2ND ROAD SAFETY WORKSHOP
16-18 August 2016 • Kuala Lumpur, Malaysia
2-й Семинар по безопасности дорожного движения
16-18 августа 2016 года • Куала-Лумпур, Малайзия

Good practice in road safety engineering for CAREC highways

Technical manuals

Phillip Jordan, Road Safety International
Consultant to the ADB "Enhancing Road Safety for CAREC Member Countries Program"

Pillar 2 - Road safety engineering for CAREC highways

- Pillar Two of the Decade of Action for Road Safety addresses “Safer Roads”
- This Pillar is a key responsibility of national highway agencies
- To reduce crash trauma in the CAREC program, road agencies need skilled engineers who appreciate the important role of the road in road safety.



During our meetings across the CAREC Program, it has become clear that you believe more can be done under Pillar Two to make your CAREC highways “safer”

There is a shortage of road safety engineers across CAREC Program countries.

Some of your standards are “unsafe”

Question One

If your national highway agency does not have sufficient, experienced road safety engineers - what can be done to build up this profession?

- ✓ Establish an RSE Department in the highway agency
- ✓ Offer opportunities for RS Engineers
- ✓ On-the- job mentoring
- ✓ Technical training workshops
- ✓ University training/courses

NOTE: Experience cannot be gained in days or weeks – it takes time and it is often best gained by working with experienced mentors on "real road projects".

Question Two

Does your national highway agency have a system to update your national road design standards so that they are in-step with the worlds best?

If not, what can be done to change this situation?

Is it possible to agree “safety standards” for CAREC highways that cross 10 countries (or more)?

Can guidelines provide useful guidance while “standards” evolve?

Are these drains “standard”?
Are they safe?

Are these lighting columns “standard”?
Are they safe?

Is this bridge cross section “standard”?
Is it safe?

Is this bridge cross section “standard”?
Is it safe?

Is this terminal “standard”?
Is it safe?

Upgrading these standards to 'international best practice" is important but can be difficult.

Nations are (naturally) quite protective of their "standards", and most will take time (years) to be convinced of the need to change.

With few national road safety engineers actively promoting such change, existing (many "unsafe") standards will remain.

Unless standards are improved and more road safety engineers are engaged, road trauma in the CAREC Program will continue at unacceptable rates.

CAREC highways are vital for national and international transport and trade

They offer an excellent starting point for producing “safer roads” (Pillar Two)

The ADB strongly supports safer CAREC highways.

Our TA has a key objective to enhance road safety engineering across CAREC program countries.

Safer design standards and more road safety engineers are long term safety objectives.

We are preparing three road safety engineering manuals (hopefully the first of a series of 7-8 manuals), followed by a series of technical training workshops across the region

This presentation outlines the three road safety engineering manuals that are being drafted to assist engineers to build road safety into CAREC highways:

- Manual 1 – Road safety audit – improving safety in road designs
- Manual 2 - Safer road works – protecting road users and workers
- Manual 3 - Roadside hazard management – safety of roadsides

Manual 1 – Road Safety Audit

- The ADB endorses the road safety audit process and supports road authorities to implement road safety audit as an integral part of the planning, design and construction of road projects within the CAREC program.
- Road agencies within the CAREC program are encouraged to establish a road safety audit policy and to build up expertise in this field.
- This manual is to be the focal point for the road safety audit process within the CAREC program.

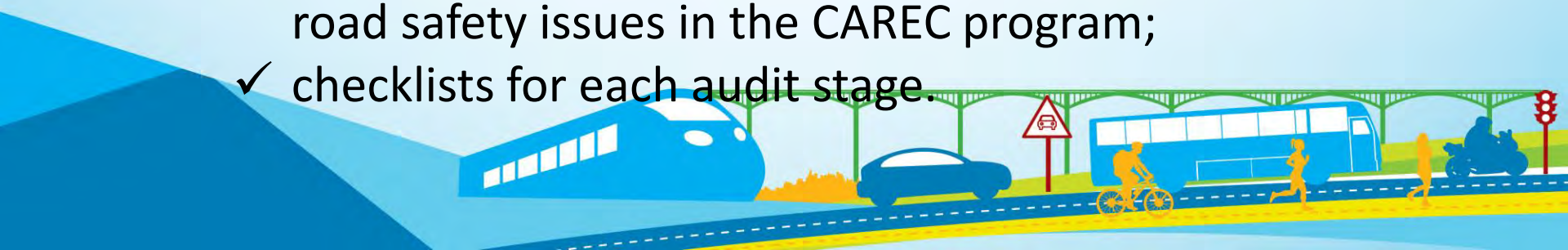
Manual One
Road Safety Audit

- It provides full information about the audit process, how to undertake an audit, and how to manage an audit. This information is essential for audit team members, project managers, designers and representatives of the Client/project team.
- It is to be adopted in all CAREC program road projects funded or supported by the ADB.
- Road safety audit shall be undertaken of all ADB funded CAREC road projects in accordance with the CAREC program road safety audit policy.

Manual One Road Safety Audit

Main topics in the manual include:

- ✓ the key steps in the audit process;
- ✓ how to write an audit report;
- ✓ how to select an effective audit team;
- ✓ an auditor accreditation scheme;
- ✓ key aspects for managing an audit – draft terms of reference, a suggested audit policy, and advice about how to respond to an audit report;
- ✓ the costs and benefits of road safety audit;
- ✓ four audit case studies that emphasise commonly found road safety issues in the CAREC program;
- ✓ checklists for each audit stage.



Manual One Road Safety Audit

A road safety audit is “a formal, systematic and detailed examination of a road project by an independent and qualified team of auditors that leads to a report listing the potential safety concerns in the project."

(ADB/CAREC 2016)

Manual One Road Safety Audit

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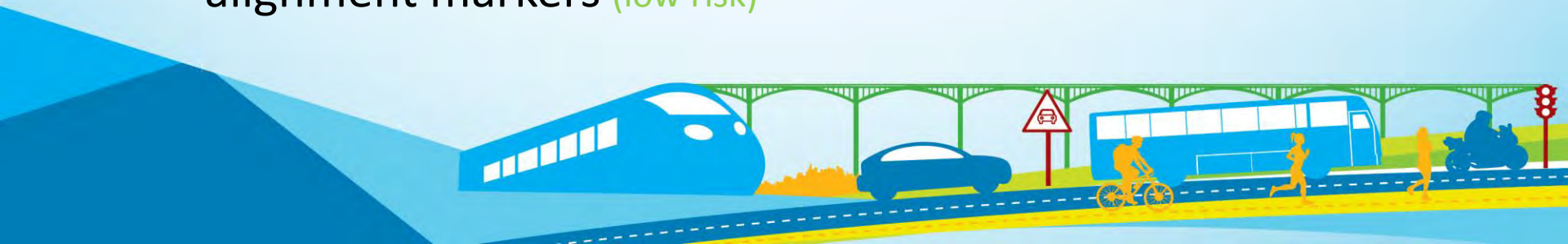
(ADB/CAREC 2016)

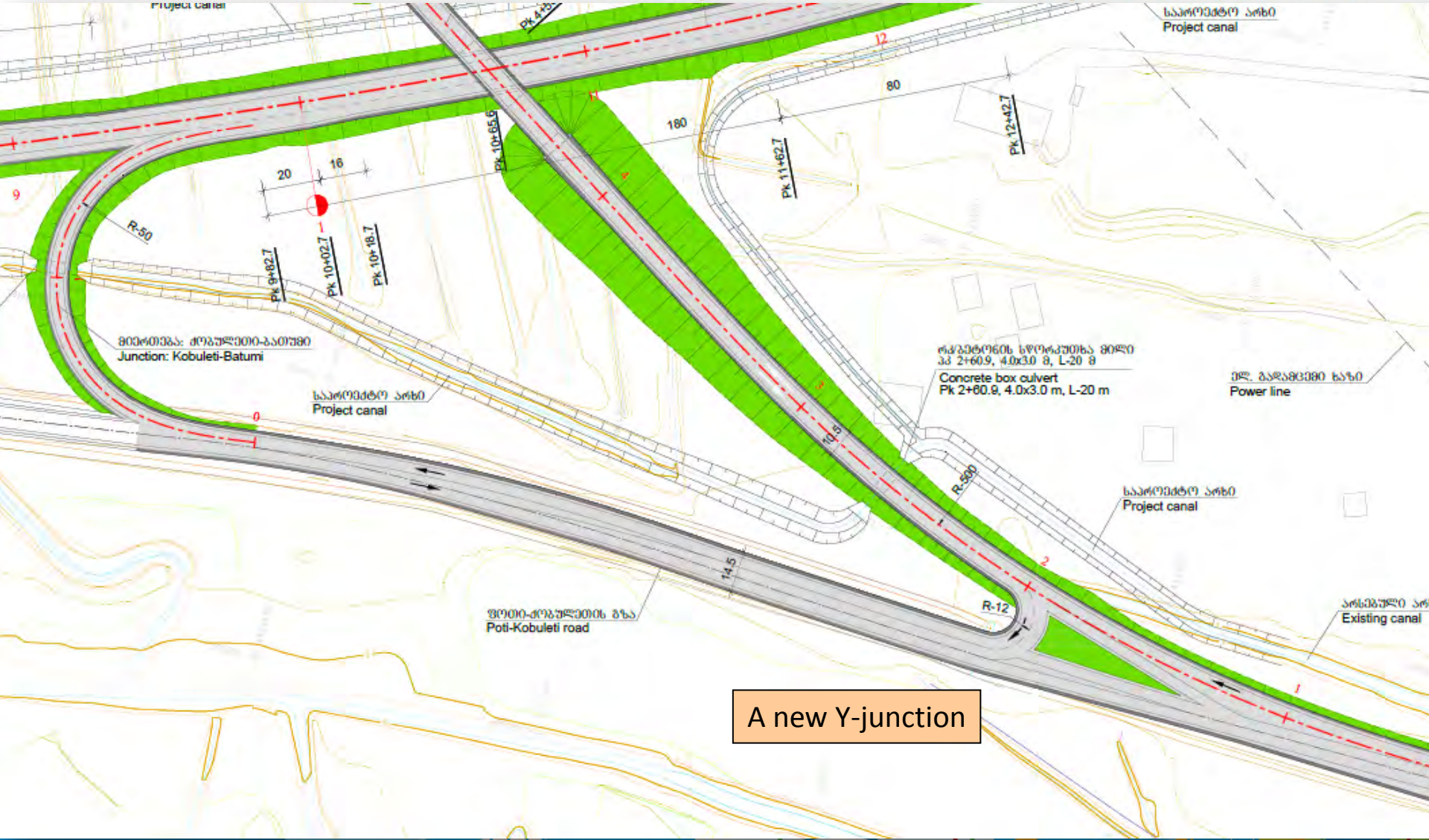
Road safety audit – *prevention is better than cure*

Manual One Road Safety Audit

Safety concerns from audits of a new CAREC By-Pass

- Detailed design audit - identified a Y junction (high risk)
- Pre-opening audit – safety barrier 100m+ short on an overpass (high risk)
- Pre-opening audit – incorrectly installed chevron alignment markers (low risk)




Project canal
Pk 4+55
Project canal
12
80
180
Pk 10+65.6
Pk 11+62.7
Pk 12+42.7
20
16
9
R-50
Pk 9+82.7
Pk 10+02.7
Pk 10+18.7
Junction: Kobuleti-Batumi
Project canal
Concrete box culvert
Pk 2+60.9, 4.0x3.0 m, L-20 m
Power line
10.5
R-500
Project canal
14.5
R-12
Poti-Kobuleti road
Existing canal
A new Y-junction


700м
700м
E70 ს2
ბათუმი
BATUMI
სარპი
SARPI
300м
BUT IT WAS BUILT!
Unsafe. High risk


Guardrail needed on both sides for 100m+


Too many CAM’s, too late, too close, and none in other direction

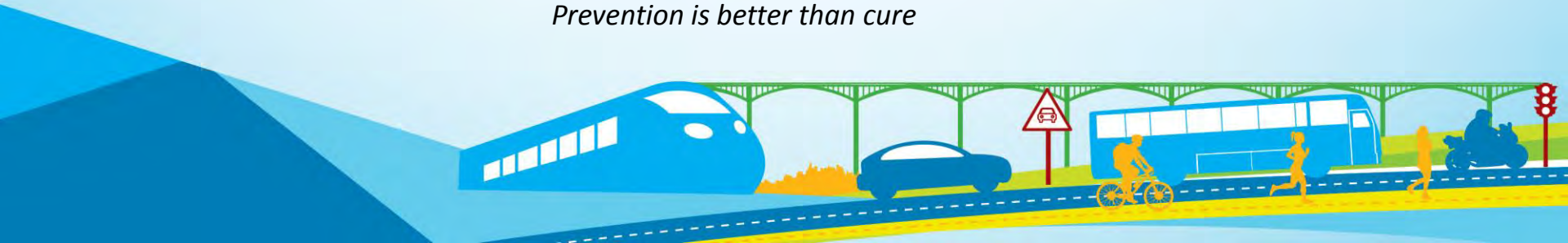

Too many CAM’s, too late, too close, and none in other direction

Manual One Road Safety Audit

Objectives of road safety audit

- to ensure high levels of safety on new road projects
- to reduce whole-life costs of projects
- to minimize accident risk on the adjoining road network
- to lead engineers to think about safety for *all* road users
- to advance thinking and actions in road safety engineering

Prevention is better than cure



The steps in a CAREC road safety audit

Road safety audit step	Responsibility
1. Determine that an audit is needed	Project Manager
2. Select an Audit Team Leader, who then engages the audit team	Project Manager and Road Safety Audit Team Leader
3. Pre-audit communication – to provide information (drawings and design reports) about the project to the Team Leader. Outline the project and discuss the audit ahead	Designer (via Project Manager) and the Road Safety Audit Team Leader
4. Assess the drawings for safety issues (the "desktop" audit)	The audit team
5. Inspect the site – daytime and night time	The audit team
6. Write the audit report. Send to the Project Manager	The Team Leader with assistance from the audit team
7. Post audit communication – to discuss the key safety issues and to clarify outstanding matters	Project Manager (plus designer) and Road Safety Audit Team Leader
8. Write a response report, referring to each audit recommendation	Project Manager
9. The way forward - following-up and implementing agreed changes	Project Manager (and designer)

Manual One Road Safety Audit

Stages of road safety audit

There are six internationally recognised stages during the planning design and construction of a road project at which road safety audits are to be conducted on CAREC projects.

- Planning (feasibility) stage
- Preliminary design stage
- Detailed design stage
- Road works stage
- Pre-opening stage; and
- Existing road

Manual One Road Safety Audit

The costs and the benefits of road safety audit

- Surrey County Council
  - 19 audited sites were compared with 19 non-audited sites
  - 2+ years of crash data were compared
  - Audited sites had a casualty saving of 1.25 pa
  - Non-audited sites had a casualty saving of just 0.25
- UK Highways Agency
  - TRL examined 22 audited sites on trunk roads
  - The costs of implementing the audit recommendations were compared with the costs of rectifying the sites after the project was constructed
  - Average saving per site of £11,373

Manual One Road Safety Audit

- Jordan
  - 9 sites that had been constructed in the past decade (not audited) and had become safety problem sites
  - It was assumed that, if the sites had been audited, they would not have required improvements later
  - First year rate of return of 120%
- Denmark
  - Assessed 13 schemes that had been audited during the design phase
  - An evaluation panel conducted cost benefit analyses of these safety audits
  - a general crash prediction method was used
  - First year rate of return of 146%

Manual One Road Safety Audit

- Australia
  - Design audits had benefit cost ratios ranging from 3:1 up to 242:1
  - Existing road audits had benefit cost ratios ranging from 2.4:1 up to 84:1

RSA – HIGH BENEFITS, LOW COST

Prevention is better than cure

Manual One Road Safety Audit

What CAREC road projects should be audited?

- Based on cost?
- On international roads – all stages of audit
- On secondary roads – one or two stages of audit

Manual One Road Safety Audit

AUDIT	EXPRESSWAYS & INTERNATIONAL HIGHWAYS	NATIONAL HIGHWAYS	MAJOR ROADS (URBAN/RURAL)	LOCAL STREETS & VILLAGE ROADS
FEASIBILITY	√	Optional	Optional	N/A
PRELIMINARY DESIGN	√	Optional	Optional	N/A
DETAILED DESIGN	√	√	√	√
ROAD WORKS	√	Optional	Optional	Optional
PRE-OPENING	√	√	√	√
SAFETY REVIEWS OF EXISTING ROADS	ACCORDING TO LOCAL POLICY AND RESOURCES			
NO. OF AUDITS	5	Minimum 2	Minimum 2	Minimum 2

Manual 2 – Road Safety at Road Works

- The ADB supports practices that improve road safety at road work sites in order to minimise trauma to road workers and road users.
- The ADB strongly encourages road authorities to include road safety as an integral part of the planning, design and operation of all work sites under the CAREC program.
- This manual will explain good road safety practices for work sites.

Manual 2 – Road Safety at Road Works

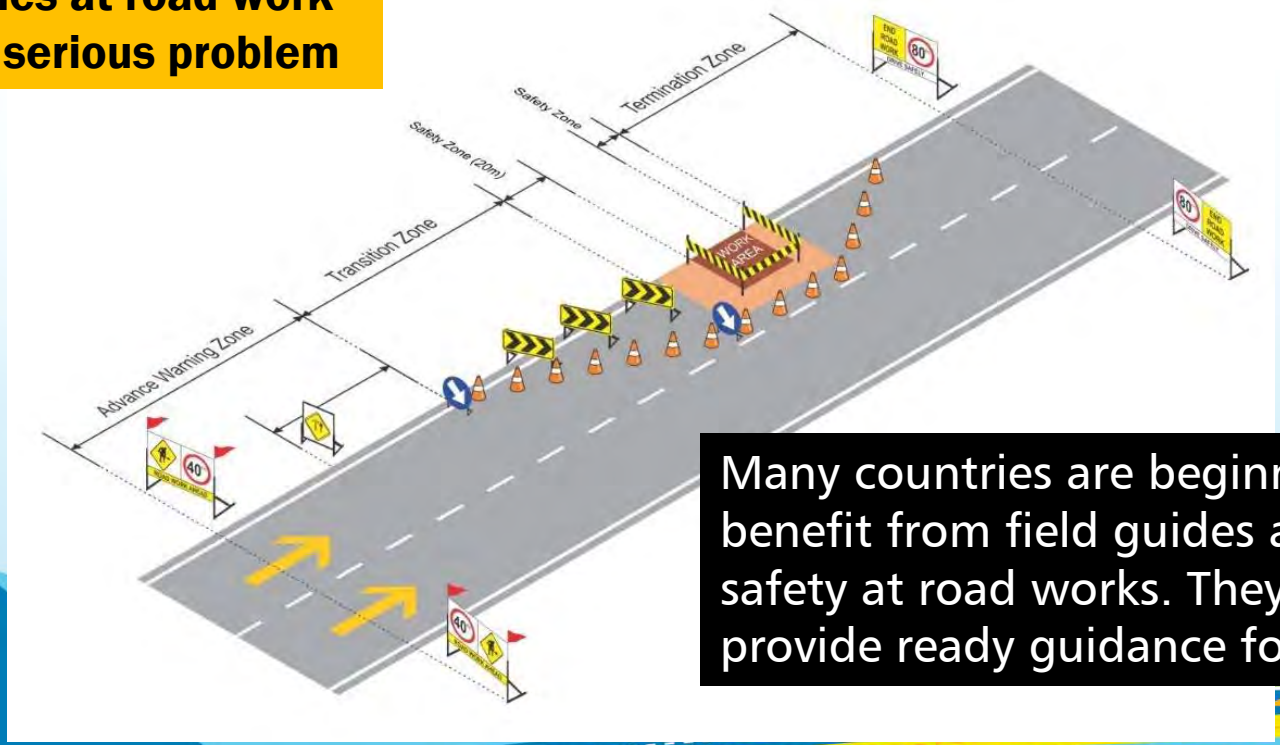
- Road authorities within the CAREC program are encouraged to promote the national use this manual, to refer to it in contracts and specifications and to build up technical expertise in this subject.
- In particular, this manual shall be the main reference document for road works in all contract documents used in CAREC program road projects funded or supported by the ADB.

Studies in Finland and Slovenia showed that 'motorists are up to five times as likely to be injured when travelling through a work zone'

Manual Two -
Road Safety at Road Works

IMPROVING WORKER SAFETY THROUGH BETTER VISIBILITY
Agota Berces,
Technical, Regulatory and Business Development Manager
3M Traffic Safety Systems Division, Sydney, NSW, Australia

Road crashes at road work sites are a serious problem



Many countries are beginning to benefit from field guides about safety at road works. They can provide ready guidance for

Manual Two -
Road Safety at Road Works

Safer road work sites – *risk of a serious crash is 5 times higher in work sites than on other sections of highway*

An example of road works on a CAREC highway. Are they “typical”? Are they safe?

An example of road works on a CAREC highway. Are they “typical”? Are they safe?

An example of road works on a CAREC highway. Are they “typical”? Are they safe?

Manual Two -
Road Safety at Road Works

The CAREC manual will encourage the use of the six zone concept

Early Warning Zone –this zone alerts drivers of the advance warning zone ahead and its reduced speed limit.

Advance Warning Zone – alerts drivers/riders of the Work Zone ahead. It uses advance warning signs and regulatory signs to warn users of the Work Zone ahead, and to regulate their behaviour.

Taper Zone – is used if motorists are required to move from their lane to pass around a Work Zone.

Safety Buffer Zone - is a longitudinal safety buffer immediately in advance of, and beside, the work area. At CAREC work sites it is to be at least 20m in length and it is to be kept free of equipment, materials and workers.

Work Zone – is the area in which the works are physically being carried out, and is set aside for workers, equipment and materials.

Termination Zone – is the zone where traffic resumes normal operations after passing the Work Zone.

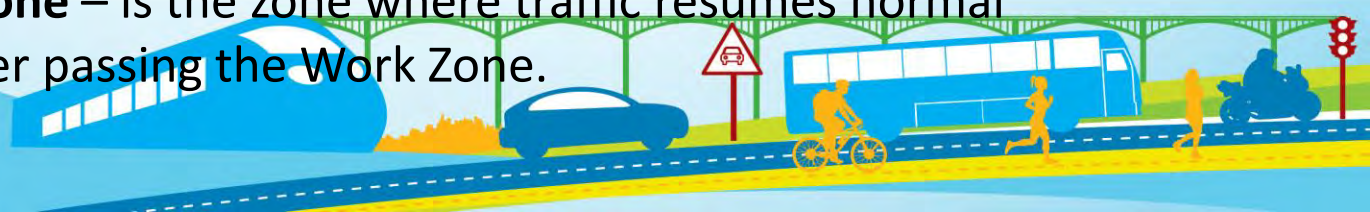
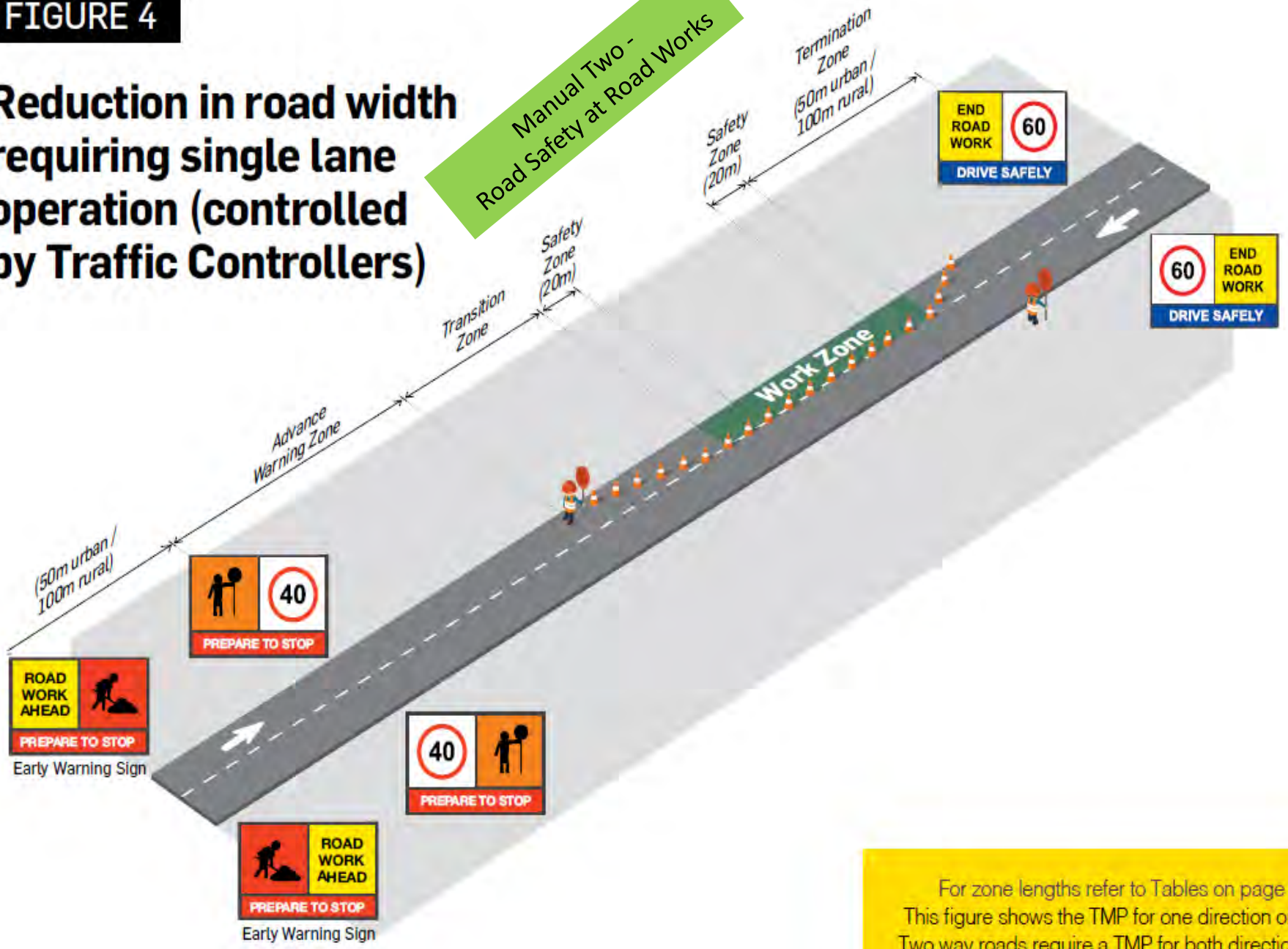


FIGURE 4

Reduction in road width requiring single lane operation (controlled by Traffic Controllers)

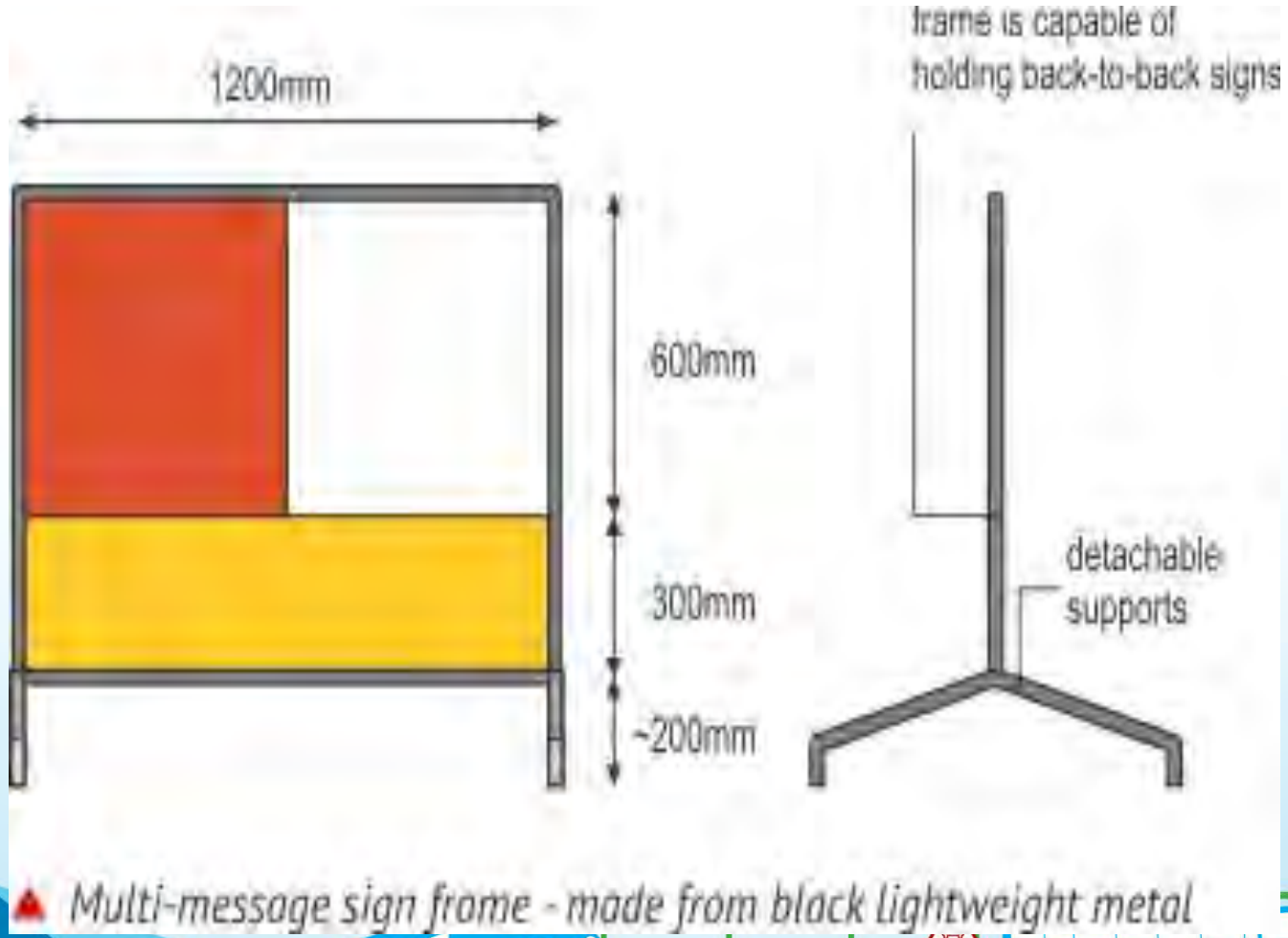
Manual Two - Road Safety at Road Works



For zone lengths refer to Tables on page 50.
This figure shows the TMP for one direction only.
Two way roads require a TMP for both directions.

Manual Two -
Road Safety at Road Works

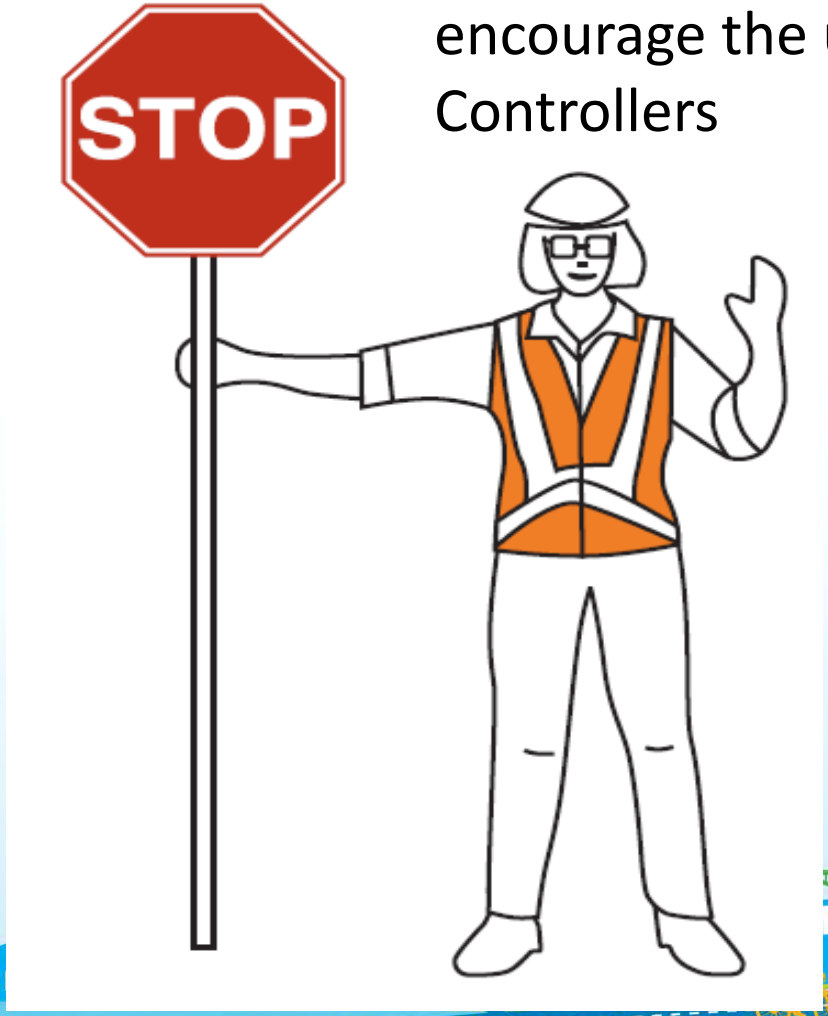
The CAREC manual will encourage the use of multi-message signs



Multi-message sign frome - made from black lightweight metal

Manual Two -
Road Safety at Road Works

The CAREC manual will encourage the use of Traffic Controllers



Manual 3 – Roadside Hazard Management

- The ADB endorses safe roadside hazard management along CAREC highways, and encourages road agencies to manage safe roadsides during the planning, design and construction of road projects within the CAREC program.
- Road agencies within the CAREC program are encouraged to establish a roadside hazard management program, to adopt the “Clear Zone” concept, and to build up expertise in this field.
- This manual is to be the focal point for roadside hazard management within the CAREC program.

Manual Three - Roadside Hazard Management

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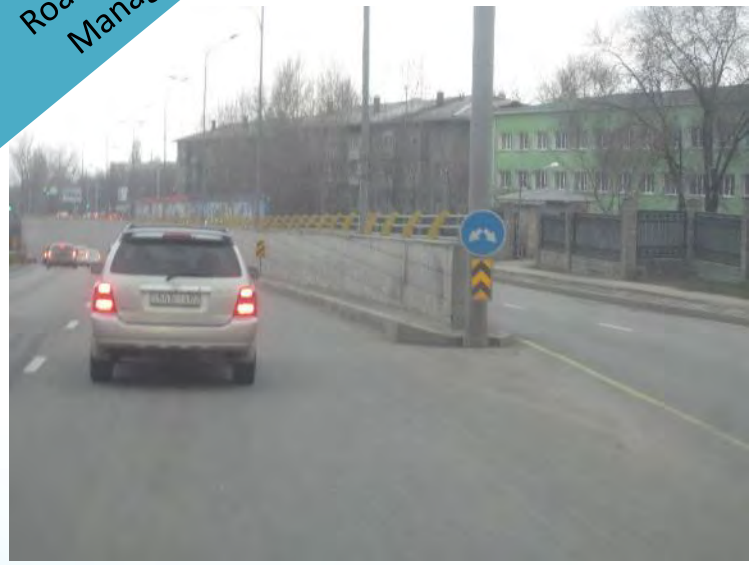
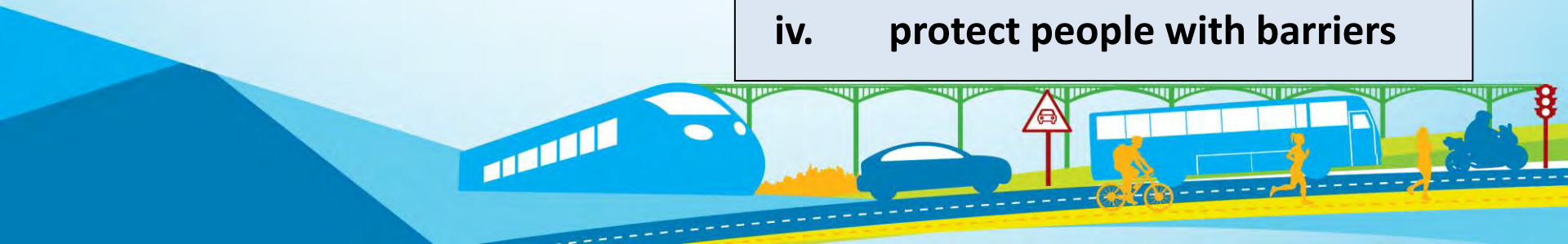


Roadside hazard management – improving your highways increase speeds, and often this increases “run-off-road” crashes. A program of roadside hazard management is needed to minimise this risk

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. protect people with barriers



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To provide a forgiving roadside environment, we ask…

What is a hazard?

How far off the road must something be before we can accept it as “safe”?

Is there one width that is used for all roads?

Clear zone?

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What is a Clear Zone ?

A clear zone is a driveable roadside area that should be kept clear of fixed hazardous objects in order to minimise the danger of a collision should a vehicle leave the road.

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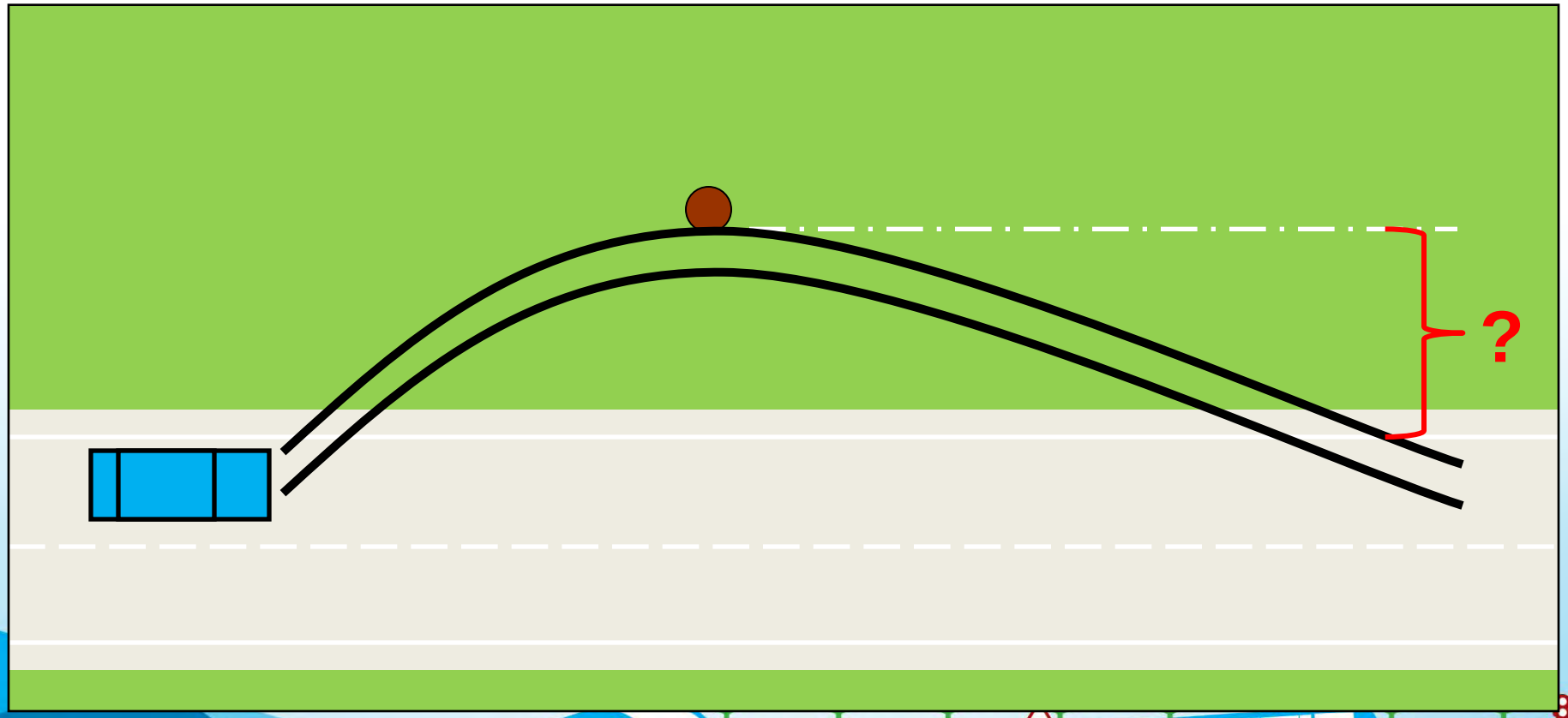
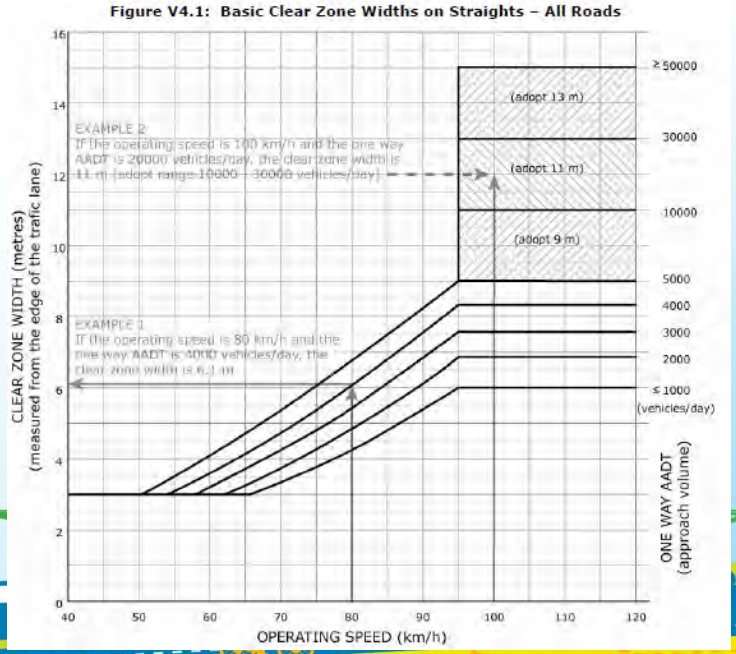
What is a Clear Zone ?



Manual Three - Roadside Hazard Management

What does the Clear Zone depend on?

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



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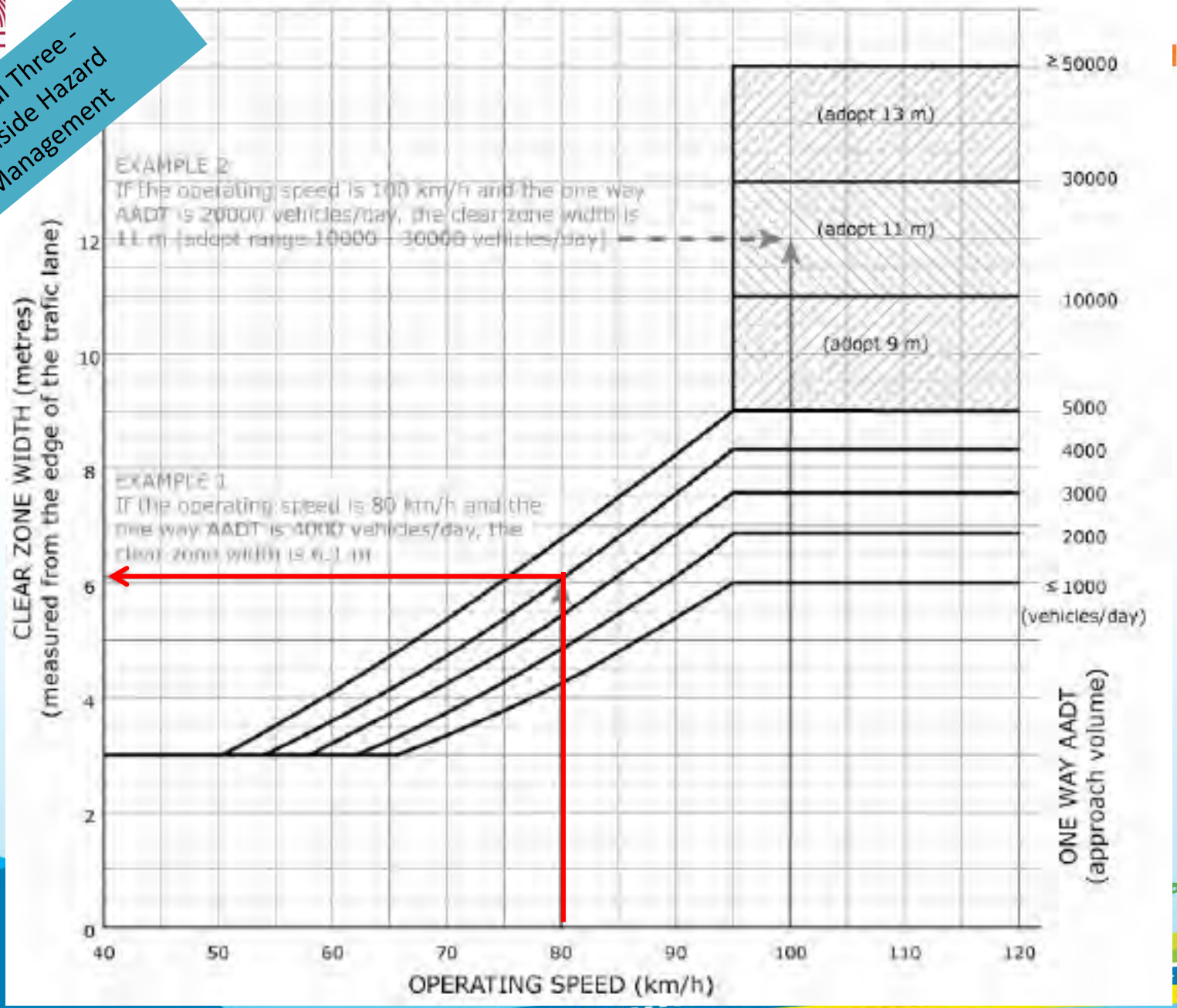
Clear Zone Chart

Figure V4.1: Basic Clear Zone Widths on Straights – All Roads



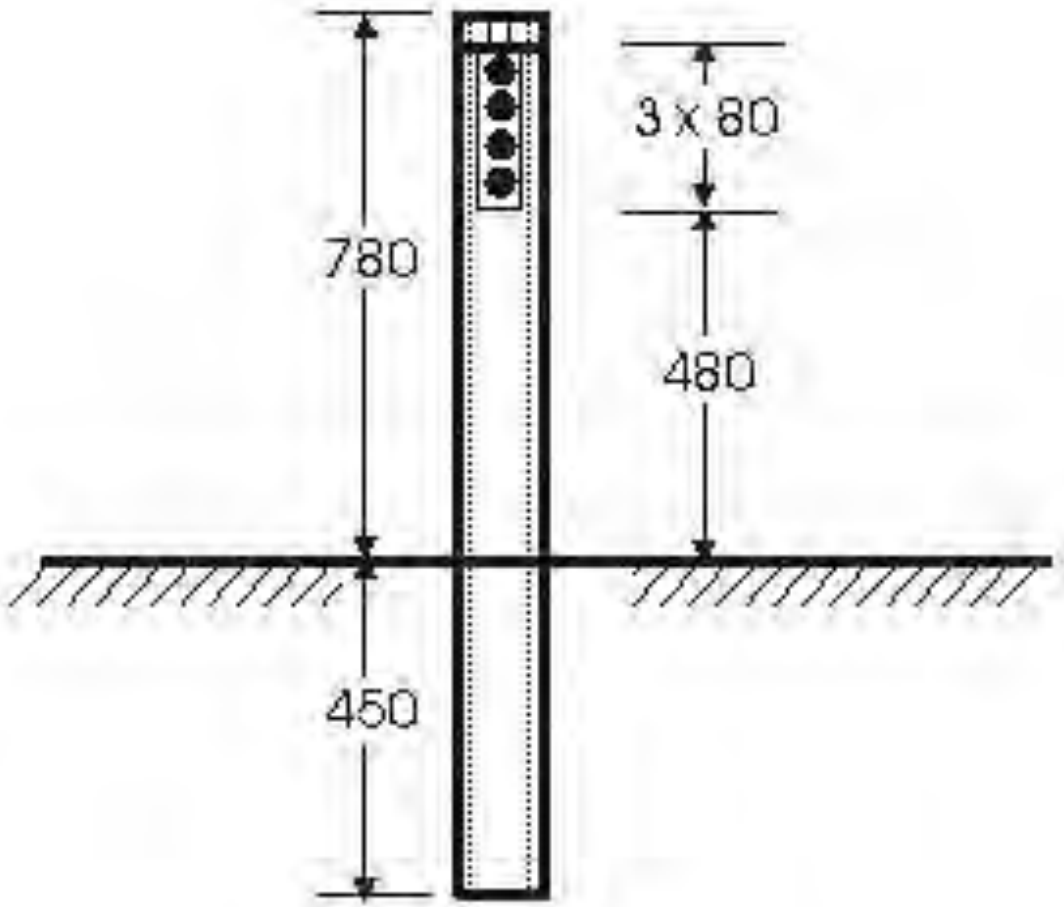

НИГОҲДОРИИ РОҲРО МДИРА
Н. ХИСОР БА УҲДА ДОРАД
NIGOHDORII ROHRO MDIRA
N. CHISOR BA UHDA DORAD
Roadside hazard


Roadside hazard


Roadside hazard


Manual Three - Roadside Hazard Management
The manual will detail the three types of safety barriers
flexible (wire rope)
semi- rigid (W-beam guardrail)
rigid (concrete)

Manual Three - Roadside Hazard Management



Wire Rope Safety Barrier

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Wire Rope Safety Barrier

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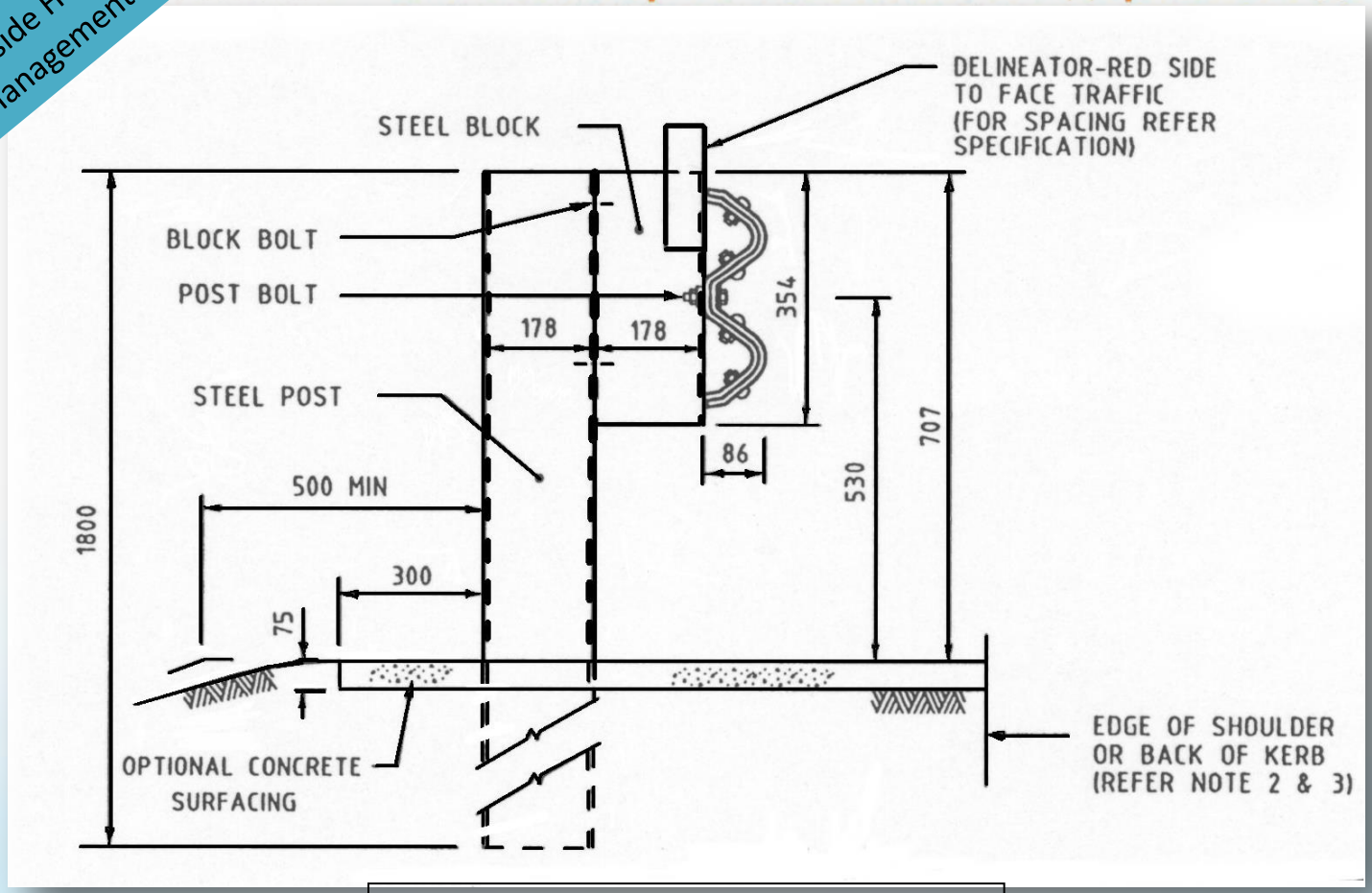
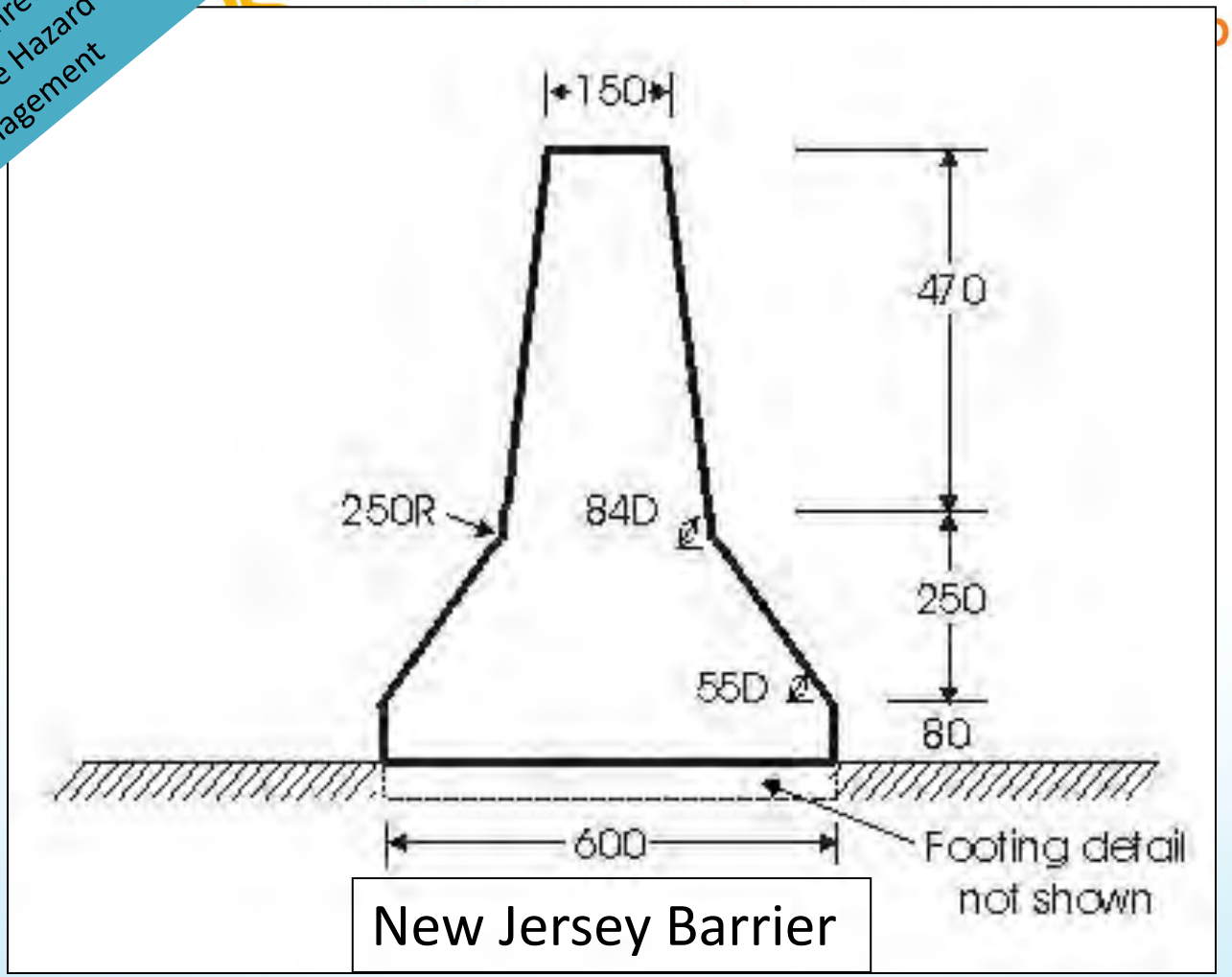


W Beam Safety Barrier


Manual Three -
Roadside Hazard
Management
W Beam Safety Barrier


Manual Three - Roadside Hazard Management
End treatments are necessary to avoid penetration into the vehicle

Manual Three - Roadside Hazard Management



New Jersey Barrier


Manual Three -
Roadside Hazard
Management
JUMEIRAH BUSINESS CENTRE TOWERS
AVIS

Good practice in road safety engineering for CAREC highways

Three technical manuals

- ✓ Will be directly relevant to CAREC highways.
- ✓ Will include CAREC examples.
- ✓ Will provide practical, up-to-date road safety engineering information for use in CAREC road agencies.
- ✓ May become texts for university courses.
- ✓ Will encourage highway engineers to think of, and act on, safety.
- ✓ Will be one step towards encouraging the road safety engineering profession in CAREC road agencies.
- ✓ Will provide guidance but will stop short of becoming “national standards”

Thank you.

I welcome
your questions