Roadside hazard management for CAREC roads and highways

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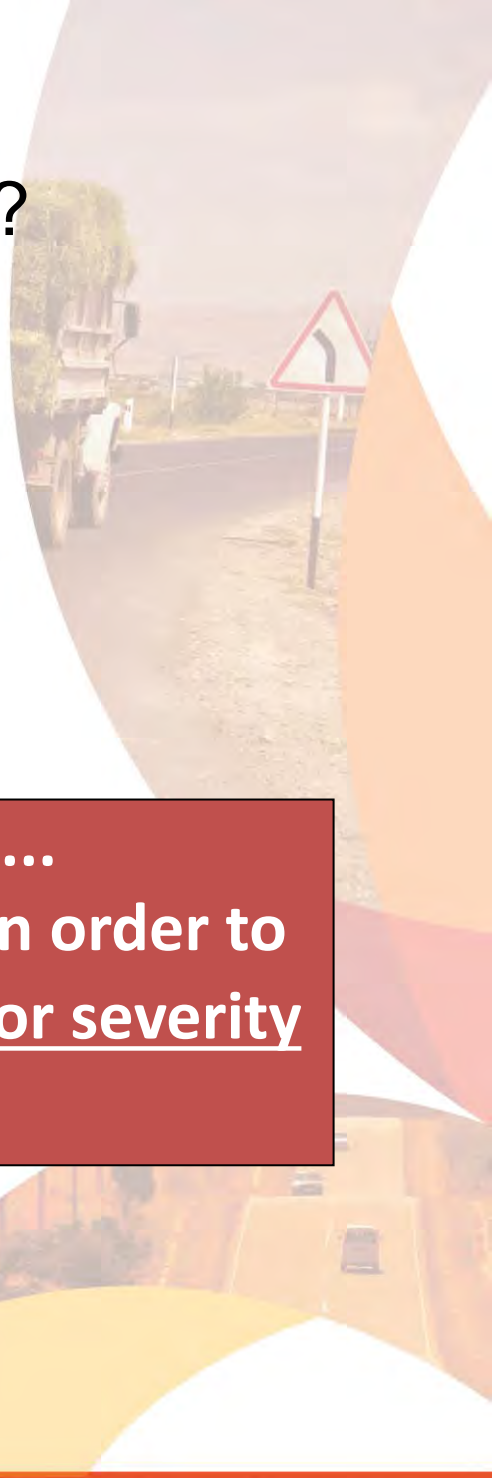
International Pty Ltd

Roadside safety is important

Objectives of this session:

- To explain roadside hazard management, and the clear zone principal
- To outline the three groups of safety barriers
- To stimulate discussion about “standards” and how to promote roadside hazard management programs

What is Roadside Hazard Management ?

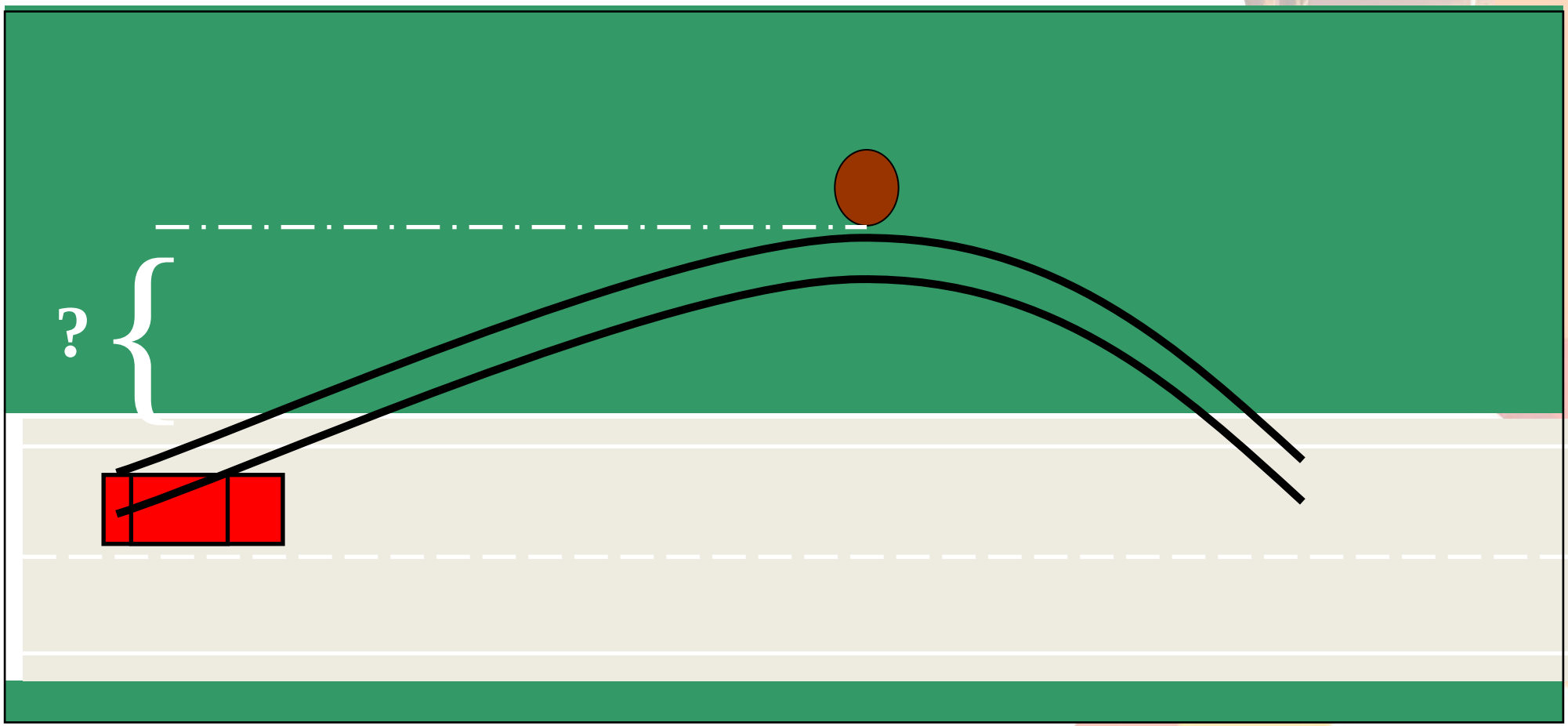


Roadside hazard management aims to.....
"identify, prioritise and treat roadside hazards in order to maximise safety by reducing the incidence and/or severity of such crashes.

What is a Clear Zone ?

A driveable 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.

What is a Clear Zone ?

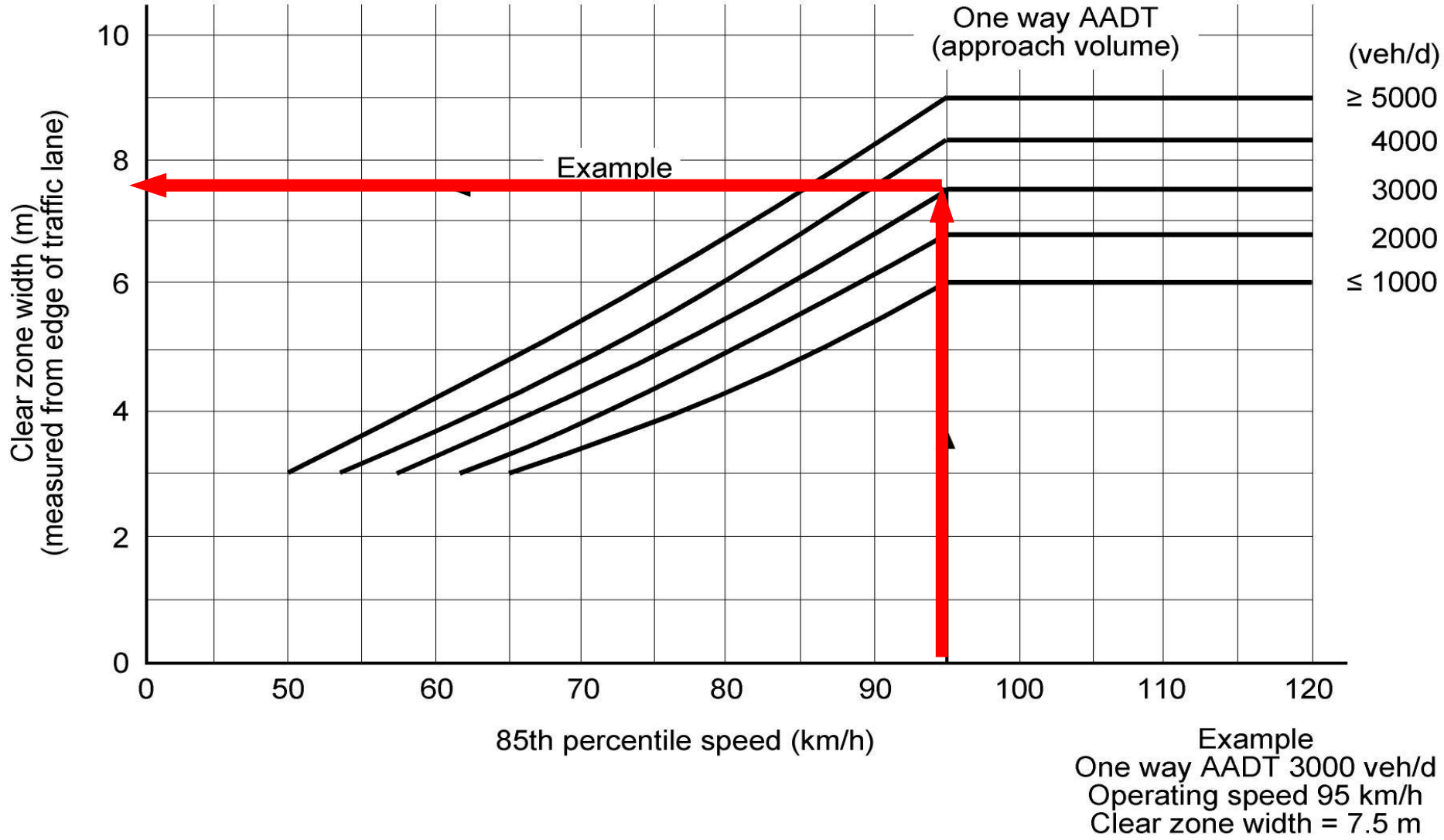


How do we determine the Clear Zone for a road?

The clear zone depends on:

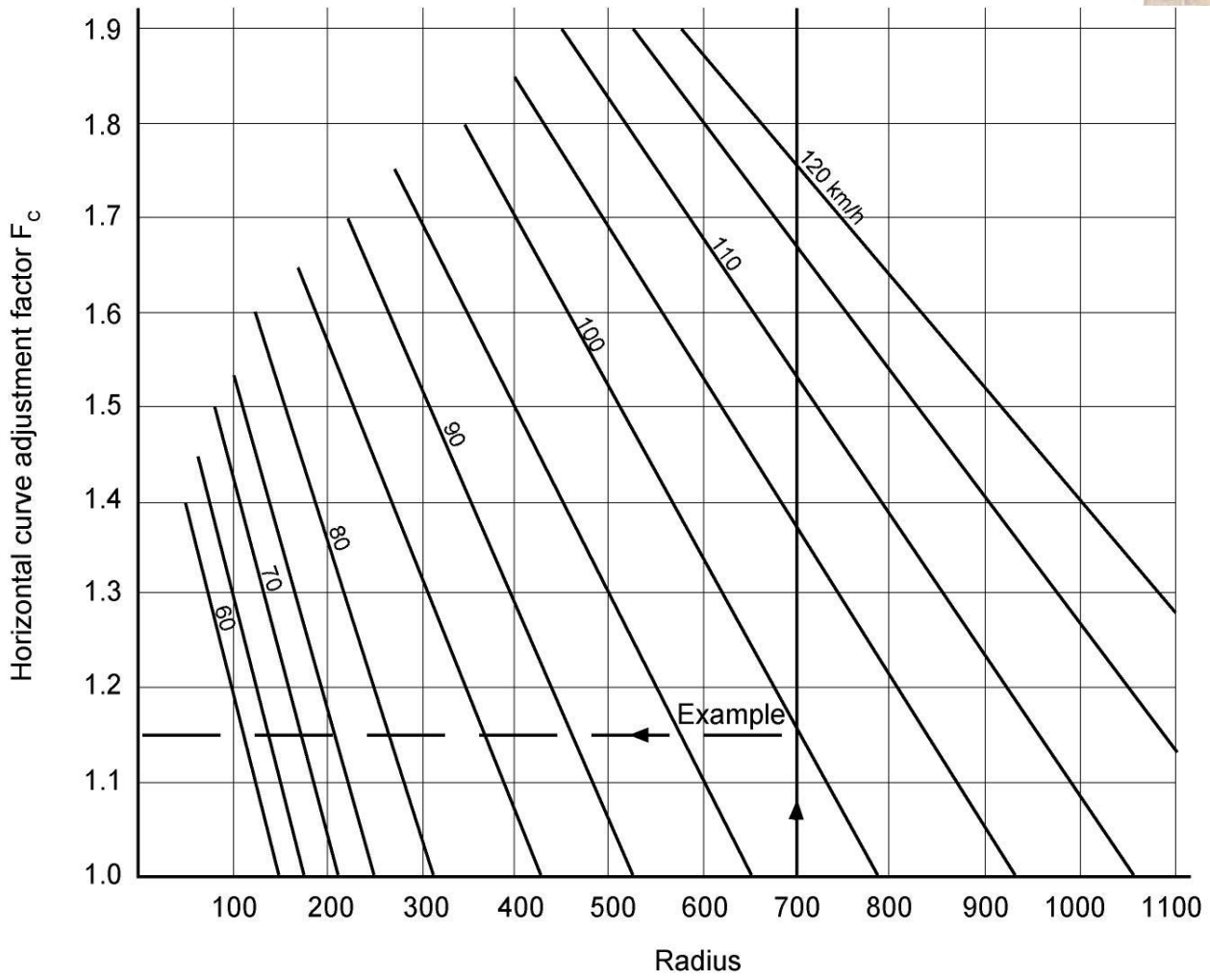
- **vehicle speeds**
- **vehicle volumes**
- **road curvature**
- **embankment slope**

How do we determine the Clear Zone for a road?



Example
One way AADT 3000 veh/d
Operating speed 95 km/h
Clear zone width = 7.5 m

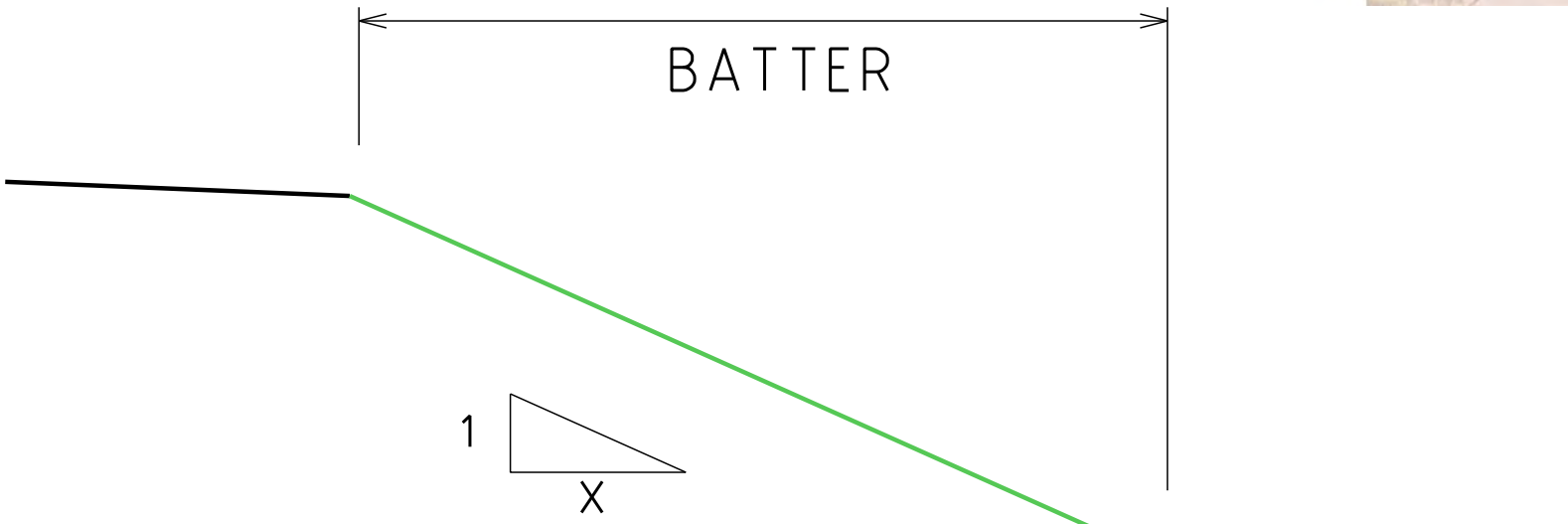
EFFECT OF HORIZONTAL CURVES ON CLEAR ZONE



Note: For Radii > 1000 metres use F_c = 1.0

Example:
On curves, a 700 metre radius curve at an Operating Speed of 100 km/h suggests an F_c of 1.15

Batter Slopes



- **6:1 Driveable Limit for Trucks**
- **4:1 Driveable Limit for Cars**
- **3:1 Limit for Mowing**
- **2:1 Generally Requires Planting Out**
- **1.5:1 Often Requires Beaching**

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 using barriers/attenuators**

Remove the Hazard

- **Remove trees**
- **Use underground power line**
- **Combine poles**
- **Demolish structures**

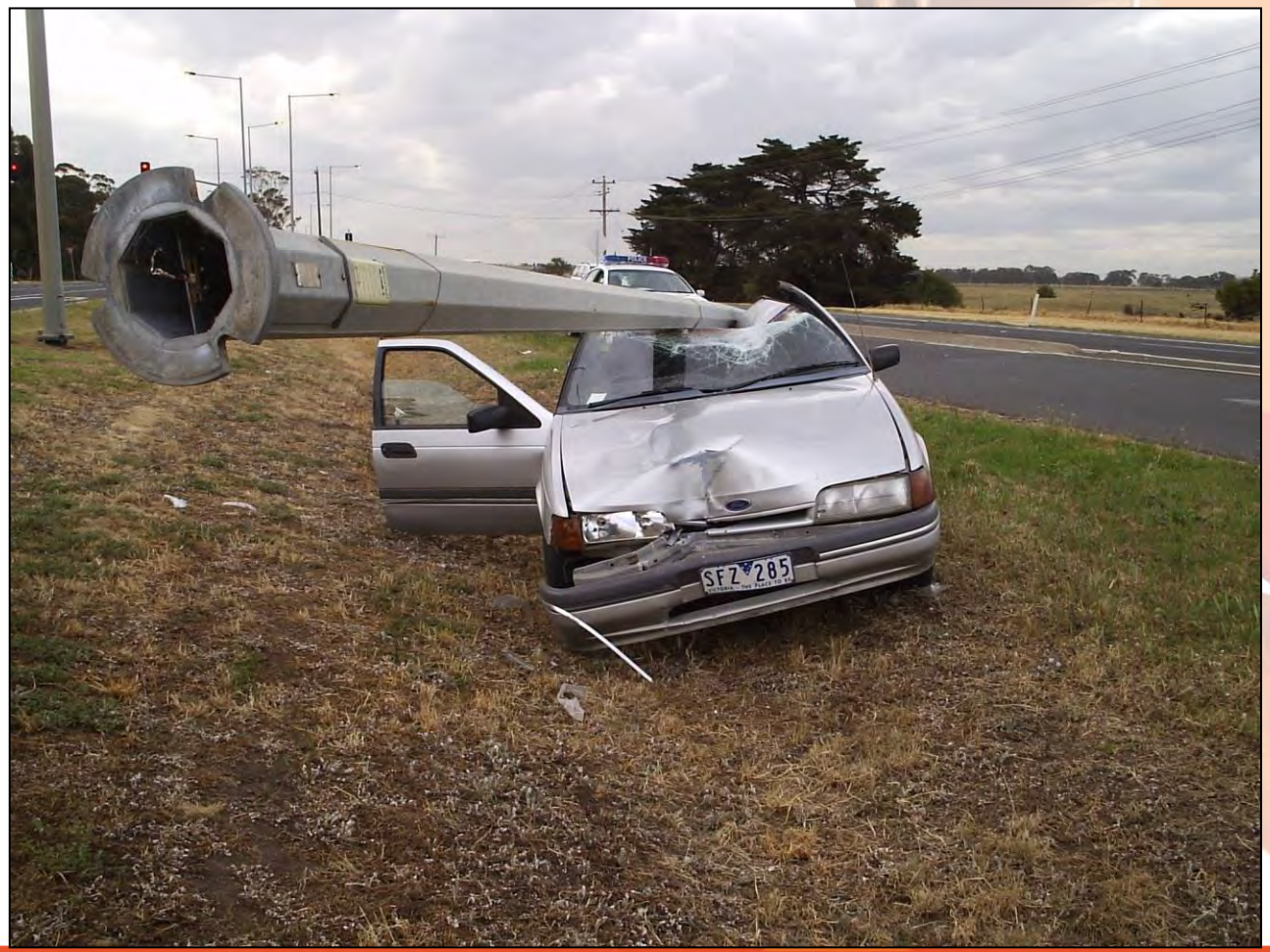
Relocate the Hazard

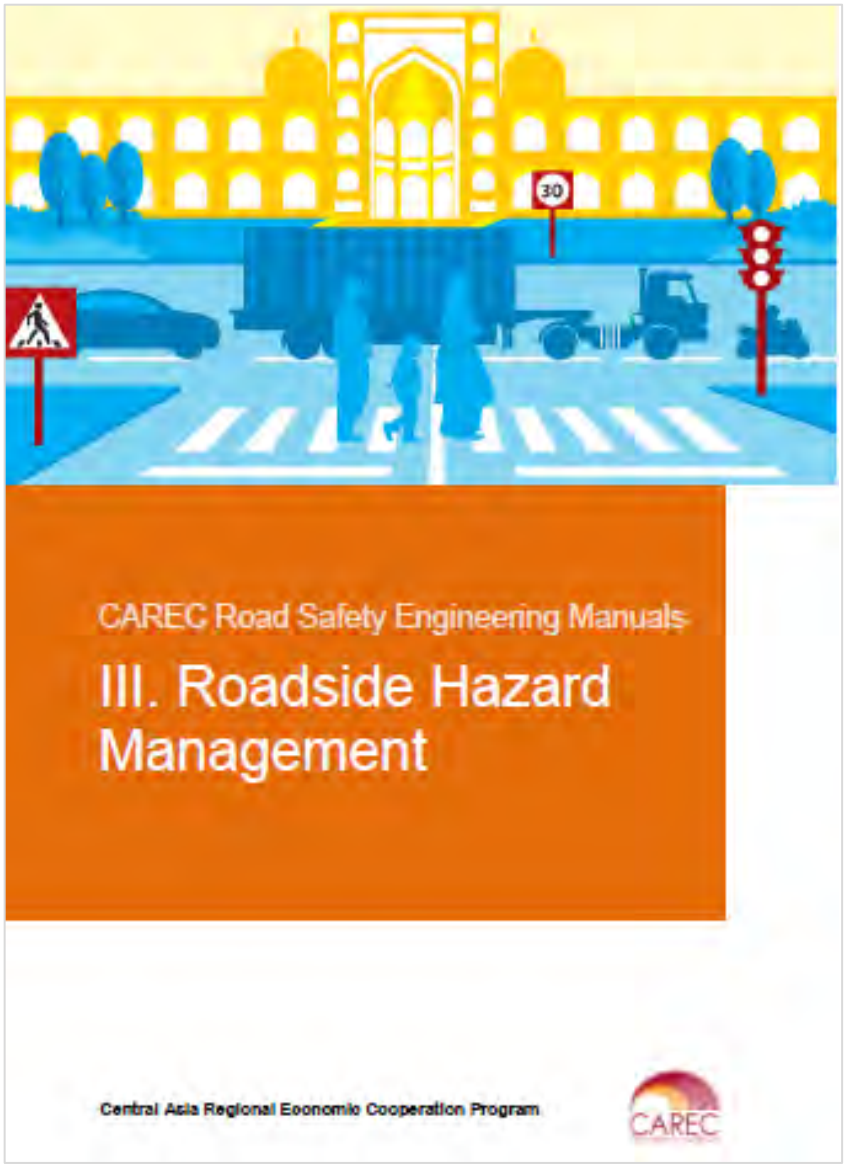
- ideally to a location outside the clear zone
- relocation to a less vulnerable position can reduce risk

Alter the Hazard to Reduce Impact Severity

- frangible lighting poles
  - slip base
  - impact absorbing
- frangible sign posts
- grade steep slopes (4:1 or flatter)
- driveable culverts

Frangible lighting poles
- slip base
- impact absorbing





CAREC now has a manual dealing with Roadside Hazard Management

So, what is a roadside hazard?

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

A strategy for Roadside Hazard Management

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

i. remove the hazard
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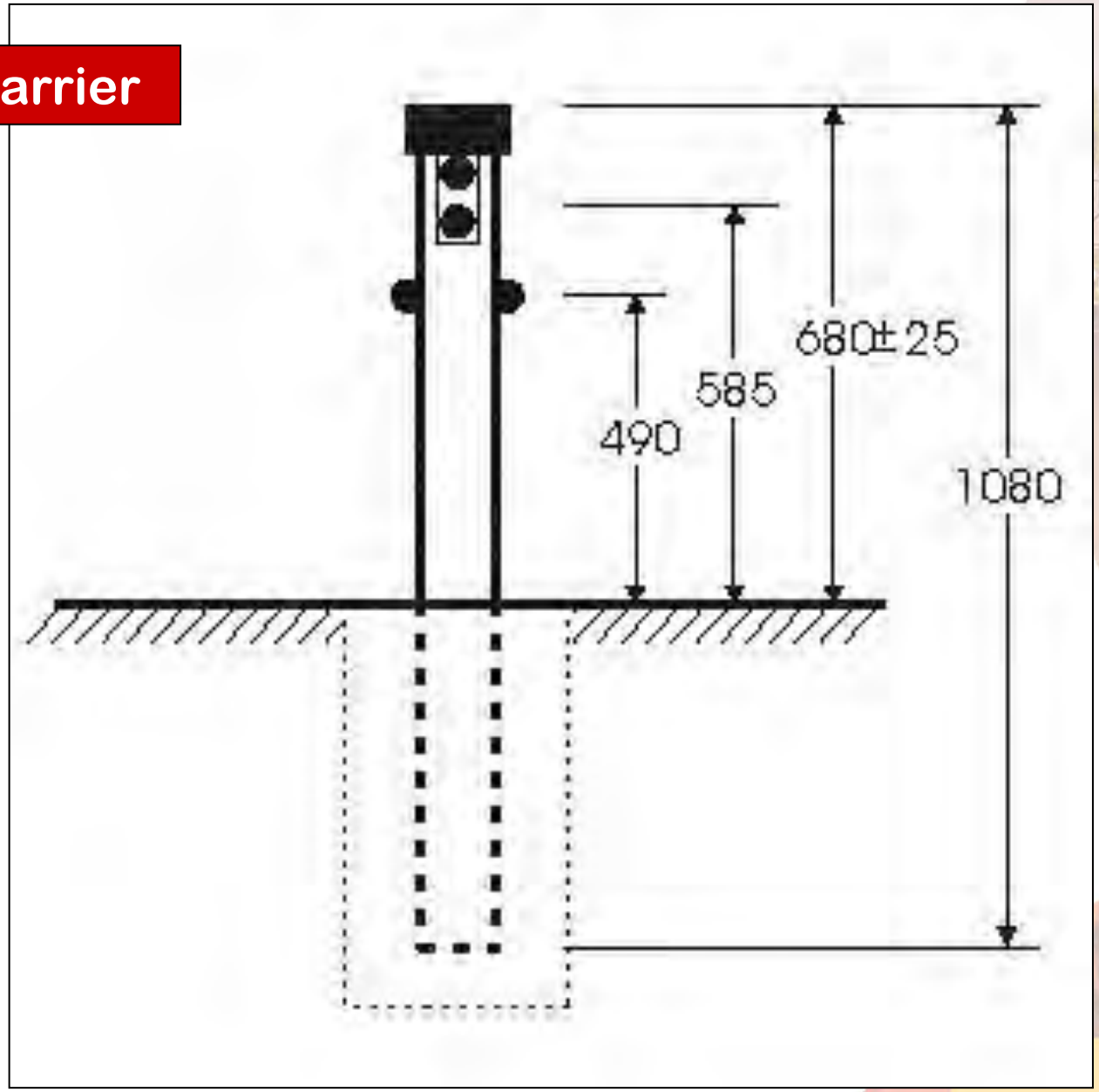
Safety barriers

Remember that safety barriers are roadside hazards – try to design the new road to avoid having to use them

Three groups of safety barriers

- Flexible barriers
- Semi-rigid barriers
- Rigid barriers

Flexible barrier



Wire Rope Safety Barrier

Wire Rope Safety Barrier

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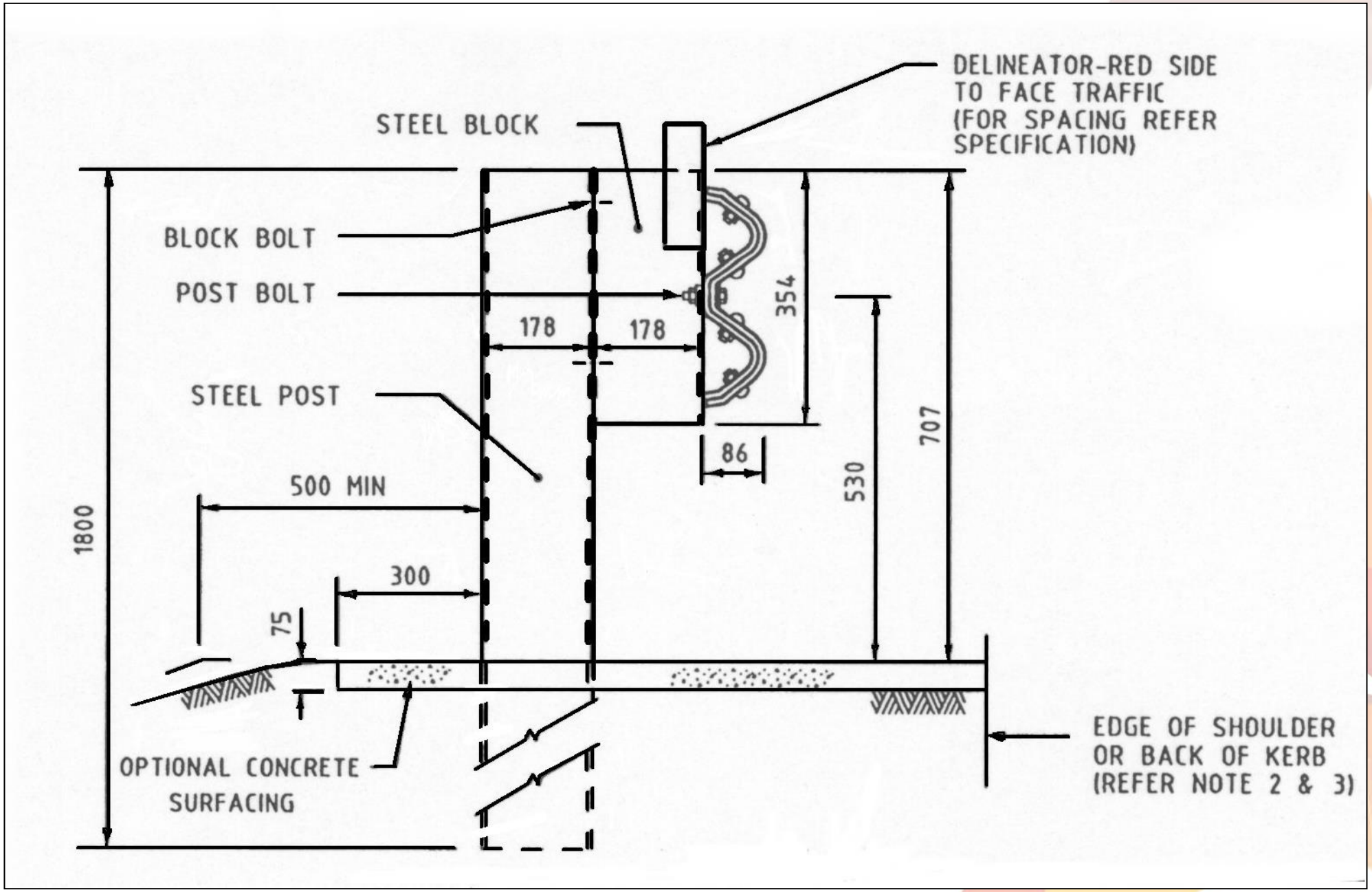
Three groups of safety barriers

Semi-rigid barriers

- **Mainly W-beam barrier (commonly called “guardrail”)**



W Beam Safety Barrier

W Beam Safety Barrier

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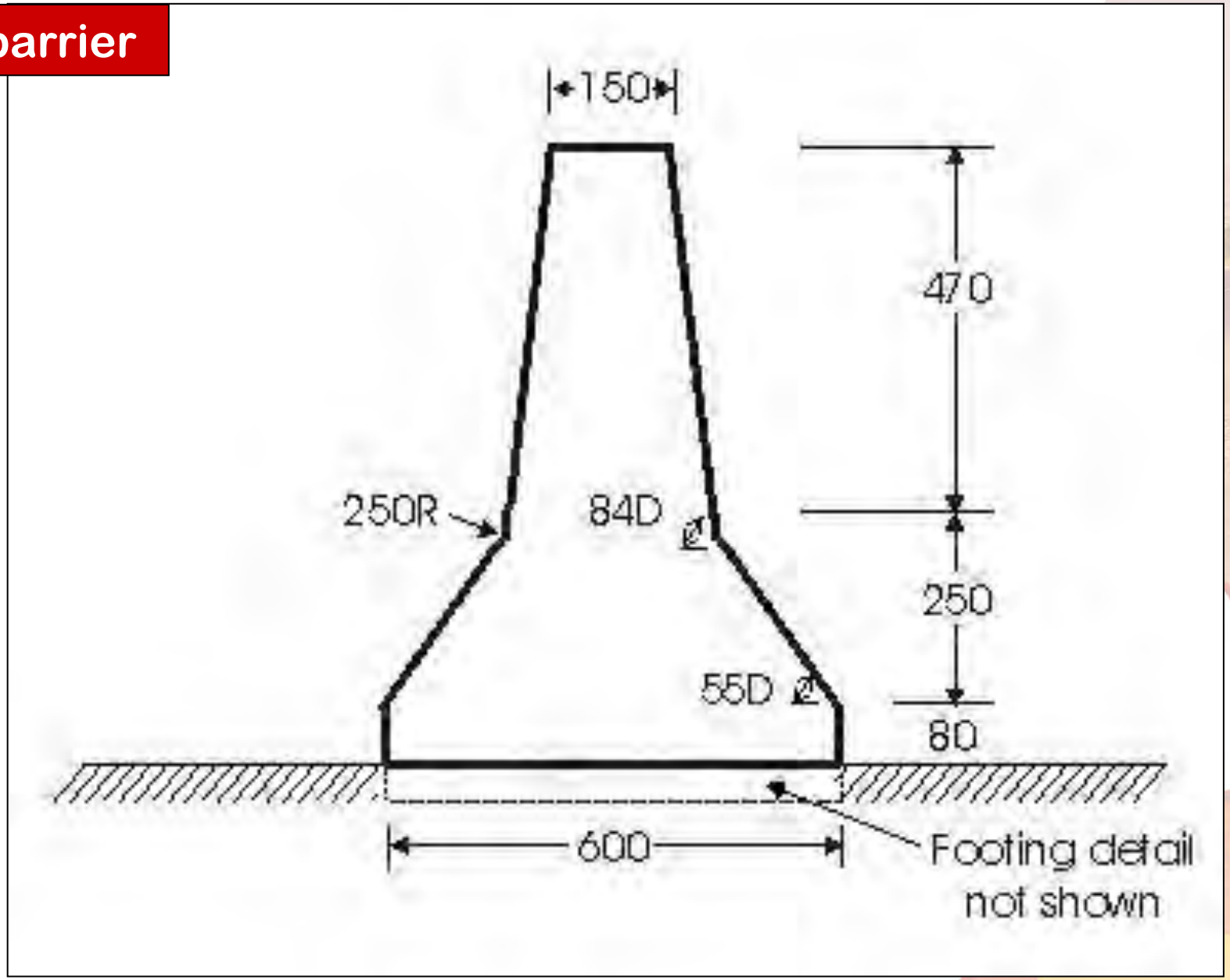
Three groups of safety barriers

Rigid barriers

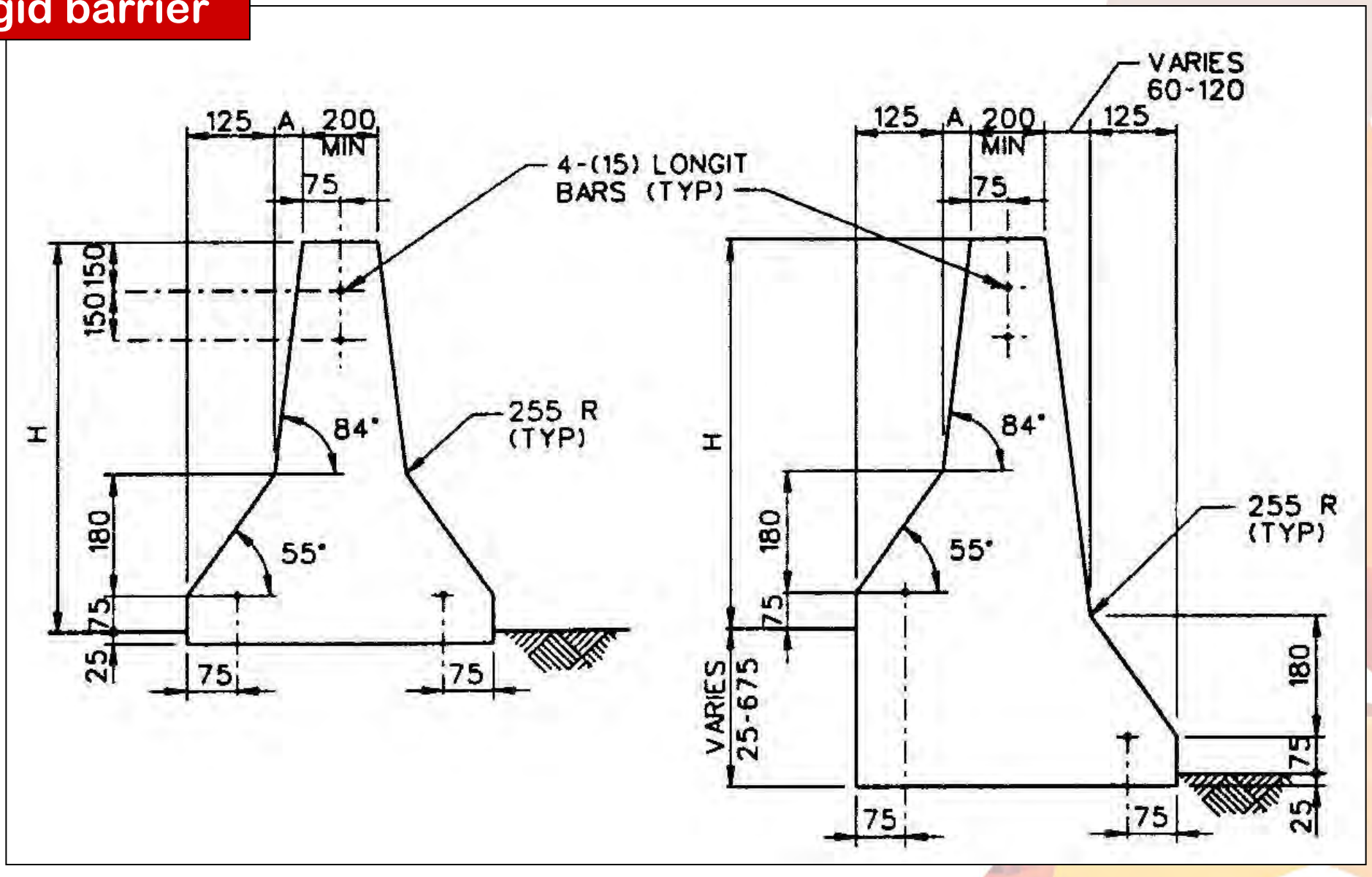
- Cast in place or set in place concrete
- They do not deflect
- Minimal repairs needed if struck
- End treatments (terminals) are vital

Rigid barrier



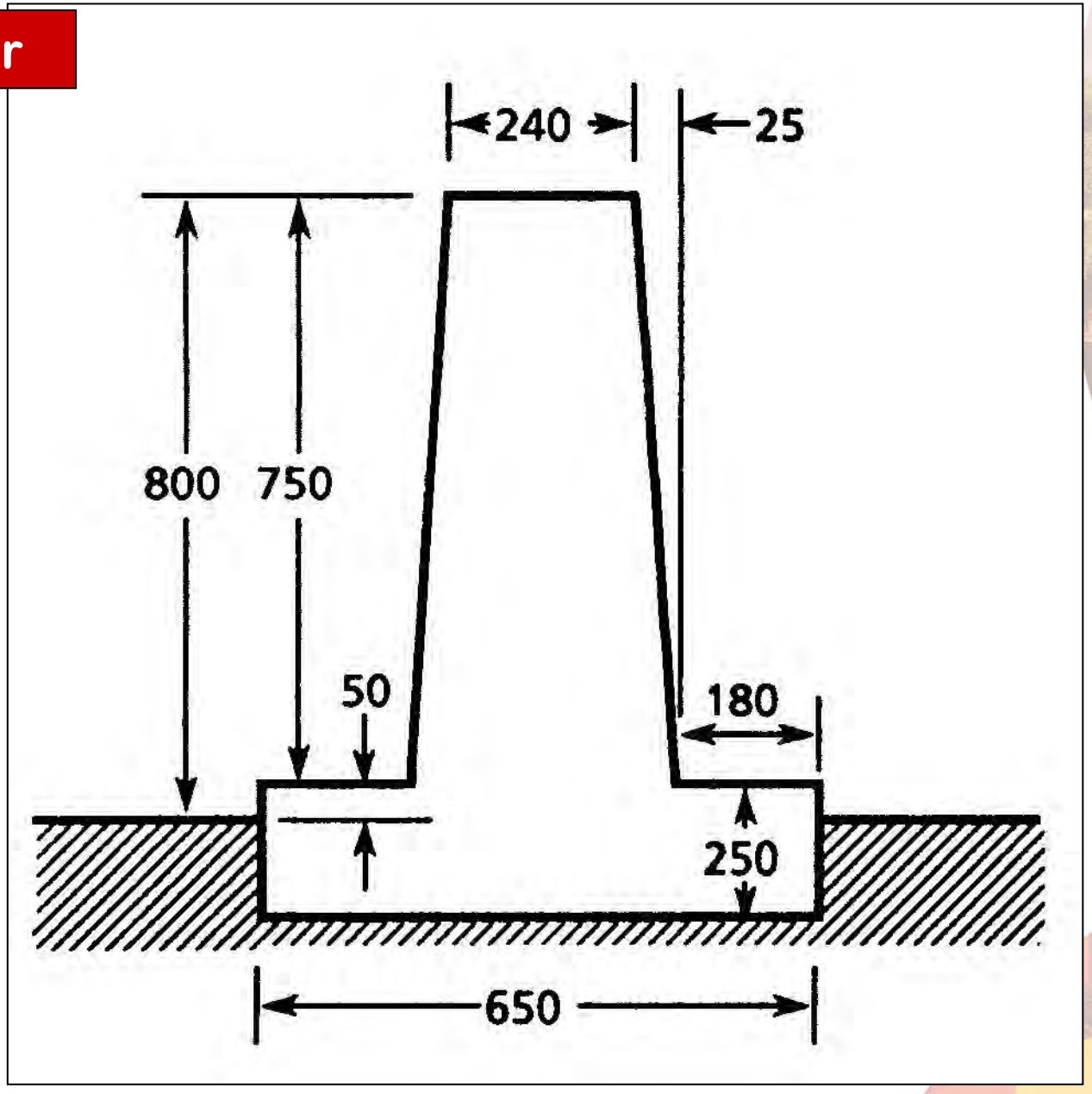
New Jersey Barrier

Rigid barrier



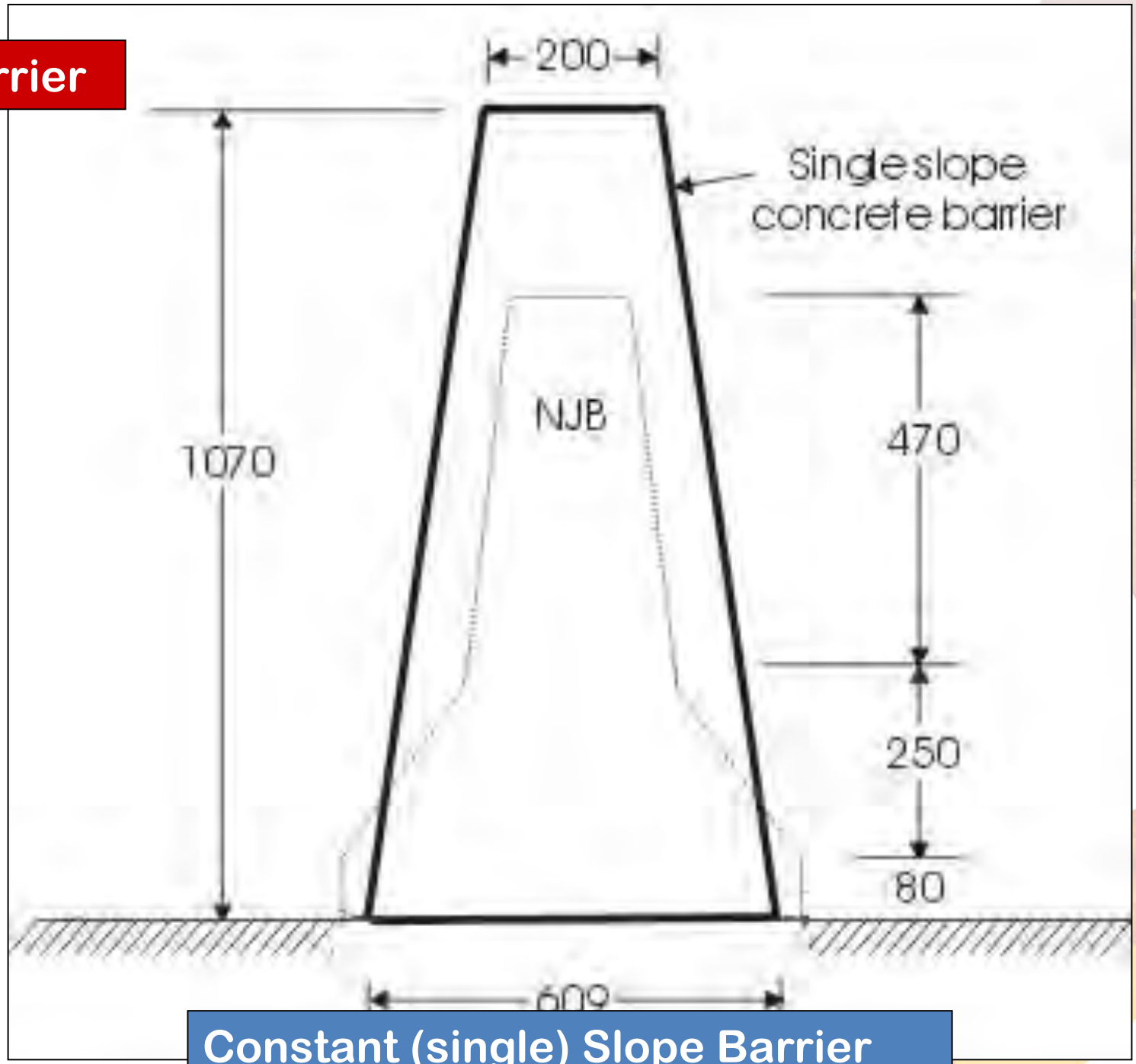
F Profile Barrier

Rigid barrier



Vertical Face Barrier

Rigid barrier



Constant (single) Slope Barrier

Things to look for when auditing barrier

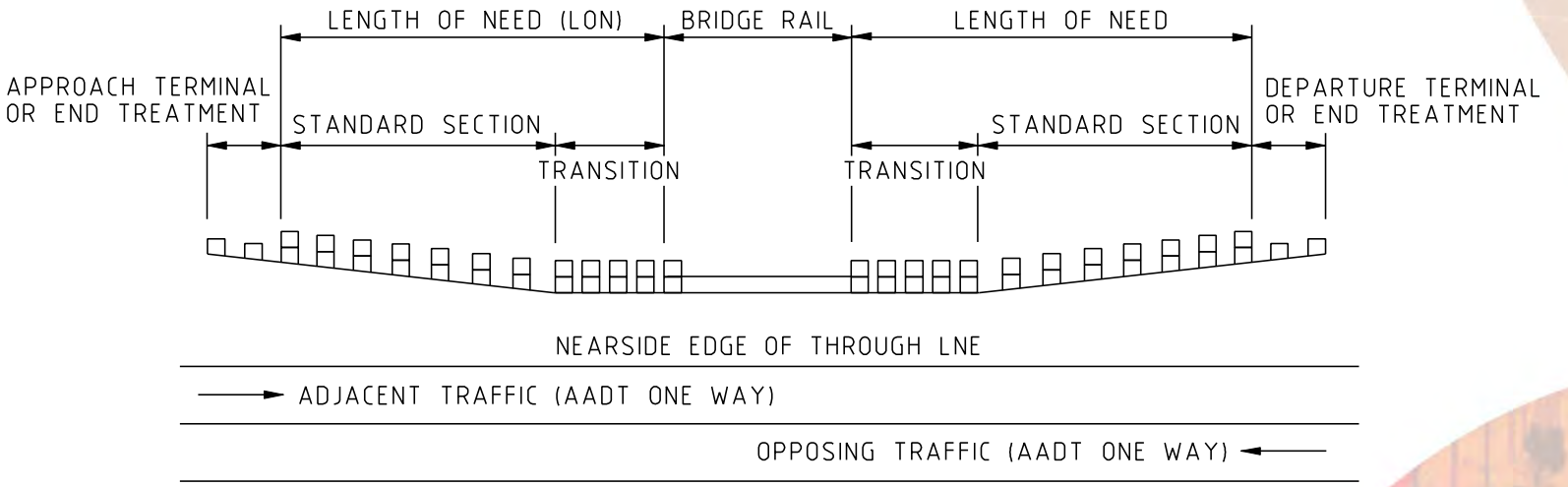
Some of the main things to think about when you are auditing a road and there is barrier involved.

- **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)**

Critical design factors with safety barriers

Length of need

This is the length of barrier needed to shield the hazard or area of concern



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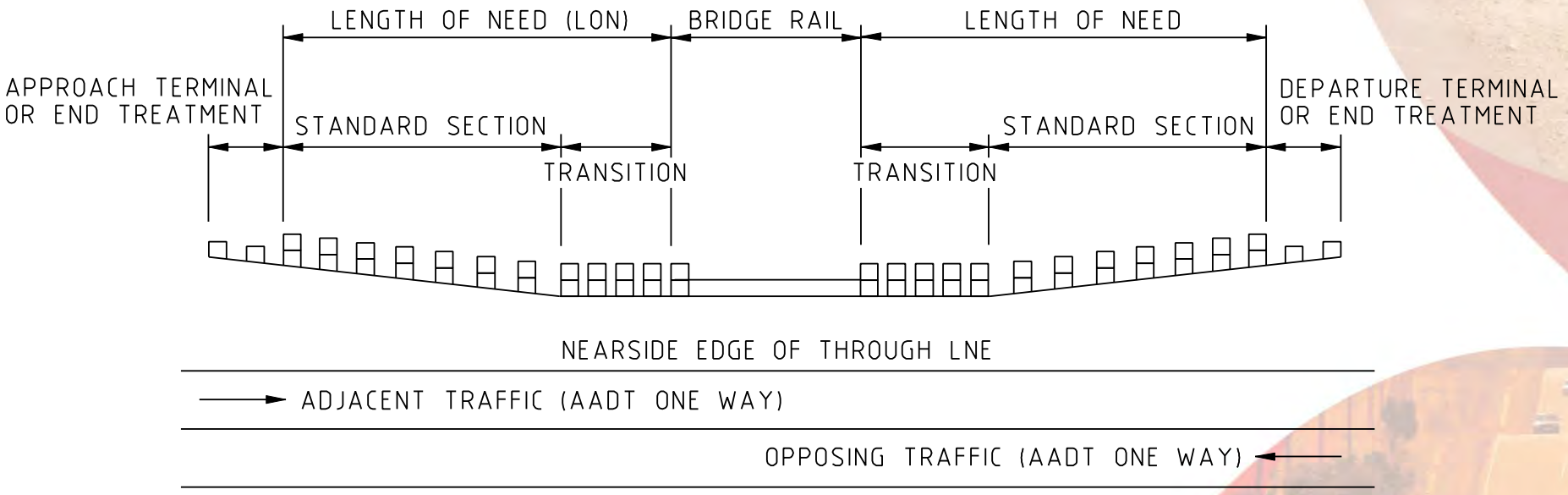
Critical design factors with safety barriers

Barrier length

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



Offset 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**

Critical design factors with safety barriers

We must design barriers to avoid:

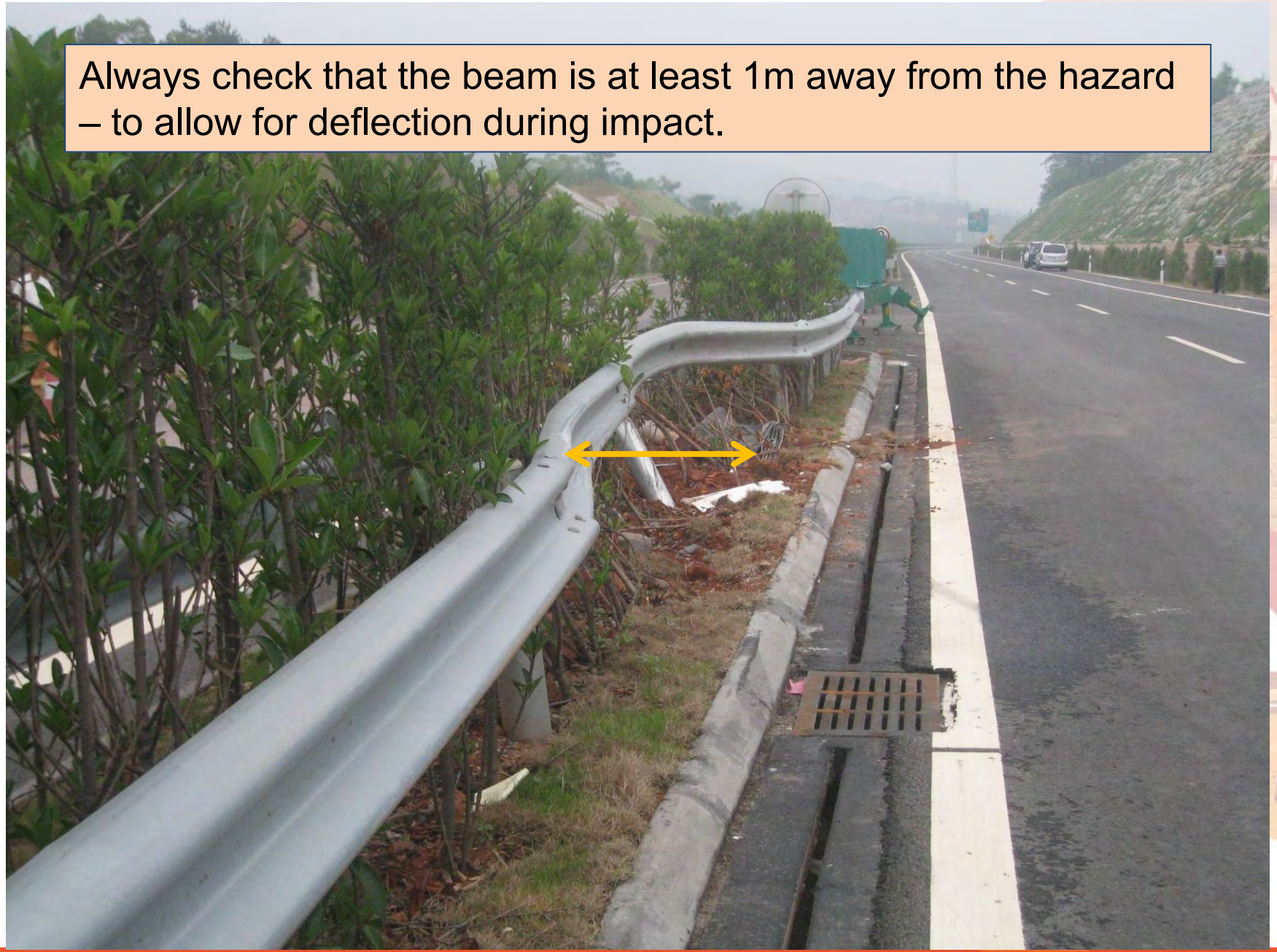
- Excessive deflection
- Vaulting
- Pocketing
- Spearing

Critical design factors with safety barriers

To do this we must watch:

- Correct installation and offsets (to avoid excessive deflection)
- Kerb placement and barrier height – (for vaulting)
- Stiffening at bridges/tunnels (for pocketing)
- Correct terminals (for spearing)

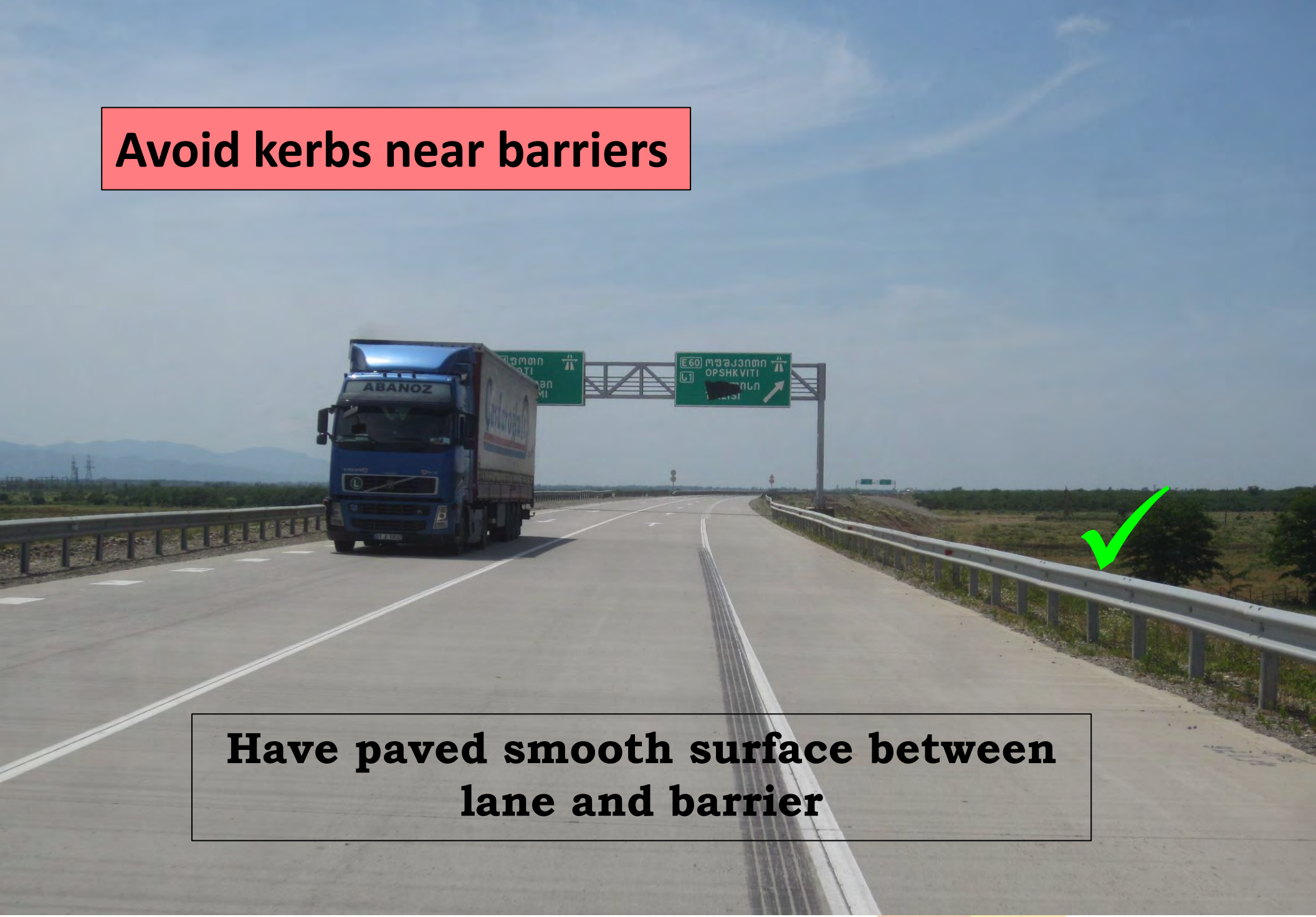
Deflection


Always check that the beam is at least 1m away from the hazard – to allow for deflection during impact.

Avoid placing kerbs near barriers

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

Avoid kerbs near barriers



Have paved smooth surface between lane and barrier

Avoid kerbs near barriers

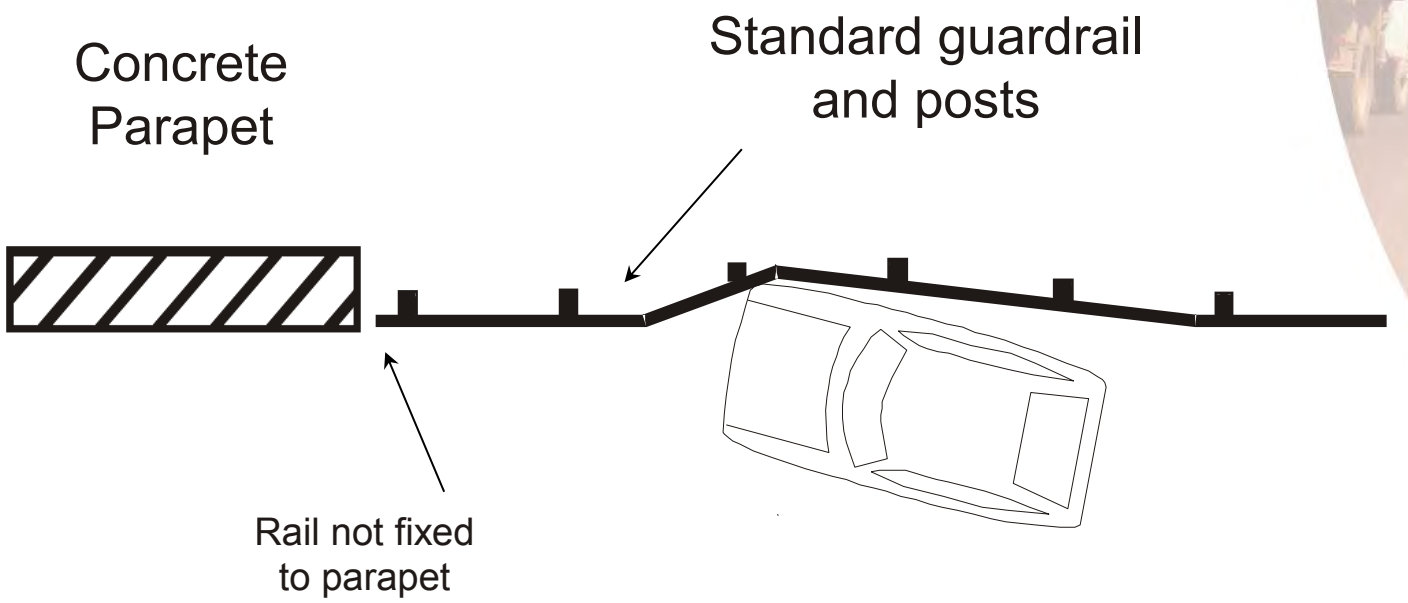
Kerb & Channel – do not use on high speed roads. Place barrier at the kerb face or more than 3 m behind it.

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.


Avoid kerbs near barriers

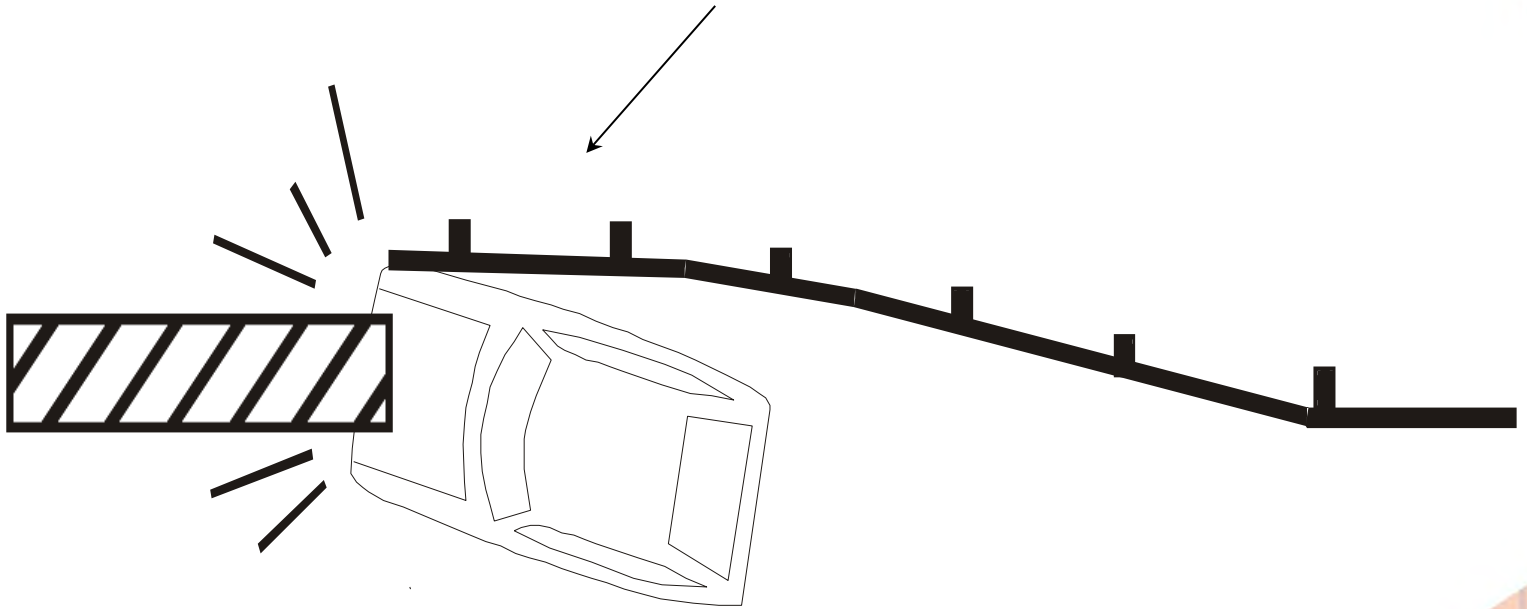
"Pocketing"



Stiffen (prevent pocketing)

"Pocketing"

Guard rail deflects and leaves the parapet exposed



Stiffen (prevent pocketing)

Pocketing and Stiffening of W beam

To prevent pocketing - close-up the post spacing's at connection points, and join firmly to parapet

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Standards?

Do they always equal safe?

What about current bridge standards?

Tell me your views please

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Safe barrier terminals are vital

(are your terminals, and standards about terminals, safe?)

Sloped end treatments are dangerous. If struck, there is a high risk of a vehicle becoming airborne or overturning.

Unsafe terminals spear through impacting vehicles and kill people

ELT's are safe and effective terminals

People die everyday from collisions with the ends of concrete barriers around the world. Never leave such hazards within the clear zone on your roads.

Impact Attenuator

Thank you – I look forward to your questions