

NCHRP Report 350 - Application to Work Zones

Including Wisconsin Compliance Standards and Implementation Dates

Federal Highway Administration (FHWA) standards require future work zone devices to meet crash-testing requirements shown in National Cooperative Highway Research Program (NCHRP) Report No. 350.

What is NCHRP 350? - a document that contains recommended crash-testing procedures for evaluating a variety of roadside safety hardware, including traffic control devices that are used in work zones. NCHRP 350 was published in 1993 by the Transportation Research Board. The full title of this report is "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

How did NCHRP 350 get to be the standard? - In the 1991 Intermodal Surface Transportation Efficiency Act, Congress directed FHWA to improve the crash-worthiness of roadside hardware devices, to include testing with the minivan/pick-up truck/4-wheel drive vehicle. That type of vehicle was well on its way to becoming 1/3 of the vehicle fleet in the United States, and previous crash-testing standards did not include testing to represent it. Through the federal rulemaking process, FHWA in 1993 adopted NCHRP 350 criteria as the testing standard for new devices used on the National Highway System. Although this effort by FHWA was initially focused on permanent features (guardrail, sign posts, etc), work zone devices are included in NCHRP 350.

What roads do these new standards apply to? - The FHWA standards apply only to roads on the National Highway System (NHS). The NHS is only about 4% of the nations highways, but carries over 40% of the travel. However, many State DOTs are applying these standards to all state highways. Local agencies often adopt their State DOT standards in many areas, so NCHRP 350 will influence the purchase and use of devices beyond just the NHS. WisDOT is applying these standards to all state highways and state-let contracts.

Does this apply only to Federally-funded projects? - No. These standards apply to all the roads and projects listed above, whether the work is being done by private contractors, public maintenance forces or utility companies.

Which work zone devices does NCHRP 350 apply to, and what are the effective dates of these standards? - The standards apply to all devices used on the National Highway System (and other routes as required by States). Implementation dates vary, according to the following categories:

- **Category 1:** Small, lightweight devices that are known to be crash-worthy from crash testing and years of experience (cones, tubes, delineators, barrels) - Since October 1, 1998, vendors have been responsible for assuring crash-worthiness, and for supplying certification to this effect to the purchaser.
- **Category 2:** Devices that produce minimal velocity change but may otherwise be hazardous, i.e. windshield penetration (portable sign supports, barricades) - Since October 1, 2000, new purchases or in-house construction of these devices must meet NCHRP 350 standards if the devices are used on the National Highway System (NHS). The Wisconsin field compliance date for barricades in state-let contracts was January 1, 2002 on NHS projects and January 1, 2004 on other projects. For portable sign supports, the Wisconsin date is January 1, 2003 on NHS projects and January 1, 2005 on other projects.
- **Category 3:** Heavier devices, expected to cause significant velocity change, for which technology has progressed to the point where crash-worthiness has been or can be developed:
 - fixed sign supports - Since October 1, 2000, new purchases must meet NCHRP 350 standards.
 - truck-mounted attenuators and portable crash cushions - Since October 1, 1998, new purchases must meet NCHRP 350 standards. In Wisconsin, a field compliance date for portable crash cushions took effect for projects bid after September 30, 2000.
 - portable concrete barrier - current units with joints that do not transfer tension and moment were required to be updated by October 1, 2000 (requires pin-and-loop or better). New purchases after October 1, 2002 must meet NCHRP 350 standards.
- **Category 4:** Heavy devices for which reasonable crash-worthy technology does not yet exist (flashing arrow panels/arrow displays, changeable message signs, temporary traffic signals) - these devices significantly increase the safety of traffic operations, even though the devices themselves pose a crash risk. FHWA has delayed action on this category. These devices should be delineated with drums, cones or barricades unless shielded by barrier.

Who is going to develop all these crash-tested designs? - Testing has been underway since 1993 by many of the State DOTs (mostly through pooled-funding efforts) and individual manufacturers. As individual designs are proven crash-worthy, FHWA is providing access to the designs via websites, etc.

Tell me about the crash tests that these devices have to meet. In general, NCHRP 350 contains two testing levels for work zone traffic control devices: the higher test level (test level 3) requires testing small cars at 20 mph and 60 mph. In the lower test level (test level 2), the high speed test is reduced to 45 mph. Truck-mounted attenuators also require testing with a pick-up truck. Briefly, a successful test is one in which the vehicle remains upright after collision, the impacted device does not penetrate the vehicle occupant compartment, and vehicle deceleration is at an acceptable rate. Windshield damage is also a consideration.

Does the speed of my roadway make a difference? - Yes. Free-standing work zone devices used only on lower speed roads (45 mph or less) need only pass test level 2. However, most manufacturers and DOTs are currently concentrating on the higher test level; only limited testing has been done at test level 2.

Will these new standards cost road agencies and contractors money? - Not right away - and not for all devices. Cones, tubular markers, plastic barrels, many fixed sign supports, and some barricades typically meet test level 3 standards already. Also, FHWA's implementation policy permits agencies and contractors to use up existing stocks until the end of each device's useful life. As a result, Wisconsin's field compliance dates were set to be about 1-4 years after the compliance date for new purchases.

My agency currently makes its own barricades, mostly out of wood. Do these new requirements now mean that future barricades will have to be purchased from a vendor? - Not necessarily. Several type III barricades have passed test level 3, including several that include wood panels mounted on steel perforated tubing or steel angles. FHWA has also approved some metal leg and wood panel designs for Type I and II barricades.

How about signs on portable trailers? - Two State DOTs - Montana and Texas - have successfully crash-tested trailer-mounted signs. Common features of these successful designs are light-weight trailer and small-tired wheels.

What's the biggest practical problem so far? - Rigid sign substrates (plywood or aluminum) - when these signs are mounted on portable steel supports or on a barricade at low mounting heights, they typically damage or penetrate the windshield during impact. A small number of portable sign supports have been accepted with rigid sign substrates. On the other hand, the combination of roll-up signs or rigid plastic signs, mounted on many X-footprint supports, usually passes test level 3. State DOT's, individual sign manufacturers and ATSSA continue to show interest in the development and testing of additional sign supports for rigid signs.

WHAT SHOULD I DO NOW?

- **cones, tubes, delineators, plastic barrels** –Devices should meet NCHRP 350 test level 3. Your vendor should be able to certify compliance.
- **Type I, II, and III barricades, portable sign supports** - Devices used on state-trunk highways and state-let contracts should meet NCHRP 350. For devices used on other projects, use up current stock. New purchases or agency-built devices should meet NCHRP 350. The manufacturers, State DOTs, and ATSSA are taking the lead in developing and testing the various devices.
- **Truck-mounted attenuators, portable crash cushions** - use up current stock. New purchases should meet NCHRP 350 for the speed of road that the devices are intended to be used on.
- **Temporary concrete barrier** - use existing stock for now. New purchases must meet NCHRP 350.
- **Lighted arrow panels, changeable message signs, other trailer-mounted devices** - no change for now. Delineate these devices with drums, cones or barricades unless they are shielded by barrier.

Where can I get more information on NCHRP 350?

At your State DOT, call Tom Notbohm, 608/266-0982

At your local FHWA office, call Bill Bremer, 608/829-7519

On the Internet, see:

FHWA at http://safety.fhwa.dot.gov/fourthlevel/pro_res_road_nchrp350.htm

ATSSA at <http://www.atssa.com/resources/tc.asp>

phone (800) 272-8772

National Work Zone Clearinghouse at <http://wzsafety.tamu.edu>

phone (888) 447-5556

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