"Practical Road Safety Engineering" online workshop

Module 2 - roadside hazard management

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Welcome back everyone

"Practical Road Safety Engineering" online workshop

MODULE 2 – ROADSIDE HAZARD MANAGEMENT

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Objectives of this module:

- To explain roadside hazard management
- To outline the three groups of safety barriers
- To provide some guidance about where to use – and not use – safety barriers
- To show safety issues relevant to barriers

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- "Single vehicle run-off-road" crashes are the single biggest group of serious and fatal crashes in most countries.
- They are particularly severe.
- They may be due to speed, inattention, fatigue, alcohol, or all.
- We can never be sure where/ when a vehicle will leave a road.

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Wear your seat belt!

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CAREC now has a manual on "Roadside Hazard Management"

English
Russian
Mongolian
Chinese

Download from the ADB website

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What is Roadside Hazard Management ?

Roadside hazard management aims to.....
"identify, prioritise and treat roadside hazards in order to maximise safety by reducing the incidence and/or severity of such crashes.

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What is a Clear Zone ?

"A drivable roadside area that should be kept clear of hazardous objects in order to minimise the danger of a collision, should a vehicle leave the road".

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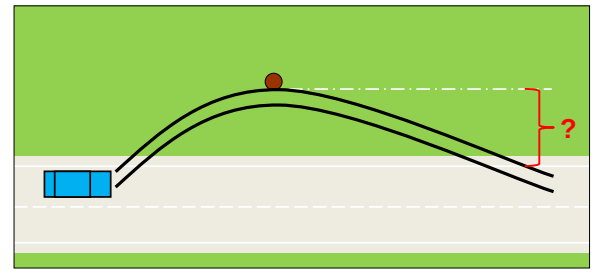
What is a Clear Zone ?



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How do we determine the Clear Zone for a road?

The clear zone depends on:

- vehicle speeds
- vehicle volumes
- road curvature
- embankment slope

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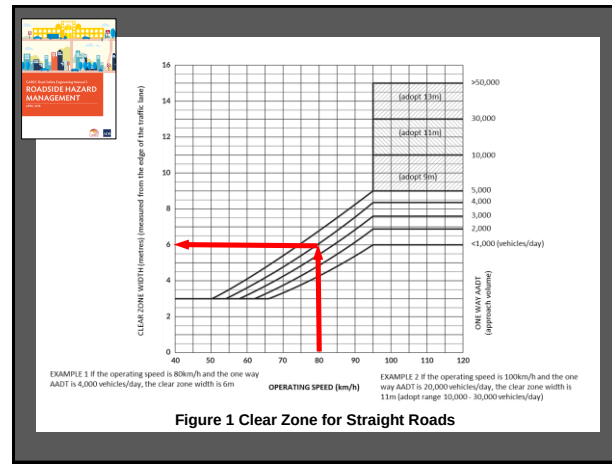

Figure 1 Clear Zone for Straight Roads

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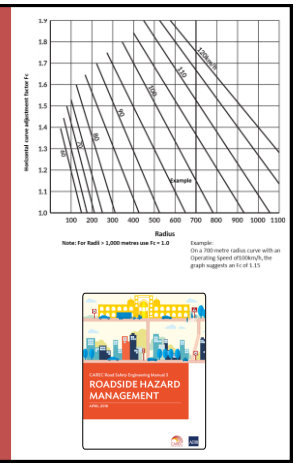
Figure 2 Clear Zone Adjustment Factors for Curves



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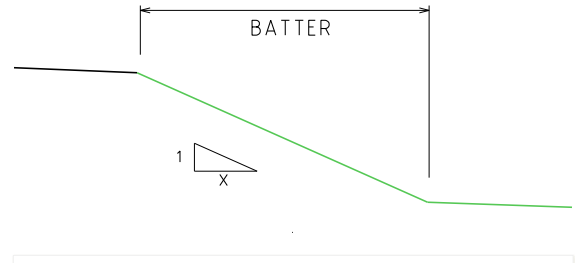

Maximum Side Slopes

- 6H:1V Drivable limit for trucks
- 4H:1V Drivable limit for cars
- 3H:1V Limit for mowing
- 2H:1V Generally requires planting
- 1.5H:1V Often requires beaching

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So, what is a roadside hazard?

Anything that is "fixed", with a diameter of 100mm or more, and is on the roadside, within the clear zone.

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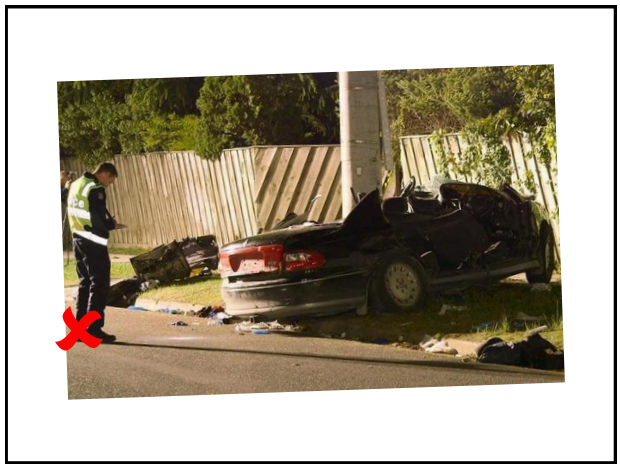

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TABLE 1-1 U.S. Motor Vehicle Occupant Fatalities in Crashes in Which Striking a Roadside Object Was the Most Harmful Event, Selected Roadside Objects, 2010–2015

Year	End Terminal	Guardrail	Concrete Barrier	Cable Barrier	Bridge Rail	Impact Attenuator	Sign Support	Utility Pole/Light Support	Tree	All Occupant Fatalities
2010	71	436	154	21	80	11	104	1,019	3,602	27,889
2011	96	402	154	21	78	14	132	913	3,567	27,140
2012	92	407	176	27	61	22	97	1,013	3,687	28,003
2013	104	393	197	21	55	21	118	921	3,616	27,175
2014	110	372	203	17	82	21	127	957	3,508	26,901
2015	99	405	189	34	68	21	117	926	3,605	28,671

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The three "I's"

- IDENTIFY
- INVESTIGATE
- IMPLEMENT

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A strategy for Roadside Hazard Management

1. Keep vehicles on the road
2. Provide a forgiving roadside

i. remove the hazard
ii. relocate the hazard
iii. alter to reduce severity
iv. shield the hazard using barriers

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Has everything been done to "keep all vehicles on the road"?

- Improve geometry
- Seal shoulders
- Line marking
- Edge lines (tactile)
- Guideposts
- Chevron alignment markers
- Improve sight lines - cut grass

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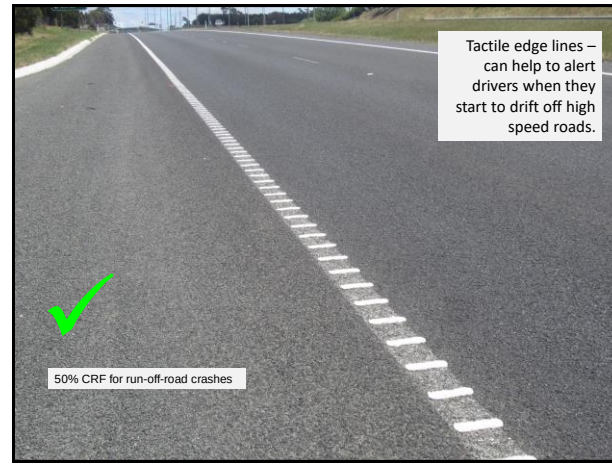

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Guideposts are good – often essential!

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Remove the Hazard

Remove trees, poles
Place power underground
Combine services onto a single pole
Demolish structures

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Relocate the Hazard

Move the hazard to a location outside the clear zone or at least to a less vulnerable position - to reduce risk

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Alter the hazard to reduce impact severity

- frangible lighting poles
  - slip base
  - impact absorbing
- frangible signposts
- "soften" steep slopes (4:1or flatter)
- drivable culverts

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Frangible lighting poles
- slip base
- impact absorbing

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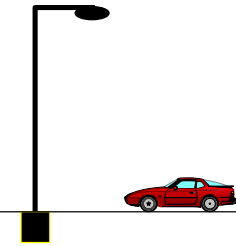
Slip Base Pole

High speed areas – 80km/h plus
Few pedestrians
Little parking



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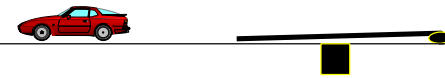
Slip Base Pole



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Slip Base Pole

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Slip Base Pole

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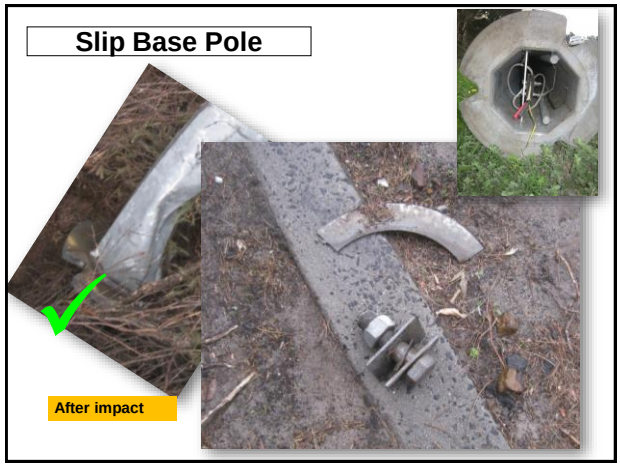
Slip Base Pole



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Impact Absorbing Poles

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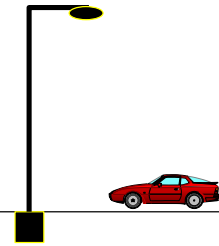
Impact Absorbing Pole

Lower speed areas
More pedestrians and parking



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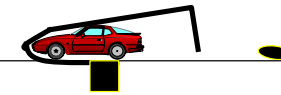
Impact Absorbing Pole



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Impact Absorbing Pole

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Impact Absorbing Pole

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Install safety barrier only to protect people from something "worse"

Use barrier to protect the occupants of errant vehicles from more serious injuries.

It must be correctly designed and installed!

Do not use barrier simply to delineate a bend, or to block access into a side road. There are safer alternatives!

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Safety barriers .....

Remember that safety barriers can be roadside hazards – unless you have good funding and can saturate your highways with flexible barrier, try to design new roads to avoid having to use barrier.

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Three groups of barriers

- Flexible barriers
- Semi-rigid barriers
- Rigid barriers

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Three groups of barriers

Flexible barriers

- deceleration forces on occupants are below the 20g critical impact force
- offer greater deflection (typically 2m), and thus impose lower deceleration forces on occupants
- can be quickly restored when struck
- visually not as unattractive as others?

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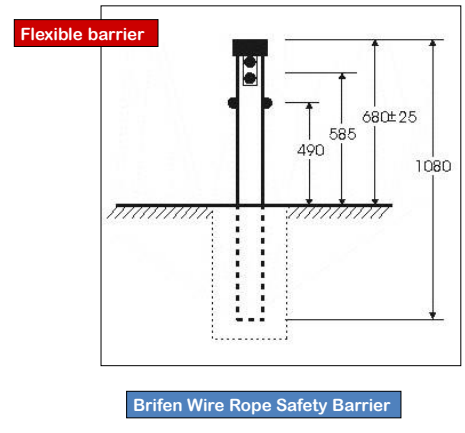

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Ezy-Guard

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Three groups of barriers

Semi-rigid barriers
- Mainly W-beam
- Widely used
- Deflects but not as much as WRSB
- Use block outs to prevent snagging
- Repairs take time
- Safe end terminals are vital

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Three groups of barriers

Semi-rigid barriers

- Deflects up to 1m (with 2.5m post spacing)
- Can reduce deflection by reducing post spacing

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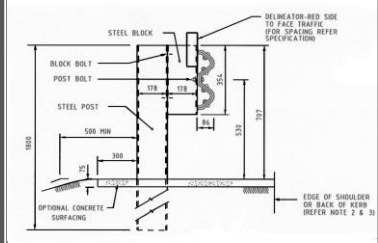
W Beam Safety Barrier



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W Beam Safety Barrier

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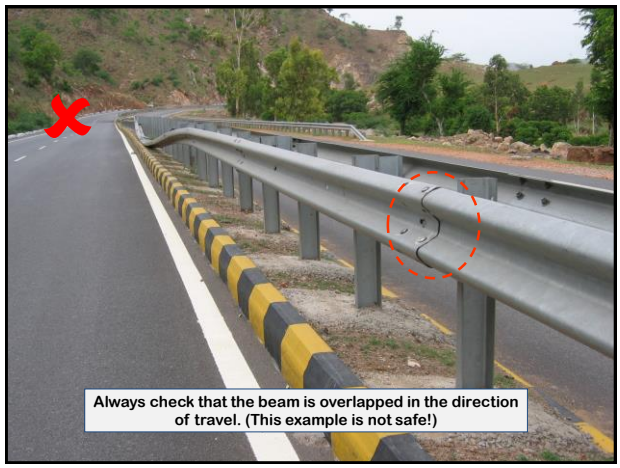

Always check that the beam is overlapped in the direction of travel. (This example is not safe!)

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Three groups of barriers

Rigid barriers

- Cast in place or set in place concrete
- No deflection
- Minimal repairs necessary
- End treatments vital

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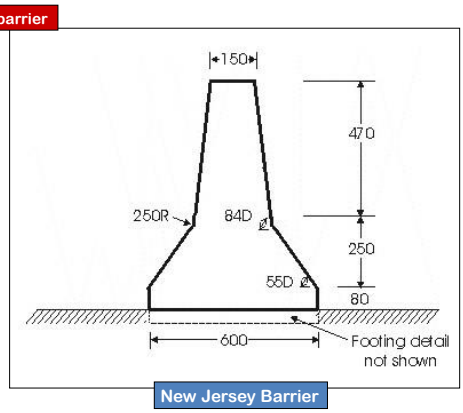
Rigid barrier



New Jersey Barrier

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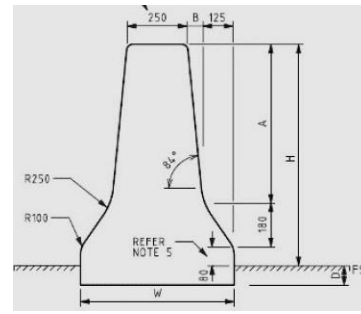
Rigid barrier



F Profile Barrier

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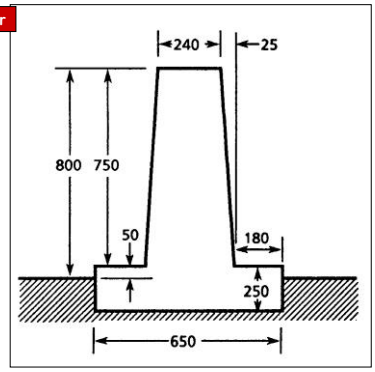
Rigid barrier



Vertical Face Barrier

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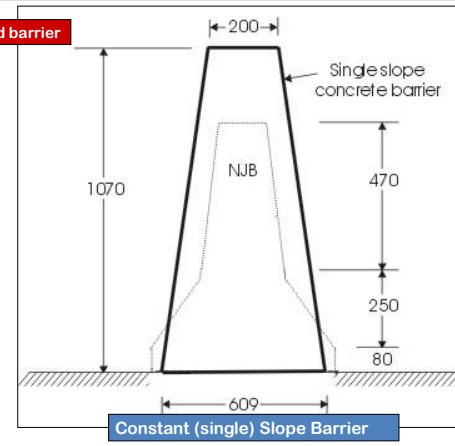
Rigid barrier



Constant (single) Slope Barrier

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Constant (single) Slope Barrier

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Safety Roller barrier

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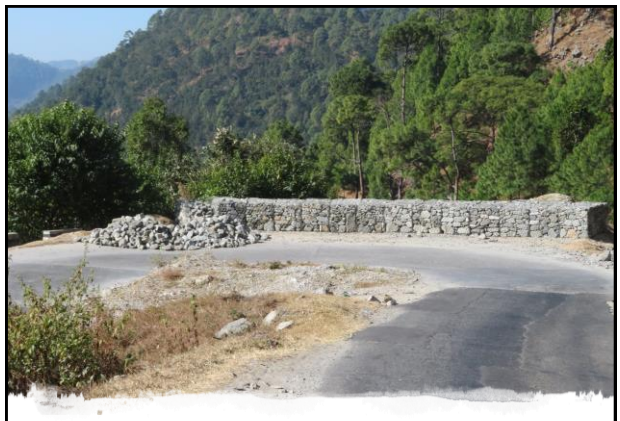

Rock gabion basket – hair-pin bend, Nepal

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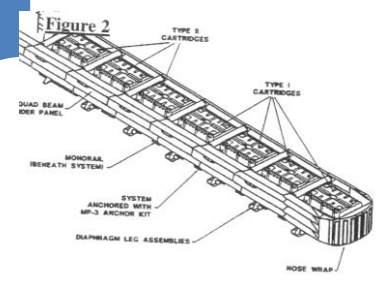
Impact Attenuator



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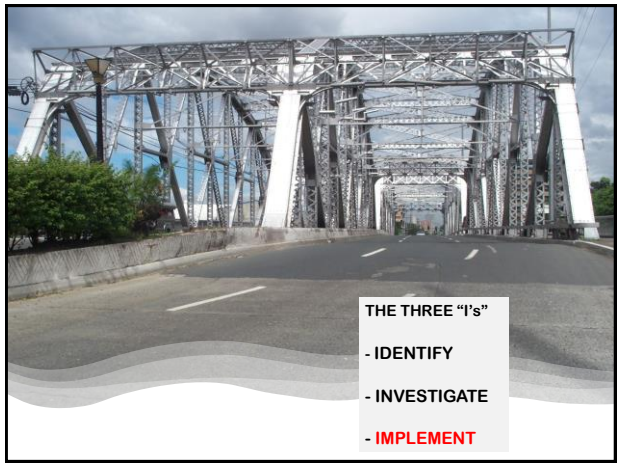

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Nine things to look for when checking barriers

To outline some of the main things to think about when you are inspecting a road and there is barrier involved.

- Length of need
- Barrier length
- Offset to the barrier
- Deflection
- Proximity to kerbs (avoid vaulting)
- Stiffen (prevent pocketing)
- Mounting height (watch for vaulting)
- End treatments (prevent spearing)
- Working Width (snagging)

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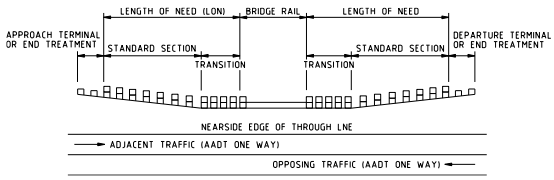

1 Length of need

The length of barrier needed to shield the hazard or area of concern

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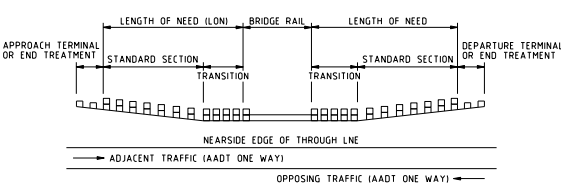

2 Barrier length

The LON (nearside) plus the LON (offside) plus the length of the hazard, plus the end terminals

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3 Offset from lane to the barrier

Offset to the barrier from the traffic lane should generally be as far as possible except for rigid barriers

- Rigid barriers – less than 4 m from lane (to minimise angle of impact)
- Wire rope and W beam barriers – as far as practical
- Try to provide space for broken down vehicles to stop
  - 1.5m desirable minimum
  - 1.0m minimum
  - 0.6m absolute minimum

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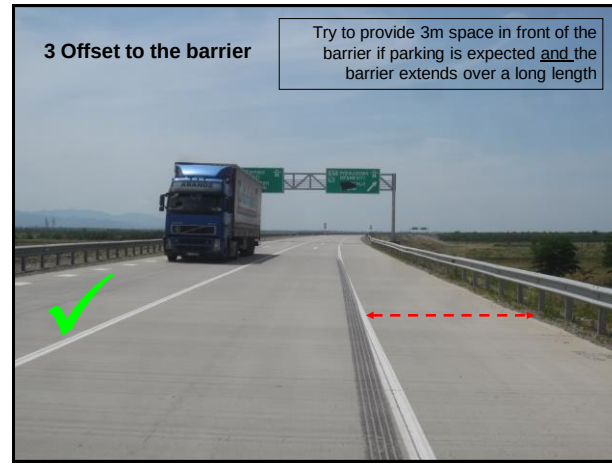

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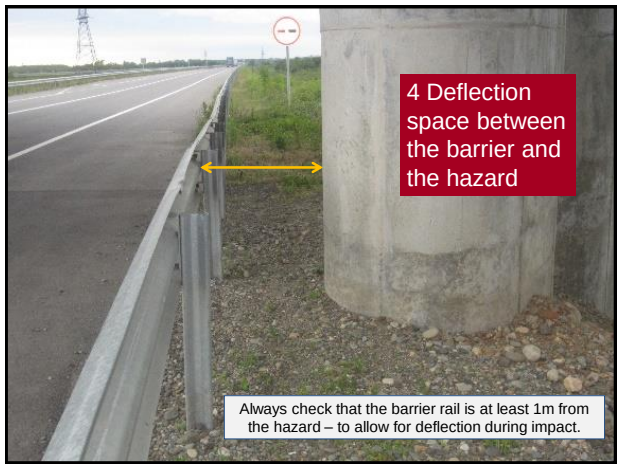

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5 Avoid kerbing near barriers

Have a smooth, paved surface between the traffic lane and the safety barrier (so that an impacting vehicle can hit the barrier at the correct height)

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Avoid kerbing near barriers

Kerb & Channel – do not use on high speed roads. Place barrier at the kerb face or more than 3m behind it.

Semi-mountable kerb – place the barrier either 0 -1m, or more than 3m, behind the kerb.

Mountable kerb – no restrictions on where to place the barrier.

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6 Avoid "pocketing"

Gradually stiffen a semi-rigid barrier as it connects to rigid barrier (to keep an impacting vehicle away from the end of the rigid barrier)

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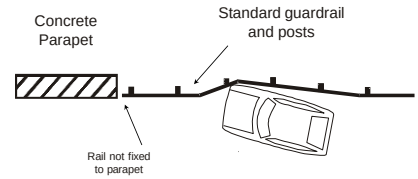
Stiffen (to prevent pocketing)



"Pocketing"

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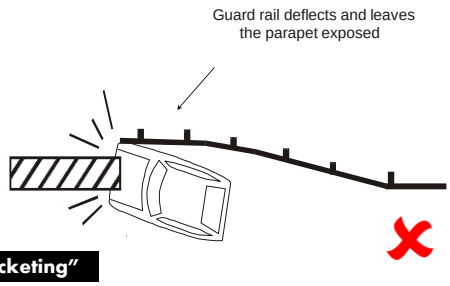
Stiffen (to prevent pocketing)



"Pocketing"

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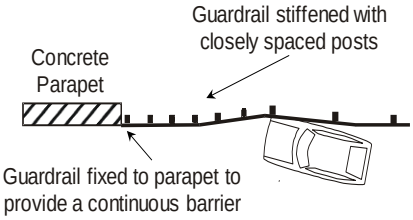

No "Pocketing"

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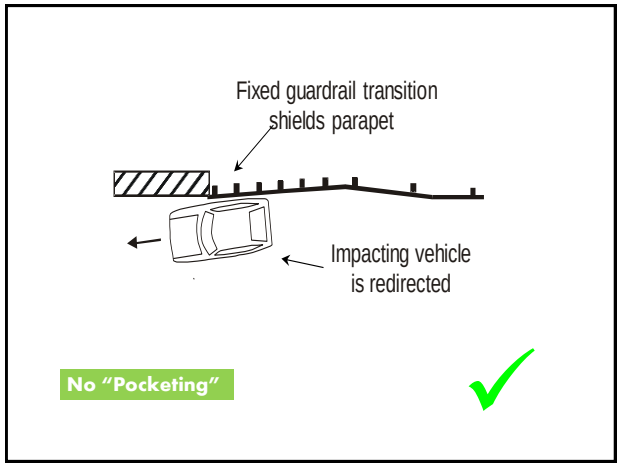

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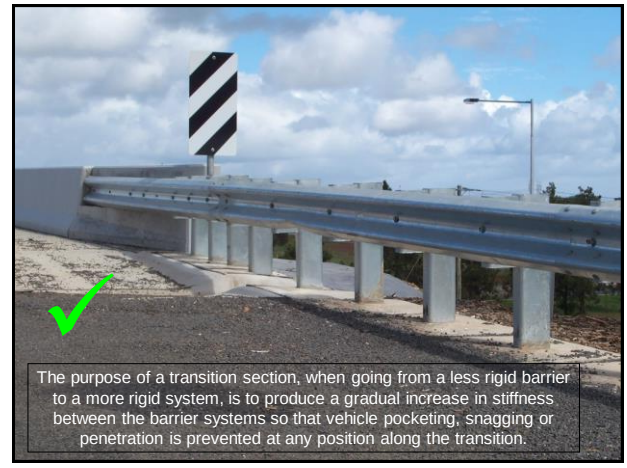

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7 Mounting height

Every barrier needs to be correct height – to reduce the risk of vaulting, or "under sliding" (so the impacting vehicle can hit the barrier at the correct height)

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8 Safe terminals

Every length of barrier has a beginning, and an end. Both ends need safe terminals.

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Impact Attenuator

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9 Working Width

The barrier must be far enough from any upright hazard to prevent "snagging" by large/tall vehicles

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Working width

To prevent snagging of high loads on piers

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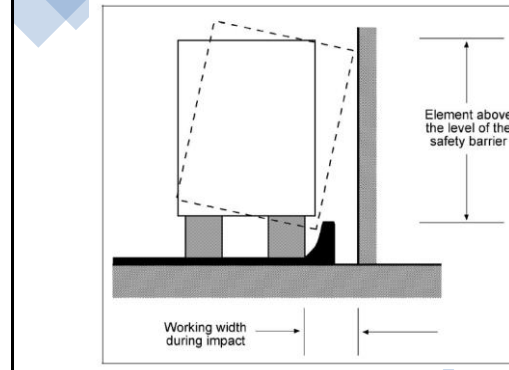

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Table 17 Barrier Working Width

Situation	Dynamic Deflection	Roll Allowance	Working Width
W-beam protecting slopes (can be penetrated by trucks)	1.7	1.1	2.8 (Light vehicles)
Concrete barrier protecting sign gantry or pedestrian bridge	0.0	3.0	3.0[17] (Trucks)
Concrete barrier protecting road bridge	0.0	2.1	2.1 (Trucks)

Working width: the width that includes the barrier deflection plus the roll distance of an impacting high vehicle. It is a necessary consideration when designing barriers to shield hazards such as bridge supporting piers on expressways from impacts by large trucks. For rigid barriers this is also known as the Zone of Intrusion.

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Working width – OK

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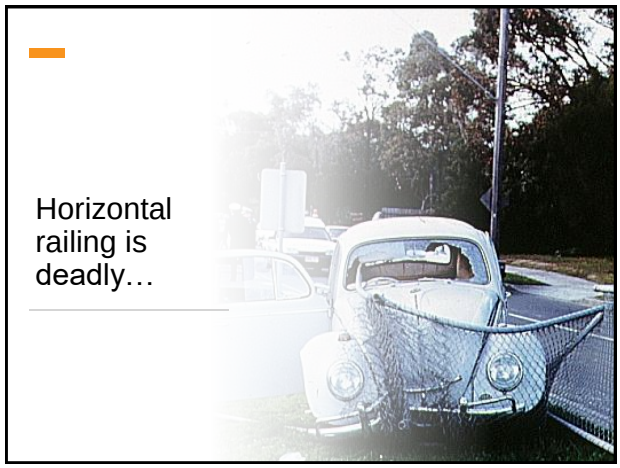

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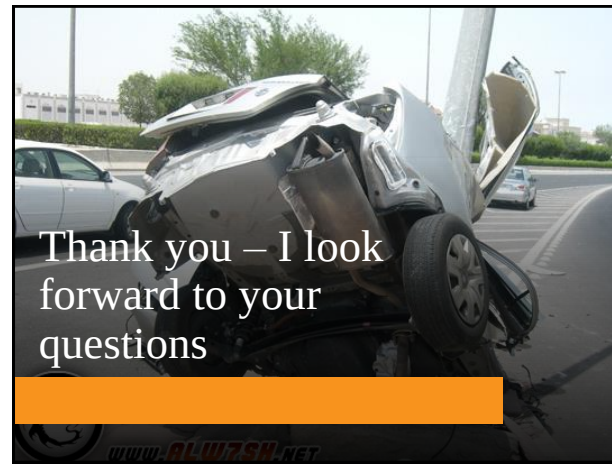

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