



NCHRP REPORT 350

DEVICES IN WORK ZONES

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Crash Testing Guidance

- National Cooperative Highway Research Program Report 350 “Recommended Procedures for the Safety Performance Evaluation of Highway Features”
- Published in 1993
- Implementation began in 1998
- Report 350 is guidance for testing



Crash Testing Policy

- AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals - 1985
- FHWA Policy Adopted NCHRP Report 350 for National Highway System (NHS) - 1993
- Millennium MUTCD Extends Crashworthiness to all roads - 2000



Crash Testing Policy

- FHWA policy now requires crashworthy devices to be used within the clear zone on all projects on the National Highway System.
- “Crashworthy” means they have met the test and evaluation criteria of Report 350 and/or have received a “Letter of Acceptance” from the FHWA

FHWA Procedures

- As a service to industry, FHWA reviews crash tested products and issues Letters of Acceptance
- Devices meeting NCHRP Report 350 guidelines posted on FHWA Safety Web:
- <http://safety.fhwa.dot.gov>



4 Categories of WZ Devices

- Category 1: Cones, barrels, delineators
- Category 2: Barricades, sign stands
- Category 3: Barriers, crash cushions, TMAs
- Category 4: Trailer mounted devices



Category 1: Cones, barrels, delineators

- Lightweight devices for which we have years of good history
- Individual crash testing not needed
- Vendor may self-certify that device is crashworthy
- Drums with lights firmly attached also in this category
- Deadline was October 1, 1998



Drum with light





Category 2: Barricades, Sign Stands

- Cones with lights, Vertical Panels
- Type I, Type II, Type III Barricades
- Portable sign stands, including X-footprint
- 100 km/hr crash testing is required, with reduced instrumentation
- Deadline was October 1, 2000
- Older devices may remain in use to the end of their normal service life



Cone w/ vertical panel & light





Type II and III Barricades





Portable Signs



Portable signs –Michigan failure



Portable sign –Michigan redesign



Category 3: Barriers, crash cushions, TMAs

- Water filled longitudinal channelizing barricades and barriers
- Portable concrete “Jersey” barriers
- Crash cushions and TMAs
- This category also includes ground-mounted signs
- Full NCHRP Report 350 testing applies



Category 3: Barriers, crash cushions, TMAs

- Category 3 devices are subject to the full crash testing requirements of NCHRP Report 350. For Test Level 3 this means a 25 degree hit at 100 kmh with a 4400 pound pickup, and a 20 degree hit with an 1800 pound car.
- Breakaway sign posts are tested with an 1800 pound car at 35 kmh and 100 kmh

Barrier or Barricade?

- A “Barrier” is a longitudinal device that has met the Report 350 criteria for a redirective barrier at TL-2 or above.
- A “Longitudinal Channelizing Barricade” does NOT redirect a vehicle. It is tested at the same speeds and angles, but the vehicle penetrates the barrier without severe forces on the occupant.

Water Filled Longitudinal Channelizing Barricade



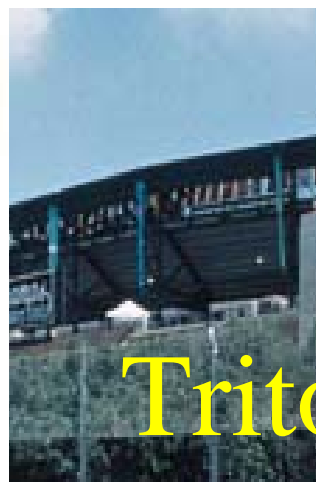
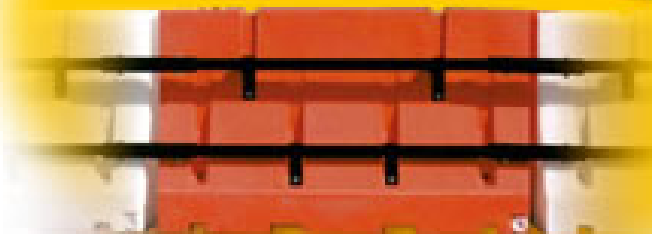


Water Filled Barriers

Safety Assembly I



Safety Assembly II



Triton

Roadguard





Temporary concrete barrier





TEMPORARY BARRIERS

- Temporary barriers
 - barrier joints must provide tensile & moment capacity after Oct. 1, 2000
 - new units must meet NCHRP 350 after Oct. 1, 2002
 - used where vehicle entry to the work zone must be avoided

TEMPORARY BARRICADES

- Longitudinal Channelizing Barricades
 - Must be tested using same NCHRP Report 350 tests as for a Barrier, but the test vehicle may penetrate the device. The vehicle may not roll over, nor can the device cause excessive forces on the vehicle occupants.
 - Used where vehicle entry behind the line of devices is acceptable.



Work Zone Crash Cushions



Energite III



Work Zone Crash Cushions

- Sand Barrel attenuators usually require complete replacement. Should be used where you have the available width, and the frequency of impact will be low
- More sophisticated attenuators are expensive, but easier to repair. They should be used when working widths are narrow and frequency of hits is likely to be high

Truck Mounted Attenuators

Safe-Stop



U-MAD

Truck Mounted Attenuators

- TMAs are optional devices, but in order to be acceptable for use they must meet NCHRP Report 350 Test Level 2 criteria at a minimum.



Category 4: Trailer mounted devices

- Changeable message signs, flashing arrow panels, portable traffic signals, work area lighting,
- Crash testing currently not required
- Should be shielded where possible
- Should be removed when not needed
- Must be delineated

Trailer mounted devices



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For additional information

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