

New Jersey Department of Transportation  
Bureau of Research

## Technical Brief



### Traffic Control and Work Zone Safety for High Volume Roads

*Fast moving traffic presents special safety challenges to work crews such as surveyors and inspectors conducting short-term work in adjacent or standing in lanes.*

*Unlike long-term work zones, only limited safety countermeasures (such as advanced warning signs and safety vests) are available to these workers due to the changing nature of their work. In addition, unlike long-term work zones, motorists have little time to find out about the presence of the workers at these temporary work zones.*

*There are some traffic control devices available that can effectively alert motorists to the presence of short-term, temporary work zones. However, the feasibility of using these new technologies on a larger scale still needs to be investigated.*

### Background

- Many New Jersey Department of Transportation (NJDOT) employees, such as geodetic surveyors, land surveyors, and bridge inspectors, work alongside roadways and highways and are constantly exposed to fast-moving traffic.
- These workers are at risk due to the close proximity to fast-moving vehicles, and NJDOT is interested in finding preventative measures to reduce the chances of incidents and increase worker safety.
- Their work presents unique safety challenges, because the duration of their work is relatively short (varies between 5 minutes and 3 hours), they work at different sites with varying traffic and roadway characteristics, and—most importantly—their workplace rapidly changes.
- Although some guidelines on deploying traffic control devices (TCD) for stationary maintenance and construction work zones are available, it is difficult to implement these at short-term and non-stationary work places of surveyors and inspectors.
- There is a need to evaluate new and emerging traffic control and safety technologies that are consistent with MUTCD guidelines to ensure the safety of NJDOT employees and motorists.

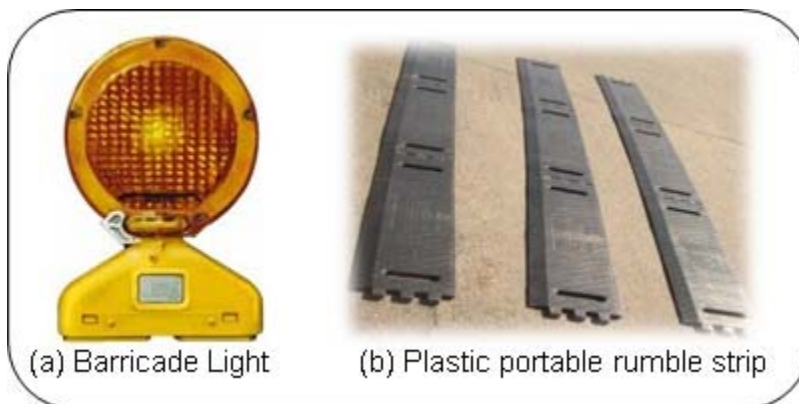
### Research Objectives and Approach

The main objectives of this research project are to:

- ✓ Identify traffic control devices (TCD) that can effectively alert motorists to the presence of short-term, temporary work zones;
- ✓ Test the effectiveness of the selected candidate TCD in laboratory and real-world settings;
- ✓ Develop recommendations and safety guidelines for surveyors and inspectors who work in short-term, temporary work zones.

HERE IS WHAT WE DID...

- Several emerging technologies and practices to enhance work zone safety were reviewed.
- The nature of short-term work conducted by geodetic surveyors, land surveyors, and bridge inspectors was investigated through numerous site visits. These visits enabled the research team to gain sufficient knowledge to understand the actual safety issues encountered in short-term work zones.
- Innovative traffic control devices (TCD) including Turbo Flare, Traffic Blanket, Plastic Portable Rumble Strips, Warning Lights, and Personal Strobe Light were initially identified as possible traffic control and work zone safety devices.
- Other countermeasures such as attenuator trucks and LiDAR technologies were also reviewed.
- Following feedback from NJDOT, laboratory tests were conducted to further examine the selected candidate devices. Turbo Flare and the Personal Strobe Light were found to be unsuitable, mostly due to their visibility issues during the daytime.
- Two commercially available devices—namely, plastic portable rumble strips (PPRS) and Warning Lights---were finally selected for field tests based on various criteria that included, but were not limited to, ease of deployment, capability, and cost-effectiveness.



- The two devices were evaluated in 18 field tests, which included short-term work zones under various roadway conditions throughout New Jersey.
- A set of surrogate measures of effectiveness (SMOE) were used to quantify the effectiveness of deployed the selected TCD. The measures considered in this study included: (1) mean speed, (2) speed variance, (3) 85<sup>th</sup> percentile speed, (4) speed limit compliance rate, and (5) braking rate. The measurement of each SMOE was interpreted from the video data recorded during the 18 field tests.
- Overall, comparative analysis demonstrated positive effects of the portable rumble strips and the warning lights in enhancing the safety at surveying sites. Specifically, the deployment of the warning lights and/or PPRS did not deteriorate the stability of traffic, as the speed variance did not statistically change compared to the use of advanced warning sign only.
- PPRS requires the use of special safety procedures so that employees are protected during deployment. We found the use of PPRS reduced the mean traffic speed by more than 10 percent on average. Significant speed reductions were observed at almost all the test sites. In contrast, the use of warning lights reduced the mean traffic speed by about 5 percent on average. The mean speeds of about one half of the test sites did not significantly decrease when warning lights were used. The combined use of PPRS and warning light yielded further reduction of about 15 percent on average.
- PPRS and the warning lights were also compared in terms of decreasing the proportion of

speeding vehicles and increasing braking rates. The results suggest that PPRS outperformed the warning lights in alerting motorists. The combination of the two devices is found to further enhance their positive effect on alerting motorists.

- Based on the test results, guidelines on how to use these devices and safety recommendations are provided.

## Findings

- It was observed that bridge inspectors' exposure to traffic is minimal, and the only recommended safety device is the personal strobe light.
- In contrast, land surveyors and geodetic surveyors were highly exposed to traffic and thus would benefit from additional TCD.
- For land surveyors, the PPRS in conjunction with personal strobe lights are recommended for land surveying work sites, based on the effectiveness of PPRS shown in the field tests. The warning lights show inconsistent effects thus they are not recommended for use without the PPRS.
- Geodetic surveyors work at a fast pace in the presence of relatively fast moving traffic. Thus, it is recommended that an attenuator truck be assigned for the sole use of the surveying department to increase the safety of geodetic surveyors, especially when working on roadways with no shoulders.
- LiDAR technology offers opportunities for surveyors to collect fast and vast amount of data in the field. Although at this point LiDAR technology might not be the best fit for all surveying needs or might not meet the required surveying accuracy standards of NJDOT, with increasing interest in the technology, it is highly likely that the accuracy level and the capital cost of LiDAR technology will meet the expectations of the department in the near future. Until then it is recommended that NJDOT take an initiative to start investigating the feasibility of this technology to stay ahead of the curve. Initially, LiDAR technology can be used in aiding the traditional surveying methods, which will reduce the number of site visits by surveyors, and therefore reducing their exposure to traffic and enhancing their safety.
- Based on the review of existing safety technologies and feedback from field personnel, it is also recommended to have additional surveyors / lookout personnel present in the field to increase the safety of the whole crew. NJDOT should internally seek possibilities of mandating a minimum number of surveyors at temporary work zones so that one person is assigned specifically for flagging / lookout purposes.

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A final report is available online at: <http://www.state.nj.us/transportation/refdata/research/>.  
If you would like a copy of the full report, send an e-mail to: [Research.Bureau@dot.state.nj.us](mailto:Research.Bureau@dot.state.nj.us).

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