Improving Work Zone Safety:
Why you should consider Longitudinal Channelizing Devices (LCDs)

Presentation Prepared by:

The Water Barrier Manufacturers Association
PO Box 1461 Salt Lake City UT 84110-1461
www.waterbarriers.org

Purpose

The purpose of this paper is to educate transportation departments, consulting engineers, and others on the safety benefits of Longitudinal Channelizing Devices as an alternative to drums or temporary concrete barrier for work zone traffic channelization.

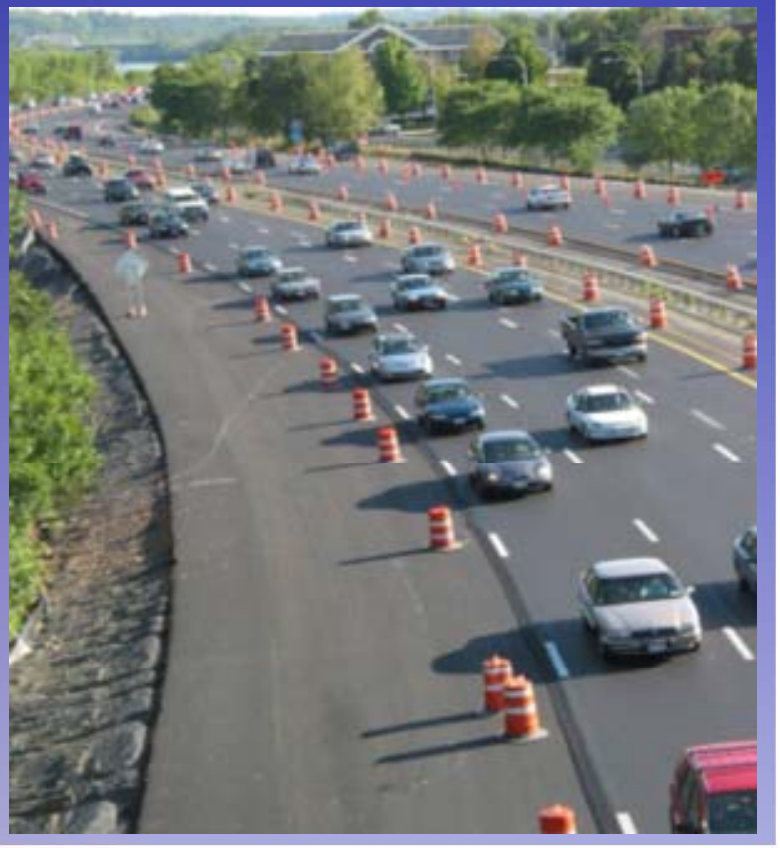
Our highway infrastructure is aging and the need for rehabilitation and reconstruction is growing. Much of this reconstruction work is occurring while at the same time traffic is maintained on the roadway under repair. Approximately 20% of the National Highway System (NHS) is under construction during the peak construction season.

More than 3000 work zones are expected to be present on the NHS during the peak season. Approximately 12 billion vehicle miles of travel a year will be through active work zones. Motorists can expect to encounter an active work zone 1 out of every 100 miles drive on the NHS.

Over the last ten years, work zone fatalities increased 45%, up to 1,010 in 2006. More than 40,000 people are injured each year as a result of crashes in work zones.

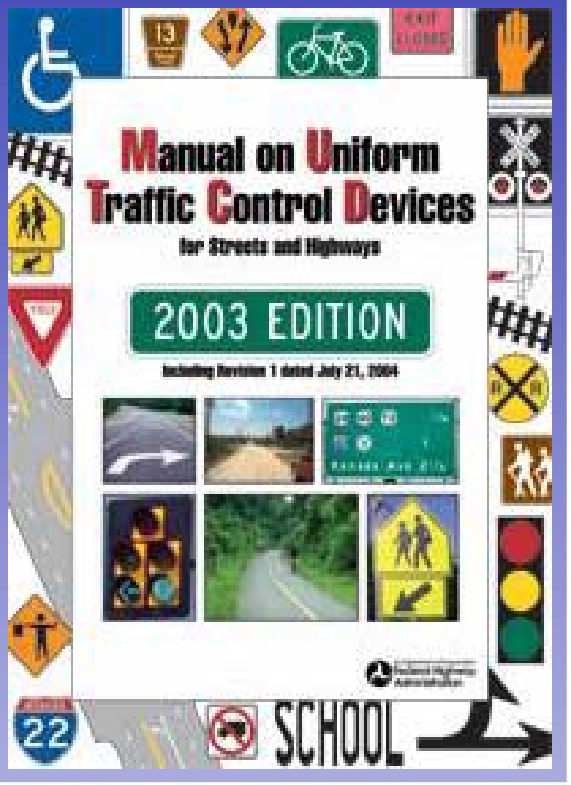
Did you know nationally there is a work zone injury every 13 minutes (110 a day)?

Improvements in transportation infrastructure will benefit all Americans by creating safer roadways, providing jobs, alleviating congestion, and saving time and energy otherwise spent commuting.



Throughout these infrastructure improvements, more attention must be given to safety and the prevention of work zone accidents, which take the lives of construction workers, motorists, and pedestrians. Our nation needs to build better roads, bridges, and transit systems *without sacrificing the safety* of motorists, pedestrians, and workers.

The *Manual on Uniform Traffic Control Devices* (MUTCD), contains the basic principles of design and use of all accepted traffic control devices for all streets and highways which are thought to provide a safe work zone environment for construction workers <u>and motorists</u>.



Longitudinal channelizing devices (LCDs), previously referred to as longitudinal channelizing barricades (LCBs), were first introduced in the 2003 Manual on Uniform Traffic Control Devices (MUTCD).

Per the current version of the MUTCD, LCDs are described as lightweight, deformable devices that can be connected together to delineate or channelize vehicles or pedestrians.

LCD’s are much safer in use than temporary concrete barrier, which, when impacted by a wayward motorists, create high G forces that can cause serious injury and death to the driver and occupants of the vehicle.

Unfortunately, LCDs have only been used to delineate pedestrian travel paths in work zones. As such, LCDs have ensured that the temporary pedestrian travel path meets the MUTCD accessibility requirements for persons with disabilities.

Although LCD’s are exceptional at meeting this requirement, there are other uses where LCD’s are accepted by the FHWA, but are rarely considered. For instance, LCD’s can be used in place of concrete barriers to close roadways to vehicular traffic.

Closing roads using concrete barrier exposes motorists to extremely hazardous high angle impacts. Using LCD’s to close roadways instead of concrete barrier mitigates this hazard.

LCDs can be used to denote the edge of the pavement or separate the active travel lanes from the work area, where positive protection is not required. Again, using LCD’s in this manner greatly reduces the risk to motorists and their passengers of an impact with concrete barrier.

In contrast to traditional channelizing devices(e.g., cones, drums, etc.) that have some open space between devices, LCDs can be connected together to form a solid line. Thus LCDs can prevent drivers and pedestrians from going between devices and entering the work area (whether inadvertent or deliberate).

A solid line of LCDs also provides continuous delineation of the travel path, which may be beneficial at major decision points in work zones, such as lane closures, exit ramps, business access points (i.e., driveways) and temporary diversions (i.e., crossovers).

LCDs also are considered to be highly visible and have good target value, thus LCDs might increase the sight distance to the lane closure. In addition, the larger size of the LCDs may allow for increased spacing of the devices (i.e., more than one times the speed limit in mph); thus fewer devices would be needed.

LCDs connected together reduce the potential for missing devices. In addition, ballasted LCDs are more resistant to becoming misaligned by passing vehicles and / or weather.

When deciding on the correct and safe choice for temporary traffic control in a work zone, an evaluation of devices should place a particular emphasis on balancing the protection of construction and maintenance workers with the safety of road users traveling through work zones.

According to the Bureau of Labor Statistics, there were 101 fatal occupational injuries at road construction sites in 2008 alone. In 2007, 831 workers and motorists were killed in highway work zones and more than 40,000 were injured. Eighty-five percent of those killed in work zones are drivers or their passengers.

A 2008 report by the Illinois Department of Transportation recorded 31 fatalities in work zones. Only two of the persons killed were road construction workers, more than 93% of fatal injuries where to drivers and their passengers.

Four out of five of the people who die in work zone crashes are motorists, not highway workers according to the Virginia Department of Transportation.

The current mindset set of the safety community is geared toward using “positive protection” to protect maintenance workers in roadway work zones.

As a result, concrete barrier has become the temporary traffic control device most commonly used in roadway work zones, even when the data from work zone accident fatalities overwhelmingly indicate that maintenance workers are in the minority of those killed in work zone.

In fact, a recent ATSSA sponsored survey of practices confirmed that temporary concrete barrier is the option most frequently used by state transportation agencies.

This has occurred even though the data from work zone accident fatalities overwhelmingly indicate that maintenance workers are in the minority of those killed in work zone.

Traffic engineers expect concrete barrier to improve safety for the motorists and reasonably protect workers, <u>but motorists can be subject to average forces of 9.55 g's and as high as 23.5 g's</u> (See table 1) when impacting at 25 degree angles when traveling in standard size pickups.

Table 1

Acceptance Code	Test Level	Material	Deflection (meters)	Deflection (feet)	Acceleration (g's)
B-149	3	concrete	1.90	6.23	8.60
B-134A	3	steel	0.70	2.30	23.50
B-134	3	steel	2.10	6.89	5.30
B-131	4	steel	1.50	4.92	13.30
B-122	3	concrete	0.29	0.94	10.98
B-117		steel	0.31	1.03	12.36
B-102	3	concrete	2.29	7.50	10.10
B-98	3	concrete	1.54	5.05	7.70
B-94	3	concrete	1.27	4.17	8.90
B-93	3	concrete	1.67	5.48	7.20
B-90	3	concrete	0.75	2.46	12.20
B-86	3	concrete	0.76	2.50	18.20
B-86	3	concrete	0.81	2.67	
B-84	3	concrete	1.60	5.25	10.40
B-79	3	concrete	2.56	8.38	9.50
B-70	3	concrete	1.10	3.61	11.70
B-69B (concrete)	3	concrete	0.61	2.00	12.30
B-67	3	concrete	1.93	6.33	
B-63	3	concrete	1.35	4.42	5.40
B-62	3	concrete	0.42	1.38	4.50
B-61	3	concrete	0.26	0.85	17.62
B-54	3	concrete	1.83	6.00	12.40
B-52A	3	concrete	1.30	4.27	
B-52	3	concrete	1.30	4.27	5.70
B-42		concrete	0.20	0.66	10.06
B-41	3	concrete	1.14	3.74	10.50
		Avg. Deflecti	1.21	Average G's	9.55

The same vehicle when impacting water-filled LCD's at 25 degrees measured average ride-down accelerations of 5.05 g's with the highest measurement at 7.4 g's, (See table 2).

Table 2

Acceptance Code	Test Level	Material	Acceleration (g's)
WZ-214	3	Plastic	3.00
WZ-255	3	Plastic	5.60
WZ-191	2	Plastic	7.40
WZ-279	2	Plastic	4.19
			5.05

Keep in mind these angles are low and motorists can expect much higher forces when striking barriers that have been located perpendicular to traffic flow to close lanes.

It is clear, when the crash test data is reviewed, that plastic water-filled longitudinal channelizing devices create more positive outcomes in the event of an accident than the use of traditional concrete barrier due to the high G's that motorists are subjected to when impacting concrete barrier.

So Why Are Water Filled LCD's not being Utilized?

If 85% of work zone accidents fatalities are drivers and their passengers, and water-filled longitudinal channelizing devices provide a higher degree of safety for the motorists passing through work zones, it would seem logical that water-filled longitudinal channelizing devices would be the traffic control device of choice.

But these devices are rarely if ever used. In road construction work zones, resistance to change to use of water-filled longitudinal channelizing devices (as with many devices new to the transportation infrastructure environment) slows industry-wide adoption of water ballast devices.

There is an enduring familiarity with concrete and a tendency to rely on concrete barrier for every use, even when it is not the safest or most appropriate device for the job.

Because there is no requirement or incentive for change, engineers simply continue to specify temporary concrete barrier for all traffic control jobs, in spite of the innovation of safer and more effective mechanisms.

In addition to the institutional factors contributing to the lack of innovation listed above, there is no funding for innovative practices.

If better safety costs more money, it must be funded. FHWA's rule on Temporary Traffic Control states:

- "… As a minimum, separate pay items shall be provided for major categories of traffic control devices, safety features, and work zone safety activities..."

To comply with this rule states create itemized lists of work zone devices. Unfortunately, innovative devices are rarely if ever listed.

For example, the Longitudinal Channelizing Device, a traffic control device listed in the MUTCD for several years, is not listed in any of the itemized lists published by any State DOT's.

It is important to recognize that utilizing the full array of work zone traffic control devices available, and deploying suitable traffic control devices for each specific job, can prevent many accidental injuries and deaths in work zones.

The continued reliance on temporary concrete barrier for every work zone application is extremely hazardous to the motoring public.

Temporary concrete barriers are appropriate in work zones when needed for positive protection, **but can create hazards in themselves if used simply for channelization.**

For decades, road transportation departments, consulting engineers, and others who specify safety equipment in roadway construction projects have had few choices in traffic control devices. Historically, engineers have specified temporary concrete barriers as a “one solution fits all” solution, and a culture has developed leaving temporary concrete barrier as the default option for channelizing delineation.

In order to reduce the number of work zone fatalities, these transportation professionals are urged to examine and consider new products offering vehicle occupants a safer environment.

When practitioners begin to look beyond familiar traffic control products, work zone safety will be improved. The occupants of vehicles traveling through work zones are frequently exposed to temporary concrete barrier being utilized as a delineator or to close a road, elevating exposure to high angle impacts.

Or, alternatively, they are required to drive through a confusing array of delineators, risking head-on collision.

Those vehicle drivers and occupants could be your family or mine, so we must ask ourselves if we are really considering all of the available traffic control devices and how the proper deployment of these devices can create safe work zones, preventing injuries and perhaps saving lives. Surely, it is worth consideration.