

Proper installation of Roadside Safety Hardware

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Discussion

- Proper installation
 - Location
 - Foundations
- Transitions
- Maintenance
 - Repair parts

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Can still hit the through the GAP



Monorail system with BAD anchoring



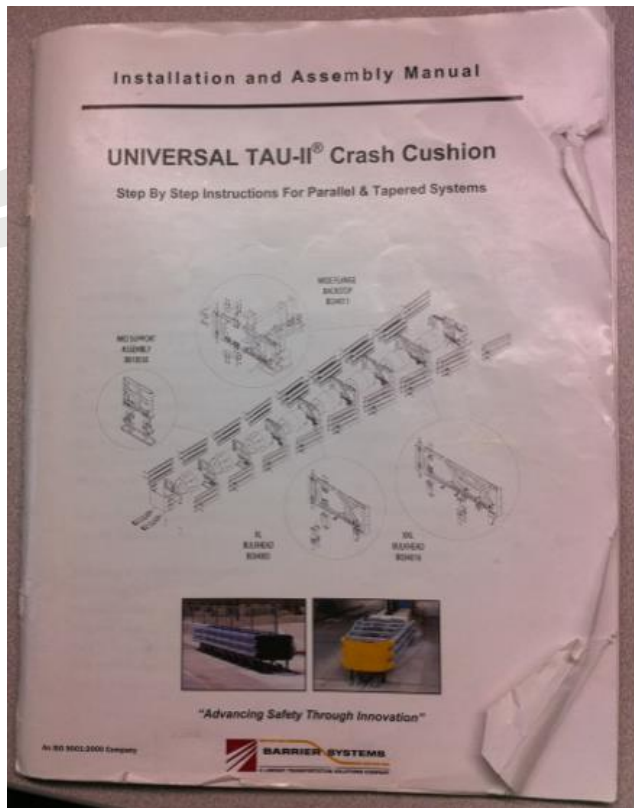
- Legs must be free to slide back along the monorail
- Are the anchors properly embedded?
- Understanding how the system works and proper install is critical to savings lives.

System performance- Bad anchors



- Dirt in the holes
- Bad epoxy
- Bad concrete
- Something else

Proper use of an installation manual



- This one has been used
- Review before install most manufacturers have good tips
- Ask for one in YOUR local language
- Manage your liability with a proper install
- Suggest a post install inspection program

Foundations are critical

FOUNDATION SPECIFICATIONS:

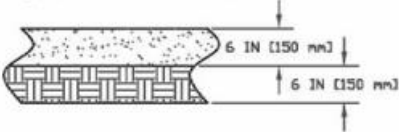
THE TAU-II CRASH CUSHION SYSTEM HAS BEEN DESIGNED TO ATTACH TO CONCRETE OR ASPHALT FOUNDATIONS. USE THE ANCHORAGE SPECIFIED BELOW DEPENDING ON THE FOUNDATION AT THE JOB SITE. REFERENCE UNIVERSAL TAU-II FOUNDATION DRAWINGS FOR FURTHER DETAIL.

1.) CONCRETE PAD



FOUNDATION: MINIMUM 6 IN. [150 mm] REINFORCED PCC PAD OR 8 IN. [200 mm] NONREINFORCED PCC PAD
 ANCHORAGE: 3/4 IN. [20 mm] X 8 1/4 IN. [210 mm] GALVANIZED ANCHOR WITH 6 IN. [150 mm] EMBEDMENT

2.) ASPHALT OVER SUBBASE



FOUNDATION: MINIMUM 6 IN. [150 mm] AC OVER 6 IN. [150 mm] COMPACTED DGA SUBBASE

ANCHORAGE: 3/4 IN. [20 mm] X 18 IN. [460 mm] GALVANIZED ANCHORS WITH 16 IN. [410 mm] EMBEDMENT

ASPHALT ANCHORING KIT REQUIRED

3.) ASPHALT ONLY

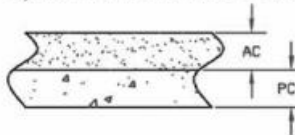


FOUNDATION: MINIMUM 8 IN. [200 mm] AC

ANCHORAGE: 3/4 IN. [20 mm] X 18 IN. [460 mm] GALVANIZED ANCHORS WITH 16 IN. [410 mm] EMBEDMENT

ASPHALT ANCHORING KIT REQUIRED

4.) ASPHALT OVER P.C. CONCRETE



FOUNDATION: AC OVER PCC.

ANCHORAGE: 3/4 IN. [20 mm] GALVANIZED ANCHORS WITH MINIMUM 6 IN. [150 mm] EMBEDMENT IN PCC - ASPHALT ANCHORING KIT NOT REQUIRED OR

IF 6 IN. [150 mm] EMBEDMENT IN PCC IS NOT POSSIBLE USE 3/4 IN. [20 mm] X 18 IN. [460 mm] GALVANIZED ANCHORS WITH 16 IN. [410 mm] EMBEDMENT - ASPHALT ANCHORING KIT REQUIRED

MATERIAL SPECIFICATIONS

PORTLAND CEMENT CONCRETE (PCC)



STONE AGGREGATE CONCRETE MIX, 4,000 PSI [28 MPa] MINIMUM COMPRESSIVE STRENGTH (SAMPLING PER ASTM C31-84 OR ASTM C42-84A, TESTING PER ASTM C39-84)

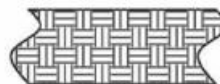
ASPHALTIC CONCRETE (AC)



AR-4000 A.C. (PER ASTM D3381 '83) 75' MAXIMUM, MEDIUM (TYPE A OR B) AGGREGATE

SIEVE SIZE	% PASSING
1"	100
3/4"	95-100
3/8"	65-80
No. 4	49-54
No. 8	36-40
No. 30	18-21
No. 200	3-8

COMPACTED SUBBASE (DGA)



6 IN. [150 mm] MINIMUM DEPTH, 95% COMPACTION, CLASS 2 AGGREGATE

SIEVE SIZE	% PASSING
3"	100
2 1/2"	90-100
No. 4	40-90
No. 200	0-25

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Typical Types of Hazards for Crash Cushion Use

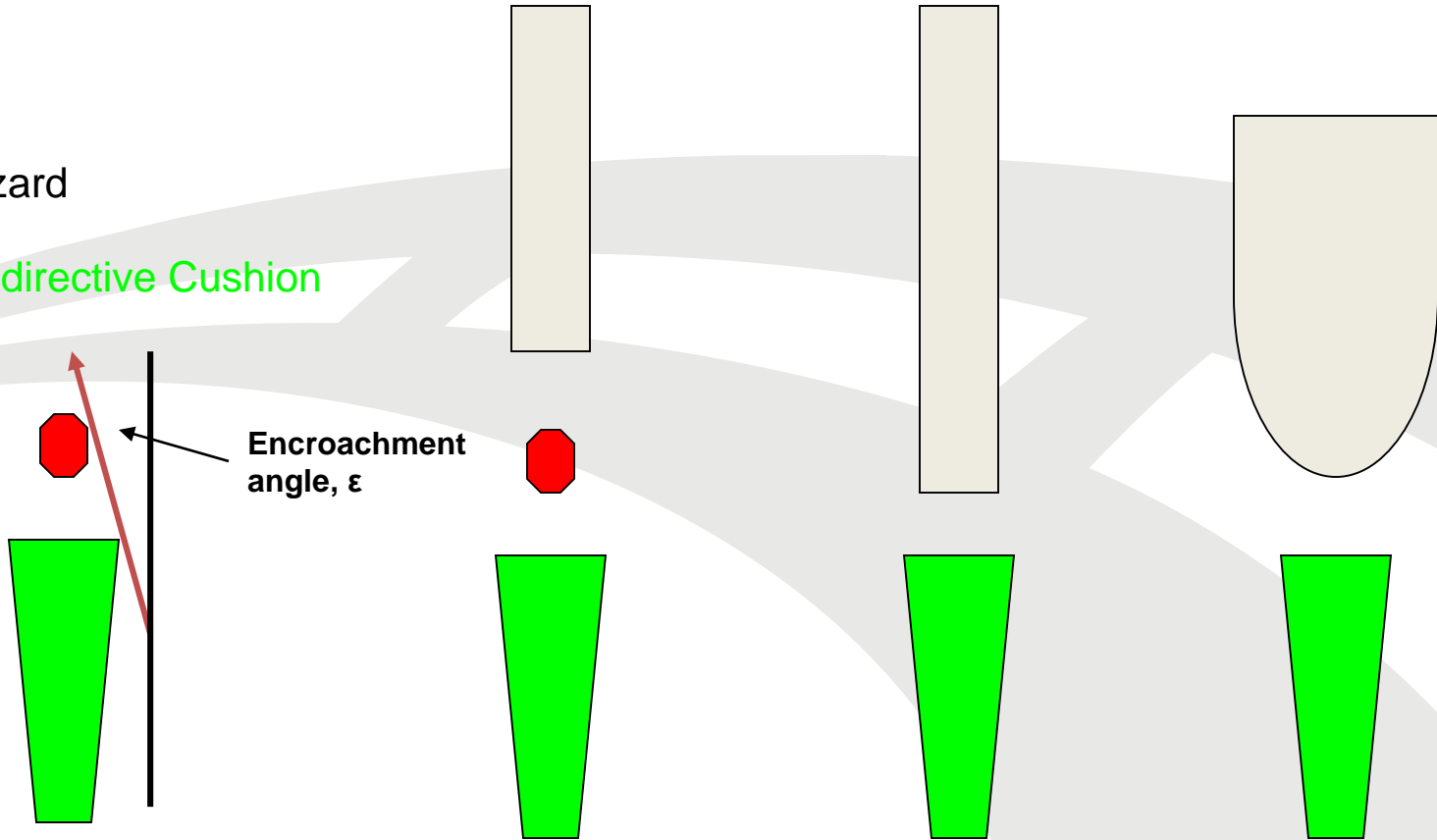
Must ensure that the obstacle is adequately shielded



Hazard



Re-directive Cushion



Point Hazard
(Typically Uni - Dir.)

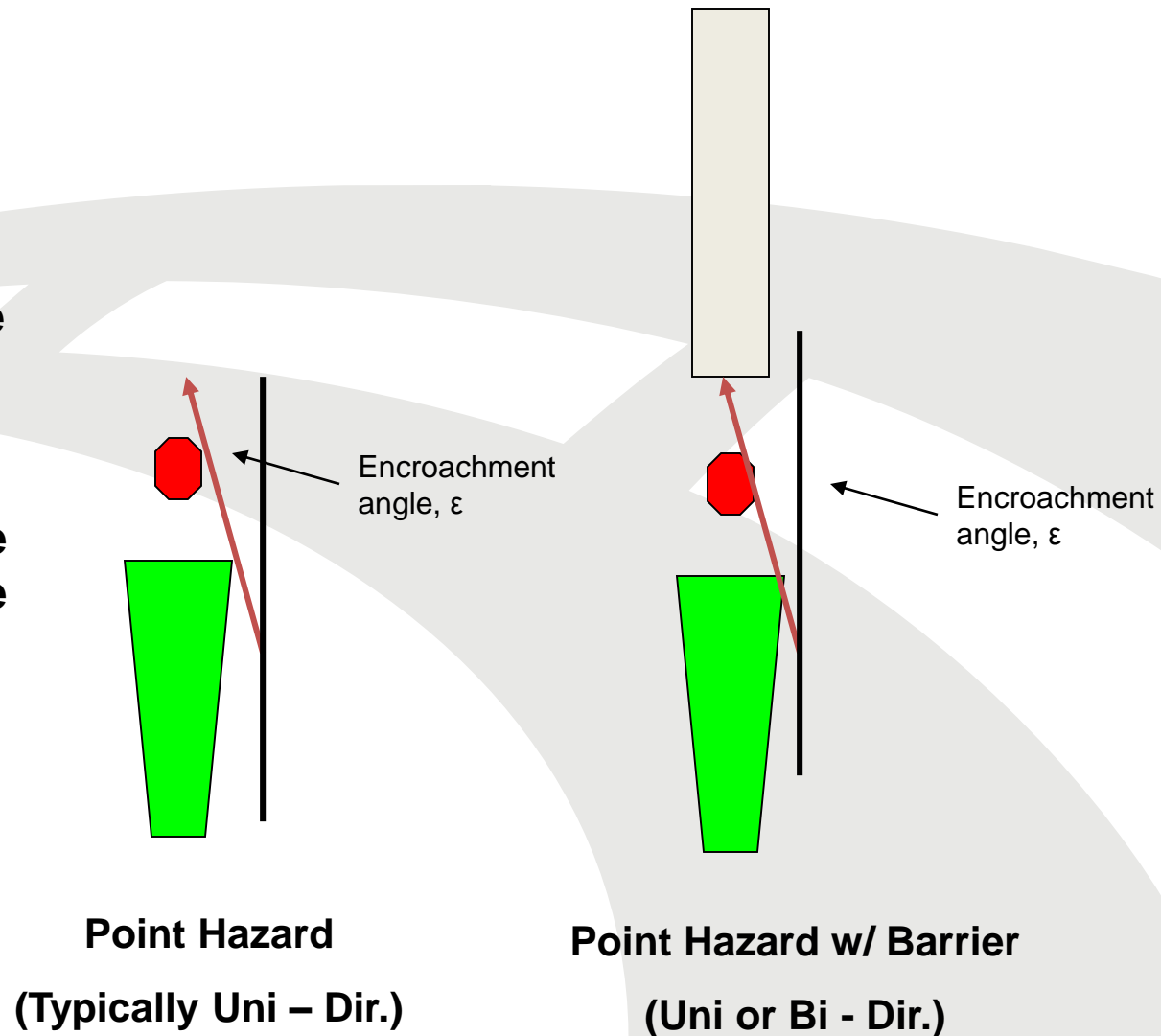
**Point Hazard w/
Barrier**
(Uni or Bi - Dir.)

**Barrier* End
Hazard**
(Uni or Bi - Dir.)

Prow Hazard
(Uni or Bi - Dir.)

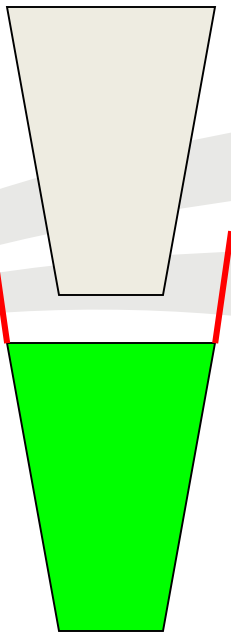
Approach Side Encroachment Considerations

Encroachment angle (ϵ) is the qualification angle of barrier elements (i.e. 25 degrees for NCHRP 350 and 20 degrees for EN1317. Ensure that the errant vehicle is not able to impact the hazard at the selected nominal angle.

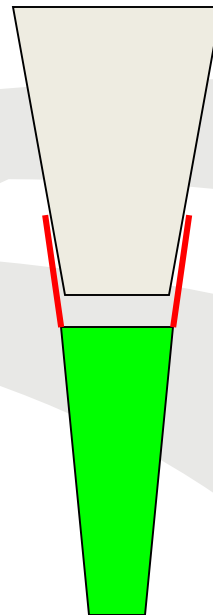


Typical Options for Uni-Directional Installations

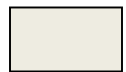
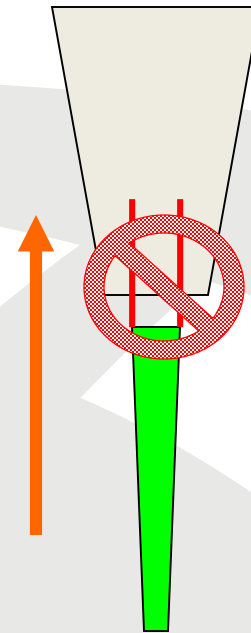
Wide Cushion



Medium Cushion



Narrow Cushion



Hazard



Re-directive Cushion

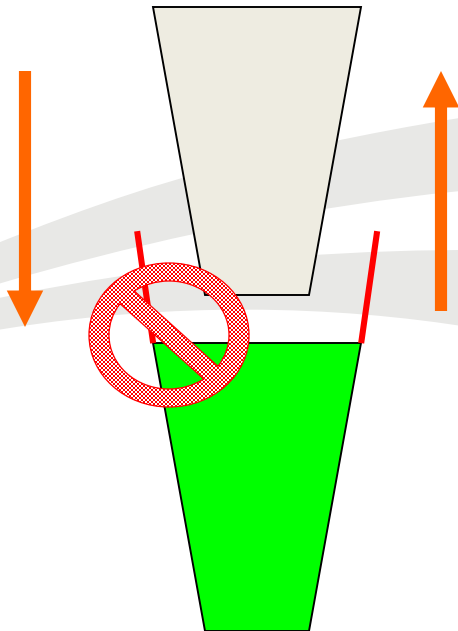


Rear Panel

Not Acceptable. Rear sliding panels may interfere with Hazard – Must use wider system or move unit forward and use a transition.

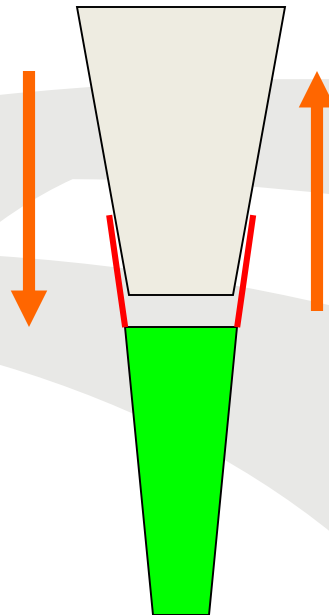
Bi-Direction Installations

Wide
Cushion

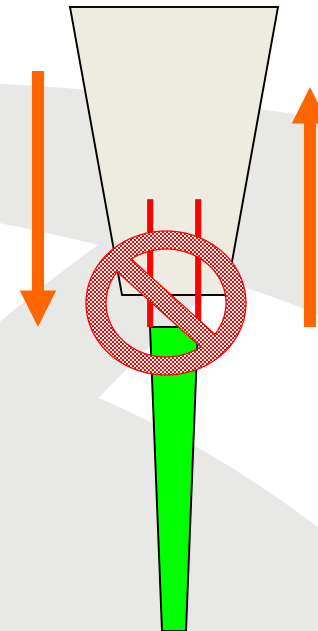


Not Acceptable.
Opposite direction
impacts snag on
rear facing panels.
See next slide.

Medium
Cushion

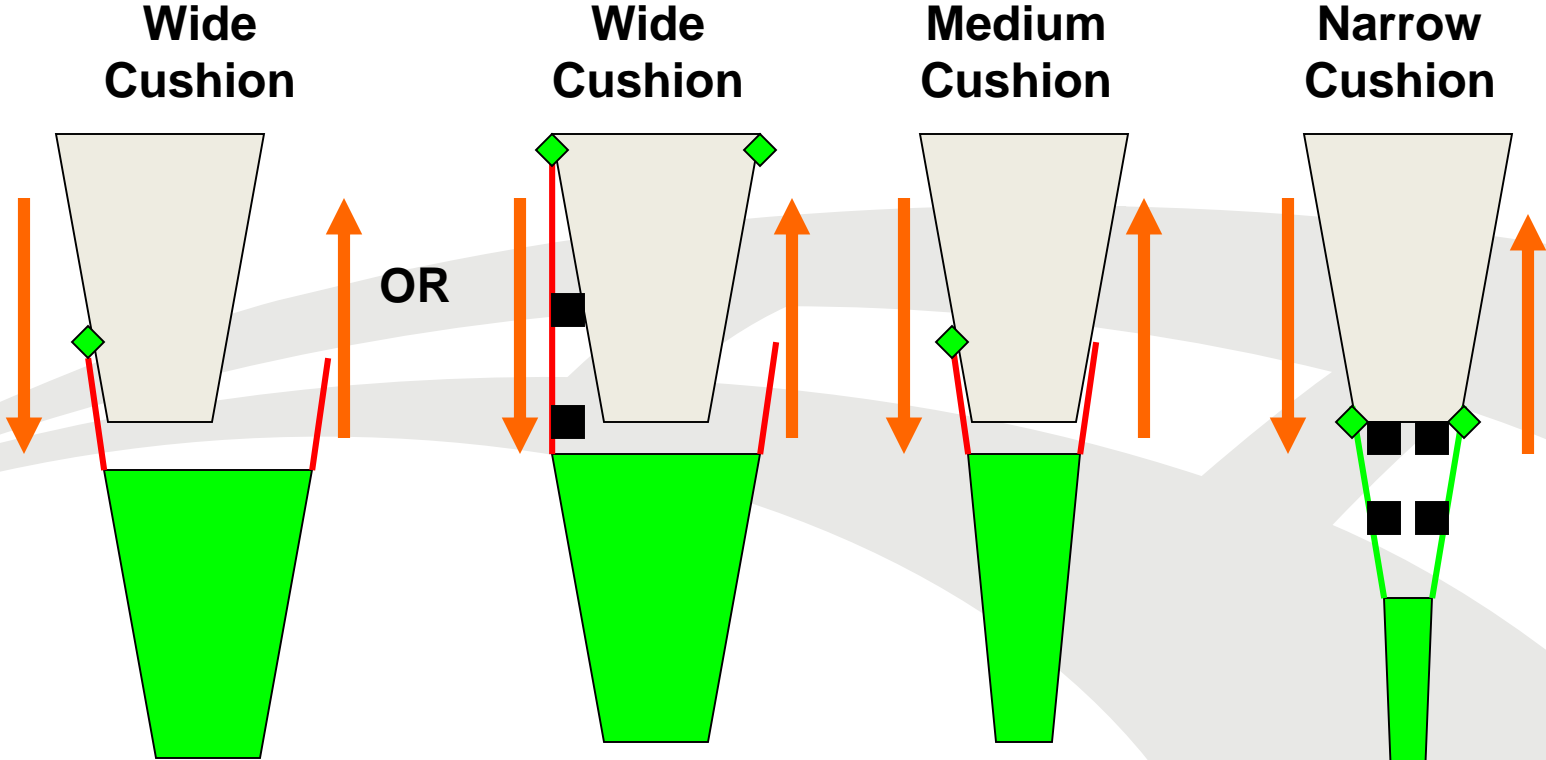


Narrow
Cushion



Not Acceptable.
Rear sliding panels
may interfere with
Hazard – See next
slide

Bi-Direction Solutions



OR

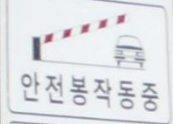
Use narrower cushion, move to one side or move forward and use proper transitions.

- Posts
- ◆ Non-Snag Attachment

Use wider cushion or move further from hazard and use transition to adapt to hazard.

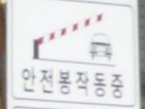
SEOUL
SUMMIT
2010

하이패스 전용



30

하이패스 전용



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Good transition but what did we protect



We left the bull nose unprotected

Reverse Snag points



Old
NCHRP
230 System

No longer
acceptable
under 350
or MASH

Correct Transition installation



2011/08/09

Correct Transition installation



Correct Transition installation



Correct Transition installation



- Wide System with Guardrail transitions

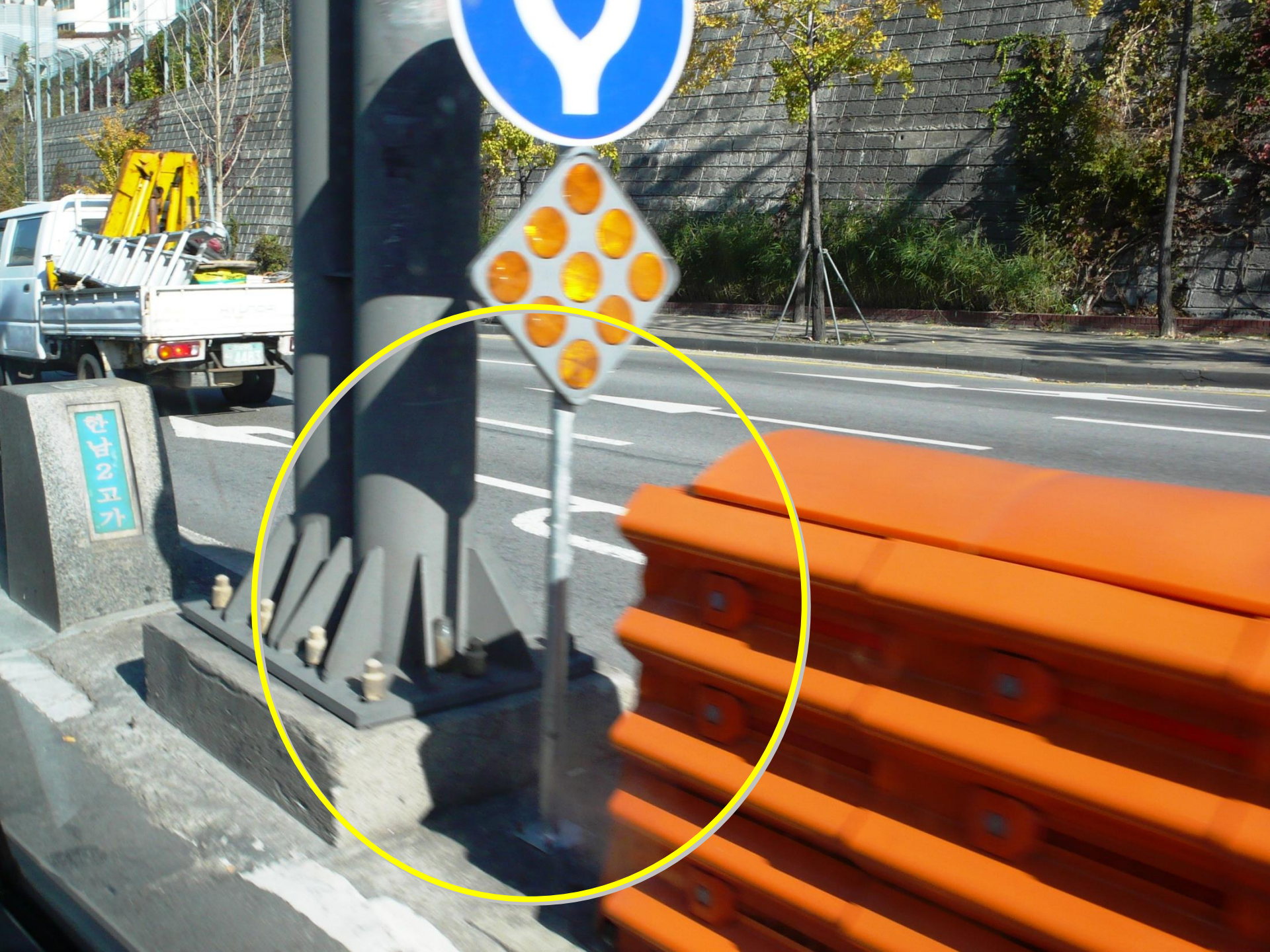


Flare Rates for Transitions and Attached Barriers



“Wrong Way” (Departure) Transitions





한남2교가

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Whats This



Why not fix the crash cushion back to its design criteria instead of adding something in front

Did they not stock spare parts

Now need two trips

Post Impact inspection and repair



Successful deceleration it worked

WHATS NEXT

- Check the asphalt anchors for pull out or movement
- Repair the cartridges / panels and other parts
- Re-torque to specs

What would the heavy barrel do to a windshield



Lets not hit the crash cushion



Launch the car and hurt someone

Protect the crash cushion from impact

?????????



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