



Safe traffic control at road works – the essentials

Phillip Jordan





Objectives of this presentation:

- To explain why safety at road works is important.
- To outline the new CAREC manual and the essential points for improved safety at road works.



**HOW MANY PEOPLE ARE INJURED OR KILLED IN ROAD
CRASHES AT ROAD WORKS IN YOUR COUNTRY EACH YEAR?**

HOW MANY PEOPLE ARE INJURED OR KILLED IN ROAD CRASHES AT ROAD WORKS IN YOUR COUNTRY EACH YEAR?

Unfortunately we do not
know for sure.....



Road crashes at road work sites are a serious problem



Road users have three times the risk of a serious crash in a road work zone compared with other parts of the road network (USA)

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



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

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



German research has shown that approximately one quarter of collisions happening on national routes occur at work zones.

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



Research has also identified that road works that take longer and extend over longer distances have lower crash rates as opposed to short term works in short length zones. (SWOV 2010)

IMPROVING WORKER SAFETY THROUGH BETTER
VISIBILITY

Agota Berces,
Technical, Regulatory and Business Development
Manager
3M Traffic Safety Systems Division, Sydney, NSW,
Australia



An unnecessary tragedy at road works!



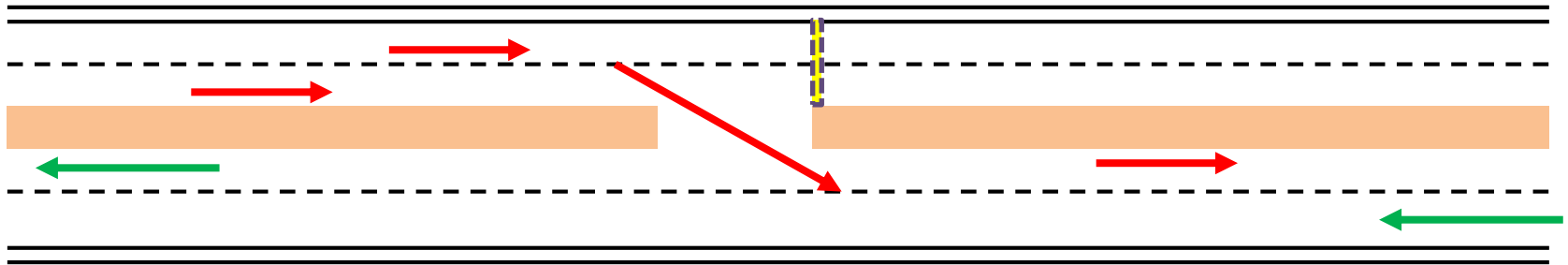


A divided national highway in northern India had pavement cracks. The Contractor closed one carriageway (for crack-sealing) with some rocks and simple signs. Traffic was directed two-way along the other carriageway.

He did not inform on-coming traffic to expect two way traffic!

A tragedy waiting to happen.....

DELHI →



← MUMBAI

**The NH 76 was a divided highway (2 carriageways).
A contractor had closed the Delhi bound
carriageway for maintenance (crack sealing).**

**DIVERSION
AHEAD
200 M
GO SLOW**

→ Madhucan Kinapuri JV

76

76



WORK IN PROGRESS
→ ROAD CLOSED
TAKE DIVERSION →





What is missing?



What is missing?



What happened?



A fatal head-on collision







Five men killed



A few days later.....signs placed to face the truck's direction of travel. Too late to prevent five deaths!

Could a similar situation exist on a
CAREC highway?

Work sites are planned and managed by engineers.

Any safety concerns at a road work site have been
created by engineers!

It is up to engineers to make their work sites safe for
workers and road users.

CAREC Highway February 2018

E60 eastbound



CAREC Highway February 2018

E60 westbound

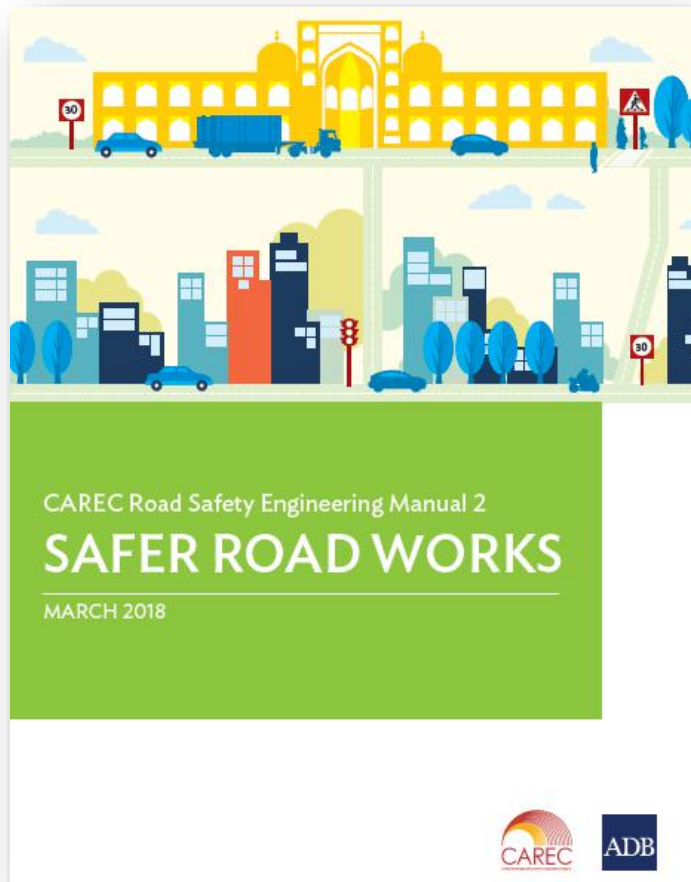


CAREC Highway March 2018 (southbound)

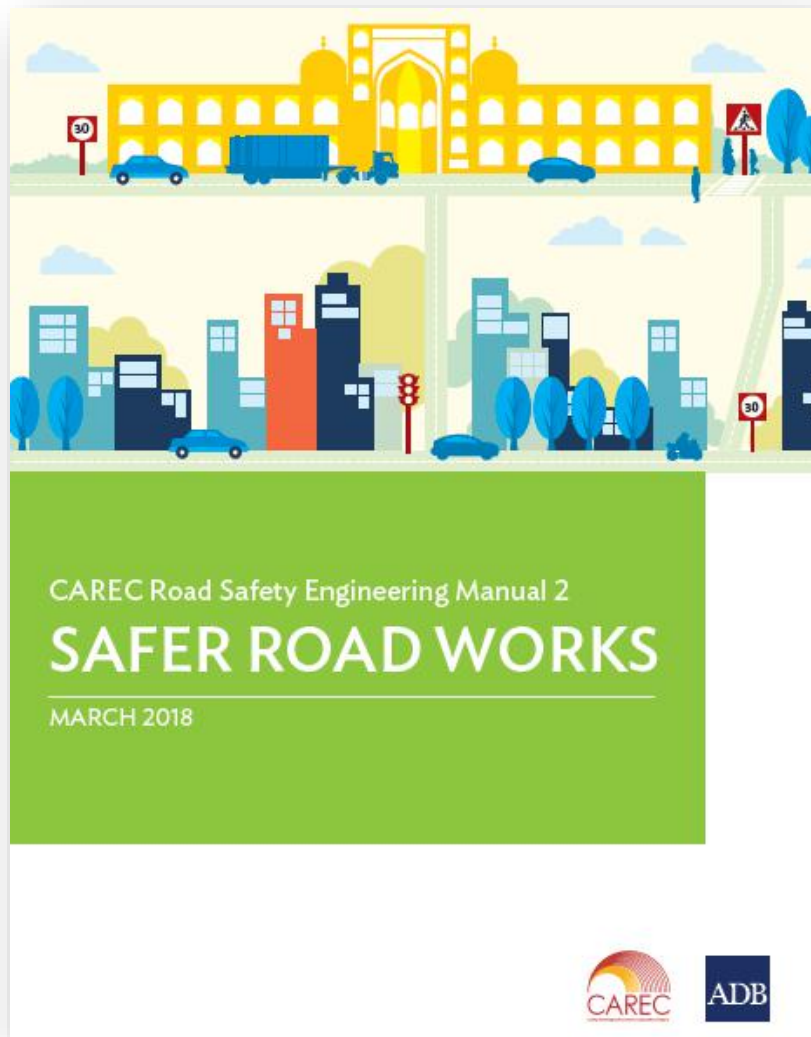


CAREC Highway March 2018 (other direction)





The new CAREC manual 2 “Safer Road Works”, provides the essentials to make road work sites safer for all.



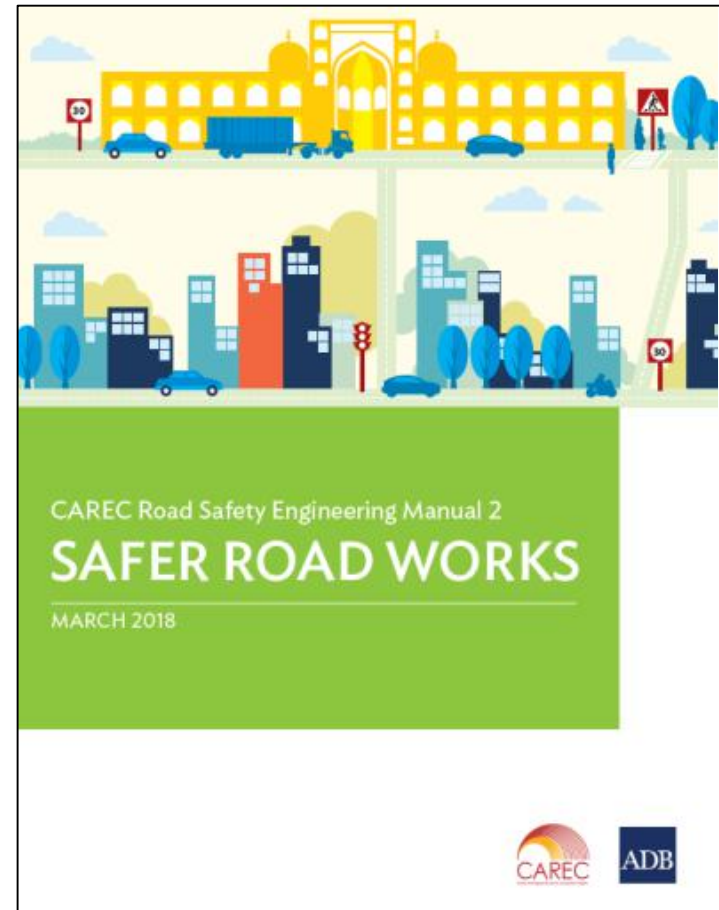
The CAREC “Safer Road Works” manual

- Short, clear, practical.
- Aimed at practitioners.
- Outlines the basics for safer traffic control at road works.
- CAREC road agencies will expect safer work sites from now on.

As a Contractor, or as a MoT engineer responsible for issuing road construction contracts, and for managing road projects – **you have a responsibility to the road users and to the road workers to provide safe work sites.**



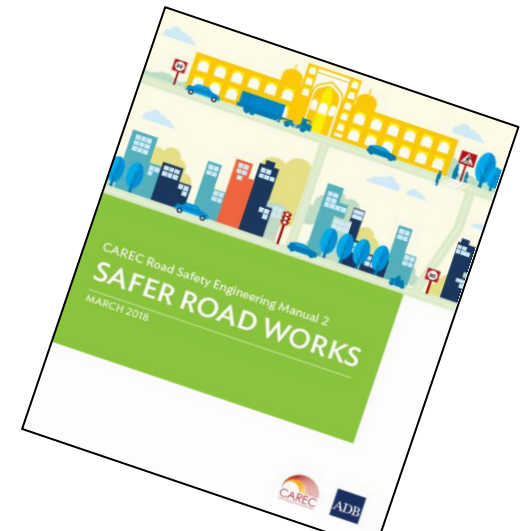
The CAREC “Safer Road Works” Manual



The new CAREC manual on Safer Road Works, provides you with the essentials to assist you to make work sites safer – for all.

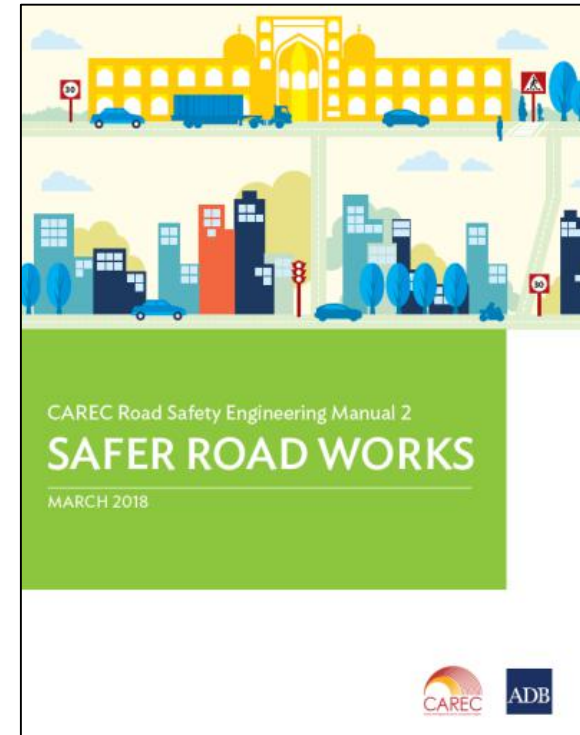
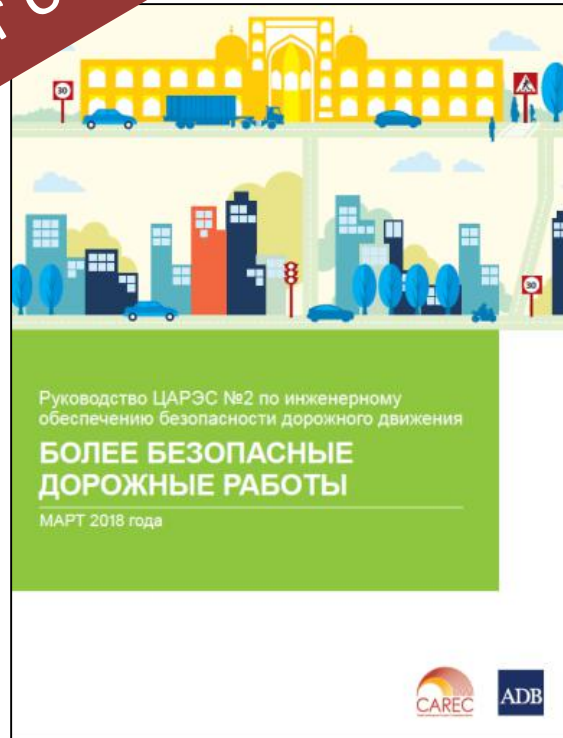
The CAREC “Safer Road Works” manual

- Short, clear, practical
- Aimed at practitioners
- Outlines the basic requirements for safer traffic control at road works.
- CAREC road agencies will expect safer work sites from now on.



The manual asks you to remember.....

Road works should not surprise any driver or rider!



Always look at your road works through the eyes of the drivers/riders – not just as an engineer!

“Safer Road Works”

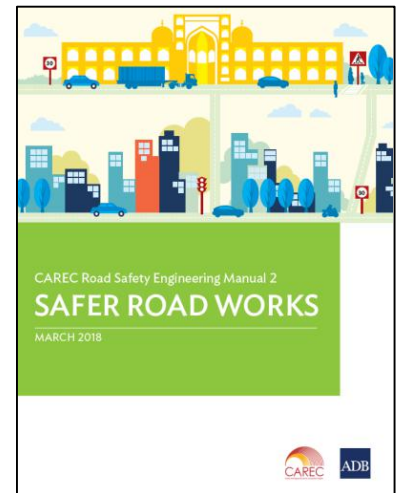


TABLE OF CONTENTS

ABBREVIATIONS	2
1. BACKGROUND	5
2. MANAGING RISK AND PLANNING FOR SAFETY	10
3. DESIGNING A TRAFFIC MANAGEMENT PLAN	20
4. IMPLEMENTING A TRAFFIC MANAGEMENT PLAN	31
5. OPERATING A TRAFFIC MANAGEMENT PLAN	34
6. CLOSING OUT.....	37
7. DEVICES FOR USE AT ROAD WORKS SITES	38
8. STANDARD LAYOUTS FOR TMP'S	57
9. HELPFUL TIPS FOR SAFETY OFFICERS.....	63
10. INSTRUCTIONS FOR TRAFFIC CONTROLLERS.....	64
11. GLOSSARY OF TERMS.....	68

Table 1: Process Flowchart for Traffic Control at Road Works

Step	Action	Considerations
Step 1	Make decisions about managing the project. How will the work be undertaken?	Will the project be long term or short term? How many stages of work are needed? What equipment will be needed? How many workers? Are there constraints on work times?
Step 2	Determine the risk rating for the site.	Will the works be taking place in a location of high risk or low risk?
Step 3	Consider the risks.	
Step 4	Explore options to reduce risk.	The hierarchy of control. Begin at the top and explore all options as you move downward.
Step 5	Decide on risk control measures	Decide how best to manage the traffic using accepted measures appropriate to the size of the road project.
Step 6	Design a traffic management plan (TMP), and seek approval from the highway authority.	Design a TMP to suit each stage of the road project. If the works will have multiple stages, there must be multiple TMPs.

What is a TMP?

A traffic management plan (TMP) shows clearly all the signs, barriers, barricades, and other devices to be installed and maintained at a worksite for the duration of the works. If work has several stages, there should be a TMP developed for each stage expected to last longer than 1 week.

Diagrammatical Representation of the Hierarchy of Controls Pyramid

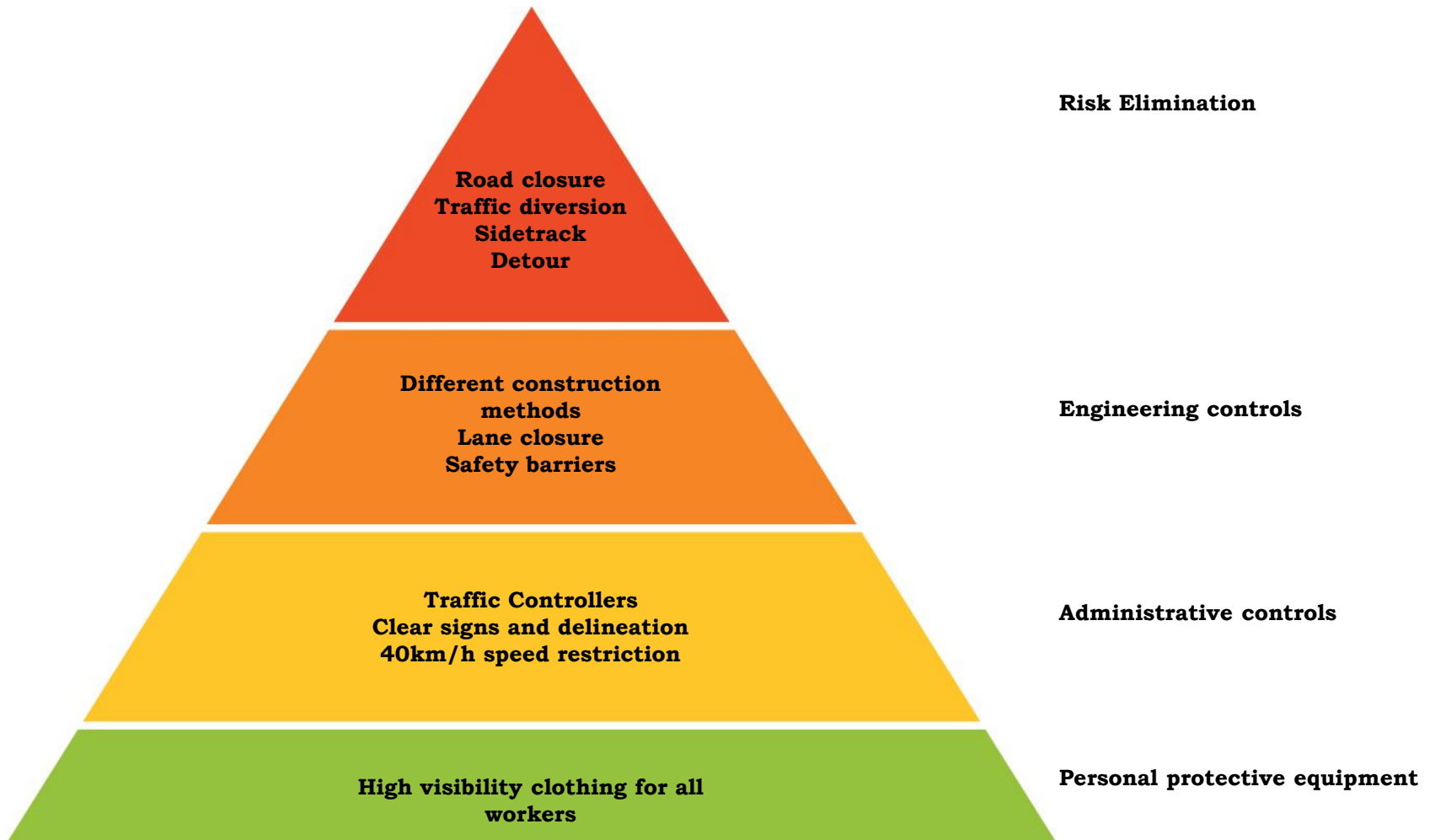
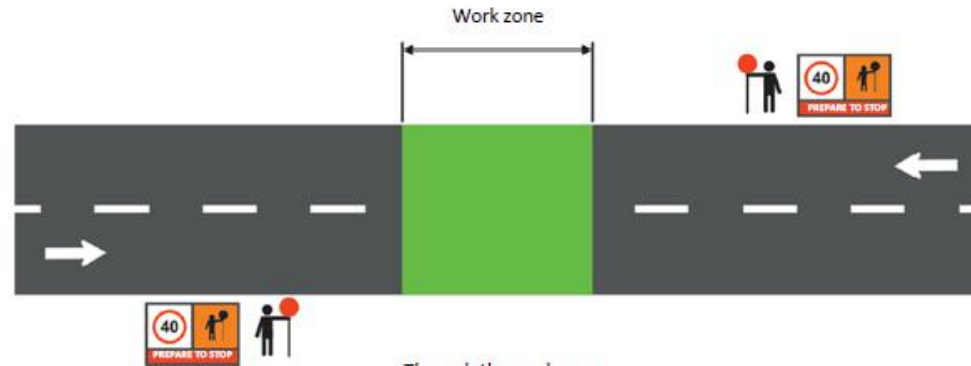
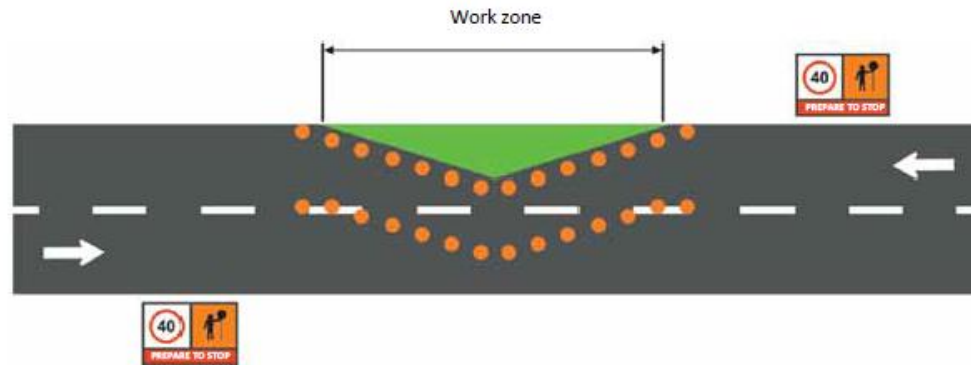


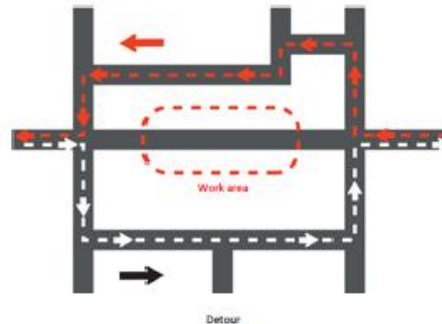
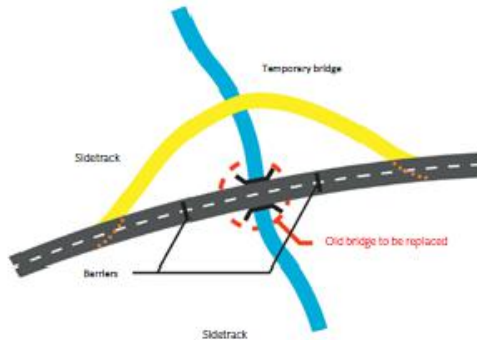
Figure 2: Four Alternatives for Traffic to Pass Through, Past, or Around a Work Zone



Through the work area

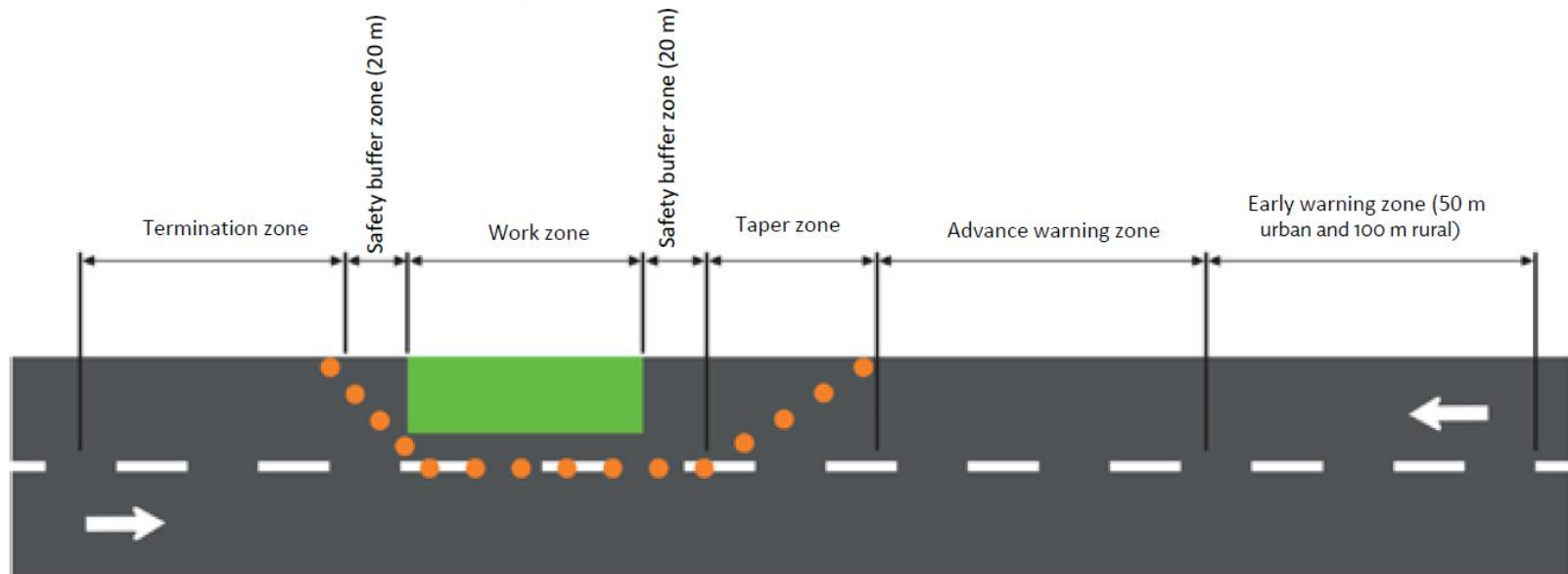


Traffic past the work area



THE SIX ZONE CONCEPT

Figure 4: The Six-Zone Concept



m = meter.

Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

The "Zone Concept" is a method of breaking a work site down into **6** individual zones.

The Six Zone Concept

- 1 Early Warning Zone** – the first zone, in which signs are placed to alert approaching drivers/riders of the presence of road works ahead.
- 2 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 behavior.
- 3 Taper Zone** – is used if motorists are required to move from their lane to pass around a Work Zone.
- 4 Safety Buffer Zone** - is a longitudinal safety buffer immediately in advance of, and beside, the work area. At CAREC worksites it is to be at least 20m in length; it is kept free of equipment, materials and workers.
- 5 Work Zone** – is the area in which the works are carried out; it is set aside for workers, equipment and materials.
- 6 Termination Zone** – is the zone where traffic resumes normal operations after passing the Work Zone (the last of the six zones).

"The "Zone Concept" breaks a work site down into six separate zones and provides a simple clear way to think about your Traffic Management Plan"

Each zone has a particular purpose. They follow the path of the vehicles as they approach, pass through and depart from a work site.

A TMP shall show clearly that these six Zones have been considered during the design of the TMP. It shall show that the road signs, the delineators and the other safety devices have been planned around these six Zones.

THE LENGTH OF EACH ZONE IS DETERMINED BY THE
MAXIMUM OPERATING SPEED ON THE ROAD WHERE
WORKS ARE TAKING PLACE.

Refer to the Tables in your
CAREC manual



Table 2: Early Warning Zone Lengths

Speed Zone	Length of Early Warning Zone
Up to 60 km/h	50 m
Above 60 km/h	100 m

Table 5: Minimum Length of Advance Warning Zones

Approach Speed (km/h)	Length of Advance Warning Zone (m)	
	Desired Speed at the End of the Advance Warning Zone	
	40 km/h	0 km/h (STOP)
50	30	75
60	60	100
70	120	160
80	170	225
90	200	295
100	250	370

The taper zone length is based on:

- width of lane to be closed is typically 3.5 m,
- diverge taper length is equivalent to 1.0 m lateral shift,
- merge taper length equivalent to 0.5 m lateral shift, and
- use the operating speed of traffic to guide the taper length.

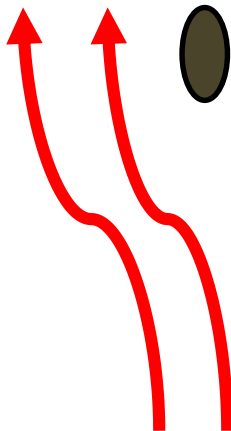
Table 6: Recommended Lengths of Taper (Transition) Zones

Approach Speed Entering the Taper Zone (km/h)	Diverge Taper (m)	Merge Taper (m)
40	50	90
50	50	100
60	60	120
70	70	140
80	80	160
90	90	180
100	100	200

TWO TYPES OF TAPER ZONES

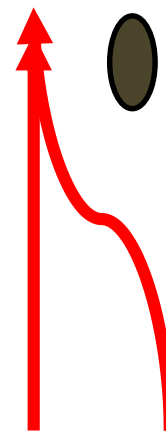
DIVERGE

Where traffic moves sideways to the left or right to pass the Work Zone

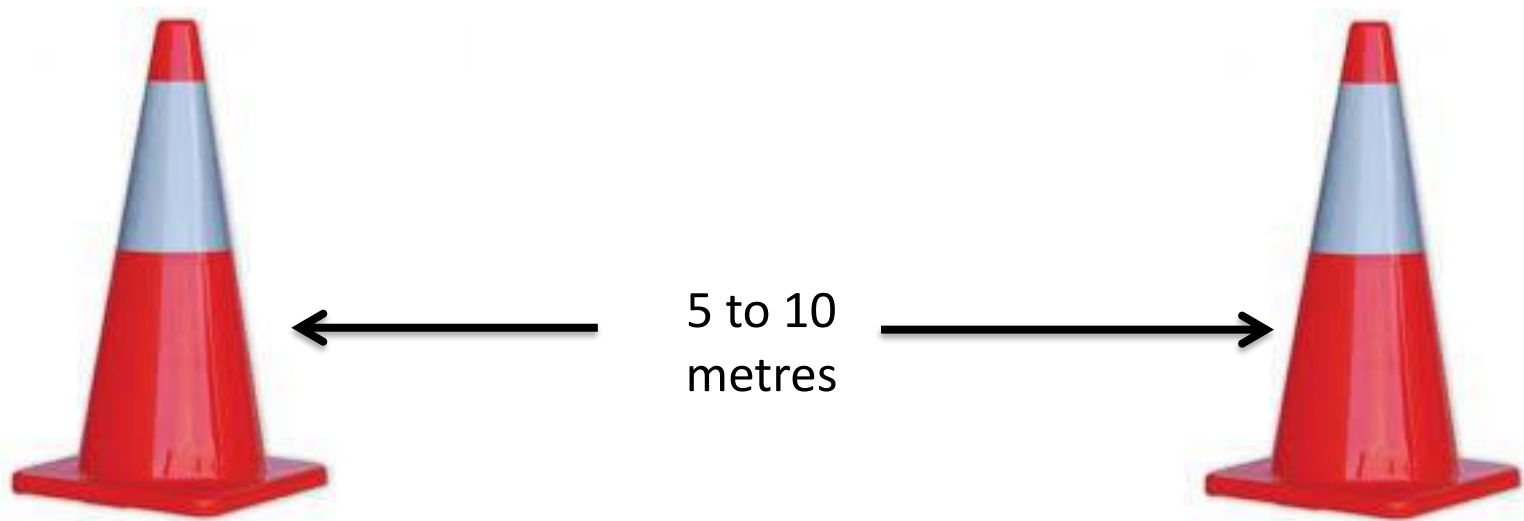


MERGE

Where two lanes of traffic combine (merge) into one lane to pass the Work Zone



Traffic cones are most effective at 5 metre intervals



Note: Traffic cones should never be spaced more than 10 metres apart

If a sign, or traffic cone, is knocked over or removed, replace it as soon as it is safe to do so.





WHAT SHOULD THE SPEED LIMIT BE IN YOUR WORK ZONE?

Table 3: Speed Limits at CAREC Road Works Where Workers are on the Road or within 1.5 Meters of Moving Traffic

Speed Limit	Safety Buffer Zone	Road Work Speed Limit
Up to and including 80 km/h	Not applicable	40k m/h
Above 80 km/h	60k m/h	40 km/h

WHAT SHOULD THE SPEED LIMIT BE IN YOUR WORK ZONE?

**Table 4: Speed Limits at CAREC Road Works
Where Workers are not Working on the Road
nor within 1.5 Meters of Moving Traffic**

Speed Limit	Safety Buffer Zone	Road Work Speed Limit
Up to and including 80 km/h	Not applicable	60 km/h
Above 80 km/h	Not applicable	60 km/h

**USE A 40 KM/H SPEED LIMIT THROUGH
ALL YOUR CAREC WORK SITES – BUT ONLY WHEN WORKERS
ARE ON-SITE AND WITHIN 1.5M OF TRAFFIC**



??









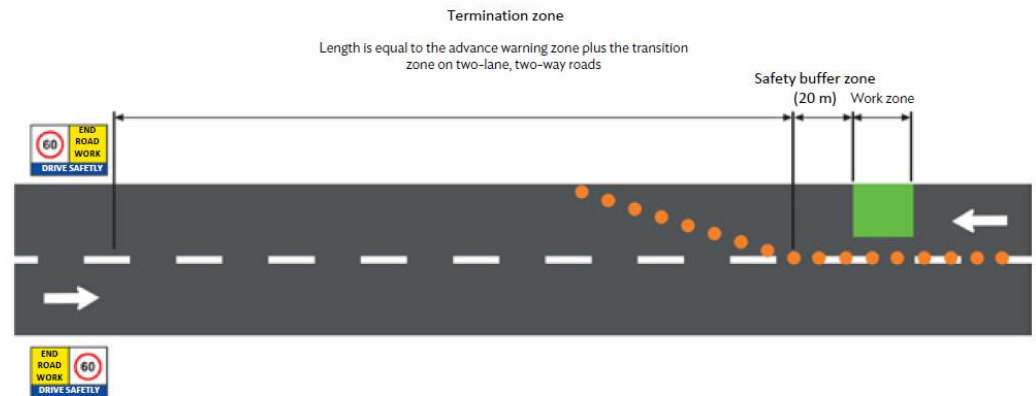
??



HOW LONG SHOULD THE TERMINATION ZONE BE?

- Rural 100m
- Urban 50m

Figure 8: Typical Termination Zone

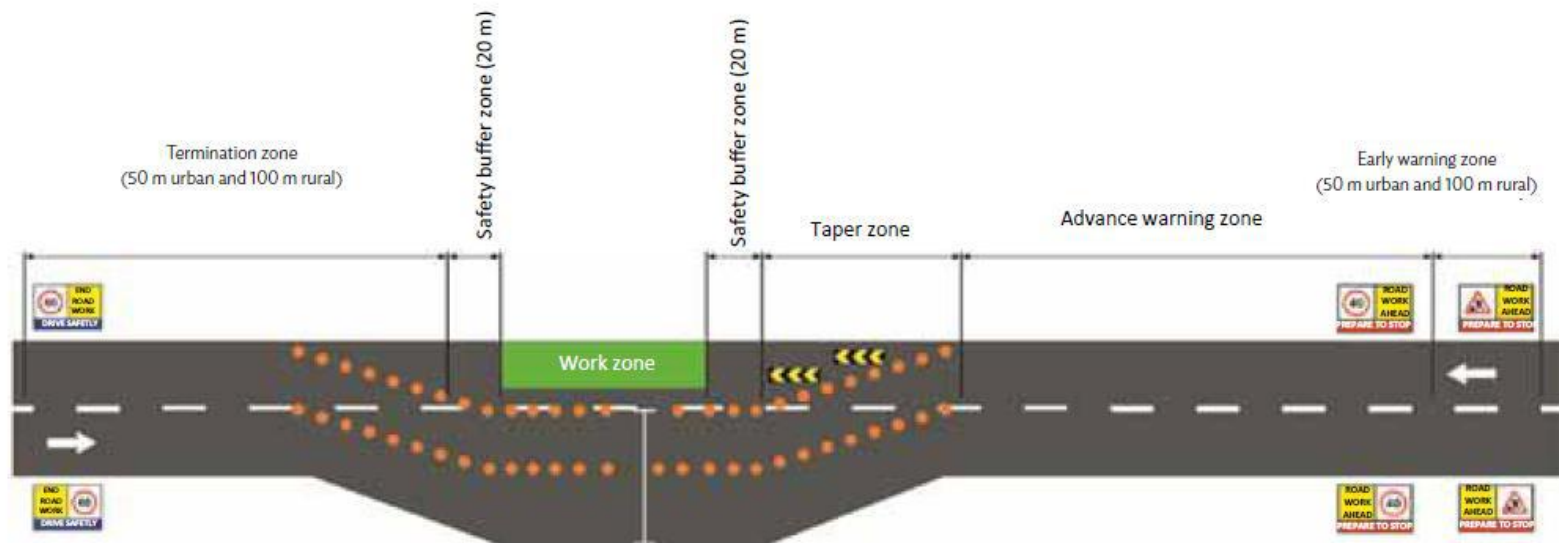


m = meter.

Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

Figure 13: A Reduction in the Available Road Width but with Sufficient Width for Two-Way Traffic

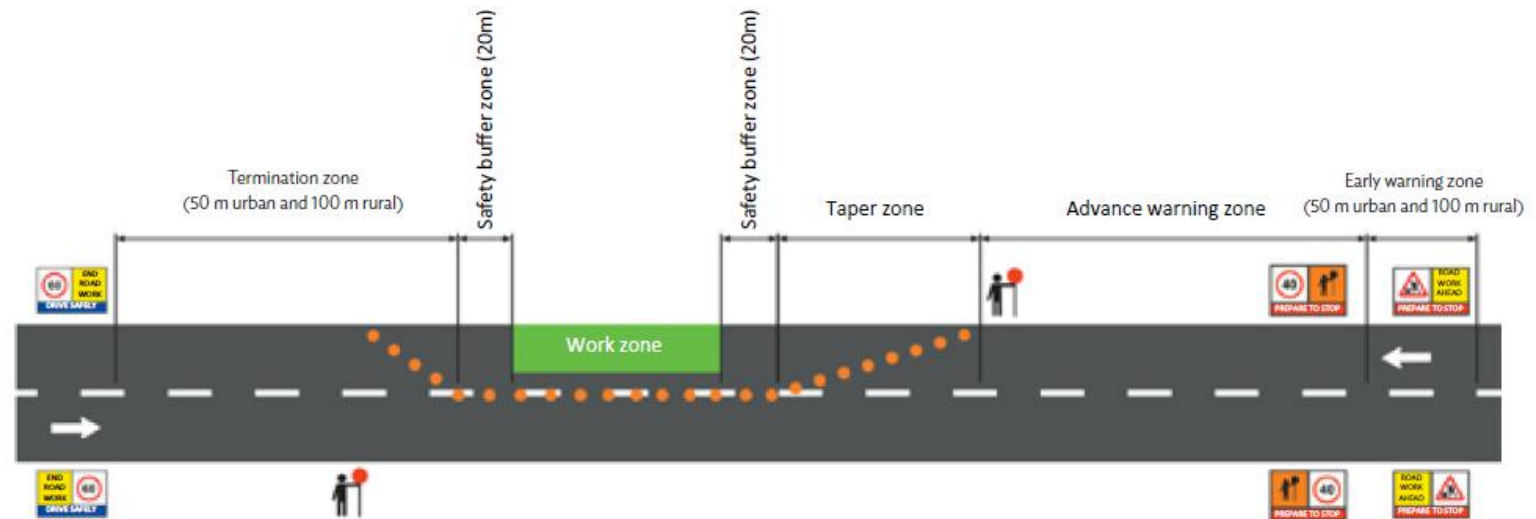


m = meter.

Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

Figure 15: Works on a Two-Way Highway Requiring Closure of One Lane with Traffic Controllers Controlling Remaining Single Lane

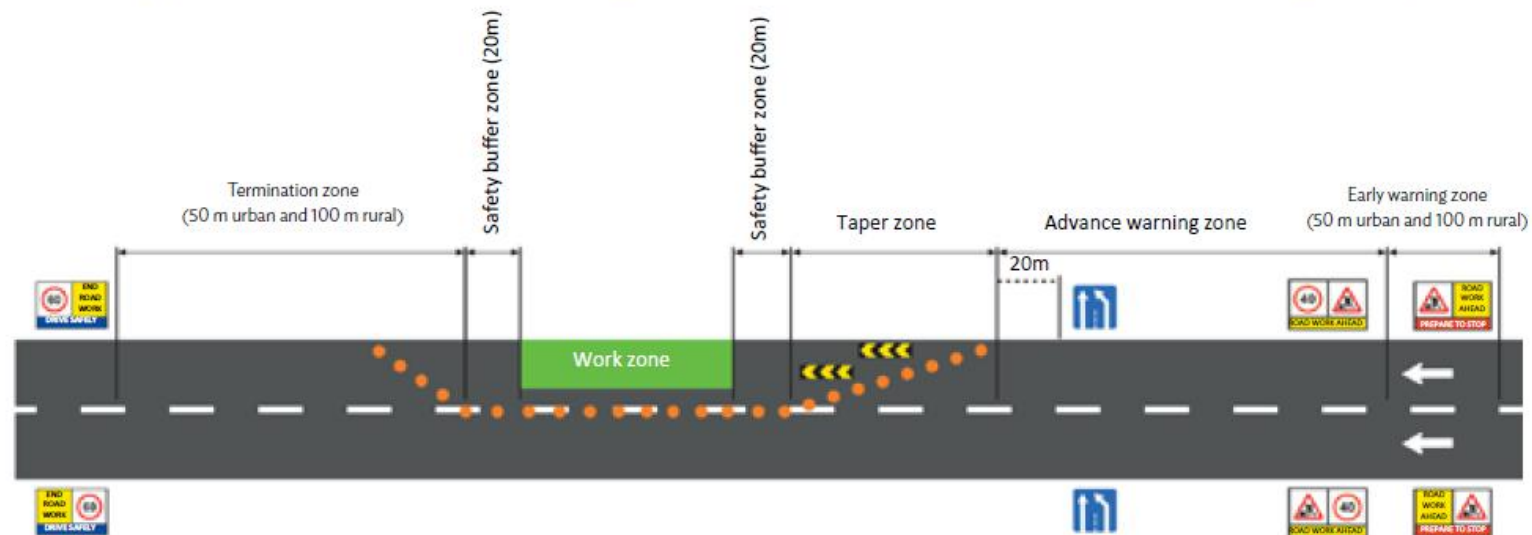


m = meter.

Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

Figure 17: Closure of the Right-Hand Lane of a Multilane Carriageway

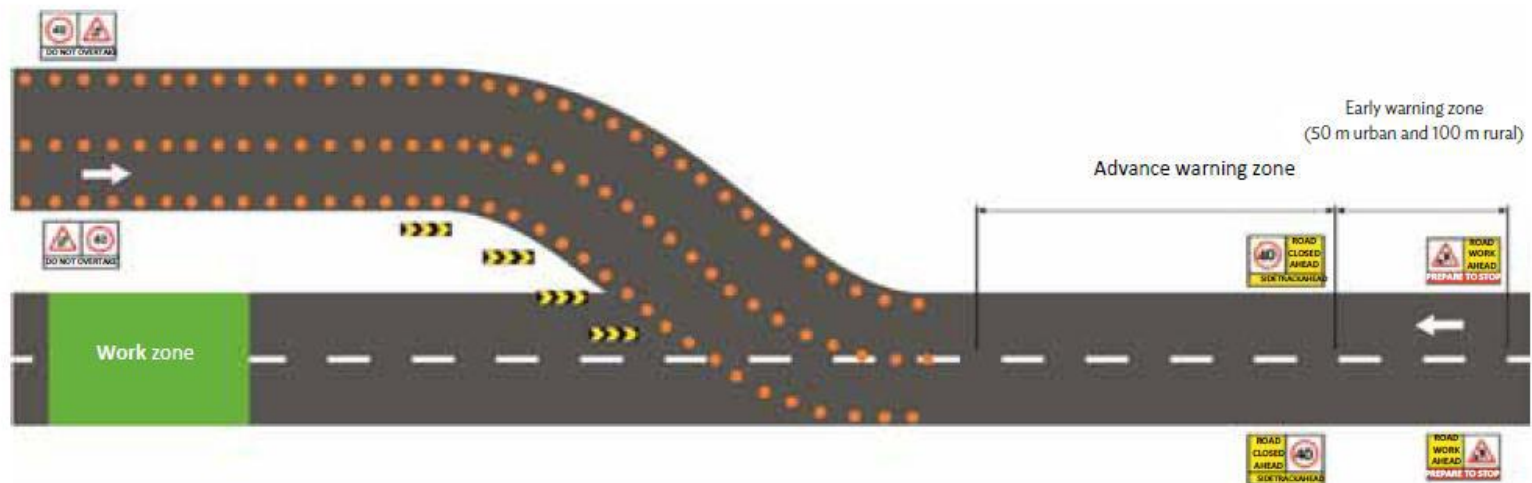


m = meter.

Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

Figure 20: Two-Way Side Track due to a Full Road Closure



m = meter.

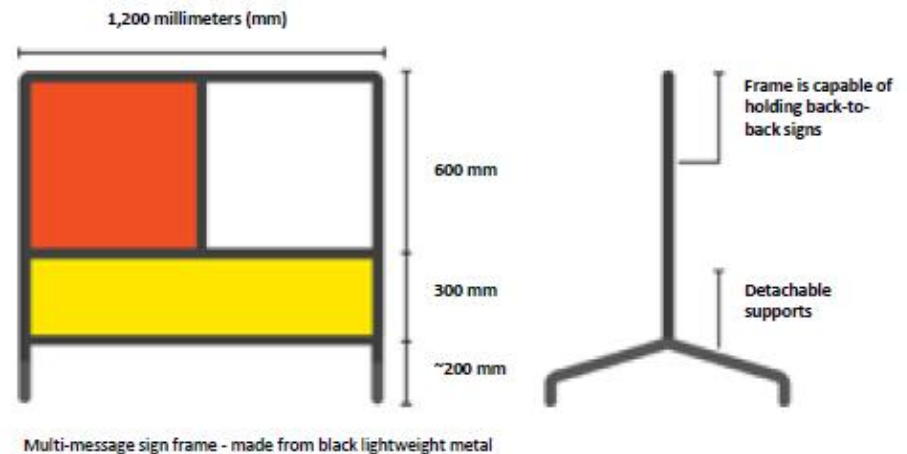
Note: The traffic management plan is for one direction of travel only.

Source: Asian Development Bank.

Multi message signs are very useful for road works.

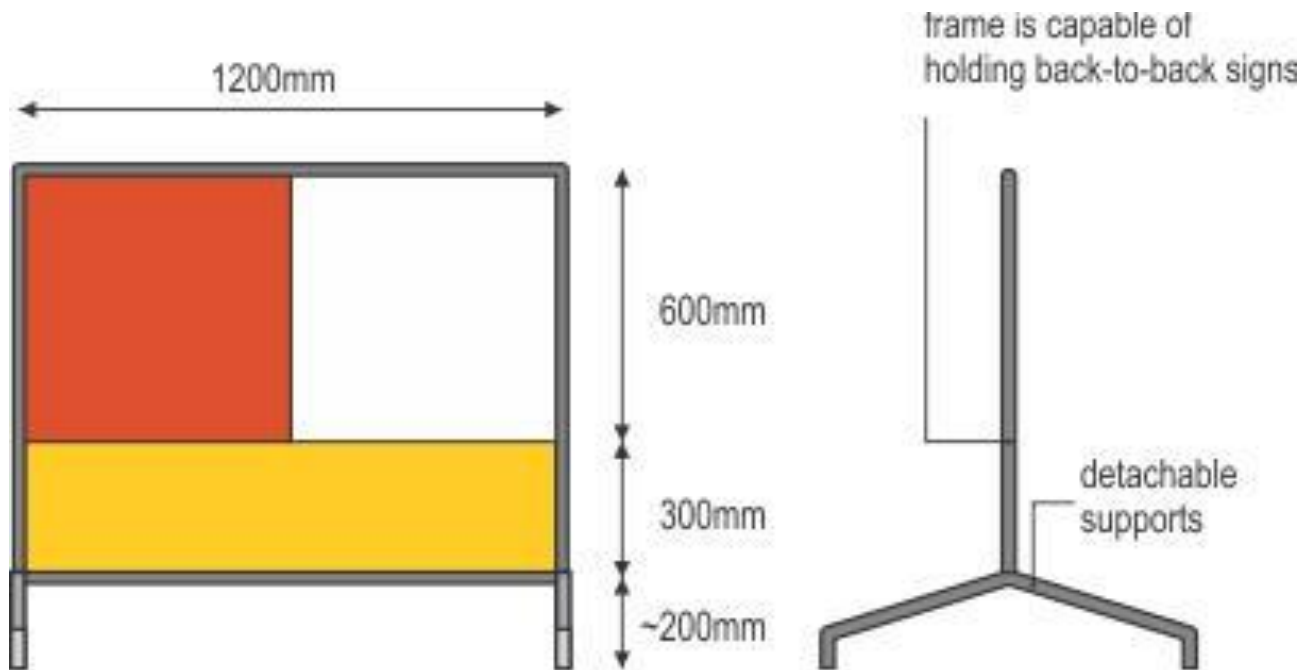
The CAREC manual encourages you to consider these.

Figure 10: Modular Multimessage Frame



Source: Asian Development Bank.

Multi message signs are very useful for road works. The CAREC manual encourages you to consider these.



▲ Multi-message sign frame - made from black lightweight metal



PREPARE TO STOP



Flagmen can
offer more for
safety than they
do at present.





INSTRUCTIONS FOR TRAFFIC CONTROLLERS

A Traffic Controller is the person on a work site who is responsible for the safety of traffic and pedestrians to pass through the work site safely (and with minimal delay).

A TRAFFIC CONTROLLER



....is the person who sets up the zones according to the TMP

Traffic controllers are used when signs and devices for works are considered insufficient to provide for personal safety, public convenience and efficient control and management of traffic around the worksite.

Traffic controllers are responsible for:

- Placing the signs in a safe and effective manner
- Placing the cones/ bollard to the correct lengths
- The safety of all motorists and pedestrians who pass though the site
- Assisting the Safety Officer with the safety of all workers on the site

Instructions for Traffic Controllers



Stop the Traffic



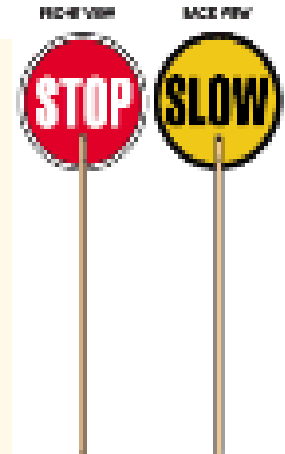
Allow Traffic to Proceed



Slow the Traffic

Источник: Консультант по инженерному обеспечению БДД ЦАРЭС

The STOP baton is a regulatory sign. It must be obeyed. Traffic Controllers display the STOP baton as an indication to drivers to stop and remain stationary for as long as the baton is displayed to them. (Traffic from the other direction will usually be able to travel through the work site facing the SLOW baton).



- Give definite and clear signals to drivers/riders as follows:
 - To stop traffic, turn the baton to “Stop”, face the traffic, and raise your other hand into the stop position with the palm towards the traffic.
 - To allow traffic to proceed, wait until all traffic from the other end of the work has passed, move to the side of the road, then turn the baton to “Slow”. Turn side on to the traffic, and with your other hand give a “Go” indication.





PERSONAL PROTECTIVE EQUIPMENT (PPE)

Traffic Controllers work in live traffic
and around machines and plant
therefore it is essential to wear the
appropriate PPE

WET WEATHER GEAR

Where personnel are required to work in wet conditions, they should be provided with, and required to wear, waterproof, warm and reflective clothing (PPE)



ROAD SIGNS

Signs at road work sites should comply with the 6C's of good signage.

Good signage is essential for safety through the work site.



REQUIREMENT	SIGN REQUIREMENT	CONTRACTOR TO ENSURE
Conspicuous	Each sign shall be able to be readily seen.	That all signs can be seen by approaching drivers and/or riders. This requires all signs to be reflective, and in good condition, and located suitably.
Clear	Each sign shall be clear and easy to read.	All signs are to be kept in good, clean condition.
Comprehensible	Each sign shall be easy to understand	All signs used comply with national standards.
Credible	Each sign shall be reasonable and believable by road users	No sign shall be used that does not show a credible (believable) message.
Consistent	The same sign shall be used for the same situation at all road works everywhere across the country	That standard signs only are used at road work sites so drivers/riders can quickly understand the message.
Correct	The sign shall be the correct sign for that situation – there are some warning signs that appear the same but have quite different meanings.	That only correct signs are used. Near enough is not good enough. Do not use “any” sign if the correct one is missing. Rather, get a correct one and install it.

SIGN POSITIONING



When positioning signs, ensure that they

- Are within driver/riders line of site
- Generally placed 1 meter clear of the travel path
- Cannot be obscured by vehicles or other objects
- Do not obscure other devices
- Are not a hazard to workers or public
- Do not direct traffic into an unsafe path
- Are securely mounted



CASE STUDY 1



CASE STUDY 1



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2



CASE STUDY 2

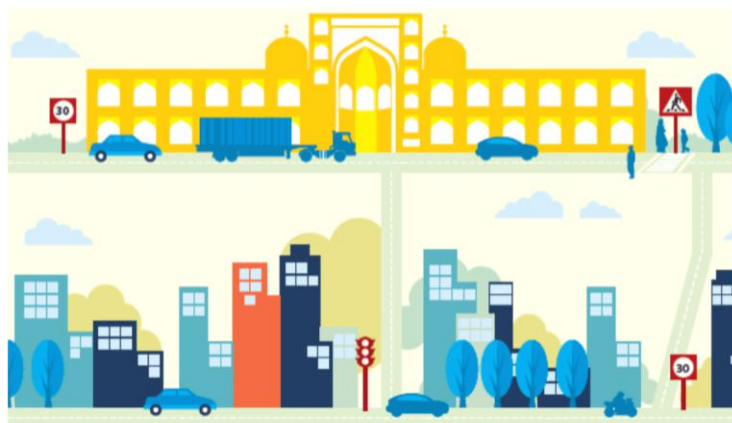


Remember the following key points:

- Always prepare a traffic management plan.
- Use the Six Zone Concept from the CAREC manual.
- Make sure the zones are long enough.
- For larger projects, have TMP audited by an independent team.
- Work with Traffic Police to keep speeds low.
- Ensure the Contractor has sufficient signs/cones

Remember the following key points:

- **Adopt a consistent road work speed limit.**
- **Ensure all carriageway changes are signed 500m and 250m in advance; correct information and warning signs.**
- **Use a 20m Safety (Buffer) Zone at each end of the Work Zone to protect your workers.**
- **Use “Two Way Traffic” signs in single lane operation.**
- **All workers to wear reflective safety vests.**
- **Employ trained traffic controllers employed (not flagmen) who use Stop/Slow batons.**



CAREC Road Safety Engineering Manual 2

SAFER ROAD WORKS

MARCH 2018



You can save lives



Remember the 6 Zone concept and put yourself into the shoes of the road users. You can make your road works safer for all.