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INVESTIGATION OF IMPROVED PROCEDURES AND TECHNOLOGIES FOR MANAGING THE MAINTENANCE OF TRAFFIC THROUGH FDOT WORK ZONES (PHASE I)

PROBLEM STATEMENT

Highway construction work directly impacts the highway user. Passage through a work zone typically involves recognizing and interpreting a variety of traffic control devices, negotiating lane closures, and reducing speed. On some projects, the work zone length may stretch for miles.

Many emerging technologies and practices have the potential to improve efficiency and safety in construction work zones. Among the possibilities for work zone area improvement are temporary curbs.

OBJECTIVES

The primary objective of this project was to design a temporary barrier that will redirect errant vehicles into the roadway. The design must:

1. Satisfy NCRHP Report 350 Level 2 requirements for roadside safety hardware, which requires full-scale tests both of a small car (1800 lbs.) and of a standard pickup truck (4400 lbs.). Tests are run at 45 m.p.h. at a 25 degree angle of impact.

2. Maintain a low profile (18 inches or less) to enhance driver visibility of cross traffic and encroaching workzone equipment.

3. Allow minimal lateral barrier deflection into the work area.

4. Be available as lightweight, 12-foot barrier segments.

5. Be maneuverable, transportable, and portable.

6. Allow for the easy replacement of damaged segments.

7. Require minimal or no fastening to road surface.

FINDINGS AND CONCLUSIONS

Researchers developed a low-profile, temporary barrier consisting of 12-foot segments that permit portability. During installation, each segment is joined to adjacent segments, resulting in a stiff, energy absorbent barrier. The final barrier design contains several innovations that offer specific advantages over commonly used portable concrete barriers (PCB):

1. The height of the developed barrier is appreciably lower than commonly used PCBs such as the Jersey-type barrier. This feature permits increased driver visibility of cross traffic (e.g., cross streets, construction vehicles leaving the work area, pedestrians partially screened by the barriers, etc.).

2. The connection system between adjacent segments dissipates local impact energy, using the entire length of the barrier system, through a continuous steel connection cast into the conrete matrix. This system thus minimizes lateral deflection, reduces localized barrier failure in the impact region, and enhances the vehicle redirection capabilities of the barrier.

3. No connection to the road surface is necessary—another benefit of the design of the connection system between segments. The mass of the multiple segment system collectively provides excellent inertial resistance to lateral motion. This feature increases portability, flexibility, speed of deployment and repair, and it reduces damage to the permanent road surface.

The iterative design process relied on computer simulations of vehicle-barrier impact based on dynamic finite element analysis. The simulations provided detailed estimates of vehicle deformation, post impact vehicle trajectory, and the internal forces within the barrier system. This information significantly aided a design process that produced a functional product that had to overcome numerous and often conflicting constraints.

Full-scale testing was used to validate the final barrier design. A professional crash test facility was contracted to test the barrier system. The performance of the barrier was excellent, easily passing the NCHRP Report 350 level 2 requirements specified by FDOT as the desired benchmark. The barrier laterally deflected approximately 6.5 inches during the truck impact test on a dusty asphalt road surface. Researchers suggest that had further testing been conducted, the barrier might possibly have passed the level 3 requirements (65 m.p.h. impact speed).

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