U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: ACTION: Proven Safety Countermeasures - Clarifying Q & A's

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From: Joseph S. Toole
Associate Administrator for Safety

In Reply Refer To: HSSD

To: Federal Lands Highway Division Engineers
Division Administrators

Last year, this office issued guidance encouraging the implementation of nine proven crash countermeasures. These countermeasures were chosen because they had shown particular promise in eliminating or mitigating some of our Nation's most serious safety problems. We continue to hear strong testimony from many states that have aggressively implemented these measures, and have documented their benefits in lives saved. Implementation of these countermeasures has also been listed as one of the agency's dashboard measures, and we continue to hear about new opportunities for further advancements.

Since the issuance of our guidance memo, we have received a number of questions from a variety of sources regarding the original July 10, 2008, guidance memo. The attachment to this memorandum provides additional clarification to some of the frequently asked questions. It is our intent to continue to update this information (as new information becomes available) about these techniques and other approaches to improving Safety. We strongly encourage you to continue to look for opportunities to use these countermeasures to address fatal and serious crashes in your State. Our office, as well as the Resource Center, is available to help support your efforts.

Please share this information with your State, local, tribal, and Federal partners and continue to strive to incorporate these countermeasures in Federal-aid projects whenever possible.

Attachment

cc: Associate Administrators
Directors of Field Services
Amy Lucero, DTS-RC-LAK-1

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Proven Crash Countermeasures
Frequently Asked Questions

General

Q: Do the recommendations in the guidance supersede the State's Strategic Highway Safety Plan?

A: No. The States' Strategic Highway Safety Plans (SHSP) have used a data-driven approach to identify and highlight the safety issues particular to each State. Although each SHSP is unique, it is not surprising that many states face similar safety problems such as crashes due to roadway departures, at or influenced by intersections and involving pedestrians. The countermeasures identified in the guidance offer States proven, cost-effective means for addressing many of these issues on a systemic or system-wide basis. Although we do not expect that every State will implement all of these countermeasures, we would expect that they would be given serious consideration as a means to address priority issues identified in the States' SHSPs. As such, States should be encouraged to adopt policies supporting the application of these countermeasures where the data indicates that safety problems exist which could be mitigated by such policies.

Rumble Strips and Rumble Stripes

Q: Does the guidance recommend shoulder rumble strips only where a clear 4-foot surface is provided beyond the rumble strip?

A: No. The guidance recommends that shoulder rumble strips be installed on all roadways meeting certain criteria regarding speed, crash history, etc. The presence of a 4-foot shoulder is one of the listed criteria. So while the guidance recommends shoulder rumble strips where there is 4 feet or greater of shoulder beyond the strips, it does not recommend ***against*** rumbles where there is less than 4 feet. In those cases there are many issues for the responsible agency to consider, including whether the shoulder is used by bicyclists and therefore needs a specified amount of paved area beyond the rumble strip to accommodate them. Using the metric of 4-feet in the recommendation allows a practice that will work as a typical application, and accommodate cyclists. Use of shoulder rumble stripes can also maximize the width of shoulder available to bicyclists.

Q: Why does the guidance recommend that a 4-foot paved or unpaved should be provided? Bicyclists cannot use an unpaved shoulder.

A: The purpose of this recommendation is to provide an area for the errant motorist to recover before striking a roadside hazard. Where bicycle accommodation is desired on the shoulder, as opposed to within the travel lane, the 4-foot area beyond the rumble strip should be paved.

Q: For new highways, is the recommendation to place both shoulder and centerline rumble strips?

A: As applicable, yes. For example, on a two-lane road that has adequate space for both centerline and shoulder rumble strips within the policy parameters, we would recommend the use of both. Freeways on the other hand, do not have centerlines, but it is recommended that the shoulder rumble strips be placed on both the right shoulder and the left (or median side) shoulder.

Q: Are rumble strips recommended for residential use?
A: Not typically. Noise is often an issue in residential areas, so other alternatives may be more appropriate. However, sometimes rumbles strips or rumble stripes are appropriate along highways with light residential land use in rural areas or on the urban or suburban fringe.

Q: Why does the guidance not recommend rumble strips on multi-lane highways other than rural freeways?
A: Rural conditions are where rumble strips can be most effective and there are few obstacles to their installation. It is not our intent to limit the use of rumble strips in non-rural applications, however, there is not enough information currently available to address those at a policy level. The policy should be applied to all rural multi-lane highways, not just freeways.

Q: The Technical Advisory suggests rumble strips should be at least 12 inches wide. Is this still the recommended minimum width?
A: Not necessarily. A few agencies have installed 6-inch rumble stripes where they have no paved shoulder. While they have shown diminished results, there are safety benefits. Since these are new, it is recommended that an evaluation be completed on each installation.

Q: Are rumble stripes (centerlines or edge lines placed within the rumble strip) allowed? They do not appear to meet the guidelines provided in the Technical Advisory.
A: Rumble stripes are encouraged where appropriate because the added benefit of providing additional delineation beyond a flat marking. The technical advisory only addresses should rumble strips and will be updated in the near future after NCHRP Project 17-32 is published.

Median Barriers

Q: Is there a speed below which cable median barrier are not recommended?
A: Although the guidance is intended to address freeways, there is no minimum speed below which cable median barrier is ineffective.

Q: Is it safe to use cable median barrier where 85 percentile speeds exceed 65 mph?
A: Yes. When updating NCHRP 350, researchers found that barrier impacts typically did not exceed 100 km/hr (62.5 mph), even when the travel speeds were higher. For this reason, crash testing of median barrier continues to be conducted at 100 km/hr.
Q: Is it true that even minor impacts to cable median barrier result in extensive damage to the barrier?
A: High-tension cable barriers are more impact-tolerant than low-tension barriers, and the cables often remain in place if not many posts have been hit. Additional information on typical repairs may be available from the vendors of the specific cable rail systems.

Safety Edge

Q: Have crash data been studied to evaluate the Safety Edge?
A: Research is now underway, although it will be some time before enough data are available to develop a crash reduction factor. Based on what we know, and the insignificant additional costs of adding this feature to a paving job, we felt comfortable including a recommendation on this countermeasure.

Q: Can a Safety Edge be installed on concrete pavement?
A: Yes, this has been done in Iowa.

Q: My State pulls up gravel shoulders as part of resurfacing projects. Is there still a benefit to using the Safety Edge?
A: Yes. Over time, unpaved shoulders can erode, either though runoff or from vehicles using the shoulder, and research has shown that this can occur within a few months. The Safety Edges provides a "safety net" of sorts until the shoulders can be regraded.

Q: My State utilizes only paved shoulders. Is there any benefit to using the Safety Edge?
A: The primary purpose of the Safety Edge is to mitigate the vertical dropoff which occurs when an unpaved shoulder erodes at its interface with the paved surface. While paving the shoulder eliminates the occurrence of this dropoff, the Safety Edge can still provide a long-term benefit where a vehicle may stray beyond the paved shoulder. The benefit is obviously greater when the paved shoulder is narrow.

Q: Is obtaining compaction on the Safety Edge a concern?
A: The typical paving process does not compact the pavement edge, and often raveling and pavement edge deterioration occurs. The current safety edge shape of 30 to 35 degrees is an important safety characteristic; however, without consolidation, the safety edge is also susceptible to deterioration. With an appropriate screed attachment shoe, such as the one developed by Georgia DOT or one that is available commercially, adequate consolidation is attained via extrusion of the material. The high degree of compaction required in the wheel path is not necessary on the edge. Compaction of concrete is, of course, not an issue.

Roundabouts

Q: How do roundabouts accommodate pedestrians and bicyclists?
A: At a roundabout, pedestrians should be accommodated with a sidewalk around the entire perimeter of the intersection, and pedestrians should not cross the traveled way to enter the central island. Most roundabout design guidelines recommend offsetting the pedestrian crossing by one to three car lengths in advance of the roundabout yield line, which not only shortens the crossing distance but allows motorists approaching the roundabout to yield to pedestrians in the crossing before they are at the roundabout merge line. Pedestrians only have to cross one direction of traffic at a time, with the splitter island in the median providing refuge, and traffic approaching a roundabout is moving at

relatively slow speeds. Roundabouts have fewer conflict points than traditional intersections, and left turns are eliminated. For all of these reasons, roundabouts, particularly single-lane ones, offer significant safety advantages for pedestrians over other types of intersections.

Roundabouts offer similar advantages for bicyclists. Roundabouts do not have striped bike lanes within the circulatory roadway. A bicyclist using a roundabout can proceed either as a motor vehicle by "taking a lane" or as a pedestrian by dismounting and using the sidewalk and marked crosswalk, same as with traditional intersections. The slow vehicle speeds in a roundabout are similar to those than be attained by experienced bicyclists. Less experienced bicyclists can choose to exit the roadway in advance of the roundabout entry and share the sidewalk with pedestrians. As with traditional intersections with multiple turn lanes, a multi-lane roundabout also becomes more difficult for bicyclists to traverse.

Q: How do roundabouts accommodate visually impaired pedestrians?
A: Since visually-impaired pedestrians rely on audible clues to know when traffic is stopped so they can cross a roadway, roundabouts present a challenge since motorists may not have to stop. Properly designed walkway edges, curb ramps and tactile marking warning devices at the sidewalk sides of the crossing and in the splitter island aligned with the crosswalk can help in detecting <u>where</u> to cross. To assist in identifying <u>when</u> to cross, there are a number of studies underway that are looking at infrastructure-related alternatives such as:

- Pedestrian-activated traffic signals, particularly on multi-lane approaches, such as the HAWK or TOUCAN (signalization at such crossings is being proposed by the US Access Board);
- Pedestrian-activated LED flashing beacons;
- Advance transverse rumble strips;
- Raised crosswalks, or speed tables; and,
- Units carried by pedestrians to detect metal, velocity and distance.

In summary, this is an issue that is receiving a good bit of attention in identifying the best solutions for sight-impaired pedestrians at roundabouts.

<u>Left- and Right-Turn Lanes at Stop-Controlled Intersections</u>

Q: Does offsetting of turn lanes provide an additional safety benefit?
A: Yes. Research has generally shown that providing offset left turn lanes, compared to left urn lanes which are not offset, provides an additional safety benefit, particularly where there is a left-turn crash problem at an existing intersection with a non-offset LT lane and there are sight obstructions caused by opposing left turn vehicles. Although research on offset right turn lanes has not been as extensive, the safety principals are the same and therefore a benefit can be expected for offsetting right turn lanes, also.

Q: Are there situations where turn lanes are not recommended, such as when they may create temporary sight obstructions?
A: There may circumstances where a left-turn lane may not be recommended at an unsignalized intersection due to horizontal and/or vertical sight restrictions. Horizontal sight obstructions may be able to be cost-effectively alleviated with an offset left-turn lane if sufficient width exists and additional right-of-way is not required. Vertical sight restrictions would be more difficult to account for, and may lead to prohibiting left turns at the intersection and providing for them via u-turns downstream or via a jughandle configuration.

Yellow Change Interval

Q: Is the guidance inconsistent with the current ITE standard practice (particularly the "should" conditions regarding extra time for truck traffic, older drivers, and red-light entries)?
A: In 1985 ITE published "*Determining Vehicle Change Intervals: A Proposed Recommended Practice*." In that ITE document it is stated "Longer yellow interval times may be required on approaches which have a high percentage of truck traffic." Given the improvement in the state-of-the-practice from 1985 to 2008 we do not consider following language contained in the guidance to be in conflict with the ITE proposed recommended practice: "An additional 0.5 second of yellow time should be considered for locations with significant truck traffic, significant population of older drivers, or more than 3 percent of the traffic is entering on red."

The ITE recommended practice is the recognized level of practice throughout the USA. The FHWA guidance included in the memo provides further information that should be considered by those applying the ITE recommended practice.

In 2008, ITE formed a technical advisory committee to help develop a Recommended ITE Practice for Change Intervals, based on NCHRP work. This should be finalized by 2010 or 2011, and would logically result in an ITE Recommended Practice. If this resulted recommended practice differs from the guidance, we will revise the guidance accordingly

Q: What is the basis for recommending speed limit plus 10 MPH where speed data are not available?
A: Upon further consideration, we have decided to revise this recommendation. When speed data needed to calculate the 85 percentile speed are not available, we recommend that the posted speed limit be used. The attachment to the July 10 memorandum will be revised to reflect this change.

Q: Is there a maximum on the amount of yellow time that should be provided?
The yellow clearance interval should not exceed six seconds. This is consistent with existing MUTCD guidance.

Pedestrian Refuge Areas

Q: For the purposes of providing pedestrian refuge areas, what is considered a "significant" number of pedestrians?
A: There is no "magic number" of pedestrians that every agency should consider to be significant. Each agency should evaluate a location in terms of the pedestrian demand; that is, review the site to determine if pedestrians regularly try to cross the street. Such pedestrian crossing volumes will differ greatly from one jurisdiction to another. The other consideration should be whether pedestrian crashes have occurred, involving pedestrians trying to cross the street. Having several pedestrians struck while crossing a multi-lane road should be a reason for strongly considering adding a raised median or median island.

Q: Are pedestrians more at risk where there are lower numbers of pedestrians (referring to the recommendation that refuge areas be provided where there are a significant number of pedestrians).
A: There is evidence that an increase in pedestrian volume will likely result in a reduction in the pedestrian crash "rate" (i.e., pedestrian crashes per number of pedestrians crossing), although the actual number of pedestrian crashes will generally increase as the pedestrian exposure increases. Although it is logical to assume that drivers will slow down and be more respectful of pedestrians in situations where more pedestrians exist, this is unclear to what extent that this is actually the case. The general recommendation to provide refuge areas where there are "significant" numbers of pedestrians is an attempt to balance costs with anticipated safety benefits, each of which can vary based on the particular location.

Q: Where there are no curbs, but the roadway, pedestrian and traffic volume criteria are otherwise met, should median refuge areas be provided?
A: The guidance was meant to provide some middle ground between the need to improve safety to the maximum extent possible and the reality that localities won't be able to provide medians everywhere due to the cost, ROW constraints, etc. That said, pedestrian crash risk increases in situations where traffic volumes increase on multi-lane roads, particularly above an ADT of approximately 10,000, regardless of whether a curb exists or not. Therefore, roadway sections should be judged in terms of needs for median refuge islands based primarily on higher number of lanes greater traffic volume, higher vehicle speeds, and greater number of pedestrians who try to cross. In summary, if the criteria are otherwise met, medians should be provided in uncurbed sections meeting the criteria as well if the locality is able to provide them.

Walkways

Q: What is the basis for recommending a 4-ft-wide walkable shoulder in rural areas?
A: The 4 foot width of walkway or walkable shoulder is a suggested "absolute minimum" distance away from the travel lane that is needed to provide at least some level of separation between motorists with pedestrians who will be walking along the road. Having little or no "walkable" area along the side of the road is likely to result in pedestrians walking on the pavement edgeline or in the travel lane, which can be deadly to pedestrians, particularly at night or other times when visibility is low (fog, dawn or

dusk, rainy conditions, etc.). Obviously, providing as much separation as feasible can further enhance pedestrian safety even beyond a 4-foot walkable shoulder. Certainly having an 8-or 10-foot shoulder is much preferred and will further reduce the likelihood of a pedestrian being struck by an errant vehicle.