"Practical Road Safety Engineering" online workshop

Module 5 – Signs, lines and delineation

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Welcome back everyone

"Practical Road Safety Engineering" online workshop

MODULE 5 – SIGNS, LINES AND DELINEATION

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QUESTION 1

Reduction in speed due to congestion can reduce accidents?	Mukund Kumar Sinha

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ANSWER 1

Yes – congestion can reduce serious collisions. Experience suggests that crashes increase as traffic volumes increase – until eventually they begin to decrease due to congestion.

In gridlock, motor vehicles cannot move, so we have a very safe situation.

But of course this is no good for anyone, for our cities or our national economies. So our aim is to manage the *safe* movement of people and goods on our road network.

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ANSWER 1

Current Understanding of the Effects of Congestion on Traffic Accidents (Sept 2019)
Angus Eugene Retallack and Bertram Ostendorf*

The role of congestion in modifying accident risk has been widely studied, but consensus has not been reached, with conflicting results leaving open questions. An inverse relationship between accidents and congestion would imply a benefit of congested conditions for road safety, posing a difficult situation for traffic management.

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QUESTION 2

Sir, most of the roads in Nepal lie in steep slope in mountainous region having sharp bends with minimum radius. These roads have carriage way width ranging from 3.75 m to 5.50 m. Is there any special design standard regarding road safety structure to reduce the accident and fatality in such hill road!	Kedar Nepal

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ANSWER 2

In such terrain you have H as well as V geometry to consider first. For most of your network this is already in place; most improvement works are done in small sections along existing alignments.

- Roadside hazard management issues
- Pedestrian issues
- Speed management issues
- Loss of brakes?

Check out:
IRC Codes
Austroads GTRD Part 3 and Part 6

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QUESTION 3

Please let me know a manual/standard regarding " Road marking with reflective road studs"?	Nalinda Sanjeewa Bandara Sri Lanka

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ANSWER 3

Start with your national Signs manual ("standards") and if your country does not have one, go to the nearest "big neighbouring country" that does have one and use it. Indian Road Congress (IRC) Codes of Practice may have a suitable volume.

Almost all manuals have a small section about road studs and how to use them – colour, spacing.

Use it consistently.

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QUESTION 4 (IN PERSON)

Vehicle video-cam recording should be a good source of crash information. Does the police share it with road managers in Australia? Also related to cooperation with police, some remedies involve actions by police (e.g. reducing the speed limit, adding traffic signals), do you suggest RSA/RSI exercise be jointly conducted with police?	Masahiro Nishimura ADB

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ANSWER 4

Blaise will answer the first point.

RSA and RSI teams can benefit having a Police officer in them.

Usually (but not always), Police inputs are best during construction stage or pre-opening stage audits, or during a road safety inspection. A little less during design stage audits.

BUT I maintain my view that Police must enforce, and engineers must manage the roads. Police inputs are essential but not the final decision.

More on RSA teams on Thursday.

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QUESTION 5

What is point no 12 in the urban collision diagram?	Priyabrota Nath

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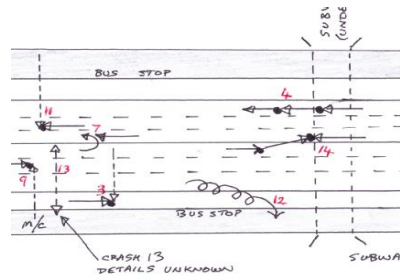
ANSWER 5



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CRASH NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
DATE	12/3	5/5	11/10	29/11	20/1	28/3	1/4	5/9	8/12	31/12	2/2	10/3	5/6	7/9
DAY OF WEEK	SUN	FRI	WED	WED	SAT	WED	SUN	WED	SAT	MON	MON	SUN	WED	SAT
TIME OF DAY	01.15	22.30	19.20	17.50	11.10	20.55	18.30	23.00	14.40	04.00	06.45	23.30	?	20.30
SEVERITY	1	2	2	3	3	3	2	1	3	1	3	1	2	2
LIGHT CONDITION													?	
ROAD CONDITION	WET	DRY	DRY	DRY	DRY	DRY	WET	DRY	WET	DRY	DRY	DRY	?	DRY
CRASH TYPE	003	003	001	303	001	102	207	002	102	004	001	502	?	301
VEHICLE 1	CAR	CAR	BUS	BUS	CAR	CAR	M/C	CAR	CAR	CAR	M/C	M/C	PED	CAR
VEHICLE 2	PED	PED	PED	TRUCK	PED	BIKE	CAR	PED	M/C	PED	PED		?	CAR
VEHICLE 3				CAR										CAR
DIRECTION VEH. 1	E	E	E	W	W	E	W	W	E	E	W	E	?	E
DIRECTION VEH.2	N	N	S	W	S	S	W	N	NE	N	S	N	?	?
DIRECTION VEH.3				W										W
OBSERVATIONS	ALC	ALC	SPEED					ALC & SPEED				SPEED		U TURN

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QUESTION 6

Does crash reduction factor only look at reduction in crash cases regardless of crash severity? Some counter measure like roundabout may cause reduced fatal/severe crashes but increase minor/ damage only crashes	Nuura Addina Mohamad

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ANSWER 6

Yes. A CRF is the average reduction in casualty crashes attributable to that device/treatment based on B/A studies.

Casualty crash means a fatal crash or a serious injury or a slight injury crash.

All are combined to generate the CRF.

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QUESTION 7

In developing countries like India, even the basic details like exact location of accident is sometimes missing. Moreover, it is sometimes cumbersome and there is huge delays in transmitting the data from Police Authorities during Crash site / Black Spot investigation. What can be done to improve this (is web based application can be used to capture data, which will make it faster)	Debashis Puzari

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ANSWER 7

Collecting and storing crash data is a fundamental matter in road safety. It is the single most important matter holding back road safety in many countries.

Police gather crash data. Should they be the ones?

Some Police gather crash data well – some do not. How can we (road safety professionals) improve data collection in ways that have not yet been attempted?

In my opinion going "hi-tech" is no guarantee of success because "lo-tech" elements need to be addressed first.

Police *should* manage a data base that is shared with government stakeholders. Crash data is public information that should be shared and used.

More thoughts welcome.

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Topics in this presentation:

- Types of road signs
- Signing principles – the 6 C's
- Placement of signs
- Delineation
- Pavement markings

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Before we start - some people think that "road safety" for engineers refers to signs, lines and barriers". Only! Minor! Not as important as structures, pavement design etc.

If so, this workshop would be over in about two modules!

Road safety engineering is a specialised field requiring experience and judgement in many issues – ranging from geometric design to signs, to traffic signals and to the provision of safety treatments for many road users.

It also includes blackspot investigations and road safety audits. Today is signs/lines/delineation – a technical topic that is necessary knowledge for road safety engineers.

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- Signs assist road users with their decision making (to make correct decisions, quicker).
- 90% of driving information is taken in by eyes.

Use	**Use standard applications** • Follow your country's standards • But always question whether "standards" are safe • Judgment
Be	**Be consistent across the road network** • Consistent use of signs and symbols • Consistent level of signage: not too little or too much
Put	**Put yourself in the shoes of the road user** • Help them in the driving task • Consider the unfamiliar driver • Do not forget pedestrians & cyclists

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So lets get our signs right!

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Types of road signs

1. Regulatory (compulsory, mandatory)

2. Warning (cautionary)
   Temporary – such as road works

3. Guide (information)
   Direction
   Tourist
   Services
   Traffic instruction
   Traffic information

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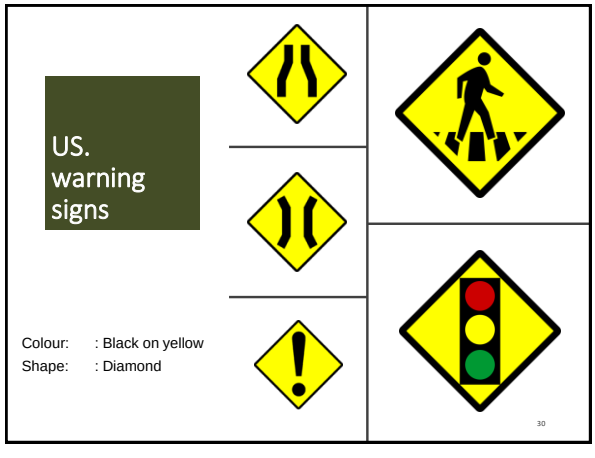

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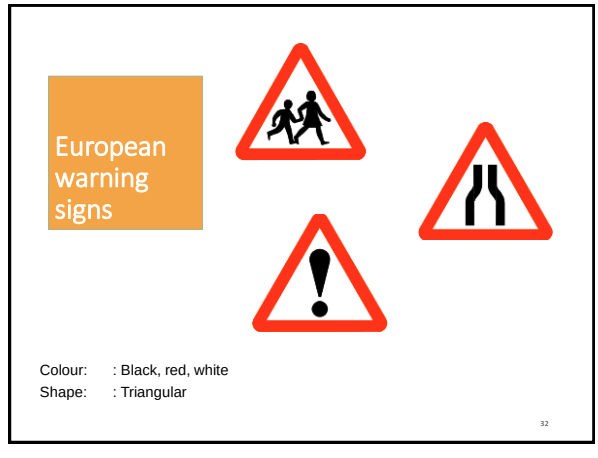

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China has another standard for warning signs

Colour: : Black on yellow
Shape: : Triangular

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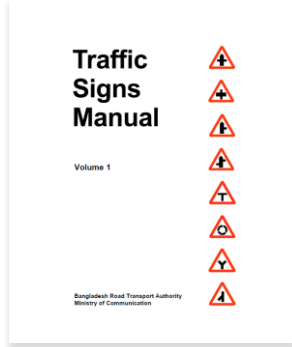
Bangladesh Traffic Signs manual



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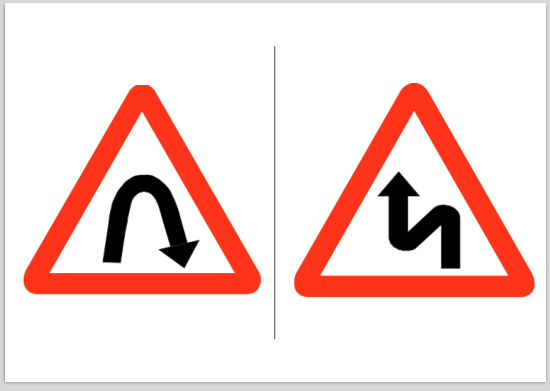

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Selecting and using the correct sign is important

Warns the section of road ahead has no footway and there are many pedestrians walking in the road. The sign should not be used unless there is a serious problem. Where the hazard occurs over a long section, supplementary plateD2 can be used.

Warns that the section of road ahead is used by children. Typical situations are near schools, routes to/from schools and play areas. Where the sign is to be sited near a school, supplementary plate D3 School may be used.

This sign warns of a ped xing ahead. It must be positioned on the approach to pedestrian crossings that are difficult to see or that are on high speed roads. It is not normally used to warn of ped crossings that are within a junction controlled by traffic signals.

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Selecting and using the correct sign is important

This sign warns that the width of the road ahead will suddenly become narrower from the right (left). The sign is often used at roadworks. The sign should not be used where the reduction in width is gradual.

This sign warns that the dual carriageway ends and becomes a two lane road ahead.

This sign warns that the road ahead will suddenly become narrower. (Not to be used where the reduction in width is gradual). Supplementary plate D6 should be attached when the road narrows to a single track. The sign should not be used to warn of the end of a dual carriageway– sign B16 is the sign for this purpose.

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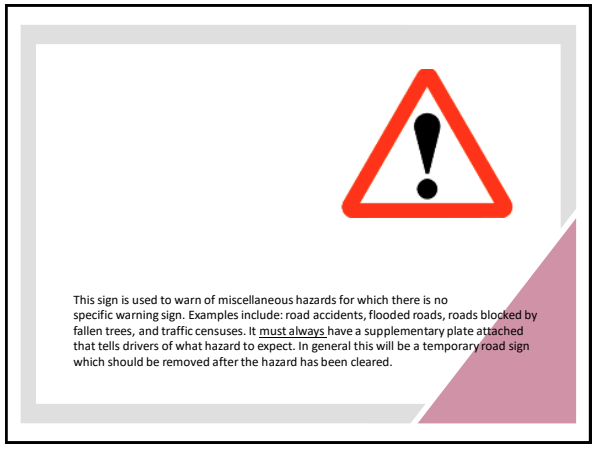

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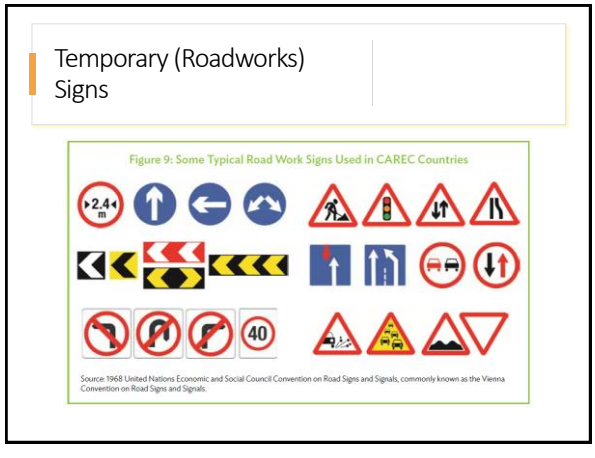

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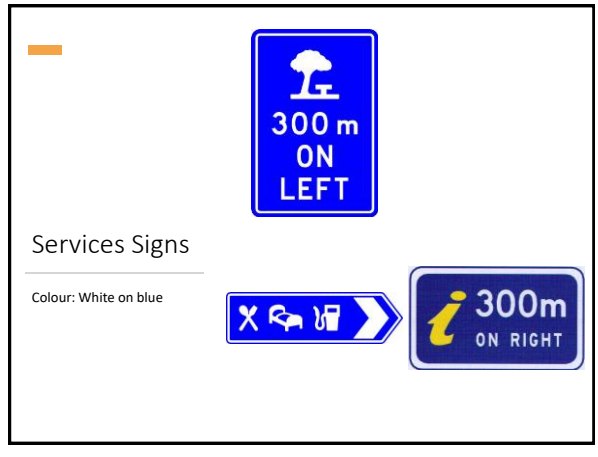

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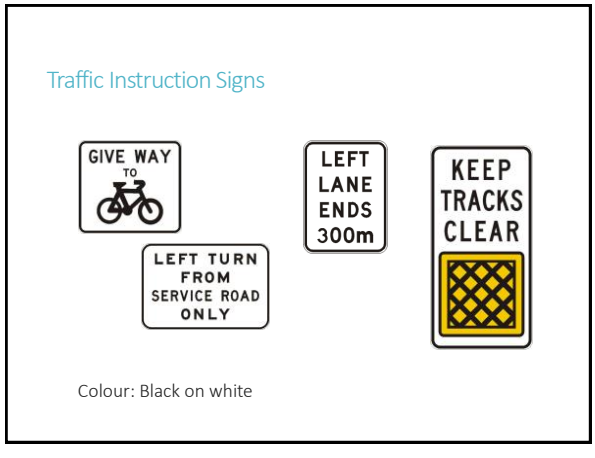

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Traffic Instruction Signs

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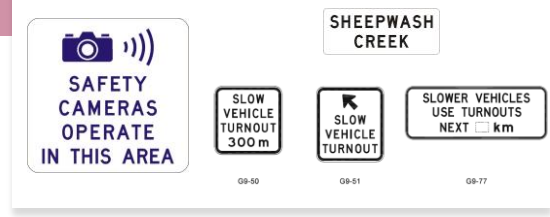

Traffic Information Signs

- Black on white
- Blue on white (related to enforcement)

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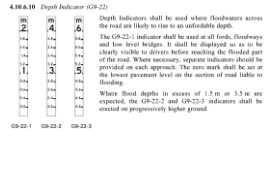
Guide (Traffic Information)



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Hazard Markers

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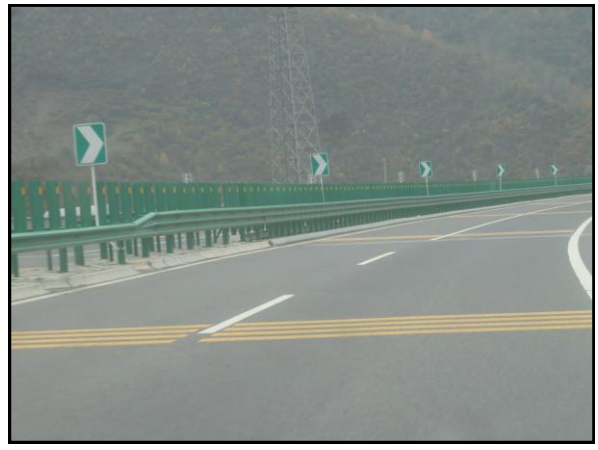

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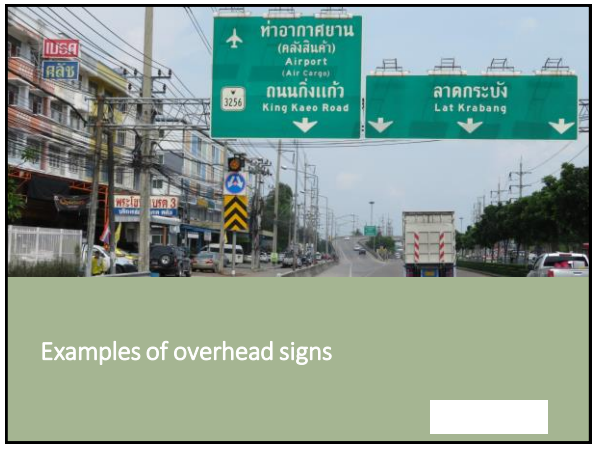

Examples of overhead signs

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Overhead Mounting

Overhead mounting is considered only for:

- Urban arterial roads – high volume of large trucks
  - narrow footpath, verandas, vegetation
  - multilane carriageways
- Urban motorways/expressways
- Arterial roads – access points to motorways
- Important rural interchanges

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Height of signs - measured to bottom of sign

- Where there are no pedestrians – 1.5 m clear above road surface
- With pedestrians and/or parked vehicle
  - 2.5m over pathways
  - 2m over verges
- Above roadway – 5.3 m (absolute minimum)

Exception: KEEP RIGHT (LEFT) signs and hazard markers, which are mounted lower

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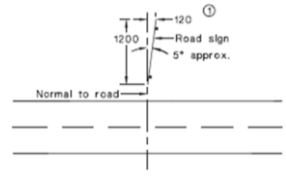
Orientation

All signs should face the road user for whom the message is intended

KEEP RIGHT – angled to face left turners

Road signs facing traffic – rotate 5° away from traffic to reduce headlight reflection



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Summary of factors to consider in sign placement

- Vegetation
- Trees with canopies
- Other infrastructure/buildings
- Distracting background (advertising, signs, shopfronts)
- Street lighting, other poles
- Bus stops
- Public utility services
- Side streets, driveways

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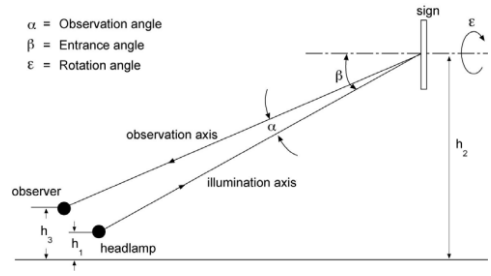
Retroreflectivity angles



Elevation view of overhead sign

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Signs can:

- Regulate road use
- Warn of a hazard
- Inform the road user
- Help the road user navigate; b**ut also:**
- Distract the road user
- Be a hazard
- Provide incorrect/inconsistent information

Signs cannot:

- Educate the road user
- Physically prevent an action from occurring
- Be 100% effective
- Replace necessary civil works

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Signing Principles – the 6 C's

- **Conspicuous** - easily seen
- **Clear** - legible, able to be read in time
- **Comprehensible** – understood
- **Credible** – believed
- **Consistent** - same symbols, and placements, across the network
- **Correct** – the sign must be correct

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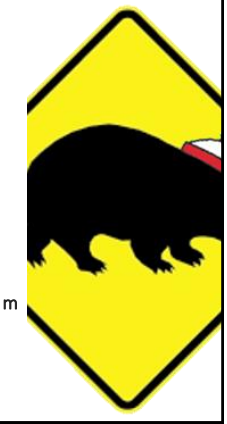
Advance Sign Placement

Location of advance warning signs before the hazard or action point:

Urban areas, 50 km/h : 80 to 120 m
Rural areas, 80 km/h: 120 to 180 m
Freeways/highways, 100 km/h:180 to 250 m



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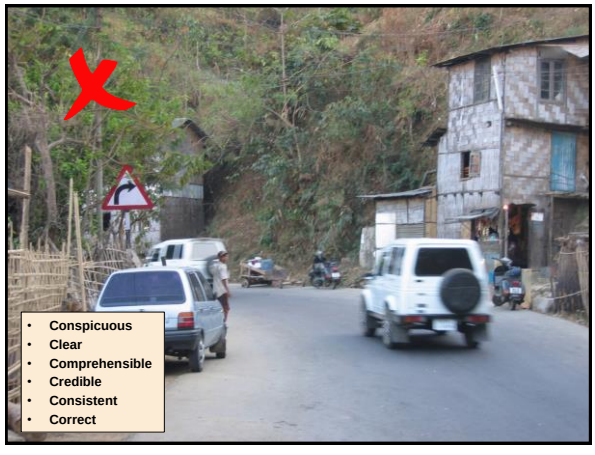

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Longitudinal separation – as a rule - separate signs by 2 seconds of travel time

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Delineation

- Guide Posts & Delineators
- Raised Reflective Pavement Markers (cats' eyes)

- Hazard Markers

- Chevron Alignment Markers (CAMs)

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Guideposts

- White post 1 metre high, 100 mm wide
- Double sided on a two-way road
- Retro-reflective delineator
- Red on the drivers side (right)
- White on the opposite side (left)

- Lateral placement:
  - 150 mm clear of outer edge of shoulder
  - 1.2 to 3.0 m from edge of traffic lane
  - Keep the lateral space consistent

A major task of a guide post is to "hold up" a reflector for drivers to see in poor light/night

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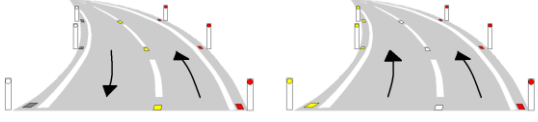
Right side driving
RRPM and guidepost delineator colours



Two-way roadway | One-way roadway

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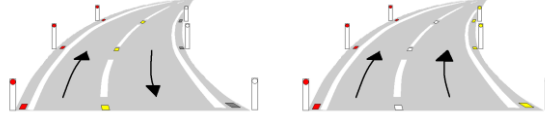
Left side driving
RRPM and guidepost delineator colours



Two-way roadway | One-way roadway

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Guideposts

Longitudinal spacing:

	Spacing of Guideposts	
Curve radius	Outside of curve	Inside of curve
<100 m	6 m	12 m
100 – 199 m	10 m	20 m
200 – 299 m	15 m	30 m
300 – 399 m	20 m	40 m
400 – 599 m	30 m	60 m
600 – 799 m	40 m	60 m
800 – 1199 m	60 m	60 m
1200 – 2000 m	90 m	90 m
> 2000 m and straights	150 m	150 m

AS 1742.2 Table 4.1

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Chevron Alignment Markers

Reserve CAM's for substandard curves only
Only place on outside of curve
Always show CAM's for both directions
Minimum of 3 CAM's in each direction
Drivers should be able to see 3 CAM's at all times
Space them evenly (but avoid driveways, lanes, other obstructions)

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Chevron Alignment Markers

- Lateral placement:
  - Min. 600mm clear of road shoulder
  - 2m to 5m from edge of traffic lane
- Height to bottom of sign:
  - 1.2m to 1.5m above road surface
  - Arrange height to give smooth appearance

AS 1742.2 Table 4.3

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Chevron Alignment Markers

Longitudinal spacing on curves:

	CAM Spacing	
Curve radius	Approach speed < 85 km/h	Approach speed ≥ 85 km/h
< 50 m	10 m	6 m
50 – 99 m	12 m	8 m
100 – 149 m	18 m	12 m
150 – 199 m	24 m	16 m
200 – 249 m	30 m	20 m
250 – 299 m	36 m	24 m
> 300 m	40 m	26 m

AS 1742.2 Table 4.3

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An Indonesian (Bali) expressway

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An Indonesian (Bali) expressway. The CAM's assist high speed delineation

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Chevron Alignment Markers

- Longitudinal spacing on curves:

	CAM Spacing	
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200 – 249 m	30 m	20 m
250 – 299 m	36 m	24 m
> 300 m	40 m	26 m

AS 1742.2 Table 4.3

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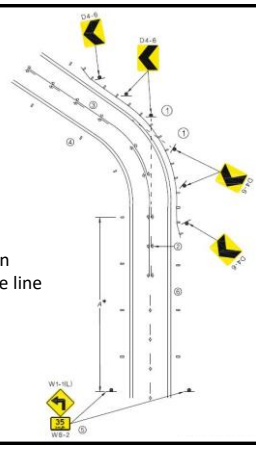
Chevron Alignment Markers
(for driving on left side of road)

- Left-hand curve: first CAM on prolongation of centre line
- Right-hand curve: first CAM on prolongation of left-hand edge line



AS 1742.2 Figure 4.7

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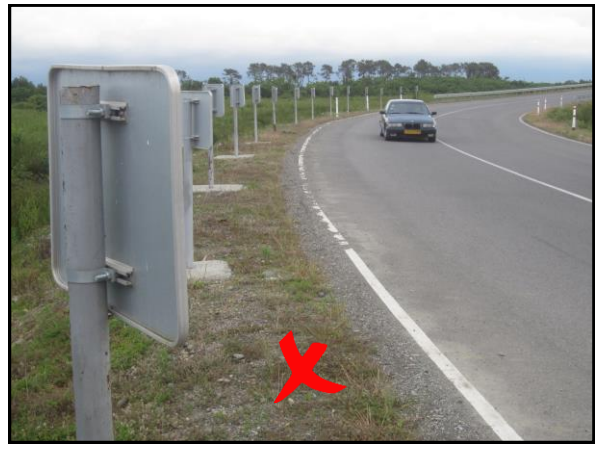

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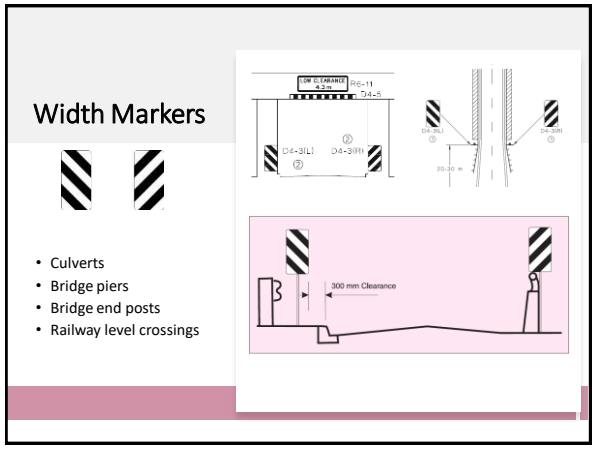

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LINE MARKING

- Provides longitudinal and also lateral guidance for drivers/riders
- Provides guidance along the road, where to turn, where to stop and where *NOT* to stop
- Thermoplastic is best for longer life
- Line marking can also be tactile

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Pavement Markings

- Dividing lines (centre lines)
- Lane lines
- Edge lines
- Pavement arrows
- Stripes and chevron markings
- Words
- Symbols

- Materials:
  - Paint
  - Thermoplastic
- Retro-reflective glass beads

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Good line marking is a valuable safety tool!

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Faded (or no) line markings make it difficult for drivers to safely retain their location on high speed roads.

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Tactile edge lines – can help to alert drivers when they start to drift off high speed roads.

122

Good line marking is a valuable safety tool!

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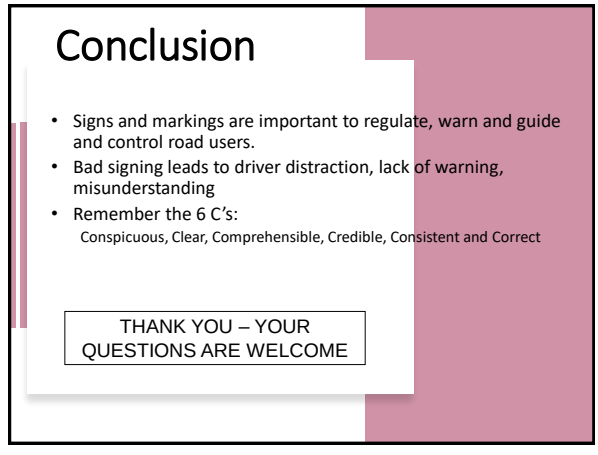

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