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Northern District Commissioner

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INTEROFFICE MEMORANDUM:

TO: All District Engineers
All Division Heads
Assistant Chief Engineers

DATE: September 23, 1996

SUBJECT: Precast Concrete Median Barrier

FROM: Kenneth I. Warren
Chief Engineer

As of this date, MDOT will use the following criteria for precast concrete median barrier in work zones.

- Flare Rates on the approach taper shall be a minimum of 8:1 as described in subsection 9.1.1.1 of the 1996 Roadside Design Guide;

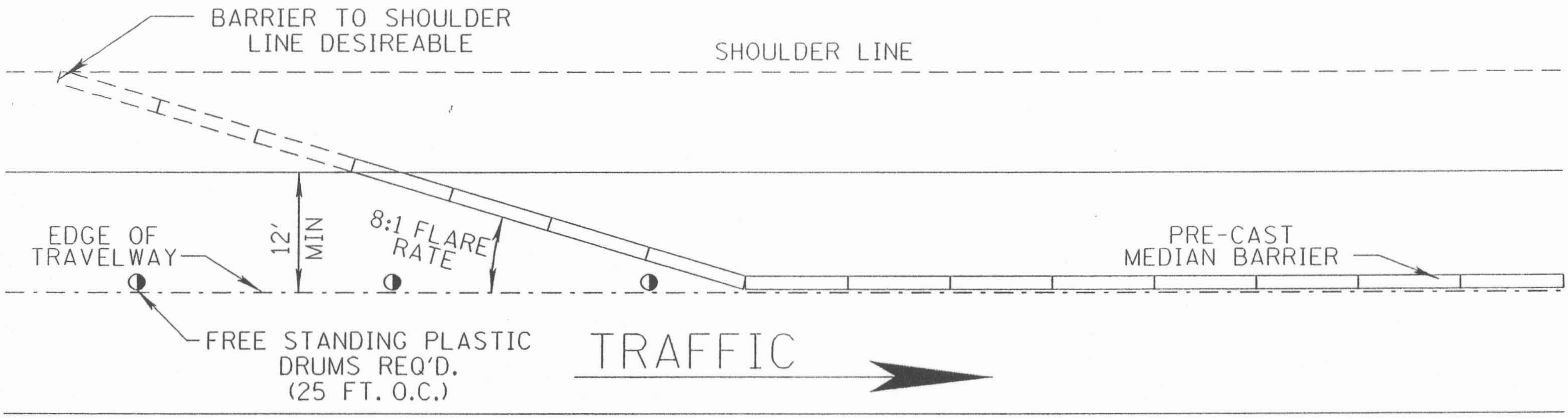
- The offset to the flared exposed end shall be a minimum of 12 ft. (3.65 m), which is the edge of the clear zone appropriate for construction traffic (see subsection 9.1.1.4 of the 1996 Roadside Design Guide).

KIW/raw

Attachments

pc: Files

COPY TO CONSULTANTS 10-1-96.



DRUM SPACING OF 25' TO BE USED IN TAPER LENGTH OF MEDIAN BARRIER. FOR NORMAL DRUM PLACEMENT SEE SHEET TCP-1 OR TCP-2

DETAIL FOR PLACEMENT OF PRECAST MEDIAN BARRIER IN WORK ZONE

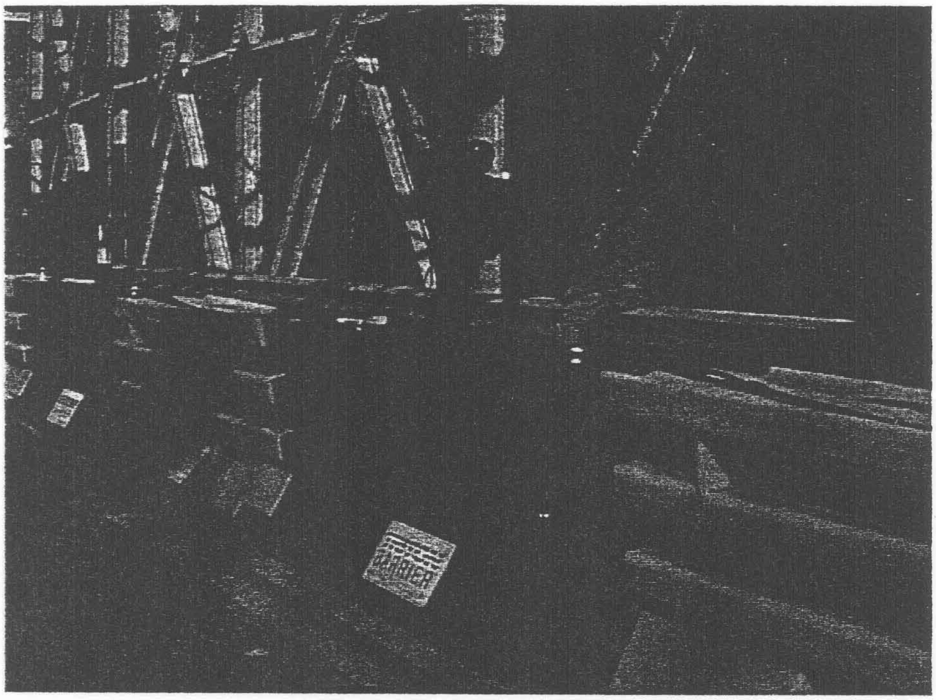


FIGURE 9.8 Triton Barrier

and 25 degrees and an 820-kg car at 70 km/h and 20 degrees with a maximum deflection of 3.8 m.

Timber Barrier Curb/Rail[7]

A 300-mm by 400-mm timber curb with a w-beam rail mounted on the 400-mm vertical face of the timber was tested. The curb redirected full-sized passenger cars at about 60 km/h and 15 degrees and displaced less than 300 mm. It may be used where speeds are 60 km/h or less.

A stacked timber barrier for use on a bridge deck consisting of 300-mm by 600-mm timbers has redirected a 2000-kg passenger car at 83 km/h and 13 degrees. It may be used where speeds are 80 km/h or less and the expected impact angle will be shallow (Figure 9.9).

No other timber barrier curb/rail should be used unless satisfactorily crash tested.[8]

9.1.1.4 End Treatments

The desirable treatments for exposed ends of barriers are:

- connecting to an existing barrier (Chapter 5), or
- attaching a crashworthy end treatment such as a crash cushion (Section 9.1.2), or
- flaring away to the edge of the clear zone appropriate for construction traffic conditions as determined by the transportation agency, or
- buried in the backslope.

For the PCB, either the buried in berm or the sloped end may be used for lower speeds:

- buried in berm (Chapter 5)—recommended for 30 km/h or less with a 1.8-m to 3-m end taper in case of soil settlement;
- sloped end—when other treatments are unfeasible, a sloped end may be used for speeds 45 km/h or less or conditions corresponding to Test Level 1 in NCHRP Report 350.[9] Generally, as the slope steepness increases, impact severity of this treatment will increase; but the probability of an impact in the sloped section will decrease as the slope increases.

For the Triton barrier, an empty section on the beginning of a length of Trition barrier run has been found satisfactory for use as an end treatment and/or crash cushion by crash testing.

Transitions

As for permanent barriers, adequate transitions should be made between barriers of differing flexibility or between a bridge rail and a temporary roadside barrier.

9.1.1.5 Applications

The length of barrier affects its redirective capability. Shorter lengths may not effectively decrease the hazard

9.1.1.1 Portable Concrete Safety Shape

Portable concrete safety shape barriers, also known as portable concrete barriers (PCBs), are widely used in work zones to protect motorists as well as workers. However, improper use of these barriers can provide a "false sense of security" for both. Therefore, care must be taken in their design, installation, and maintenance.

PCBs are free-standing precast concrete sections 2.4 to 9 m in length with built-in connecting devices. Barrier weight varies from 600 to 750 kg/m depending on exact cross-section geometry and amount of reinforcement. The mass of individual segments can vary from 2000 to 7500 kg, thus requiring heavy equipment for installation and removal. Adequate longitudinal reinforcement and positive connections insure that the individual sections act as a smooth continuous unit.

The impact performance of PCB depends, among other factors, on segment length and mass, manner in which segments are joined, and manner in which segments are anchored.

The acceptable cross sections are the same as those described in Chapter 6. Corners of barriers may be beveled to minimize snagging of snowplows and to allow placement of the barrier sections in curves. A disadvantage is that, with the removal of the corners, resisting moment to lateral displacement is reduced.

When impacted, the mass of the PCB and friction between the PCB and the underlying surface tend to limit movement and overturning. Each section should be properly connected to the adjacent section to provide barrier continuity to resist movement, snagging, and/or instability of impacting vehicle. When lateral displacement of the barrier cannot be tolerated, it may be necessary to anchor the PCB to the underlying surface to prevent lateral movement. This can be done with drift pins or anchor bolts attached to the pavement or bridge deck. The pins or bolts should not protrude beyond the face of the PCB. Another method to limit sliding is to provide a mechanical interlock between the barrier and the pavement surface. This mechanical interlock can be provided by placing the PCB on a grout bed.

The designer should allow for adequate drainage through the PCB to prevent ponding.

Flare Rates

Flare rates for temporary barriers should be selected to provide the most cost-beneficial safety treatments possible. Low flare rates lead to longer flared sections and increase the number of impacts with the temporary barrier. Higher flare rates lead to shorter flared sections and fewer impacts but, for those impacts, increase the severity of redirection accidents and the number of barrier penetration accidents. Benefit/cost analyses of temporary concrete barriers indicate that total accident costs appear to be minimized for flare rates ranging from 4:1 to 8:1. A flare rate of 5:1 or 6:1 may be slightly more favorable for urban streets with high traffic volumes where speeds are lower and impact angles are higher.

Offset

A minimum offset of 0.6 m from the traveled lane to the PCB is desirable.

Types of Portable Concrete Barrier (PCB) Connectors[4]

To perform properly and redirect vehicles, the PCB system should be capable of withstanding severe impacts. A PCB system's weakest point is its joint which includes the physical connection and mating faces of adjoining segments. The methods for connecting PCB segments vary widely.

TABLE 9.1 Design for Temporary Barriers

Type	PCB	Quick Change	Low Profile	Triton
Structural adequacy	Variable depending on the type of joint	*	TL-2**	TL-2**
Deflection	0-1.5 m	1.5 m	.125 m	3.8 m
Typical Uses	Two-lane, two-way operation Shielding obstacles and false work Shielding edge	Shielding for changeable lanes	Work sites in urban and suburban areas where sight distance is a problem	Shielding where high portability is desired: i.e., rapidly changing and/or emergency traffic control measures. Protection in congested urban work sites.

* NCHRP Report 230 — 2000-kg passenger car at 25 degrees and 92 km/h

** NCHRP Report 350 — 2000-kg pickup at 25 degrees and 70 km/h