

REPORT TO THE LEGISLATURE PURSUANT TO ACT 149 SECTION 28

Use of Lighted Paddle Signaling Devices Report

December 1, 2022

Submitted to

Senate Committee on Transportation

House Committee on Transportation

**Vermont Agency of Transportation
Highway Division**



AUTHORIZING LEGISLATION

Sec. 28. USE OF LIGHTED PADDLE SIGNALING DEVICES; REPORT

(a) Pilot program. On or before September 1, 2020, the Agency of Transportation shall identify a minimum of 10 projects to pilot the use of STOP/SLOW paddle signaling devices modified to improve conspicuity by incorporating either white or red flashing lights on the STOP face and either white or yellow flashing lights on the SLOW face in one of the patterns and consistent with the standards detailed in Part 6E.03 of the Manual Uniform on Traffic Control Devices (MUTCD). The Agency shall select projects that will allow the testing of such devices in a range of projects to collect data on the effectiveness, reliability, and availability during the 2021 and 2022 construction seasons.

(b) Report. The Agency shall file a written report on the pilot program identified in subsection (a) of this section with the House and Senate Committees on Transportation on or before December 1, 2022. At a minimum, the report shall cover:

- (1) the selected projects, including location and a brief description; and
- (2) an evaluation of the effectiveness, reliability, and availability of the lighted paddle signaling devices.

REPORT

As directed by Act 149, Section 28, signed into law on 7/13/2020, the Agency of Transportation is providing this written report on a program piloting the use of Stop/Slow paddle signaling devices modified to improve conspicuity by incorporating flashing lights.

Devices:

The Manual on Uniform Traffic Control Devices (MUTCD), published by the Federal Highway Administration (FHWA) and adopted under 23 VSA 1025, sets the standard for traffic control devices in Vermont. The Manual provides the option that “The STOP/SLOW paddle may be modified to improve conspicuity by incorporating either white or red flashing lights on the STOP face, and either white or yellow flashing lights on the SLOW face” and goes on to provide specific information and requirements about the arrangement and operation of such flashing lights if they are being used. (Section 6E.03 Hand-Signaling Devices). Other requirements for flagger apparel and use of the STOP/SLOW paddle contained in the MUTCD remain the same.

Project List:

The Agency identified a list of ten contracts on which to pilot the use of these devices in the summer of 2020, as required by Act 149. The projects were selected based on proposed advertising and construction schedules in order to meet the timelines of the pilot, and with a goal of selecting a representative range of projects to include both urban and rural areas; various types of work (e.g. paving, bridges, etc.); and both day and night work.

The selected projects were as follows:

- Craftsbury-Irasburg STP FPAV(32) and Eden STP FPAV(29)
 - *Paving along VT-14 from Craftsbury mm 7.47 to Irasburg mm 0.032*
 - *Paving along VT-118 in Eden from mm 0.0 to mm 4.6*
- Williston STP 5500(7)S – (night work)
 - *Reconstruction of the intersection at Industrial Ave and resurfacing of US-2 in Williston, beginning at the South Burlington-Williston town line and extending easterly 1.05 miles*
- Chester BF 0134(50)
 - *Replacement of Bridge No. 51 on VT-11 in Chester*
- Essex BF 5400(9)
 - *Replacement of failing buried structure (Bridge No. 2) on VT-117 in Essex, over Alder Brook*
- Calais BHF 037-2(10) (11) and (12)
 - *Replacement of Bridge No. 74 on VT-14 in Calais, over Pekin Brook*
 - *Replacement of Bridge No. 82 on VT-14 in Calais, over Kingsbury Branch*
 - *Rehabilitation of Bridge No. 77 on VT-14 in Calais, over Kingsbury Branch*
- Chester-Springfield STP 2942(1), STP PS19(4) and Springfield STP PS19(5)

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- *Resurface VT-10 in Chester and Springfield, beginning at the VT-103 intersection and extending easterly 4.373 miles to the VT-106 intersection*
- *Resurfacing of VT-11 beginning in Chester at mm 5.206 and continuing until Springfield mm 3.528*
- *Resurfacing on VT 106 in Springfield from mm 0.058 to mm 3.283*
- Enosburgh BF 0283(42) and Berkshire STP SCRP(23)
 - *Replacement of existing Bridge No. 24 (short) on VT-118, along with related approach roadway and channel work*
 - *Remediation of culvert PID # 65099 located on VT-118 at mm 0.312 in Berkshire*
- Springfield BF 0134(43) and (45)
 - *Replacement of Bridge No. 57 on VT-11 in Springfield, over Chester Brook*
 - *Replacement of Bridge No. 60 on VT-11 in Springfield*
- Wilmington-Brattleboro, NH 2971(1)
 - *Resurfacing along VT-9 from Wilmington mm 7.077 to Brattleboro mm 4.178*
- Montgomery, STP DECK(40) and (47)
 - *Emergency repair of roadway slope on VT-118 at Bridge 19 located in the town of Montgomery, approximately 8.355 miles northerly of the Belvidere / Montgomery town line*
 - *Replacement of deck and minor related work on Bridge 19 on VT-118 in Montgomery over Trout River*
 - *Replacement of deck and minor related work on Bridge 20 on VT-118 in Montgomery over West Hill Brook*

Specification/Contract Requirements:

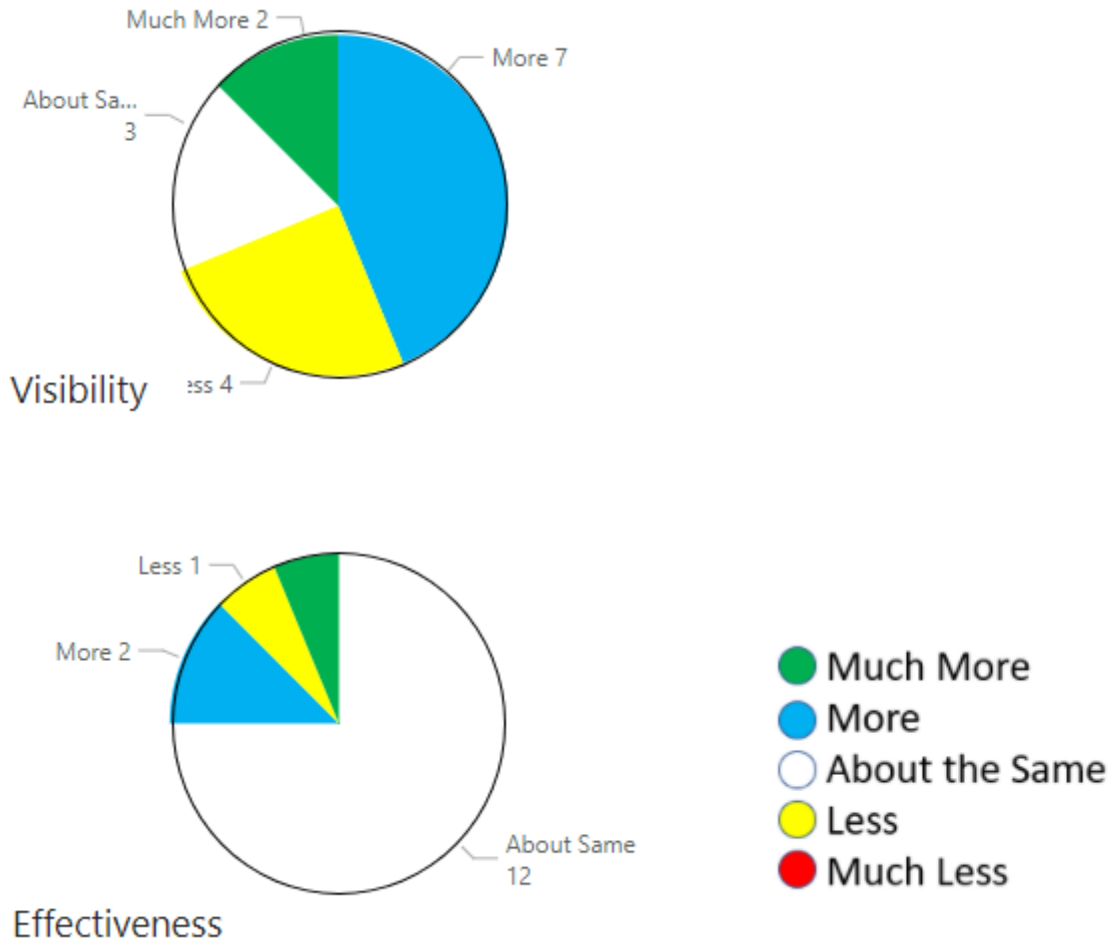
In order to comply with the requirements of the pilot program, a Notice to Bidders was developed for inclusion in the contract documents of the selected projects. This language included reference to the statutory requirement for the pilot, that the project was one of the selected projects, and that the Agency would be evaluating the use of the paddles in accordance with the requirements of the pilot program. The Notice to Bidders also clarifies the requirement that all flaggers on the selected projects shall use lighted paddles in accordance with the MUTCD and State Standards Drawing T-30, and that payment for the flashing paddles will be considered incidental to the Contract Item 630.15 Flaggers.

Evaluation:

As required by the pilot program, the Agency collected data on the use of the paddles to evaluate them on the criteria of effectiveness, reliability, and availability. The data was collected by VTrans staff or consultants on projects in consultation with the Contractor for each project and is summarized below.

Effectiveness:

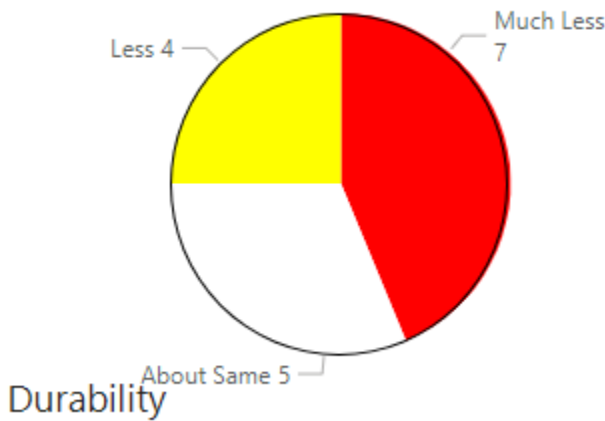
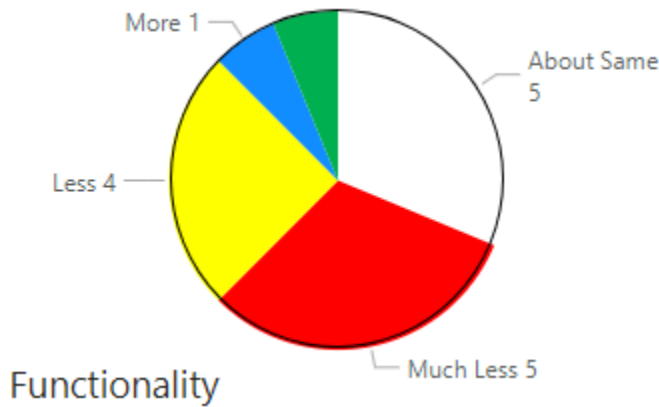
The evaluation forms used asked flaggers and inspection staff to rate the use of the paddles on two measures directly related to the effectiveness of the paddles. One measure was whether they found the flashing paddles to be more visible than conventional paddles, and the other was whether they found the flashing paddles to be more effective than conventional paddles. Results from these questions are summarized graphically, below.



A more detailed review of the submitted forms including the commentary associated with the responses identified a common theme throughout the responses which may explain the apparent discrepancy between visibility and effectiveness. Many reviewers noted that while the flashing lights made it easier to see the paddles (visibility), they made it more difficult to identify which face of the paddle (“STOP” or “SLOW”) was facing approaching traffic (effectiveness). Several of these comments also specifically identified bright sunlight as a contributing factor to making the paddles more difficult to read for approaching traffic. The one project which did report the paddles to be “much more effective” was the one constructed at night, in an urban environment.

Reliability:

The evaluation forms used also asked flaggers and inspection staff to rate the use of the paddles on two measures related to the reliability of the paddles. One measure was the functionality of the devices, and the other was the durability of the devices. The data is summarized below.



In reviewing the comments, functionality and durability concerns focused on battery life, lack of waterproofing of the devices, and general fragility of the devices (e.g. when transporting in a car trunk) relative to standard flagger paddles.

The evaluation forms also asked specific questions related to battery life, asking specifically for both battery life in hours, and the number of battery changes required over the course of a flagger's shift. The average battery life was reported to be 4.65 hours, and the average of reported battery changes per shift was 2.68. Many evaluation forms included comments about the battery life being an issue with the flashing paddles, and some comments also expanded to explain that this was difficult not only because of the need to swap batteries a few times per shift but also because of the costs associated with that many extra batteries and the logistical challenges of getting the batteries recharged- particularly on projects that had a large number of flaggers and/or did not have an on-site field office for the contractor.

Availability:

The survey asked an open-ended question about issues procuring the paddles; responses to this question varied but were generally neutral, with several citing supply chain issues for these devices similar to many commodities.

The survey also collected information about the cost of the devices. The average price reported was \$309.00 per paddle, which is significantly more than a standard paddle which typically costs between \$100-130. Note that since the paddle system consists of multiple components (paddle, staff, battery pack(s) and chargers), there may be some inconsistency in exactly what components are included in this number, and that lifespan of components (paddles, batteries, and chargers will vary, but is likely to require regular replacement.

Summary:

As directed, the Agency of Transportation piloted the use of flashing flagger “STOP/SLOW” paddles on ten projects constructed during the 2021 and 2022 construction seasons, and collected information about the devices, focusing on effectiveness, reliability, and availability. The flashing paddles were generally found to be more visible but not more effective on most projects, with several projects noting that it was more difficult for approaching traffic to tell which face of the paddle they were seeing.

Durability, and in particular battery life, were concerns raised by most of the pilot projects, with overwhelming sentiment that the cost and inconvenience of having spare batteries, keeping them charged, and getting them to the flaggers created an undue burden on the flagging crew. Several contractors also noted that the paddles themselves were less durable than conventional ones, particularly in transport (e.g. when in the trunk of a car), and that they were not sufficiently waterproof to be used when working on rainy days.

Availability of the flashing paddles was not noted to be a significant concern in most of the pilot projects, although delays due to general supply chain issues were noted on several projects, and one contractor did advise of lead-times of 1-3 months during the summer of 2022. Cost of the devices, and of sufficient batteries to keep them operational, were noted as a concern on several projects as well.

Additionally, the Agency received a formal, written request to discontinue the use of these devices on one project – Wilmington-Brattleboro NH 2971(1) - citing higher than anticipated costs due to lower than anticipated durability and a higher number of batteries required than anticipated.

Based on the findings of this pilot, the Agency recommends that no legislative changes be made with regard to the use of these devices. The findings of this pilot will be shared with stakeholders at the Agency of Transportation, the Association of General Contractors (AGC) and the American Council of Engineering Companies (ACEC) through the Work Zone Steering Committee, and the use of the devices may be considered on a project-by-project basis by designers or contractors, as appropriate.

STOP/SLOW Lighted Paddle hand-signaling Devices Questionnaire

Inspected By:		Date:	
Project Specifics -			
Project Name:		Project No.:	
Town:		Route:	
Time of Day:		Weather Conditions:	
Lighting Conditions: (day, night. Tree cover, etc.)		Roadway Surface: (gravel, asphalt, etc.)	
Flagger Information -			
Flagger Name:		Location:	
Flagging Company		Contractor:	
Paddle Information			
Paddle Vendor:		Paddle Condition:	
Staff Height:		Paddle Length:	
Color of lights on STOP side of Paddle:		Sheeting Type:	
Number of lights:		Locations of Lights:	
Color of lights on SLOW side of Paddle:		Sheeting Type:	
Number of lights:		Locations of Lights:	

QUESTIONS:	MUCH MORE	MORE	ABOUT THE SAME	LESS	MUCH LESS
In your opinion, compared to the traditional non lighted STOP/SLOW paddle, how effective is the lighted STOP/SLOW paddle in controlling traffic?					
In your opinion, compared to the traditional non lighted STOP/SLOW paddle, is the lighted STOP/SLOW device more visible or less visible?					
In your opinion, did the device function as expected?					
In your opinion, were you able to comply with the Notice to Bidders as written?					
Comments:					