



Caltrans Mobile Work Zone Protection System: The Balsi Beam

Results: A highly mobile work zone protection system was designed, built and deployed to protect maintenance workers performing work tasks on the highway. It consists of a tractor-trailer combination, with the trailer converting into a thirty-foot long work space in between the rear axles and tractor, shielded on one side with two steel beams.

Why This Research Was Pursued:

In January 2001 Mark Balsi, a Caltrans District 4 maintenance employee, was severely injured when a motorist crashed into the work zone where he and others were picking up trash along I-280 in Santa Clara County. The vehicle entered the work zone from the side at such a steep angle that the shadow vehicle upstream of the work zone was bypassed. Mark eventually had his leg amputated as a result of the injuries.

Typically maintenance operations deploy a shadow vehicle or barrier vehicle placed upstream from the activity. A shadow vehicle will have a truck mounted attenuator (TMA) to cushion the impact of an intruding vehicle. These vehicles, however, only provide positive protection to workers from errant vehicles intruding the work zone directly from the upstream flow of traffic or at very shallow angles. Motorists can enter the work zone from the side at much higher angles on wide highways with many lanes, or as a result of losing control from an impact with another vehicle, barrier or over steering.

As a result of the Balsi accident, the Caltrans Division Chief of Maintenance, Larry Orcutt, ordered a research project be initiated to solve this problem.

What Was Done:

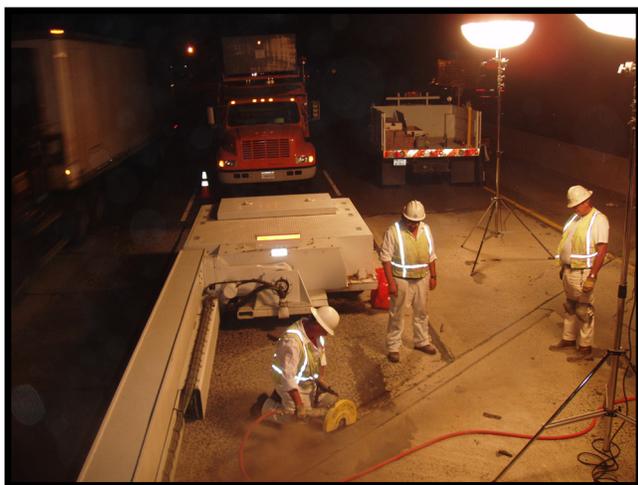
In May of 2001 the Caltrans Division of Research and Innovation began researching concepts for a lateral protection system of temporary maintenance work zones. A proposal was written and funding for the research project was obtained in July 2001. The Caltrans Division of Equipment was tasked



with the design and fabrication of the system, and started in August 2001. They designed and built a Mobile Work Zone Protection System known as the Balsi Beam.

The protection system is essentially a semi-trailer with two telescoping beams on each side, instead of a bed that would support freight. Each of the beams can be rotated to the other side to stack on the other beam, and provide a double beam barrier on the edge of a live traffic lane. The trailer can be extended to provide a thirty-foot work space between the 3rd and 4th axles, shielded from traffic by the beams. It has its own dedicated tractor truck to transport it to the work site at normal highway speeds without the need for any permits. Once on site, the Balsi Beam can be easily set up by the driver in about 15 minutes. It can be used both in median and shoulder areas by rotating either of the beams to the other side.

A working prototype was completed in 2003. A demonstration crash test with a Geo Metro was conducted in March 2003. A proof crash test using a ¾ ton pickup truck was conducted in April 2003. This was a *NCHRP Report 350* Test Level 2 test, a 2000-kg pickup truck at 70 km/hr and an angle of 25 degrees into a longitudinal barrier. A level 2 test was decided since TMA's are only required to pass at level 2. The results of the pickup test were compared to test criteria in *NCHRP Report 350*, and passed all. The steel beams did not deform permanently and the trailer only shifted about 3 inches at the rear tires.



Deployment:

The Balsi Beam was delivered to the Division of Maintenance in August of 2003 for field trials. After a slow start, and some down time for modifications and the addition of a TMA for added rear-end protection, the District 3 Bridge Maintenance crew began using the system in their normal operations on a regular basis. It works well for jobs that are very localized, such as deck repairs, bridge rail repairs, and bridge joint maintenance. They are currently using it and have found it to be a very valuable safety asset, as it provides a high level of confidence in protecting them from potential intruding vehicles while working within a few feet of live traffic.

One of the drawbacks to this system is that it occupies eight feet of lane width, and does not allow large equipment access into the work zone directly from the rear. An adjacent lane or shoulder must be available for vehicles to access the protected work area. This is only a problem, however on two-lane conventional highways or freeways with very narrow shoulders.

A second generation prototype is currently being designed that will feature attached work tools and equipment easily accessible to the work area. This will enable more operations to be performed without having to haul equipment and tools inside the protected space. Eventually this system may be developed so that specialized units will have all the tools and equipment built-in or on board the Balsi Beam. These units would be dedicated for certain operations such as bridge repair or guardrail repair, and eliminate the need for additional vehicles while streamlining the work processes.

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