newark, and Byers Industrial considered the "clankers" project to be substantially complete. **Halloween 2022 and 2022 Holiday Season:** In the months that followed the implementation, local residents and commuters expressed their overwhelming interest in "clanker balls," resulting in over 100,000 media posts, comments, tweets, likes, and other engagement. The clankers were also highlighted in various costumes and vehicle/float decorations by Aetna Hose, Hook and Ladder Company in City of Newark's Halloween parade, and nearby homeowners crafted clankers-style Halloween (pumpkin) and Christmas (tree ornament) lawn displays. Lastly, the clankers also resulted in two cycles of online homegrown tee-shirt sales from the local fan base. On **August 7, 2023**, the Newark Post once again highlighted the effectiveness of the "clankers" with its top story noting that there have been **ZERO** reported bridge/tunnel strikes in over a year since the safety countermeasures were installed.

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.

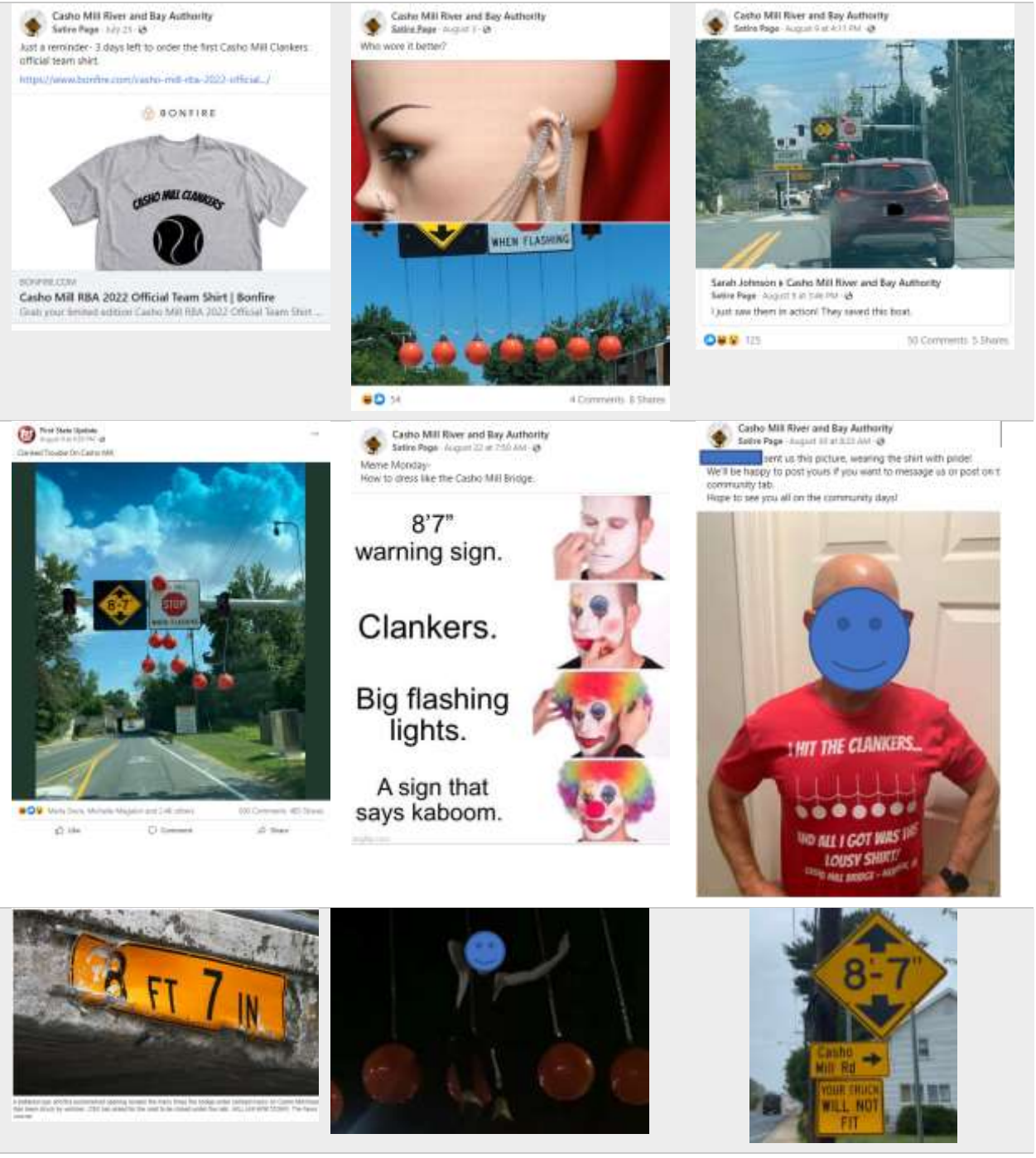
DelDOT and the City of Newark have actively responded to, and participated in, dozens of media requests and social media public awareness/education opportunities.

Initial news coverage throughout entire Philadelphia market/region:
https://www.delawareonline.com/story/news/2021/09/29/delaware-bridge-underpass-newark-casho-mill-road/5813733001/

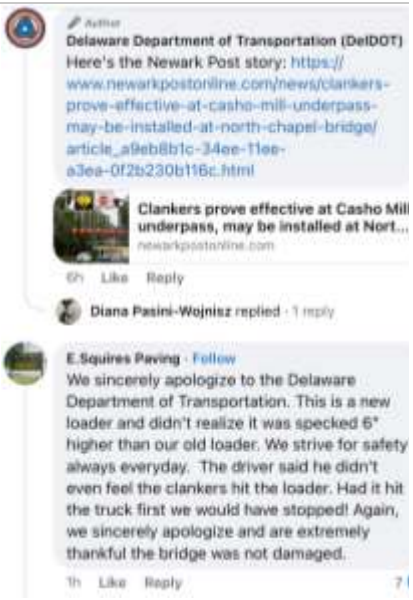
https://www.nbcphiladelphia.com/news/local/clanker-balls-deldots-creative-clearance-solution-for-headache-bridge/3299479/
https://6abc.com/deldot-bridge-clankers-casho-mill-road-newark-delaware/12049702/
https://www.wdel.com/clanker-balls-installed-on-casho-mill-road-near-its-railroad-underpass/image_0247621a-0307-11ed-b5f4-d7abd5e5a280.html
https://www.delawareonline.com/story/news/local/2022/07/14/new-crash-prevention-devices-added-to-casho-mill-road-newark-underpass/65372545007/

Example of follow-up media coverage (with video footage involving a private boat being towed) illustrating successful deterrence/safe "clanker" strike and a one-year follow-up news story on the project's effectiveness:
https://www.newarkpostonline.com/news/stop-now-or-kaboom-video-shows-casho-mill-road-clankers-in-action/article_c6129047-8b69-553c-b42b-14ec28a6bde7.html
https://www.newarkpostonline.com/news/clankers-prove-effective-at-casho-mill-underpass-may-be-installed-at-north-chapel-bridge/article_a9eb8b1c-34ee-11ee-a3ea-0f2b230b116c.html

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



Casho Mill River and Bay Authority
Satire Page
Just a reminder - 3 days left to order the first Casho Mill Clankers official team shirt.
BONFIRE
CASHO MILL CLANKERS
Casho Mill RBA 2022 Official Team Shirt | Bonfire
Casho Mill River and Bay Authority
Satire Page
Who wore it better?
WHEN FLASHING
Casho Mill River and Bay Authority
Satire Page
Sarah Johnson ▸ Casho Mill River and Bay Authority
Satire Page
I just saw them in action! They saved the boat.
8'7"
STOP
Casho Mill River and Bay Authority
Satire Page
Meme Monday:
How to dress like the Casho Mill Bridge.
8'7" warning sign.
Clankers.
Big flashing lights.
A sign that says kaboom.
Casho Mill River and Bay Authority
Satire Page
sent us this picture, wearing the shirt with pride!
We'll be happy to post yours if you want to message us or post on t community tab.
Hope to see you all on the community days!
I HIT THE CLANKERS...
AND ALL I GOT WAS THIS LOUSY SHIRT!
8 FT 7 IN
8'-7"
Casho Mill Rd
YOUR TRUCK WILL NOT FIT


TRICK OR TREAT KABOOM


Author
Delaware Department of Transportation (DelDOT)
Here's the Newark Post story: https://www.newarkpostonline.com/news/clankers-prove-effective-at-casho-mill-underpass-may-be-installed-at-north-chapel-bridge/article_a9eb8b1c-34ee-11ee-a3ea-0f2b230b116c.html
Clankers prove effective at Casho Mill underpass, may be installed at Nort...
newarkpostonline.com
6h Like Reply
Diana Pasini-Wojnisz replied · 1 reply
E.Squires Paving · Follow
We sincerely apologize to the Delaware Department of Transportation. This is a new loader and didn't realize it was specked 6" higher than our old loader. We strive for safety always everyday. The driver said he didn't even feel the clankers hit the loader. Had it hit the truck first we would have stopped! Again, we sincerely apologize and are extremely thankful the bridge was not damaged.
1h Like Reply


8FT 7IN


STATE PROPERTY
NO TRESPASSING


8'-7" TUNNEL
PROHIBITED
RVS & TRAVEL TRAILERS
SCHOOL & TOUR BUSES
BOX TRUCKS
SEMI - TRUCKS
FIRE & EMS TRUCKS
RENTED MOVING VANS
STOP NOW!
OR KABOOM


STOP!
WHEN FLASHING
TURN OUT


8-7
STOP
WHEN FLASHING


STOP!


STOP!

## 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

Follow-up media coverage (with video footage involving a private boat being towed) illustrating successful deterrence/safe "clanker" strike by prototype/technology and a one-year follow-up news story on the project's effectiveness:
https://www.newarkpostonline.com/news/stop-now-or-kaboom-video-shows-casho-mill-road-clankers-in-action/article_c6129047-8b69-553c-b42b-14ec28a6bde7.html
https://www.newarkpostonline.com/news/clankers-prove-effective-at-casho-mill-underpass-may-be-installed-at-north-chapel-bridge/article_a9eb8b1c-34ee-11ee-a3ea-0f2b230b116c.html:

The "clankers" prototype has been piloted successfully along Casho Mill Road in Newark, Delaware; however, the eventual deployment/construction resulted in several unforeseen adjustments and upgrades due to public response (vandalism) and actual overheight vehicle impact-testing. DelDOT is actively developing site-specific (custom) engineering designs at the next 4 highest low-clearance statewide strike locations – 2 require coordination with CSXT; 1 requires outreach with Amtrak; 1 requires state/municipal cooperation for a high-profile navigable waterway for the regional fishing/crabbing industry – following the documented success noted in the before/after reported crash data for the Casho Mill Road pilot deployment (i.e., **ZERO** reported strikes in over a year since implementation).

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

Active monitoring of traffic cameras (CCTVs) along both approaches to the Casho Mill Road bridge/tunnel, visual inspection of the wear-and-tear of the rectangular Low Clearance (W12-2a) warning signs installed on the façades of the railroad structure (i.e., historical litmus strips for both reported and

unreported strikes directly above the 8'-7" vertical clearance), "clankers" maintenance logs via city officials, city police department crash reports/narratives when reported strikes occur to identify vehicle/driver trends, and the monitoring of public outreach input and observations from the very active residential/social media community

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 |
|---|---|---|---|
| The Port Authority of New York and New Jersey | Angel L. Rios, PMP and Daniel Angel | (212) 435-2248 and (212) 435-5701 | arios@panynj.gov and daangel@panynj.gov |
| Township of Raritan, New Jersey | Brion Fleming | (908) 782-1695 | Brion.Fleming@raritantwpnj.gov |
| Cressona Borough, Pennsylvania | Frank Killian | (570) 385-2933 | Click or tap here to enter text. |
| Ohio DOT | Ty Thompson, PE | (740) 323-5194 | Ty.Thompson@dot.ohio.gov |
| Maryland DOT/State Highway Administration | Matt Baker | (410) 545-0410 | MBaker4@mdot.maryland.gov |
| Illinois DOT | Ken Meek | (847) 478-9700 | kmeek@gha-engineers.com |
| New York State DOT | Dan Carey, PE | (518) 457-7114 | Daniel.Carey@dot.ny.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?

Numerous video/photographic evidence supports a very high level of success (e.g., visual inspection of the current undamaged conditions of the rectangular Low Clearance warning signs installed on the façades of the railroad structure). DelDOT and the City of Newark also track formal reported crash data via police reports/narratives – e.g., **ZERO** reported crashes in over a year since implementation (albeit video/photographic evidence generally indicates that historic reported crash statistics may be significantly underreported due to hit-and-runs, minor property damage, lack of witnesses, etc.)

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: |
|---|---|
| Improved Customer Service | Short-term solution/compromise with CSXT that allowed Casho Mill Road to remain open for city residents, local commuters, and emergency personnel and alleviate significant concerns regarding circuitous nature of long diversion/alternate routes affecting multiple communities and inter-state traffic flow for rural Maryland and Pennsylvania |
| Improved Safety | To date since steel and "clankers" erection in mid-July 2022, **ZERO** reported crashes striking the railroad bridge/tunnel. Since 2005, there have been 72 reported crashes (with over 25 resulting in personal injuries). |
| Cost Savings | When a bridge/tunnel strike occurred in the past, City of Newark's police department and public works personnel had to initiate and facilitate the vehicle extraction/removal process and then a high-priority safety and structural evaluation needed to be performed via CSXT and DelDOT – i.e., multiple agencies, staff members, etc. over an approximately 3 to 4-hour time period for each reported strike. There was also a secondary local traffic impact to a commuter route serving nearly 15,000 vehicles per day plus the insurance costs and property damage to affected overheight vehicles/loads. Further, roughly one-third of the reported bridge/tunnel strikes have resulted in personal injuries, which also carry a significant financial consequence. |

Provide any additional description, if necessary:

Improved asset management/performance by maintaining the integrity of the railroad bridge/tunnel that serves as a critical thoroughfare for city/local residents plus inter-state traffic flow to rural Maryland and Pennsylvania

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)?

Multiple uses for “clankers” in both public (bridge/tunnel/ferries) and private sectors – e.g., parking garages, drive thrus – especially as vehicle fleet and load sizes continue to increase as well as a much higher frequency of ad hoc commercial delivery services and inexperienced truck drivers (i.e., post-pandemic effects of exponentially higher online purchasing, shipping, mobile food delivery, recreational vehicle sales, etc.)

## 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 | DelDOT ensured that municipal leaders and local elected officials were involved in the decision-making process, especially considering the intent of devices being intentionally struck. Additionally, problem solving on-the-fly to proactively address longer-term maintenance, safety, and operational issues was crucial, and having the trust of DelDOT’s executive leadership to professionally think outside the box and “gamble” on a relatively unsure/unproven countermeasure was remarkable. |
| ☒ | Communicating benefits | There was a fair amount of public criticism due to the relatively high capital cost; therefore, identifying key metrics/monitoring tools to convey levels of success for executive leadership and local |

| | | |
|---|---|---|
| | | stakeholders was key. Overall, the public's excitement level was extremely high and the nearly instantaneous video/photographic evidence of the "clankers" benefits spoke for themselves. In the months that followed the implementation, local residents and commuters expressed their overwhelming interest in "clanker balls," resulting in over 100,000 media posts, comments, tweets, likes, and other engagement. The clankers were also highlighted in various costumes and vehicle/float decorations by Aetna Hose, Hook and Ladder Company in City of Newark's Halloween parade, and nearby homeowners crafted clankers-style Halloween (pumpkin) and Christmas (tree ornament) lawn displays. |
| ☒ | Overcoming funding constraints | The "clankers" were not a cheap option, but the project was also inclusive of modal upgrades (e.g., dual-purpose pedestrian refuge islands/ADA ramps). However, the "clankers" are a much more cost effective step-wise upgrade versus a full roadway/bridge/tunnel closure and again versus raising the railroad tracks or lowering the roadway profile. |
| ☒ | Acquiring in-house capabilities | Understanding and being proactive with the eventual maintenance aspects of a device that is effectively |

| | | |
|---|---|---|
| | | intended to be struck/damaged, monitoring conditions across many different channels/media, having a general sense of humor, and maintaining public awareness and public education focus when local excitement reaches unprecedented levels (e.g., the Casho Mill Road "clankers" to date have resulted in 2 cycles of online tee-shirt sales from the local fan base!) |
| ☒ | Addressing legal issues (if applicable) (e.g., liability and intellectual property) | The safety concerns associated with overheight vehicles striking the "clankers" and then consequently leading to flying projectiles for innocent bystanders/property as well as severely damaging the vehicles or loads themselves (i.e., the blame game) |
| ☒ | Resolving conflicts with existing national/state regulations and standards | The physical deterrent aspect of "clankers" arguably stretches the definition of a formal traffic control device |
| ☒ | Other challenges | DelDOT's willingness to problem solve on-the-fly, absorb lessons-learned, and continue to improve based on site-specific monitoring and anecdotal/local feedback |

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

**Cost**: Approximately $400,000, including the corresponding preliminary engineering and design/construction aspects of addressing multiple modes (i.e., the pedestrian refuge islands/ADA ramps along Casho Mill Road are dual-purpose for unsignalized pedestrian crossing safety and ground-mounted overheight vehicle stop beacons)

**Level of Effort**: In the short-term, a relatively moderate level of effort when compared to the design and evaluation process for raising the CSXT railroad tracks/bridge or lowering the vertical profile of Casho Mill Road. Ultimately, the effort post-construction to continue adapting the "clankers" and supporting attachments based on traffic monitoring and public feedback was generally unforeseen and required DelDOT's contractor, Byers Industrial, to acquire unique site-specific materials and re-mobilize on several occasions.

**Time**: The "clankers" are not considered to be the "last resort" (nuclear option) for the CSXT bridge/tunnel along Casho Mill Road; however, DelDOT's example project involved multi-agency and legislative outreach from 2014 – 2022 to commit to an "all-out" countermeasure that succeeded several other step-wise improvements. Final construction took approximately 6 months, including relatively minor adjustments based on vandalism, maintenance, traffic monitoring, and anecdotal feedback.

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.

DelDOT's open and trusted relationship with a local, on-call contractor, Byers Industrial, was extremely valuable – e.g., mobilization to shift construction timeline following 3 untimely bridge/tunnel strikes (while under construction) to erect the steel supports and "clankers" in advance of other materials; continuing to re-mobilize as needed ("on call") to further improve maintenance/operational aspects; utilizing boat fenders/bumpers to procure "safe" (crashworthy) and available materials; juggling post-pandemic supply chain and material constraints and labor shortages; etc. As a result, DelDOT now has significant lessons-learned from the Casho Mill Road pilot implementation to have a reasonable blueprint for additional statewide "clanker" installations based on reported bridge/tunnel strike data – e.g., this process should not require extremely specialized design or construction services, and the implementation timelines moving ahead should be shortened significantly.