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HIGHWAY ENGINEERING AUSTRALIA

FEBRUARY 2017

V48.5

HIGHWAY ENGINEERING AUSTRALIA hea SINCE 1968

TRANSPORT
INFRASTRUCTURE
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PRINT POST APPROVED - 100001888

SMART CUSHION
Speed Dependent Crash Attenuators

GAME CHANGER

VicRoads installs Victoria's first SMART CUSHION at busy Princes Freeway exit

Building on its success in locations internationally and in Australia - including some 40 locations in metropolitan Sydney - the remarkable SMART CUSHION Speed Dependent Crash Attenuator continues to go from strength-to-strength, following the installation of the first SMART CUSHION unit in Victoria by VicRoads.

Renown not only for its remarkable performance in the field - both in terms of its impact energy absorbing capabilities and the speed and ease with which the unit can be reset following an impact - SMART CUSHION is also being lauded by governments, road authorities, contractors and infrastructure owners alike for the significant reduction in post-impact repair and reinstatement costs that it offers when compared to other traditional impact barrier systems.

"The unit was craned from the back of the delivery truck directly into position on the prepared concrete slab, the holes were drilled, epoxy anchors put in place and the unit bolted into position. It was installed and operational within a couple of hours."

VICROADS TRIAL SITE

Victoria's first SMART CUSHION was included as part of a trial of two innovative safety barrier products for VicRoads' Metro North West (MNW) Region.

The Region had approached VicRoads' Network Design Services Division for an alternative solution to the existing guard fence end terminal for the busy Princes Freeway inbound exit ramp at High Street, Laverton in Melbourne's west. The existing guard fence on the inbound off ramp had been struck numerous times in the past, and the end terminal was not functioning as intended at the location due to the fact that was often struck side-on rather than head-on. Impacts at the site generally resulted in the end terminal and a large portion of the

guard fence having to be replaced, which was proving to be both costly and time-consuming.

With that in mind, Daniel Cassar and Richard Bortko from VicRoads Safe System Design, Network Design Services (NDS) suggested to MNW Region that the location would be ideal to trial two new VicRoads approved products, namely: the KSI Safety Roller Barrier and the SMART CUSHION Speed Dependent Crash Attenuator.

Daniel Cassar, Manager – Safe System Design with VicRoads Network Design Services, explained:

"Having decided to trial the Safety Roller Barrier at this location, which curves around the off ramp and terminates in between the through lanes of the Princes Freeway and the straight section of the off ramp, a suitable end treatment was still required for the front end of the Safety Roller Barrier. As this location was identified as a trial site, we felt that it also provided us with the ideal opportunity to use the SMART CUSHION."

This collaborative initiative was well supported by management at both MNW and NDS, with funding to undertake the trial works being quickly arranged. The installation works were carried out by VicRoads' Road Services Division in time for Christmas.

Another area in which the SMART CUSHION excels is the speed and ease with which the units can be installed.

Delivered to the site as a complete assembled unit, once the unit is craned into position onto a prepared concrete base, it is bolted down into position using an epoxy anchoring system.

"We're extremely pleased with the results at the Laverton Site," Daniel Cassar said. "The SMART CUSHION installation was extremely fast and went very smoothly thanks to VicRoads Road Services Division and Dane from LB Australia."

"The unit was craned from the back of the delivery truck directly into position on the prepared concrete slab, the holes were drilled, epoxy anchors put in place and the unit bolted into position. It was installed and operational within a couple of hours," he said.

"In fact, the Laverton trial site installation went so well, that MNW Region have already installed another unit at the busy Tullamarine Fwy/Calder Fwy Diverge near Essendon Airport and we're looking at other potential sites for SMART CUSHION installations," Daniel Cassar added.

OUTSTANDING 'WHOLE OF LIFE' COST BENEFITS

The Smart Cushion unit was tested to US test standard NCHRP350 TL3 in 2003 and in the ensuing 14 years more than 5,000 units have been produced, the vast majority still in service. The outstanding performance of the Smart Cushion has been documented in several FHWA funded surveys and webinars. The Smart Cushion is loosely classified a 'severe duty" crash cushion suited for critical areas like the gore where resets and repairs must be effected with minimal disruption to the travelling public and with maximum safety to repair crew and the TM crew.

SMART CUSHION has set a new benchmark for crash attenuator performance and has redefined what road safety experts regard as 'good value' in crash cushion selection. This sense of value was further enhanced in 2016 when the unchanged SMART CUSHION attenuator was successfully tested and approved to the new US MASH TL3 standard.

Not surprisingly, SMART CUSHION's value is also clearly apparent in the Australian installations. Indeed, to 31 December 2016, after only 18 months of use in Australia, there had been a total of 40 resets at various sites

PICTURED BELOW:

1. The SMART CUSHION is delivered to the site as a complete assembled unit ready to be craned into position.

2. Once positioned on the prepared concrete slab, holes are drilled for the anchoring bolts.

3. Applying epoxy for the anchoring system.

4. The anchoring bolts are inserted into the epoxy filled holes, where they will become permanently embedded when the epoxy cures.

across metropolitan Sydney. The total cost for the replacement parts required following these impacts was $4,360.00 - an average of $109 per impact.

What's more, the average reset time for the 40 impacts was only 56 minutes, generally with a one man crew.

Together with the significant reduction in labour and traffic management costs offered by SMART CUSHION following an impact, the speed and ease with which the units can be reset also ensures that they are able to be reinstated into active service in the shortest possible timeframe, thereby delivering maximum protection for all road users and minimising exposure for repair crews.

Not surprisingly, with post-impact repair costs such as these, an ever-increasing number of road engineers and safety experts are now looking at 'Whole of Life' cost rather than just the purchase price when assessing the true 'value' of impact attenuating barriers.

Paul Hansen, Managing Director of road safety systems and engineering specialists LB Australia Pty Ltd, SMART CUSHION's exclusive Australian distributor, commented:

"While in these days of tight budgetary constraints and ever-increasing demands to 'do more with less' it may be tempting to opt for a product or solution with a lower initial cost, but when it comes to road safety barriers, 'whole-of-life' cost benefit analysis is a critical consideration."

"Low initial cost does not always equate to getting a good return on the investment," he said. "This is particularly true for impact protection systems, which, by their very nature, are extremely likely to require repairs and/or replacement parts following a vehicular impact."

"Put simply, what may appear at the outset to be a 'better value' solution can, in fact, end up being an extremely expensive selection, with repair costs quickly adding up to multiples of the initial purchase price," Paul Hansen added. "If every impact results in a majority or even total replacement of the unit, perceived savings can soon disappear – and the costs will continue to escalate... year after year!"

PROVEN PERFORMANCE - SMART DESIGN

The key to SMART CUSHION's remarkable performance lies within its unique design, which incorporates methodologies to dissipate energy both by mechanical and by hydraulic means.

Paul Hansen, explained: "The impacting vehicle's momentum is safely reduced by three interacting processes simultaneously dissipating energy. It's an innovative product which is well founded on good engineering design and is considered to the leader in what may be a new generation of smart attenuators."

"Unlike the old style attenuators, the SMART CUSHION attenuator rarely reaches maximum stopping resistance due to the interactive feedback nature of the system. It is this continuous interactive feedback system that allows the lowest ridedown accelerations when impacted end-on. The hydraulic porting in the cylinder ensures the vehicle will stop before it reaches the end of the cushion's usable length," he said.

There are two SMART CUSHION models depending on the road speed classification and the traffic mix. The most common model is the NCHRP350 TL3 tested model that is widely used across the USA. The other model is the NCHRP350 TL2 model tested at 70kph and commonly used in Work Zones and on secondary lower speed roads.

Specifically developed to maximize both safety and reusability, SMART CUSHION's fully redirective, non-gating, bi-directional, design delivers outstanding performance and durability - before, during and after an impact. The unit's side panels are fabricated from 10-guage (3.4mm), 60ksi (414MPa) minimum yield steel with a G90 galvanized coating for

REPLACEMENT PARTS

When it comes to spare/replacement part costs after an impact, the SMART CUSHION is truly in a league of its own.

Due to the smart engineering design where the strength and durability of the side panels for side angle impact situations, the SMART CUSHION crash attenuator rarely requires call-out for side angle impacts. Caltrans (California Department of Transport) estimates that in their network, the use of Smart Cushions has reduced call-outs buy one-third - a significant number considering there are 350 SMART CUSHION units in place.

SMART CUSHION requires only a minimal inventory of spare parts, with the most commonly replaced parts being the two 1/4" shear bolts, with a total cost of less than $5.

For the NCHRP350 TL3 and TL2 testing in 2003 there was no side panel damage to the attenuator for either the side impact test or the reverse angle side impact test.

maximum service life even under the harshest operating conditions. The panels' outer profile not only delivers a significant increase in strength, the fact that it also allows for the edges to be bevelled helps to reduce the potential for sagging and damage during reverse direction impacts.

SMART CUSHION's design has smart features. The widely separated two rows of anchor pins allow greater foundation stability for the SMART CUSHION in both side-on and angled front-on impacts, compared to cushions designed with a single central "spine". In addition, the front sled is guided

"Unlike the old style attenuators, the SMART CUSHION attenuator rarely reaches maximum stopping resistance due to the interactive feedback nature of the system."

by rollers that allow the force of an angled front-on impact to be safely redirected to the longitudinal axis of the SMART CUSHION roller guide. These rollers help to by reduce friction and resistance at the point of impact, thereby resulting in a smooth, straight mobilization of the sled during an impact. The wire rope, the sheaves and the hydraulic cylinder are located in the base between the tracks for the frames. There, these components are protected from damage, and provide easy access when exposed for repair work. The hydraulic cylinder does not have a return spring so there is no danger of vehicle rebound causing a secondary accident or incident.

For further information on the SMART CUSHION crash attenuator, please visit the website: **www.smartcushion.com.au** or contact LB Australia Pty Ltd,
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