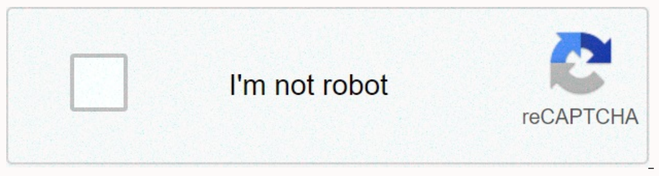

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Aashto roadside design guide

American Association of State Highway and Transportation Officials. Roadside Design Guide, April 4, 2015 American Association of State Highway and Transportation Officials, Washington, D.C.: 2011. Download Version PDF [82 KB] US Department of Transportation Federal Highway Administration Subject: ACTION: AASHTO Roadside Design Guide 4th Edition Date: June 26, 2012 From: Tony Furst, Associate Administrator for Safety In Reply Refer to: HSST To: Division Administrators Safety Field Federal Division Lands Engineers AASHTO Roadside Design Guide (RDG) 4. The Office of Safety distributes a copy to most FHWA offices, where larger offices receive two copies. The purpose of this note is three times: Repeat the status of the RDG for FHWA Summarize significant changes in the RDG 4th edition Add FAQ to our website Status of RDG for FHWA Plans and specifications for projects on the National Highway System (NHS) must provide facilities, including roadsides that are conducive to safety. RDG is included in the FHWA Policy and Guidance Centre (PGC) as a guide to use when designing motorway projects and solving roadside problems on the NHS. The first edition of the RDG was adopted by the FHWA through the Federal Register, effective July 25, 1990, and recommended as the document states should use to develop roadside safety design policies. This memorandum replaces the FHWA Memorandum dated 19 December 1999. Each state highway agency should have a written policy for designing roadsides that includes wide clear zones, traversable drainage structures, and breakaway signs and lighting support structures in new construction and reconstruction and, as far as practicable, in 3R-type projects. Road policy should also describe how other hazards can be moved, modified, foreclosed or delimited. The provisions of the AASHTO RDG should be used by each State to prepare their roadside policy document. Action Each department office should: 1) encourage their state highway agency to have a written roadside policy, and 2) review their state's compliance with RDG 4. If there are significant differences, the State should be encouraged to update their practices in order to be consistent with the current development of development and development of development and development. cc: Director of Field Services John R. Baxter, Associate Administrator for Infrastructure, (HIF-1) Jeffrey A. Lindley, Associate Administrator for Operations, (HOP-l) Fred R. Wagner, Chief Counsel. (HCC-1) Attachments Attachment No. Attachment No. Attached #1 Significant changes to the RDG 4th edition This section presents a brief overview of changes from the third edition, plus provides additional details on significant problems that may affect the state's design standards. Chapter 1 – An introduction to roadside safety statistics for road accidents is updated. AASHTO Strategic Plan for Highway Safety and NCHRP Report 500 Series of Guides are referenced to assist states in their efforts to reduce crashes and deaths. References FHWA hardware eligibility letter Site for further information on the eligibility of crash tested hardware for reimbursement under the Federal-aid Highway program. Chapter 2 – Economic evaluation of only roadside safety editors. The Roadside Safety Analysis Program (RSAP) is rescripted under the NCHRP Project 22-27 Roadside Safety Analysis Program Update and will be available online when completed. Chapter 3 - Roadside Topography and Drainage Features Clear-Zone Terminology coordinated with AASHTO Green Book. Clear-Zone for additional lanes defined. Curb discussion moved to Chapter 5. Chapter 4 - Signs, Signal, and Luminaire Supports, Utility Poles, Trees, and similar roadside features Update breakaway discussion re: AASHTO Manual for assessing safety hardware (MASH) - pickup testing, windshield damage, roof crush. According to NCHRP Report 350, vehicle speed change, stubble height and passenger risk numbers were the only pass-fail criteria where accidental vehicle damage was subjective. Now the mash provides thresholds for deflection and intrusion of the windshield and occupant compartment of the test vehicle. Citing MUTCD breakaway requirements. Mutcd requires all characters within the clear zone of all roads open for public travel in the United States to be mounted on secession/providing structures, or be shielded with a crashworthy barrier. All new installations of signs on a road shall be breakaway or shielded if they are located within the clear zone. Retrofits of non-breakaway supports are required on January 17, 2013, on roads with posted speed limits of 50 mph or above. Recommending outbreak units in urban areas like run-off-road crashes tend to occur in times of reduced pedestrian traffic. Notes that MUTCD requires that breakaway supports housing electrical components utilize electrical switches to reduce the risk of fire and electrical hazards after impacting a vehicle. Stresses the need for directional support at intersections and other places where traffic is approaching from different directions. Discussing high mast lighting supports and traffic signal supports. These are generally not taken into account for breakaway hardware, but there are certain situations on high-speed roads where moving hardware or foreclosure should be considered. Refers to NCHRP Report 500, Volume 8 for the handling of utility poles. Chapter 5 – References to roadside barriers MASH and AASHTO FHWA's joint implementation plan. For more details of the implementation plan, see AASHTO's Discusses motorcycles and barrier design. While various treatments are used in Europe, the United States is studying the extent and nature of motorcycle crashes in barriers. If U.S. crash experience shows that European treatments can have a significant effect on the reduction of crash severity, then treatments need to be evaluated to see if they will have a negative impact barrier performance under the current MASH criteria. Links to Task Force 13 'A Guide to Standardized Highway Barrier Hardware' (Barrier Hardware Guide) and FHWA Eligibility Letters. Barrier Hardware Guide is available at: new W-beam systems, including mgs and the proprietary 31-inch systems. These are described in detail in our May 17, 2010, memorandum, available here: severity/policy_memo/memo051710/. Zone of Intrusion (ZOI) concept. ZOI is the area measured beyond a barrier system where an impacted vehicle or a larger part of the system may stretch during a collision. The amount of intrusion is related to the height and profile of the barrier, as well as the vehicle size, speed and angle of impact. For Test Level 4 and Higher, the designer should try to accommodate this additional clearance for ZOI. Revised discussion of handrails behind curbs. Two designs of 31-inch tall handrail have been successfully crash tested behind the curbs. Runout lengths reduced for barrier design. This generally results in shorter length of need for barriers. Handrail chairs in cutting or cutting strips. Strong-post guardrail systems require the posts to be able to push through the ground at impact. RDG offers designs for leave-outs when placing positions in the sidewalk or rock. Upgrading existing systems audited. The old RDG three inch +/- tolerance allowed railings that were too low to remain in place. W-beam railings that are less than 26 1/2 inches tall after an overlay should be raised, reset, or reconstructed. While new installations must be at least 27 3/4 inches tall, this guide recognizes that it is not cost effective to raise an existing barrier if it is slightly lower. See frequently asked questions for instructions on raising the railing. Chapter 6 – Median barriers 50 foot width for barrier recognition. This was introduced in the 2006 Update to Chapter 6 and is incorporated in the 2011 4th Edition. Note that Figure 6-1 in early print editions of RDG 2011 displays the wrong graphic. Download the bugate from the AASHTO Bookstore website. Details generic low voltage and proprietary high voltage cable barriers. Discusses median terrain effects on barrier performance and location. For more information on the placement of cable barriers on sloping terrain, see the final nchrp report 22-25 to be covered in future FHWA guidance. All new and existing barriers can be found in the hardware barrier guide: . Chapter 7 - Bridge Railings discusses MASH, and AASHTO Load, and Resistance Factor Bridge Design Specifications (LRFD). LRFD requires 42-inch or 54-inch tall barriers to protect bridge piers that aren't designed to withstand a 400-kip impact. NCHRP Project Guidelines for the design and foreclosure of Bridge Piers will develop legitimate criteria for these barriers, transition, and approach handrail. Includes Protective Screening at Overpasses, which was once a separate AASHTO guide. References Task Force 13 Bridge Rail Guide. All new and existing bridge railings can be found in the TF13 Bridge Rail Guide: . Chapter 8 – End Terminals Discusses classification prior to and behind terminals. Displays a number of new terminals and crash pads. All new and existing end terminals are available in the Barrier Hardware Guide: . Contains a table of comparative maintenance requirements. Chapter 9 - Work Zone Devices Generic and proprietary portable concrete barrier design enumerated. Provides a discussion of how you can reduce deflection by attaching barriers and other treatments. Excellent discussion of water filled barriers vs longitudinal channeling pumps and why it is important to distinguish the two. Chapter 10 – Road safety in urban or restricted environments Describes improved lateral offset for use in urban areas where conventional clear zone widths are impractical. Research into crashes shows that an improved lateral offset of 4 meter minimum, 6 meters desirable, will solve most crashes in urban areas. Urban control zone concept: keep obstacles away from intersections, driveways, speed switching lanes. Emphasizing 1.5 feet of lateral displacement to obstacles is not a clear zone. This is a critical point to get over to designers. The 1.5 foot minimum distance behind a curb and operational offset is intended to accommodate truck mirrors and open car doors. It should not be used as a clear zone. Chapter 11 - Mailboxes Contains a

discussion of heavy and dangerous mailboxes, including vandal proof boxes and secure, locked mailboxes where they should not be placed. Advocates the use of lightweight plastic design. Includes strategies to get homeowners to allow the replacement of dangerous rural mailboxes. Chapter 12 - Road safety on low-volume roads and streets New chapter for RDG covers roads where the majority of fatal accidents occur but rarely have high accident sites that can be solved with major improvements in a cost-effective way. Emphasizes low cost systemic strategies for signing, sidewalk markings, and demarcation to reduce run-off-road incidents. Provide as much clear zone as it is convenient to breakdowns involving trees, utility poles and rollovers on dams. Attached #2 FHWA FAQ The following questions and answers provide clarification on certain roadside issues not covered by FHWA policy or topics that simply need further explanation. Roadside Design Guide: Q1.) What if my state challenges all or part of the Roadside Design Guide? A1.) The roadside design guide is neither a standard nor design policy. It is intended to be used as a resource document offering guidance from which individual motorway authorities can develop standards and policies. Although much of the material in the guide can be considered universal in its application, several recommendations are subjective in nature and may need changes to fit local conditions. Handrail: Q1.) Is it appropriate to use newly galvanised or salvaged railing poles and rail in longitudinal barriers for new construction and/or maintenance repair projects? A1.) No, only new posts and rails that are accompanied by a material certification should be allowed on Federal-Aid projects or on NHS routes. FHWA also recommends that state DOTs should not use salvaged or refurbished railing material on government projects next to the NHS because w-beam railings are at performance limits when all the materials used conform to specifications. Unde documented components should not be used. New steel guardrail positions must be consistent with AASHTO M270/ASTM A-36 steel and AASHTO M111/ASTM A-123 for galvanizing. New W-beam rails must conform to AASHTO M-180 specifications. When these components are delivered to construction sites, they are typically accompanied by mill certifications. Salvaged material is often an assortment of varying ages, bolt-hole locations, steel grades, etc. The state highway agency should be able to track and control the source of these materials to ensure that the barrier will function as designed because it is difficult to determine that salvaged railing material meets the correct specifications. It is recommended to use new material. There is an exception where the conditions for remote and reset apply. If the highway agency approves the condition of the in situ barrier components, it can be adjusted to the current specifications within the limits of the project. Concerns about the environmental aspects of old handrails can be reduced because most salvaged posts and rails are recycled and used to produce new steel. FHWA's general guide on salvage credit is located at: Q2.) Is it appropriate to use re-directed railing w-beam panel? A2.) No. The W-beam rail is located under significant tensile voltage load when the barrier is affected. A minimum 27 3/4 high w-beam rail is on its when tested for AASHTO Manual for Assessing Safety Hardware (MASH) Test 3-31 using quad cab pickup truck on on degrees and 100 km/h. Any potential change in the strength of the rail by deformation under an impact or by re-smoothing may compromise its performance. Useful FHWA links: W-Beam Guardrail Repair Guide criteria for restoration of Longitudinal Barriers Task Force 13 Guide to Standardized Highway Barrier Rail Hardware: Q3.) How do you handle railing poles when using in extended polystyrene (EPS) fill, geofoam, lightweight fill, since it will not create the necessary support for proper resistance of the railing when hit? Can you just expand positions? A3.) There are a few ways to do this: 1) bury EPS deep enough and cover with conventional soil that develops the required length, 2) construct as a moment plate and barrier (similar to mechanically stabilized Earth walls), or 3) use a load distribution plate (an reinforced concrete plate overhead EPS) an anchor railing in it. 4.) Would drilling a new hole in the Midwest Guardrail System (MGS) railing weaken the system? A4.) FHWA does not recommend changing a conventional w-beam rail by drilling new holes to accommodate MGS. If the rail does not come with the slots punched at the 3' 1 1/2 mark, attempts to drill a new hole may compromise the performance of the rail or limit its lateral movement. The cross-section of all w-beam rail is already reduced on splices and there is a gap in the middle span location. Providing additional factory punching holes or bolts at the 3' 1 1/2 marks does not reduce the effective cross section. Q5.) Are there other products (w-beam guardrail systems and terminal sections) currently being tested? A5.) Yes, research sponsored by NCHRP and pooled fund studies at the Midwest Roadside Safety Facility (Lincoln, NE) and the Texas Transportation Institute (College Station, TX.) is ongoing. Location next to incline breakpoints, transitions, terminals, etc., will be tested and/or evaluated. Proprietary terminals are also developed and tested under the MASH criteria. Railings Height: Q6.) Have terminal sections for 31 w-beam railing been found justified without blockouts or have all systems have either 8 or 12 blockouts? Can they be used with systems without blockages? A6.) Currently eligible terminals for 31 handrails were listed in Appendix C to our May 17, 2010 note: . Relevant terminals are also listed in Chapter 8 of the RDG. Alternatively, a 27 or 27 3/4 inch terminal can be installed and transferred to 29 inches or 31 inches when you reach 25 feet beyond the downstream end of the terminal. The terminal manufacturer should be consulted with regard to design details. Q7.) What about the national trend to become greener and the growing preference for smaller, lower-profile vehicles? Is there a need for a higher railway in the future? A7.) Green vehicles such as battery-powered cars are larger and heavier than the 820C test vehicle of the NCHRP Report 350, so the extra rail height should not be harmful when considering the future fleet. Q8.) Will there be similar new height requirements for box beam rail? A8.) No. The metric version of the box beam is 27 1/6 inches tall and that's the height at which it was tested. The difference from a 27 high box is negligible, especially since the box beam is a weak entry system where the box differs quickly from the post and remains in contact with the vehicle. Q9.) Has there been a statistically significant number of crashes and/or deaths with the lower altitude rail that drives the increase in height, or is it all based on crash testing and simulation? A9.) The recommendations for increased w-beam height are based on crash testing and an increase in the number of tall center-of-gravity vehicles currently running on highways and roads compared to the 1960s, when the 27-inch standard was set. Q10.) Would a nominal height of 29+/- 1 with an 8 blockout be acceptable? At what height is a 12 blockout recommended? Can you adjust the simulation to test heights between 27-3/4 and 31? A10.) Conventional G4 (1S) strong-post handrail of 29 inches to the top of the rail should have 8-inch blockouts. The size of the blockout is not just a factor in the height of the railing. When the 30-inch maximum height of the G4 (1S) railing is exceeded, a completely different system occurs. The generic MGS system with a nominal height of 31 has a blockout that is 12 inches deep and splices between the posts. MGS and some of the proprietary 31 systems have the advantage that they will also meet crash test criteria at lower altitudes, but should be installed at 31 (or slightly higher to accommodate upcoming overlays). This is also discussed in Chapter 5 of the RDG. Q11.) How was 31 height chosen? Did the performance, testing or simulation of small cars play a role? A11.) In the early 2000's Midwest Roadside Safety Facility (MWRSF) conducted a study to develop a better performing roads barrier. This research showed that the performance of the G4 (1S) strong steel post guardrail improved when the splices were moved to the middle of the span. Increasing blockout depth also improved crash test performance, which did raise the height of the rail from 27 3/4 to 31, which reduced the embedding of the position. MGS represents the combination of these factors. MGS has also been crash tested with 8 blockouts and Texas DOT is currently (June 2012) preparing to submit a request for eligibility.) Other systems were developed that also has a 31-inch mounting height. Q12.) When do you need to raise the railing when an overlay has reduced height? A12.) The AASHTO Roadside Design Guide, 4th Edition, states that the handrail that is at least 26 1/2 inches tall after an over can remain in place. (See RDG 5-17) Q13.) How high do you need to raise railings that are lower than 26 1/2 inches? What are the best ways to do it? A13.) The handrail must be raised to 29 inches, representing the target height for new installations of strong post w-beam systems. If the pavement work requires the barrier to be moved, then the posts must be carefully extracted and, if in good condition, re-driven at the new location so that the rail will be at 29 inches. If the barrier doesn't need to be moved, then raising blockout up to three inches is a common practice. This will require field drilling or punching a new hole in the railing post. Guardrail Terminals: Q14.) I thought a non-gating terminal caught everything that hit it? A14.) According to the criteria of NCHRP 350, it was not a requirement for a non-gating system to intercept all vehicles affecting the terminal's nose. The test with a 2000P vehicle that affects at an angle of 15 degrees on the nose of the system (Test 3-33 for 100 km/h) can get the vehicle into the system and go a significant distance behind it. However, according to the new MASH criteria, there is a specific requirement for non-gating systems, which any blow to the nose or near the nose must contain and redirect the vehicle or bring the vehicle to a controlled stop; the vehicle must not enter . . . Therefore, the criteria used (NCHRP Report 350 or MASH) determine whether a system should be called gating or non-gating. So it is important to know how a system works and where it affects the vehicle will end up during each of the required impact tests on the nose - zero degrees, at an angle (5-15 degrees depending on the criteria), or on the side. Regardless of the type of system used, a safe driving distance is needed after the start of the system, either for the situation where the vehicle passes through the system or where the vehicle simply misses the end of the system and continues behind it. Likewise, proper classification provides a mainly flat pad and traversing side slopes to ensure the stability of the vehicle is necessary, regardless of the type of system. The terminal is only re-directive beyond the point where the need is, which should be specified by the manufacturer. Concrete barriers and bridge rails: Q15.) Can a decorative texture or graphic design be added to the face of a crashworthy concrete barrier? A15) Yes, but the relief of this texture is subject to certain limitations. These limitations are described in NCHRP's Report 554 Aesthetic Concrete Barrier Design. Miscellaneous: Q16.) Can computer modeling be used as a substitute for full-scale crash testing of new devices? A16.) No. FHWA's determination of Federal-aid refund eligibility for road hardware is performance-based, which means full-scale crash testing under the AASHTO Manual for assessing safety hardware is necessary to determine such eligibility. Manufacturers developing new hardware are encouraged to use Finite Element Analysis (i.e. LS-DYNA) to develop their device using the verification and validation process as described in NCHRP Web-Only Document 179 in efforts to refine their design and reduce the cost of system deployment testing. For existing devices that have already demonstrated that they comply with NCHRP Report 350, some minor system changes can be evaluated using Finite Element Analysis. In addition, all Finite Element analyses submitted to the FHWA as part of the documentation package to determine eligibility for reimbursement under the Federal-aid highway program should be accompanied by a verification and validation report as described in NCHRP Report 22-24. Q17.) Do we need to have the vertical units (road pipes, vertical panels, etc.) in place when crash testing a braking system as a working zone unit in category II. A17.) Yes. MASH section 3.4.1 states the test article must be designed and constructed in a manner that is representative of in-service installations and should conform to the specifications and drawings of the manufacturer or designer. FHWA has issued several letters to curbing systems since 2002, and the tests themselves have evolved to include vertical elements from 2004. Over the next several years, more and more tests incorporated delineator style vertical elements, as this became the operating condition of almost all brake systems used in this country. In an attempt to improve road safety and evaluate systems that reflect service conditions, all future test documentation should include the vertical elements marketed by manufacturers with the braking systems. Q18.) Is it OK to add a decorative shell or casting to a breakaway light rod to make it more aesthetic? A18.) Adding decorative hardware to a breakaway fixture support can affect proper performance. Thus, aesthetic or decorative modifications should crash tested. Page last modified on 4 April 2005

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