Welcome back to the CAREC "Road Safety Engineering" Workshop

- for professionals in Kazakhstan

Module 3 Road Safety Engineering
– PEDESTRIAN SAFETY
Tuesday 19th October 2021

CAREC
Central Asia Regional Economic Cooperation Program

Module Three: Pedestrian Safety.

Encouraging you to remember pedestrians in your road safety engineering work

Outlining key issues for you to think about in pedestrian safety during your daily work, during audits, or when investigating blackspots

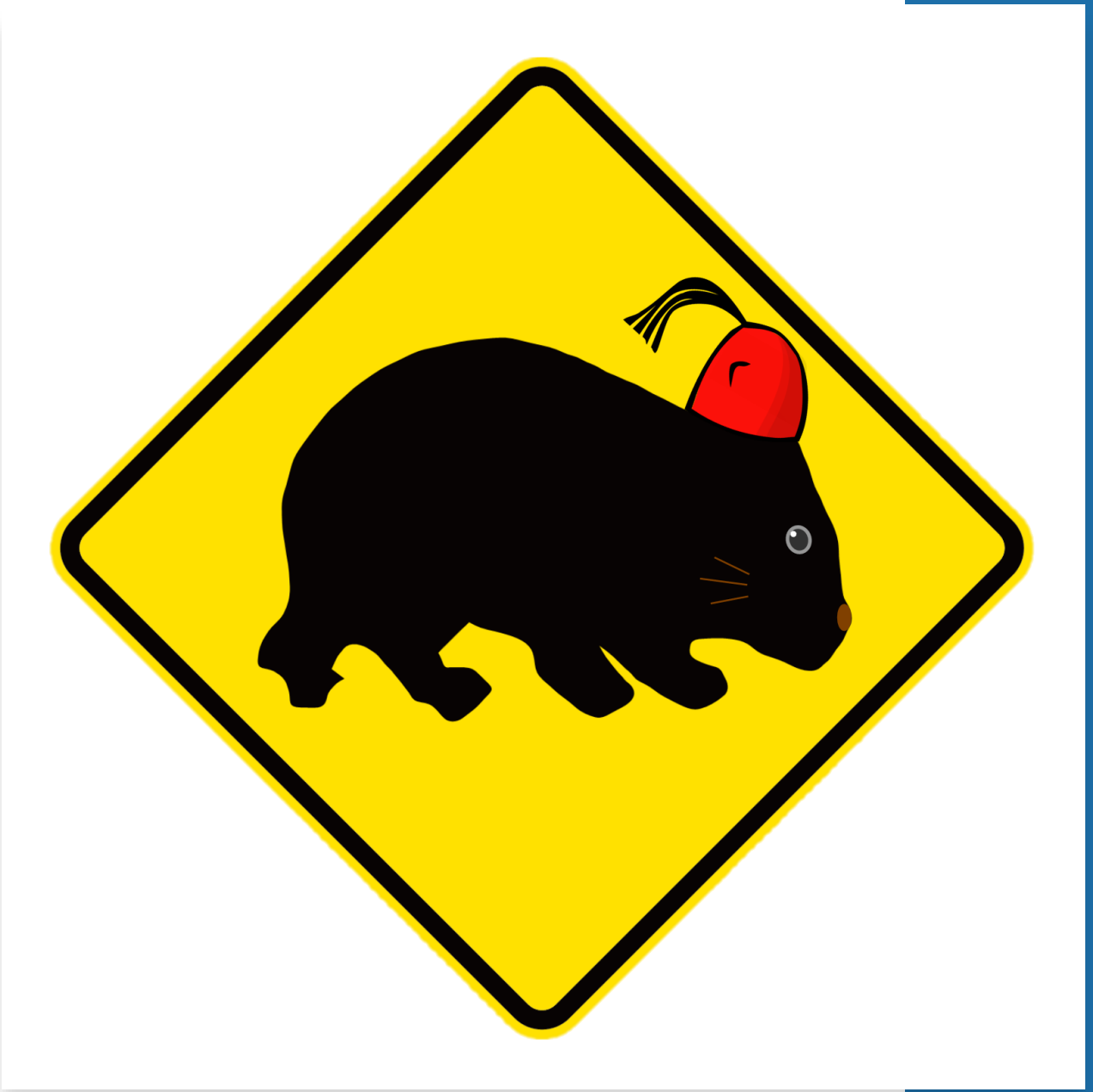
Detailing some of the special safety needs of pedestrians, especially the four groups “most at risk”

Pedestrians are the largest group of road users – in every country


Galaxy Note8
Everywhere!

Everywhere!

IF YOU DO NOT LIKE CRASHES, TURN AWAY NOW…….




COME
POST OFFICE

WHAT IS A PEDESTRIAN?

WHAT IS A PEDESTRIAN?

A pedestrian is anyone on foot and….

What do your Road Rules say?

18 Who is a pedestrian

A ***pedestrian*** includes—

(a) a person driving a motorised wheelchair that cannot travel at over 10 kilometres per hour (on level ground); and

(b) a person in a non-motorised wheelchair; and

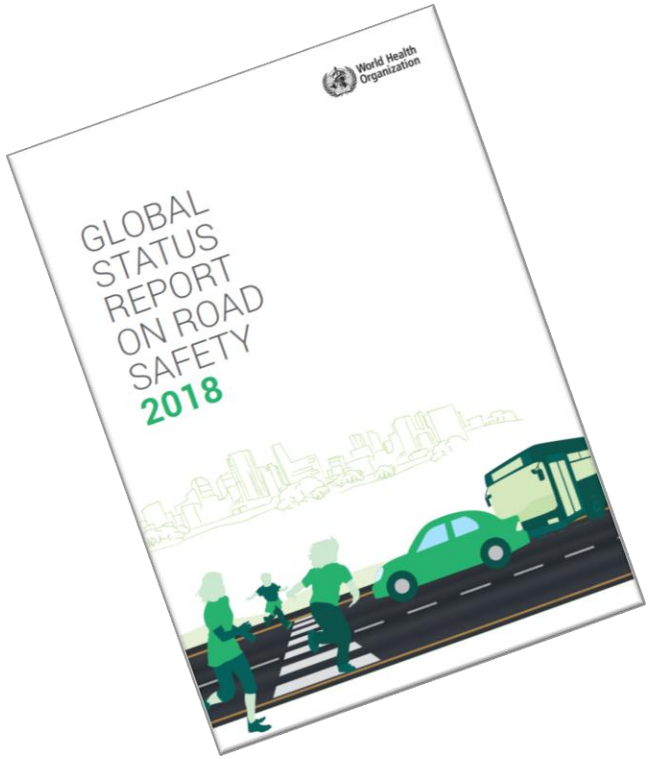
(c) a person pushing a motorised or non-motorised wheelchair; and

(d) a person in or on a wheeled recreational device or wheeled toy; and

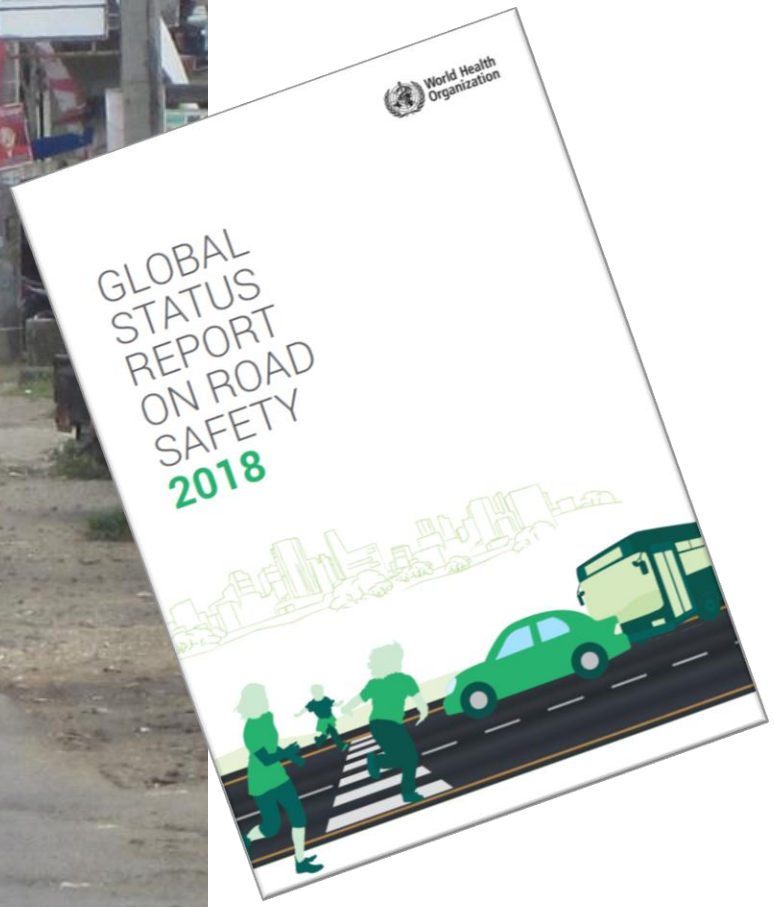
(e) a person travelling on an electric personal transporter.

Note

Electric personal transporter, ***travel on***, ***wheelchair***, ***wheeled recreational device*** and ***wheeled toy*** are defined in the dictionary.



Why should <u>we</u> be concerned for pedestrian safety?



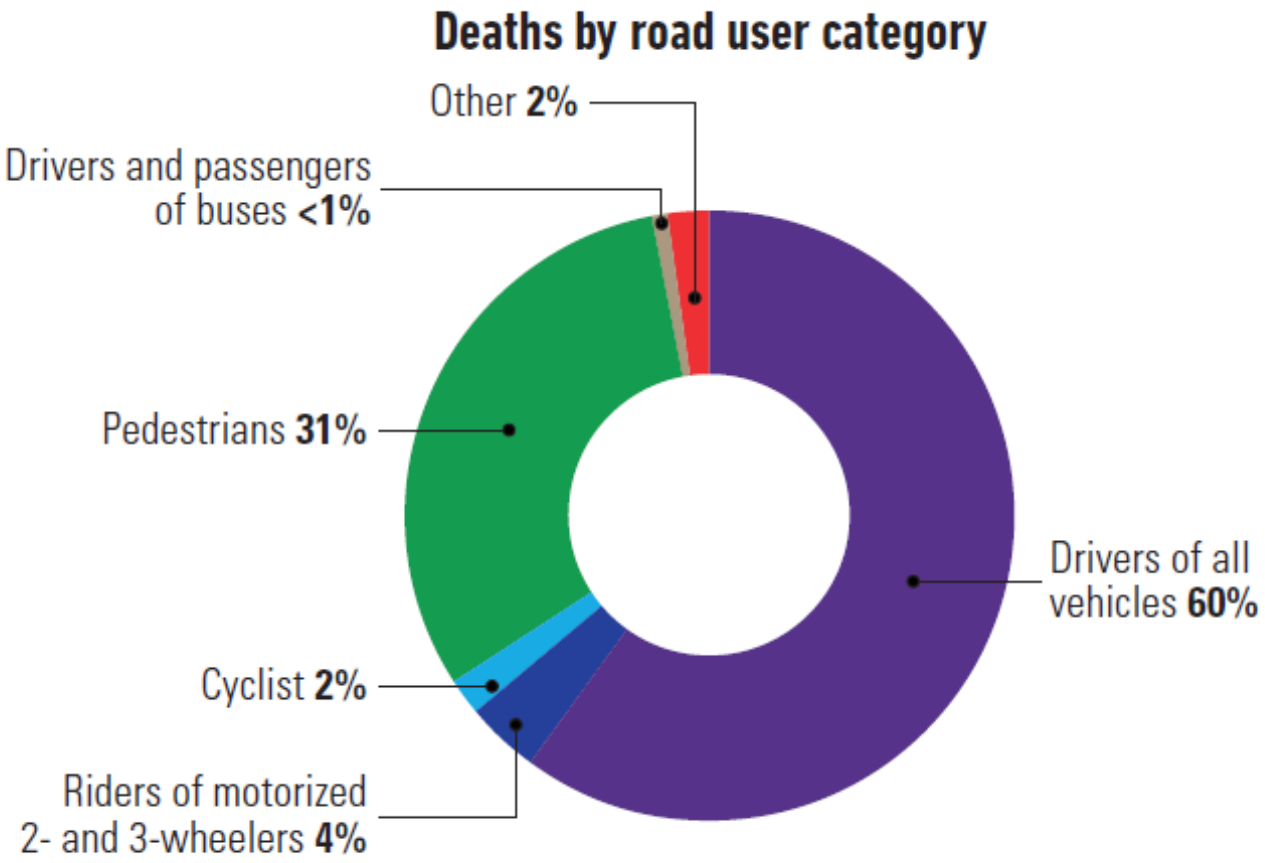
WHY SHOULD WE BE CONCERNED FOR PEDESTRIAN SAFETY?

KAZAKHSTAN

2,625 reported fatalities

3,158 WHO est. fatalities

31% = 1000 pedestrians/year
= 20 ped. deaths/week



Source: 2016, Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan

Pedestrians come in all shapes, sizes, races, ages and types

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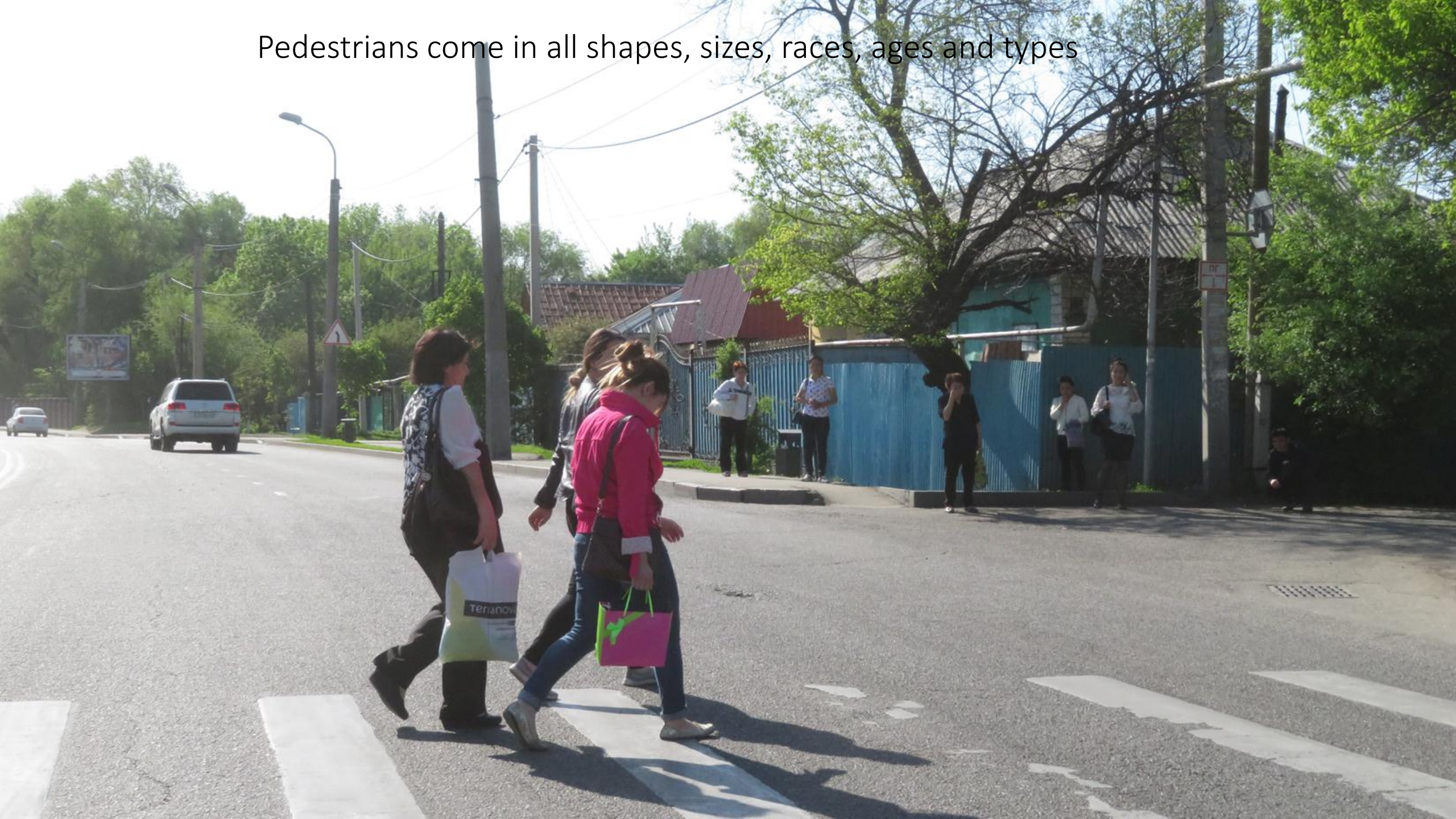
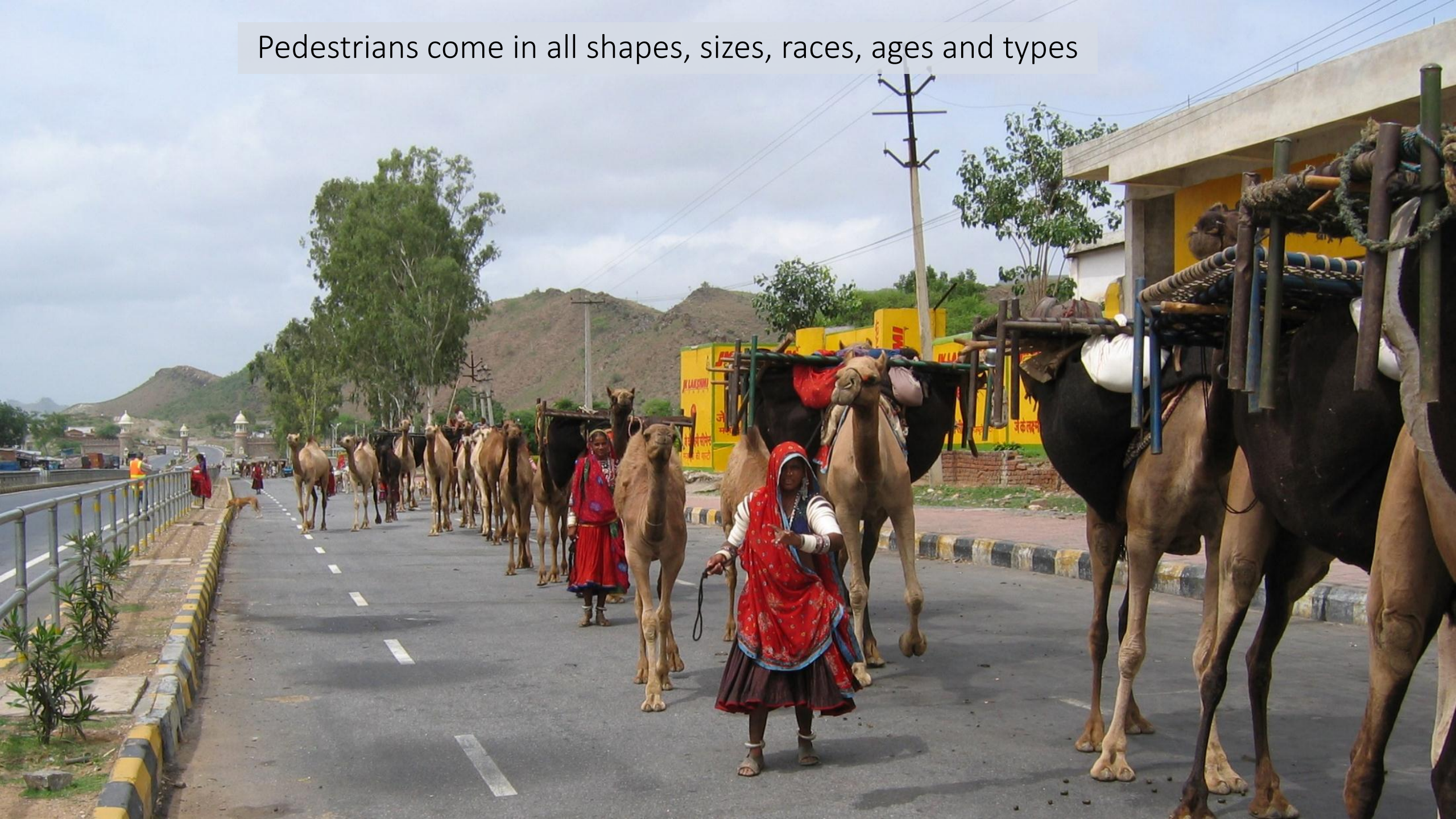


Pedestrians come in all shapes, sizes, races, ages and types




Pedestrians come in all shapes, sizes, races,
ages and types


Pedestrians were here first – before the motor vehicle

IF YOU DO NOT LIKE CRASHES, TURN AWAY NOW.....


دکتر مجید عودار
ADERAT IRAN

Please show me your pedestrian licence!

- Pedestrians are the largest group of road users (globally)
- No pedestrian licence needed
- Very mobile
- All ages
- Very vulnerable - serious injuries if struck
- 15 - 50% of road fatalities (depending on city, country)
- About 400,000 pedestrians killed on the roads (globally) per annum
- More than *1000* every day!

If you and your organisation don’t provide facilities to assist pedestrian safety - who will?

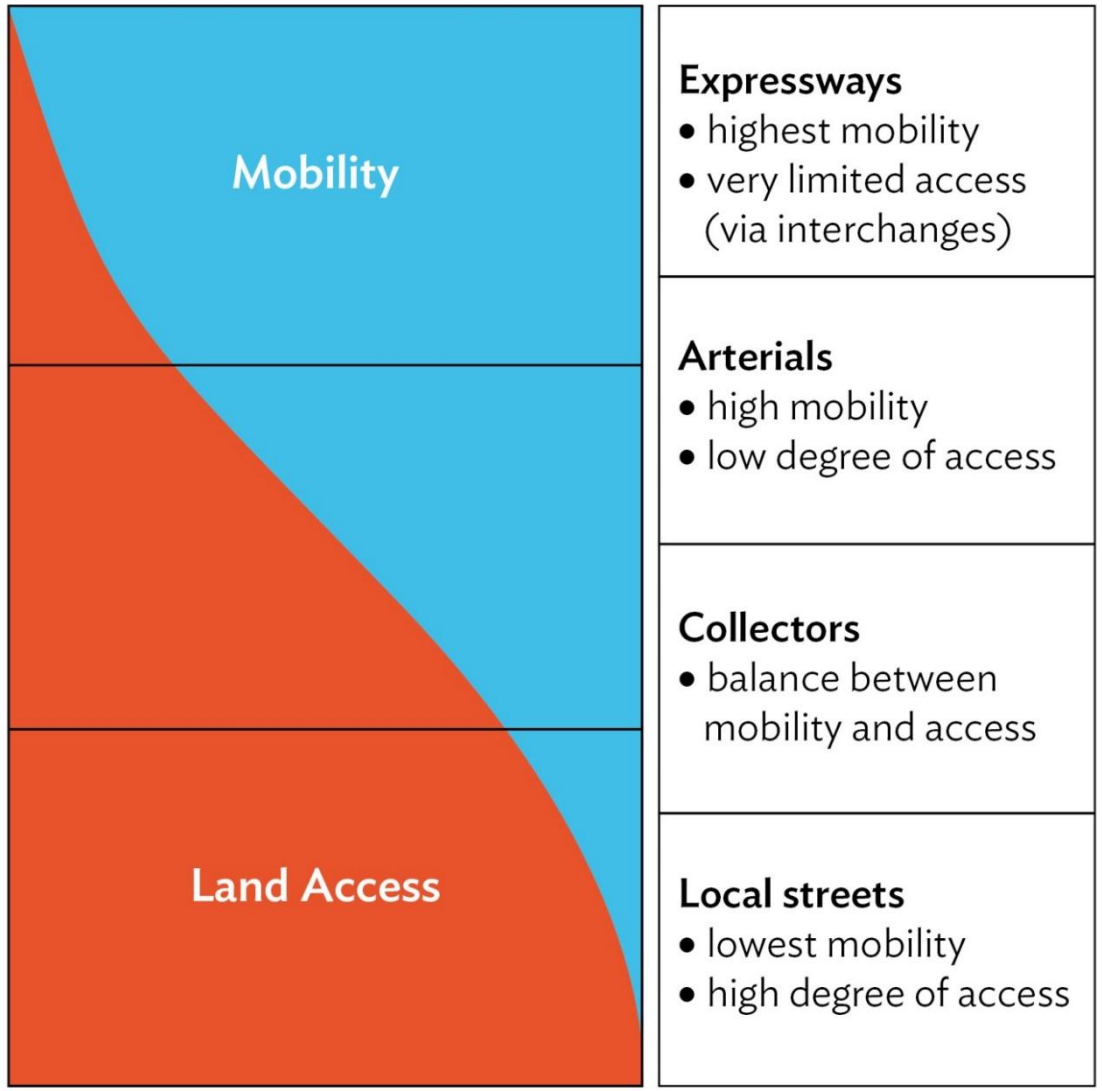

If you and your organisation don’t provide
facilities to assist pedestrian safety - who will?

What can engineers do to reduce pedestrian trauma?

Engineers…..

- Remember the pedestrian – they are valid road users.
- Think carefully and logically about what they need.
- Be prepared to expand the range of facilities your agency normally would offer.
- Use technology – push buttons, PUFFINs
- But remember the low-cost civil works too.

Start with your road hierarchy



	Overpass	Pedestrian Operated Signals	Pedestrian Crossing (with flashing lights)	Pedestrian Crossing (without flashing lights)	Flagged School Crossing	Pedestrian Refuge
Primary Arterial	❍	●	X	X	❍ +	❍
Secondary Arterial	❍	●	❍	X	❍	❍
Collector	X	❍	❍	❍	●	●
Local Road	*	*	❍ =	❍ =	❍	❍

● Most likely to be appropriate
❍ May be an appropriate treatment
X Inappropriate treatment
* Pedestrian devices should not be needed
+ Flagged school crossings are sometimes used on low volume primary arterials especially in rural areas
= Pedestrian crossings (zebra crossings) may be appropriate in a local shopping centre

What facilities do we have to help pedestrians?

3

3

3

There are three basic pedestrian strategies…


Segregation
Separation
Integration

Segregation – expressways

Segregation – Malls

Segregation

Separation

Integration

in time

in space

SEPARATION – IN TIME

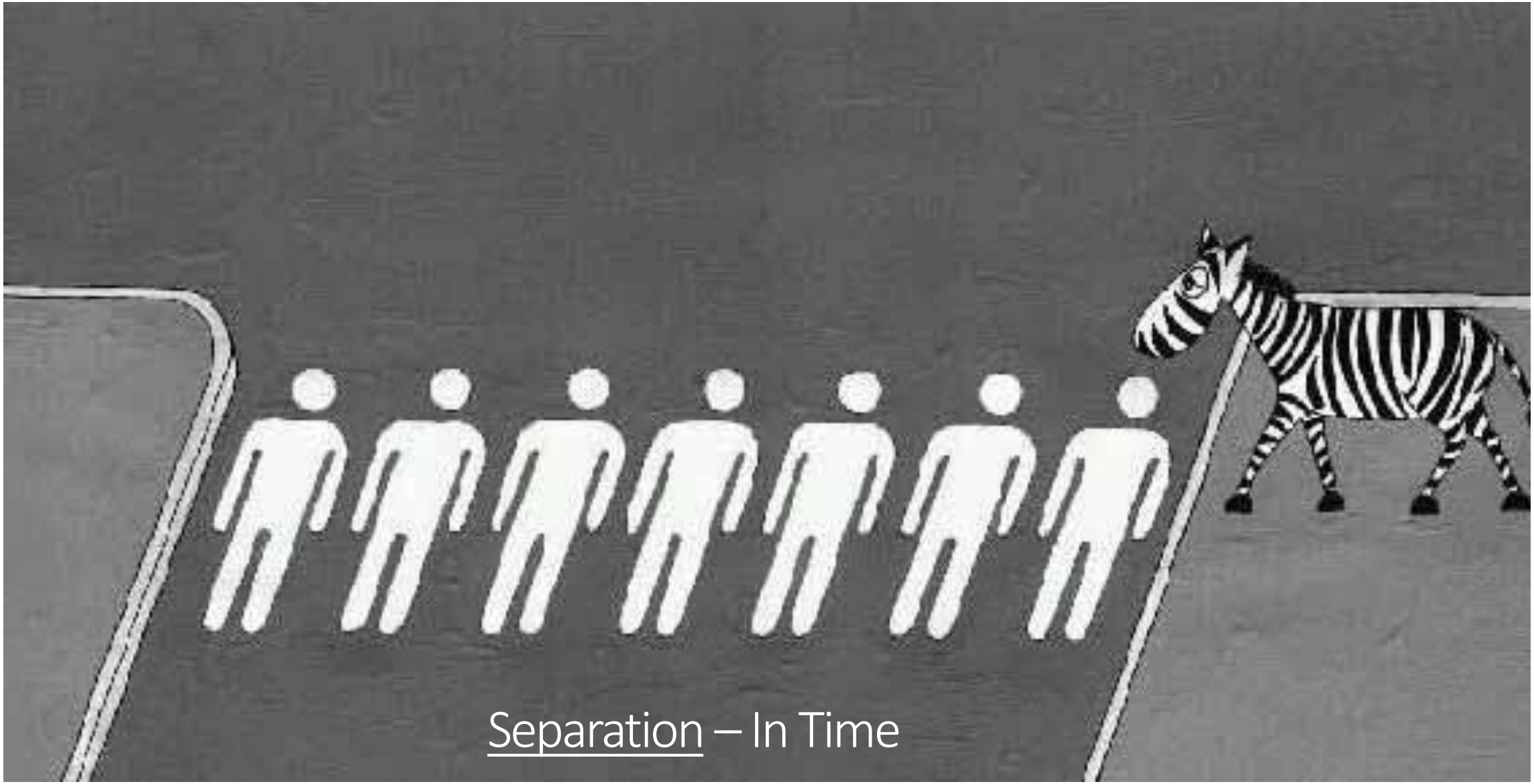
SEPARATION – IN TIME

SEPARATION – IN TIME

Separation – In Time

SEPARATION – IN TIME
(A PART-TIME CROSSING)

Separation – In Time



Separation – In Time


ЭНЭТХЭГ
БАРАА
INTERNET
КАФЕ

(3) A ***pedestrian crossing*** is an area of a road—

(a) at a place with white stripes on the road surface that—

(i) run lengthwise along the road; and

(ii) are of approximately the same length; and

(iii) are approximately parallel to each other; and

(iv) are in a row that extends completely, or partly, across the road; and

(b) with or without either or both of the following—

(i) a *pedestrian crossing sign*;

(ii) alternating flashing twin yellow lights.

What do your Road Rules specify?

Pedestrian crossing sign

Crossing the road –

questions for the engineer to ask

- Is a crossing needed?
- What type of crossing?
- Will it be used correctly?
- Will Police enforce it?
- Will a crossing actually increase the risk for the pedestrians?
- Sometimes – its better to <u>not</u> put in something.
- A refuge or a kerb extension may work better and be safer……

Do not simply follow “old” norms.

Ask:

Do the pedestrians need help to select a safe gap in traffic?

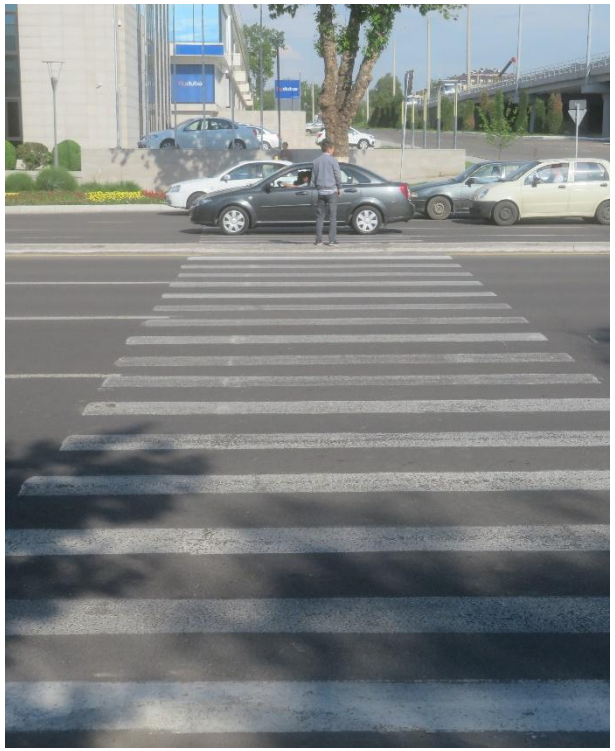
How long will they take to cross?

How many gaps are there?

Speeds? Will drivers give way?

Is it safer to NOT install a crossing?

Never allow a Zebra on a high-speed road



Never allow a Zebra across more than a single lane in each direction.

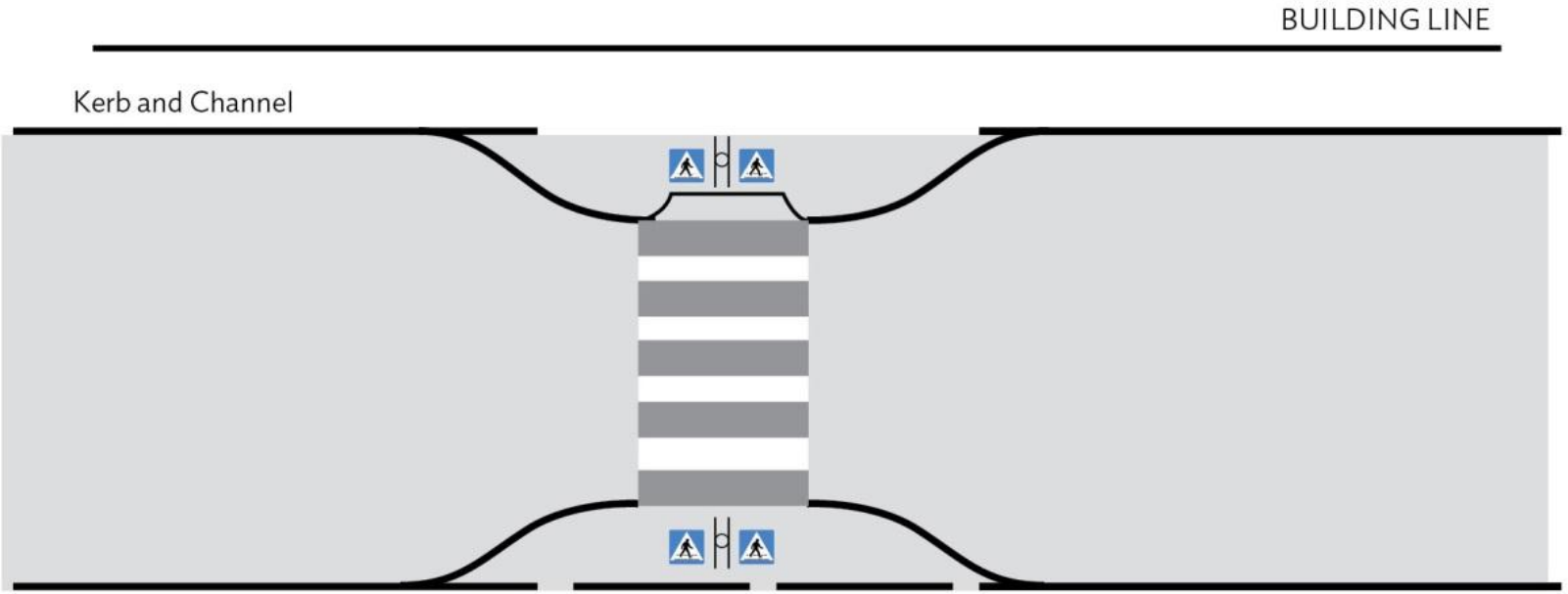
Why do we install such crossings where they are not obeyed?

Zebra crossings rely on a driver seeing the pedestrian and deciding to give way.

Never install a “Zebra” on a high-speed road

Zebra crossings rely on a driver seeing the pedestrian and deciding to give way.

Kerb extensions used in conjunction with a pedestrian (zebra) crossing



Maintenance!

Maintenance of all facilities is important…….

- To comply with Road Rules
- To alert approaching drivers/riders
- To show that engineers/authorities respect the needs of their customers (the road users)

- Plus – placing a crossing on top of a road hump increases safety for the pedestrians A LOT!
- This offers a *73% reduction* in pedestrian collisions

A Zebra Crossing is a form of time separation. Humped Zebras (like this) give a proven 73% reduction in casualty crashes

Crossings on humps are
“safety enhanced”


Crossings on humps are
“safety enhanced”

Crossings on humps are "safety enhanced"

What other types of “time separation” pedestrian facilities can you think of (in your country or anywhere)?

Pelican Crossings

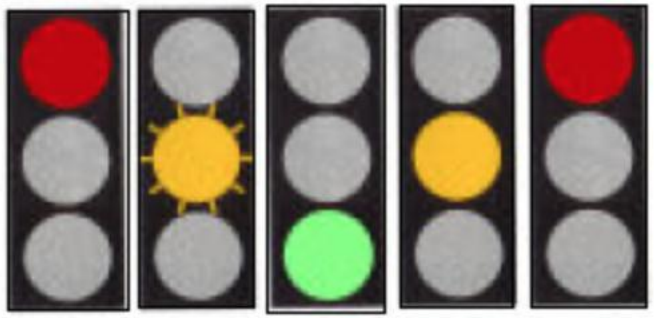
WHEN FLASHING GIVE WAY TO PEDESTRIANS

What is a Pelican Crossing?

Pelican Crossing

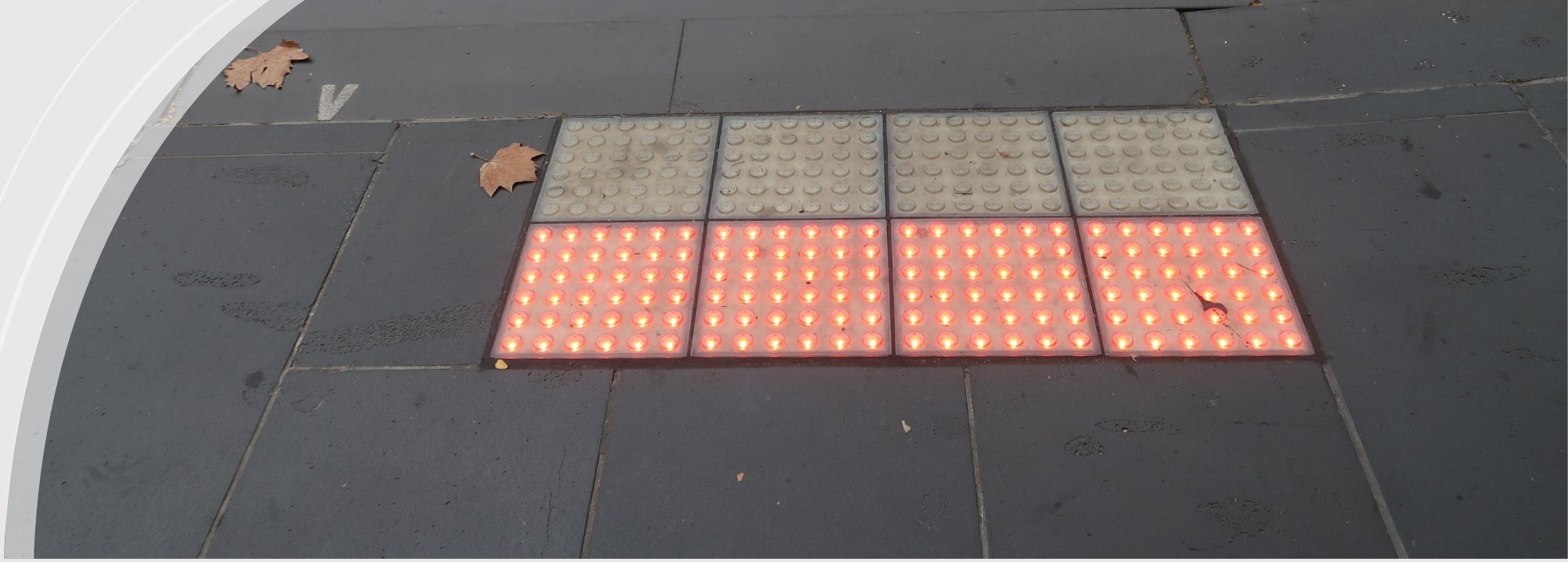
If the crossing goes straight accross the road (even when there is a central refuge) treat it as a single crossing

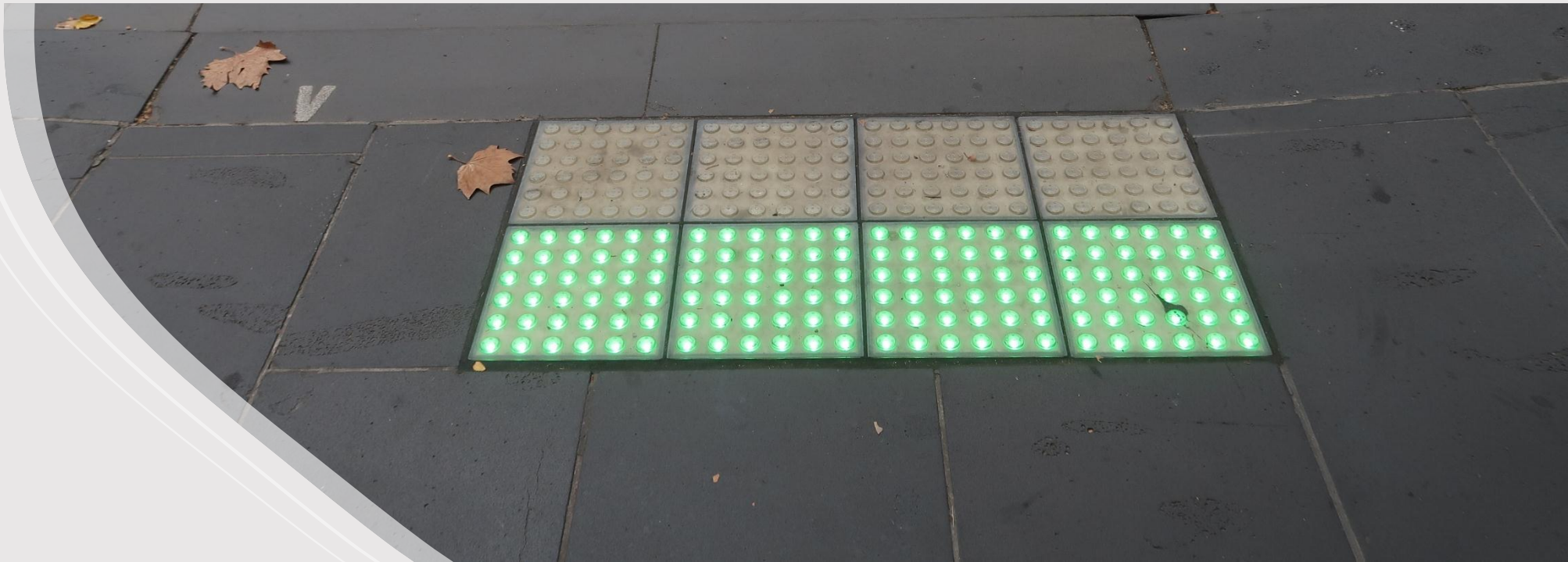
If the crossing is staggered treat it as two separate crossings.



Flashing Amber Phase

For pedestrians who are looking down at their phones, rather than at the signals.





Puffin Crossings

Pedestrian User-Friendly Intelligent Crossing

Toucan Crossings

SEPARATION – IN TIME

Signalised intersections offer scope to assist pedestrians

Signal hardware

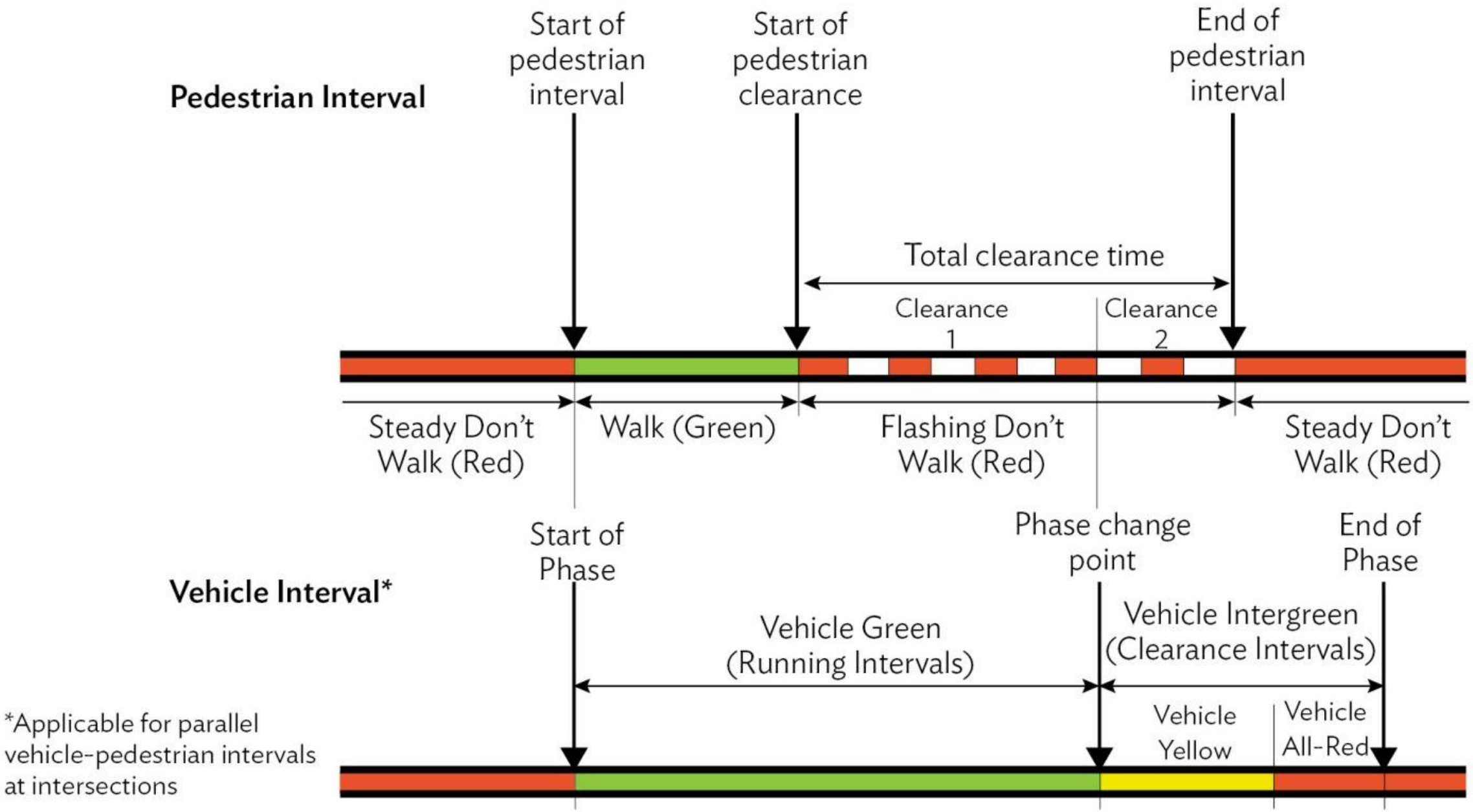
- Provide pedestrian displays
- Provide audio tactile pedestrian push buttons – so they can call up their phase even with no motor vehicles present
- Ensure all conflicting drivers CAN see the pedestrians (clear away obstructions)

Signal phasing and software

- Generally, run pedestrians with parallel traffic
- Give adequate clearance time – based on road width and a walking speed of 1.2m/sec.
- Consider an early start for the pedestrians if there is a lot of turning traffic
- Audio-tactile devices - benefit disabled pedestrians
- NEVER run a pedestrian phase across a turn arrow

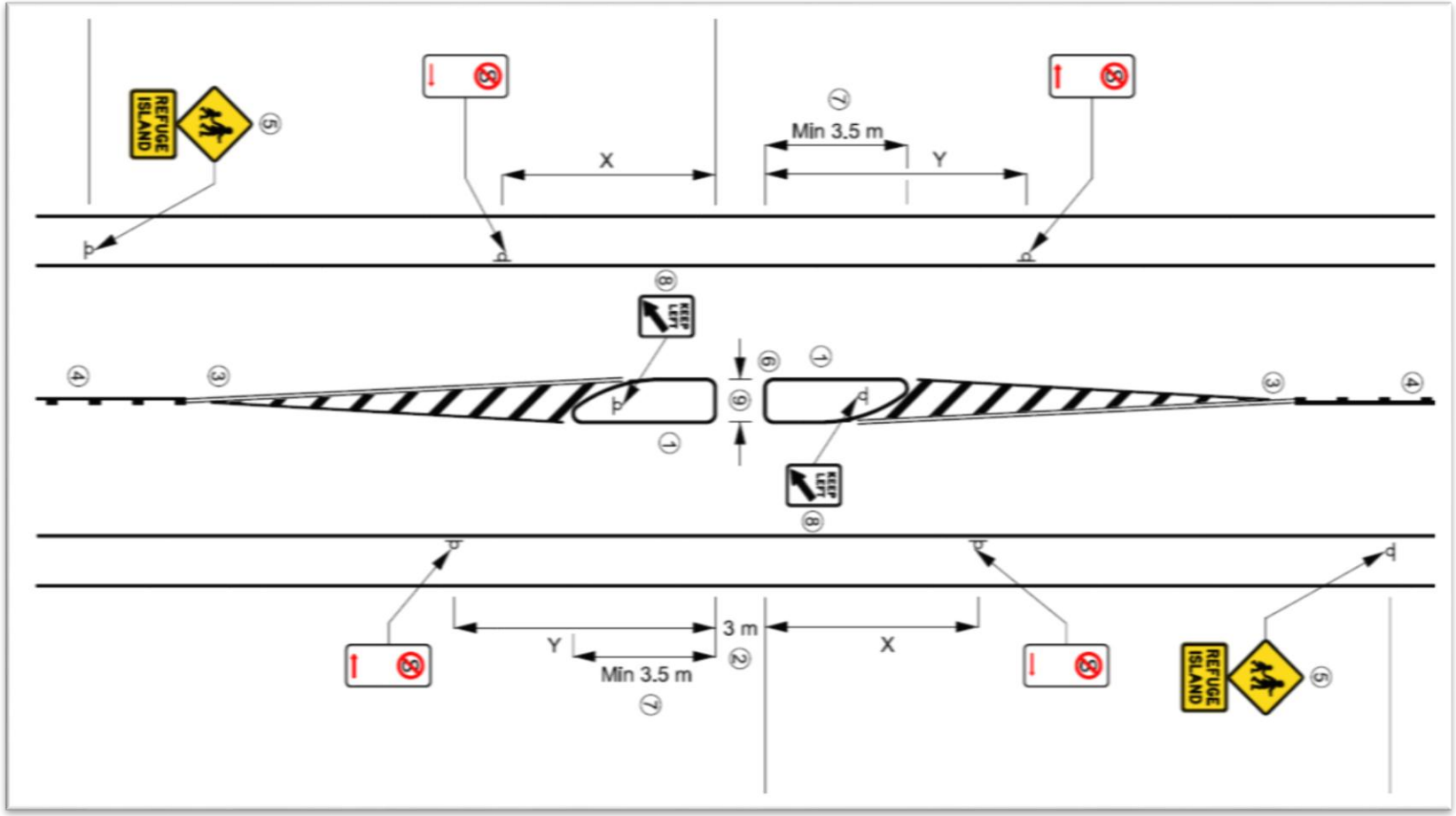
Civil works

- Kerb ramps and DDA tiles
- Obvious and clear pedestrian paths
- All-weather footpaths leading to/from the intersection
- Kerb extensions
- Street lighting
- No obstructions along footpaths


Pedestrian Interval
Start of pedestrian interval
Start of pedestrian clearance
End of pedestrian interval
Total clearance time
Clearance 1
Clearance 2
Steady Don't Walk (Red)
Walk (Green)
Flashing Don't Walk (Red)
Steady Don't Walk (Red)
Vehicle Interval*
Start of Phase
Phase change point
End of Phase
Vehicle Green (Running Intervals)
Vehicle Intergreen (Clearance Intervals)
Vehicle Yellow
Vehicle All-Red
*Applicable for parallel vehicle-pedestrian intervals at intersections

What is VERY wrong and unsafe here?

SEPARATION – IN SPACE



Separation in space – a pedestrian refuge


BF10 UNX

SEPARATION —

IN SPACE

A pedestrian refuge like this in a side street prevents vehicles “cutting the corner”, thus assisting pedestrian certainty.


Separation in space
Kerb extension

SEPARATION – IN SPACE

SEPARATION – IN SPACE

SEPARATION –

IN SPACE

Are pedestrian overpasses really the best?

Separation in space (grade separation)

- Do pedestrians like grade separation – as much as engineers do?
- Most will use it if they can access it *and* it saves them distance.
- USA research (Zegeer 1993) showed:
  - 95% of pedestrians will use grade separation if there is no loss of travel time compared with walking across the road (at grade)
  - almost nobody will use them if it will take 50% longer (or more).
- Of the two alternatives, people usually prefer an overpass.
- But the disabled need assistance too.
- If you *must* have a subway, design one with a straight through view (for personnel safety)
- Some subways include shops – to encourage people. More people = safer overall.

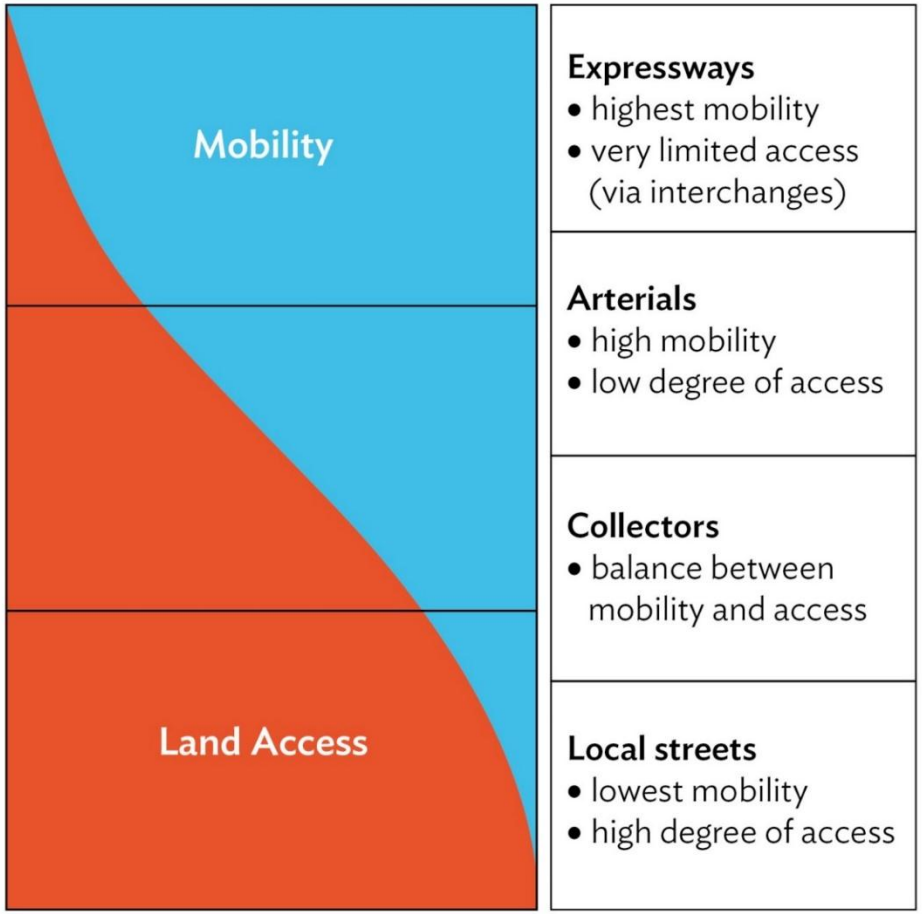
Go back to your road hierarchy

Expressways – always grade separate

Arterials – examine all options

Collectors –separation in space, Zebra Crossings if narrow, PUFFINS if busy and/or wide.

Local streets – traffic calming and small civil works



Separation – in space

Motorcycles can also ride over this overpass.

Separation – in space

Separation – in space

Separation – in space

Separation – in space


ქართული ოცნება
დემოკრატიული საქართველო
41


R. LALZAUVA
AIZAWL CITY BUS

Separation – in space

Separation – in space

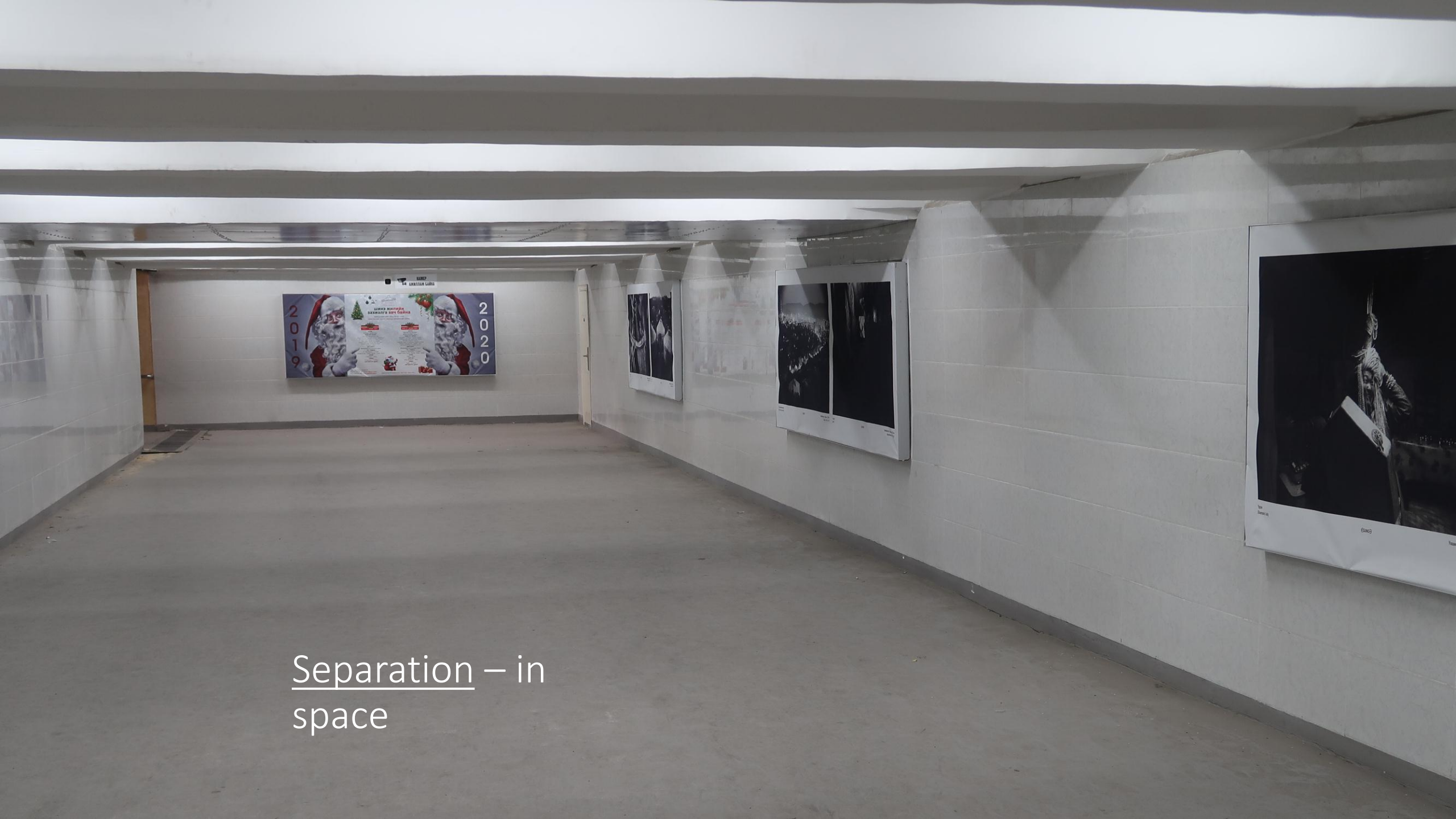
Separation – in space

Separation – in space

Separation – in space

Separation – in space

Separation – in space



Separation – in space

Separation – in space

Separation – in space

Segregation
Separation
Integration

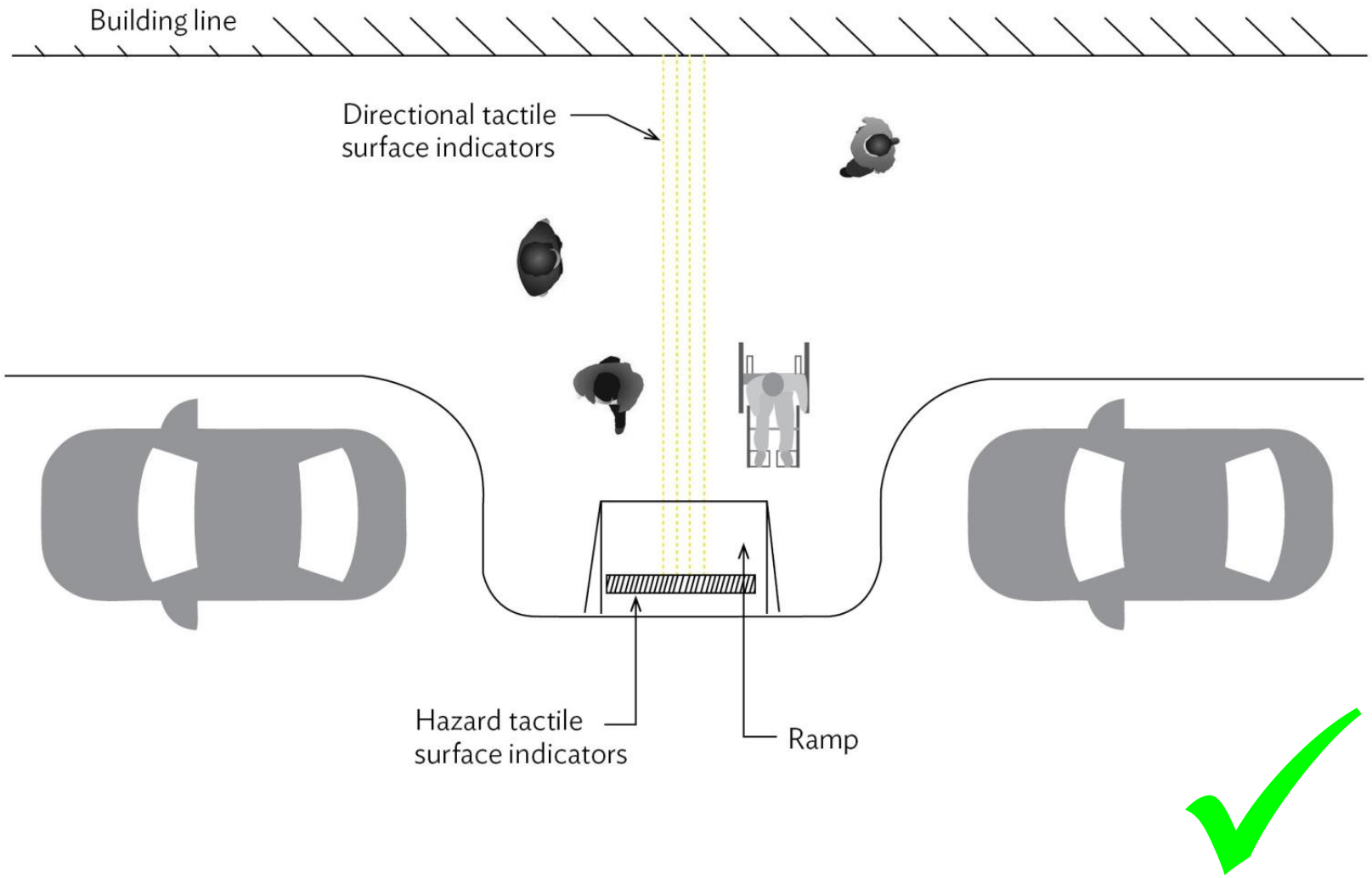
INTEGRATION – VEHICLES AND PEDESTRIANS “SHARE” THE ROAD

INTEGRATION – VEHICLES AND PEDESTRIANS "SHARE" THE ROAD

Small scale civil works – kerb ramps


Small scale civil works

A typical kerb extension




ЖАШТАРАЗ
ПАРИКМАХЕРСКАЯ
КСЕРОКС
КСЕРОКС

Provide “cut throughs” – for pedestrian convenience, to focus pedestrians to one point and for wheeled pedestrians

Provide “cut throughs” – make them wide enough for all pedestrians

Medians – give separation (in space)

Pedestrian fencing – use sparingly

Count down timers

We need to think of all pedestrians, but there are four groups at greatest risk…

4

4

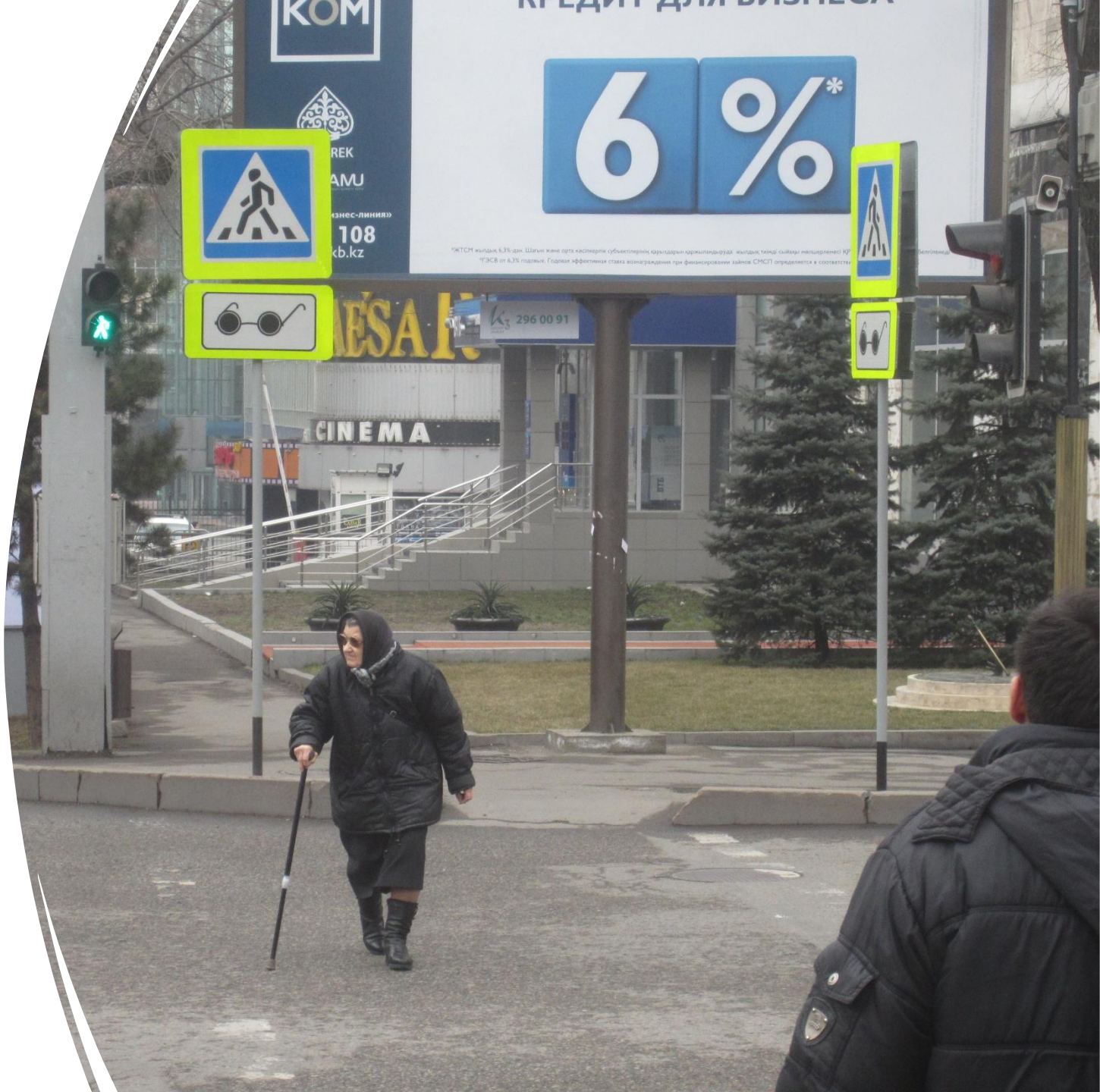
4

4

Four special groups of pedestrians need your assistance:

- senior citizens - 19% of pedestrian fatalities are over 65 years
- young - 20% of pedestrian fatalities are aged 4-12 years
- intoxicated - 43% of nighttime pedestrian fatalities ≥ 0.15% BAC
- the disabled

SENIORS - 19% of pedestrian fatalities are over 65 years



YOUNG - 20% of pedestrian fatalities are aged 4-12 years

The intoxicated

- 43% of nighttime pedestrian fatalities ≥ 0.15% BAC in Victoria

(3 times the limit for drivers in Australia)

HOW SAFE ARE THE DISABLED IN YOUR COUNTRY?

To help seniors…

who tend to be struck more at nighttime,
on arterials/collectors,
and more seriously injured than younger pedestrians

Street lighting?

PUFFIN Crossings?

Kerb ramps, kerb extensions?
Smooth footpaths?

Pedestrian refuge?

To assist child pedestrians…

who tend to be struck after school,
in local streets,
not at crossings, and
less seriously injured than elderly

Speed management?

Parking and other visibility problems?

Fencing outside schools? Kerb extensions?

Part time crossings?

Adult supervision?

To help intoxicated pedestrians

who tend to be males who are struck at nighttime, on arterial roads

- Street lighting?
- Parking and other visibility problems?
- Fencing needed outside hotels? Kerb extensions? Medians/refuges?
- Will they use a formal crossing?

Disabled pedestrians – three main groups

- Mobility impaired
- Wheeled
- Sensory impaired

Disabled pedestrians – there are three groups.....

- Mobility impaired
- Wheeled
- Sensory impaired

Mobility impaired pedestrians

People who may, or may not, need a walking stick, or a frame, or a supporting person – or they may simply move slowly, sometimes with a limp

A clear width of 1000 mm is adequate for people with ambulant disabilities.

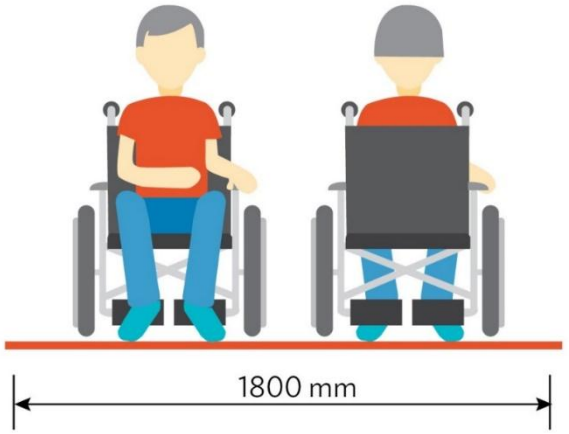
Signals – adequate clearance time? Is a PUFFIN needed?

Have kerb ramps been provided on all corners/medians?

Can kerb extensions be built?

Can a wide refuge be provided?

Wheeled pedestrians

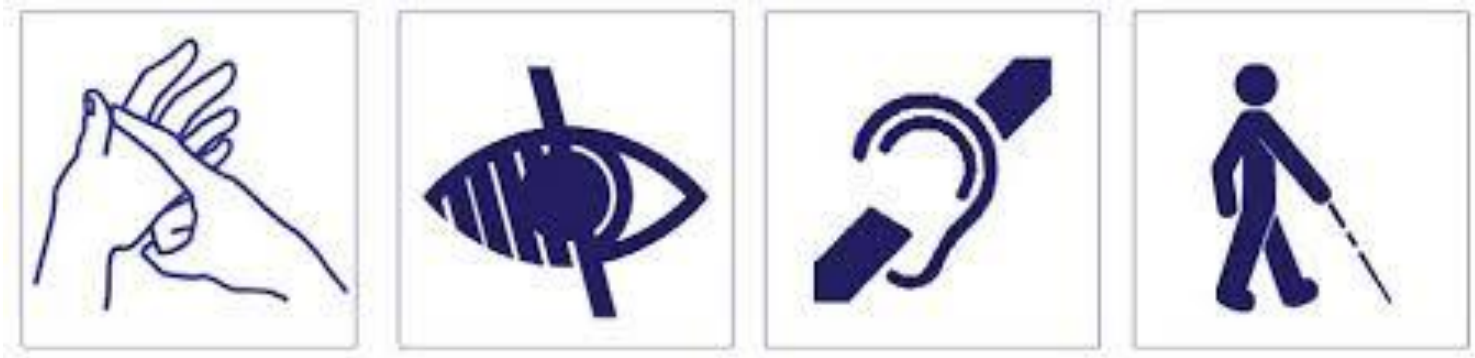


To allow wheelchairs to pass comfortably, a clear width of 1800 mm is required

- Adequate clearance time at signals? Is a PUFFIN needed?
- Have wide kerb ramps been provided on all corners/medians?
- Can kerb extensions be built?
- Can a wide refuge be provided?

Sensory impaired pedestrians

Visually impaired (not always totally blind), hearing impaired, maybe both



Do signals have audio-tactile push-buttons? Adequate clearance time?

Have kerb ramps been provided on all corners/medians?

Can kerb extensions be built? Street lighting?

Are DDA tiles in place? Correct?

Tactiles

Are “tactiles” like this really necessary?
Do they trouble wheeled pedestrians?

Pedestrian push buttons

What do sensory disabled pedestrians really need?

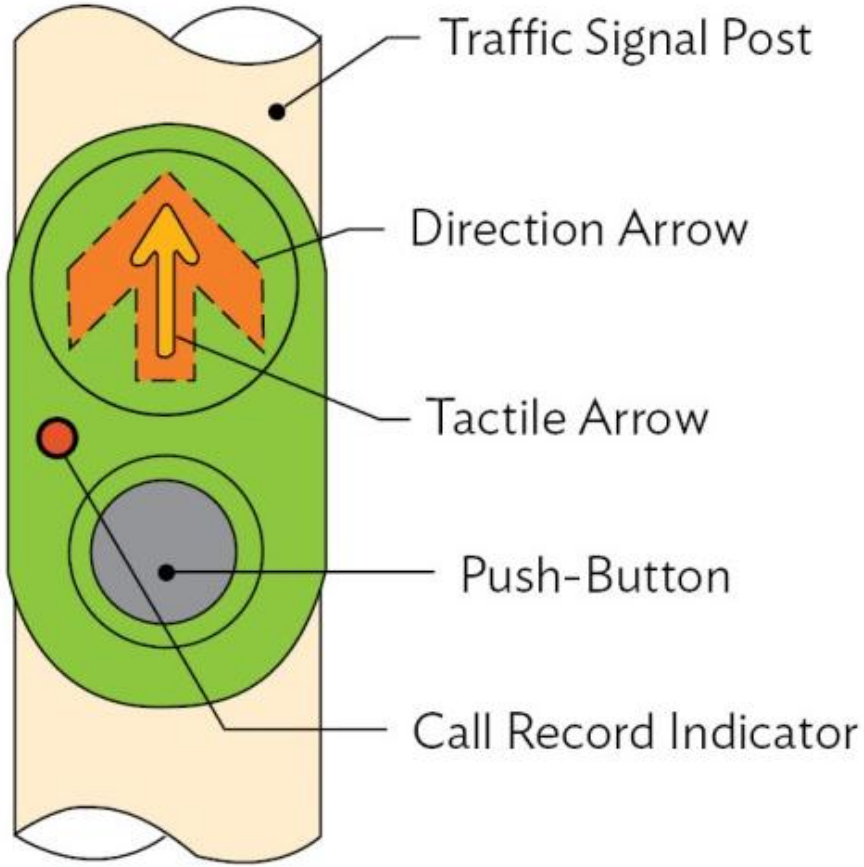
The visually impaired need “audio” to find and use the signals. Other pedestrians want a call record indicator, and a simple button to press.

Blind/deaf pedestrians welcome a tactile arrow.

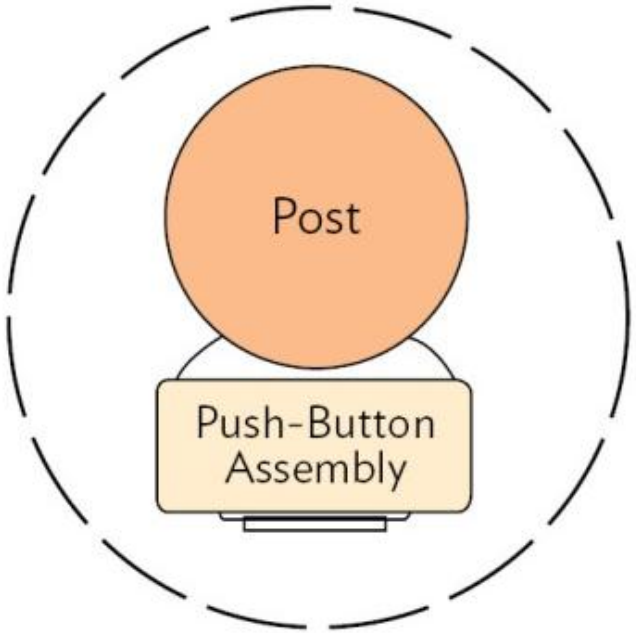
Desirable features:

- Large push button
- Call record light
- Audio and tactile
- Arrow orientated to the crossing
- Consistent placement, height, orientation

A typical pedestrian push-button assembly



ELEVATION



PLAN

During the COVID pandemic in Melbourne - 2021

ELDERLY CITIZENS IN SINGAPORE CAN “TAP” THEIR PUBLIC TRANSPORT CARD TO INCREASE THEIR WALK TIME

Direction signs for pedestrians


TSUTAYA
ALVARK
TSUTAYA

Safer ?

Maybe.

More efficient ?

Doubtful

Where diagonal markings exist in Japan:

- All motor vehicles are stopped by red signals
- Pedestrians can cross in any direction
- This adds an additional phase to the signal cycle
- It therefore increases delays for all users – hence NOT efficient.

BUT – a few seconds additional delay to give pedestrians freedom to take their shortest route can be a positive initiative with:

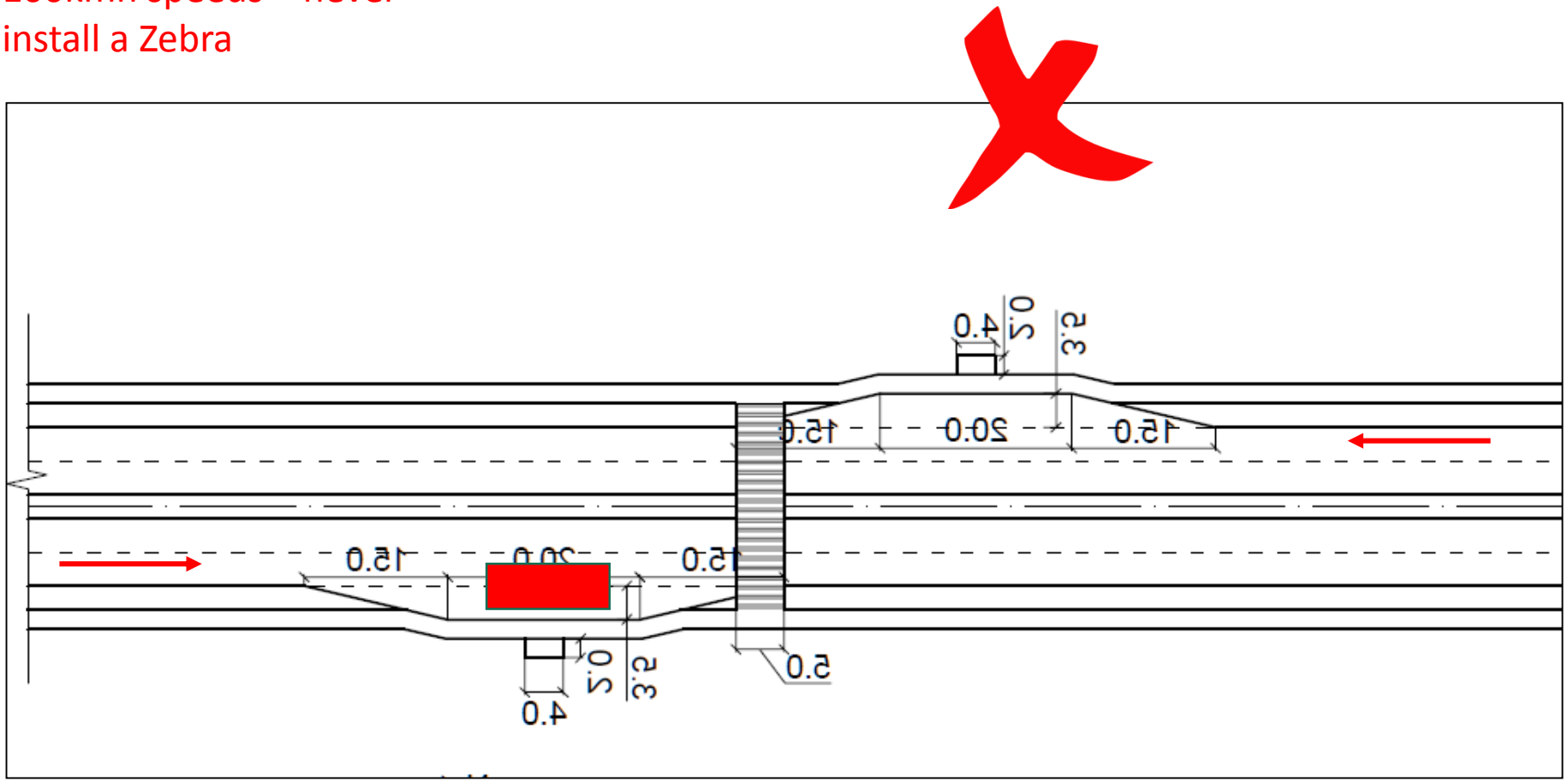
- Very large numbers of pedestrians for most of the day
- Compliant drivers <u>and</u> pedestrians
- Good maintenance

Provide clear flat footpaths for pedestrians to use.
Why are these bollards here?

Whether auditing or doing blackspot work, always ask yourself – will this contribute to the safety needs of pedestrians

Bus stops – pedestrians must cross
a road to access them (at least once)

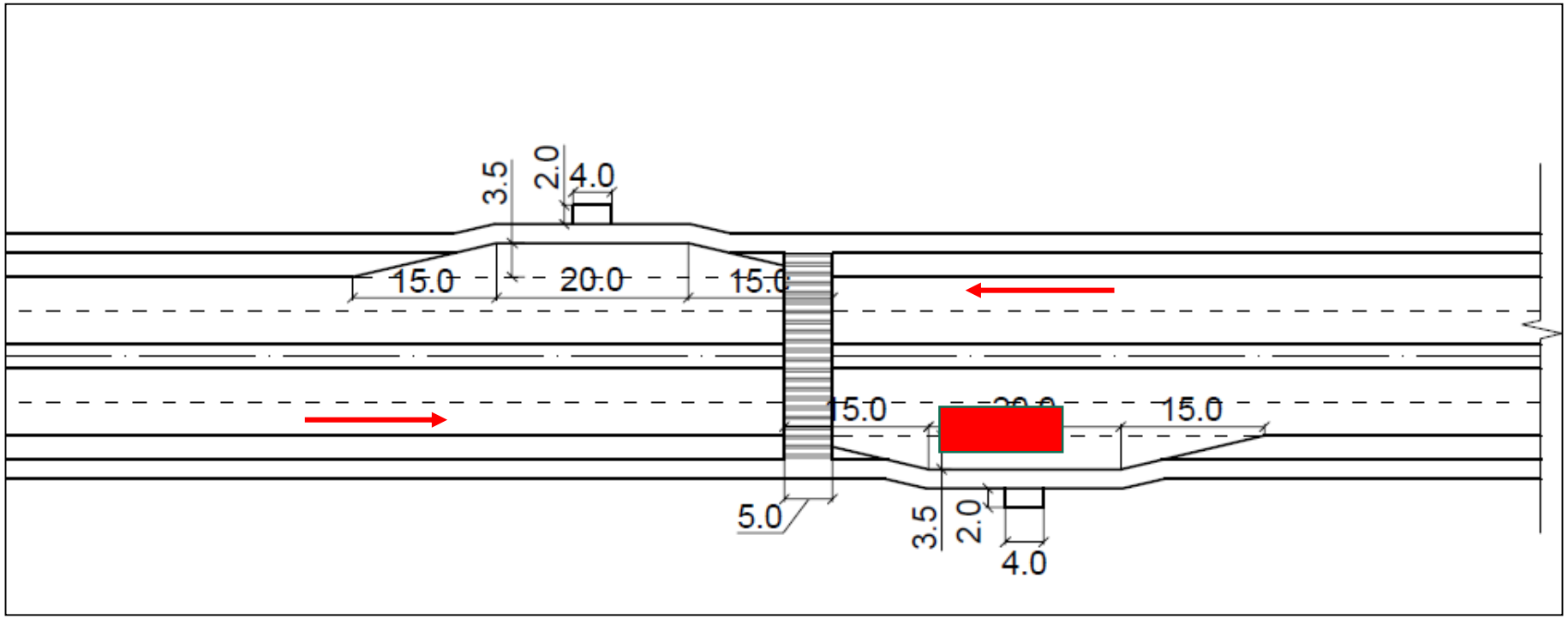
100kmh speeds – never install a Zebra



If this design is built, the bus may obscure sight lines to/from a pedestrian on the crossing. It is safer to place the bus stop beyond the crossing, or no crossing at all!

Safer!

100kmh speeds – never install a Zebra even if this design is used!



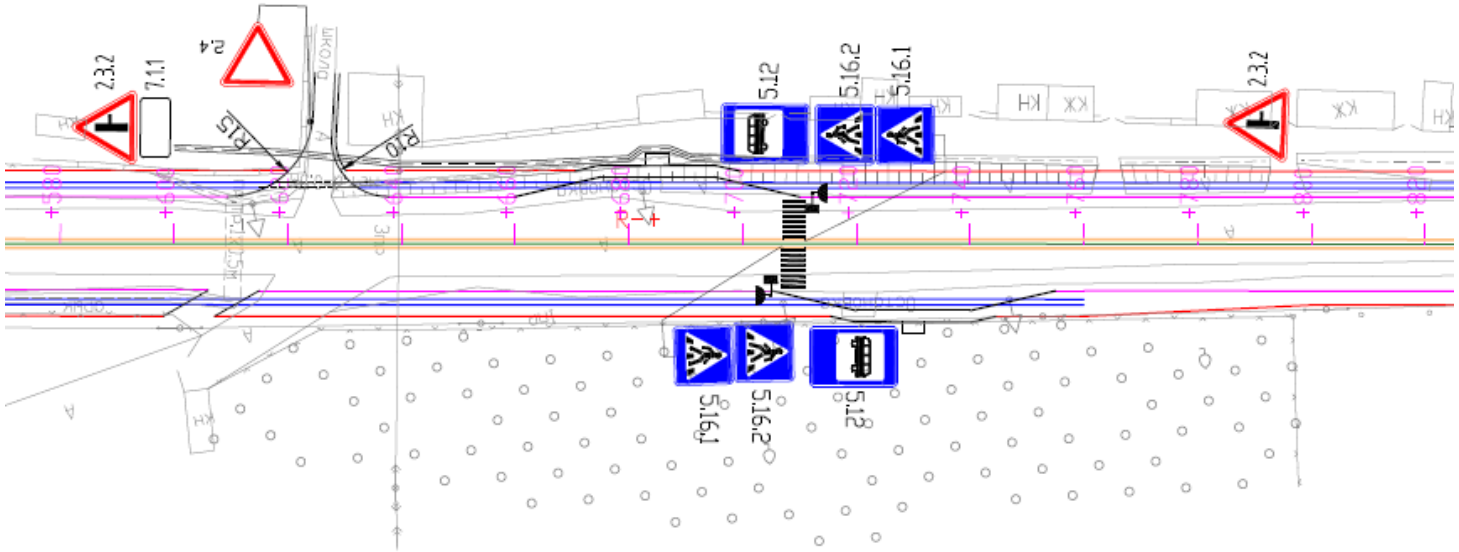
With this configuration, the bus will not obscure sight lines to/from a pedestrian on the crossing. But still do not allow a crossing in high-speed zones!

Imagine……

You are an auditor of a large highway duplication project. You see in the drawings that a Zebra Crossing is proposed near Km 32+700 to serve two bus stops.

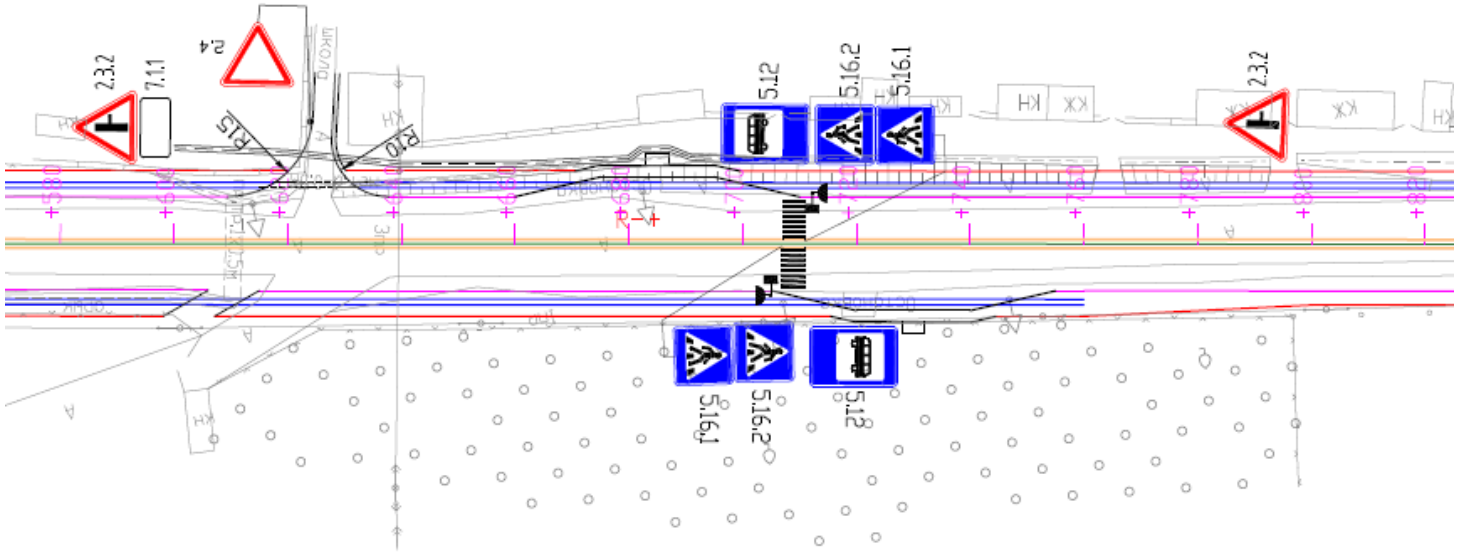
This is a rural area, speeds will be 100kmh (or higher).

What, if anything, will you put in your audit report?



Report……

- Zebra Crossings are high-risk in high-speed areas, and on roads with more than one lane per direction.
- Reducing speeds is not an option.
- Placing the Zebra on a hump is unacceptable in a high-speed area.
- Signals? Warning signs? Streetlights?
- Pedestrian overpass?
- The median can serve as a “refuge”
- Pedestrian volumes will be low and intermittent
- What will you recommend?



5.12
5.16.2
5.16.1
КЖ
КЖ
5.16.1
5.16.2
5.12

I would recommend:

- Do not install a Zebra Crossing here
- Duplicate warning signs “Pedestrians” on both approaches
- One streetlight at each bus stop
- A paved area on the median to “funnel” pedestrians
- Off-road footpaths to/from each bus stop

Engineers…..

- Remember the pedestrian – they are valid road users.
- Think carefully and logically about what they need.
- Be prepared to expand the range of facilities your agency normally would offer.
- Use technology – push buttons, PUFFINs
- But remember the low-cost civil works too.

What can you do to assist your pedestrians?

Use small scale civil works to help pedestrians

Use more push button pedestrian signals in your cities

Introduce PUFFIN crossings

Set a high standard for signalised intersections.

Ensure intersection signals include pedestrian signals

Provide adequate pedestrian clearance times at all signals – based on the width of the road @ 1.2m/sec

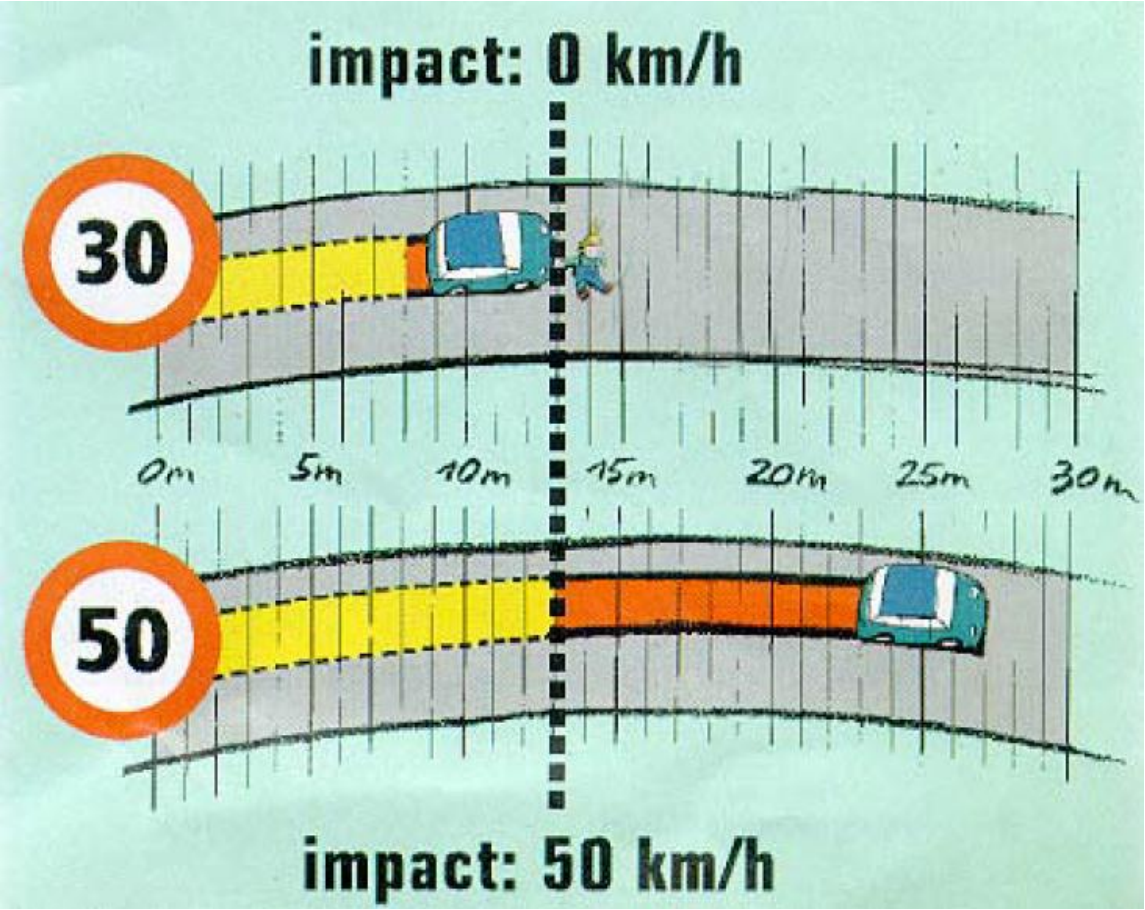
Remember all pedestrians – but especially the four main groups at risk

Speed management and traffic calming

Ask:

- Will drivers/riders know the speed limit on the new road?
- If not, how can we expect them to comply?
- What will the operating speeds be? Will they be safe for the environment?
- Is electronic enforcement available? Will there be good Police enforcement?
- If not, what about traffic calming?

The effect of a small change in travel speed in an injury outcome



A small change in travel speed

↓

A relatively large change in stopping distance

↓

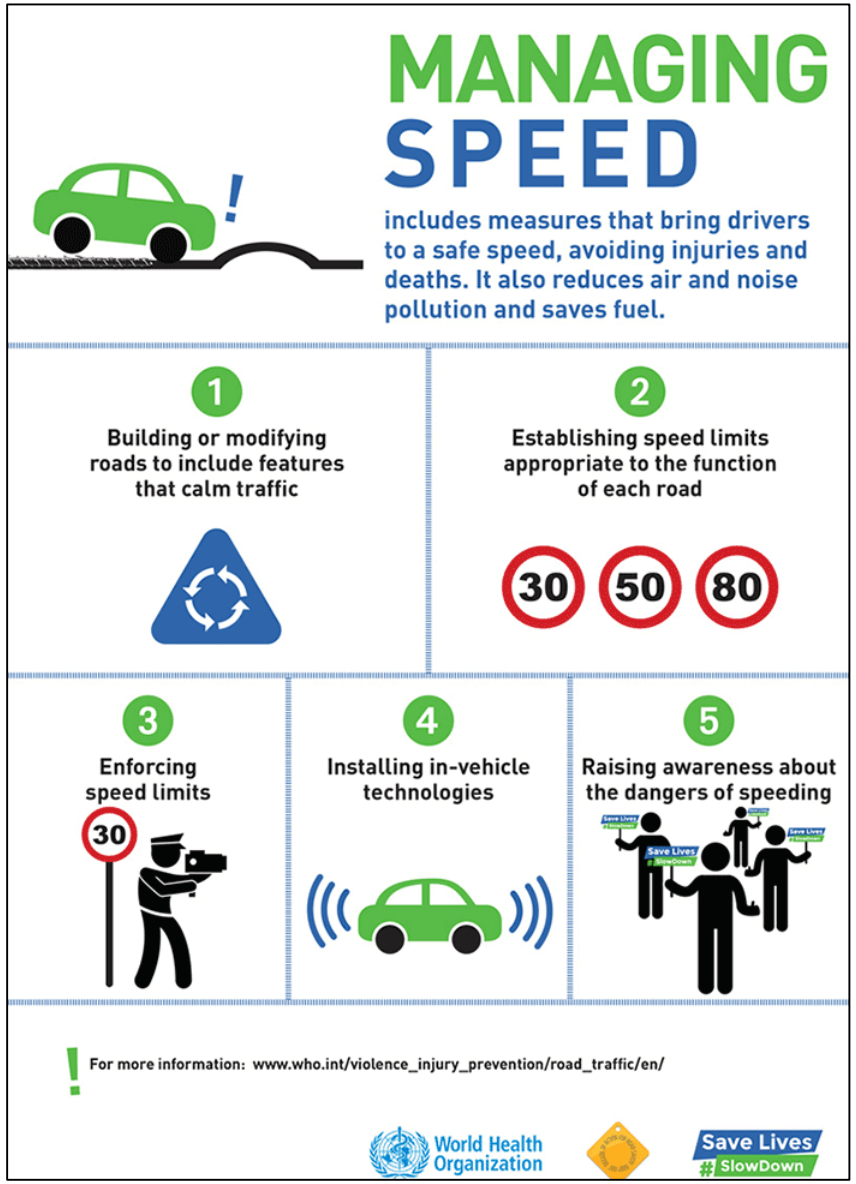
A much larger change in impact speed

↓

A still larger change in impact energy

↓

A very large change in probability of death and serious injury



What is “speed management”

Speed management involves a balance:

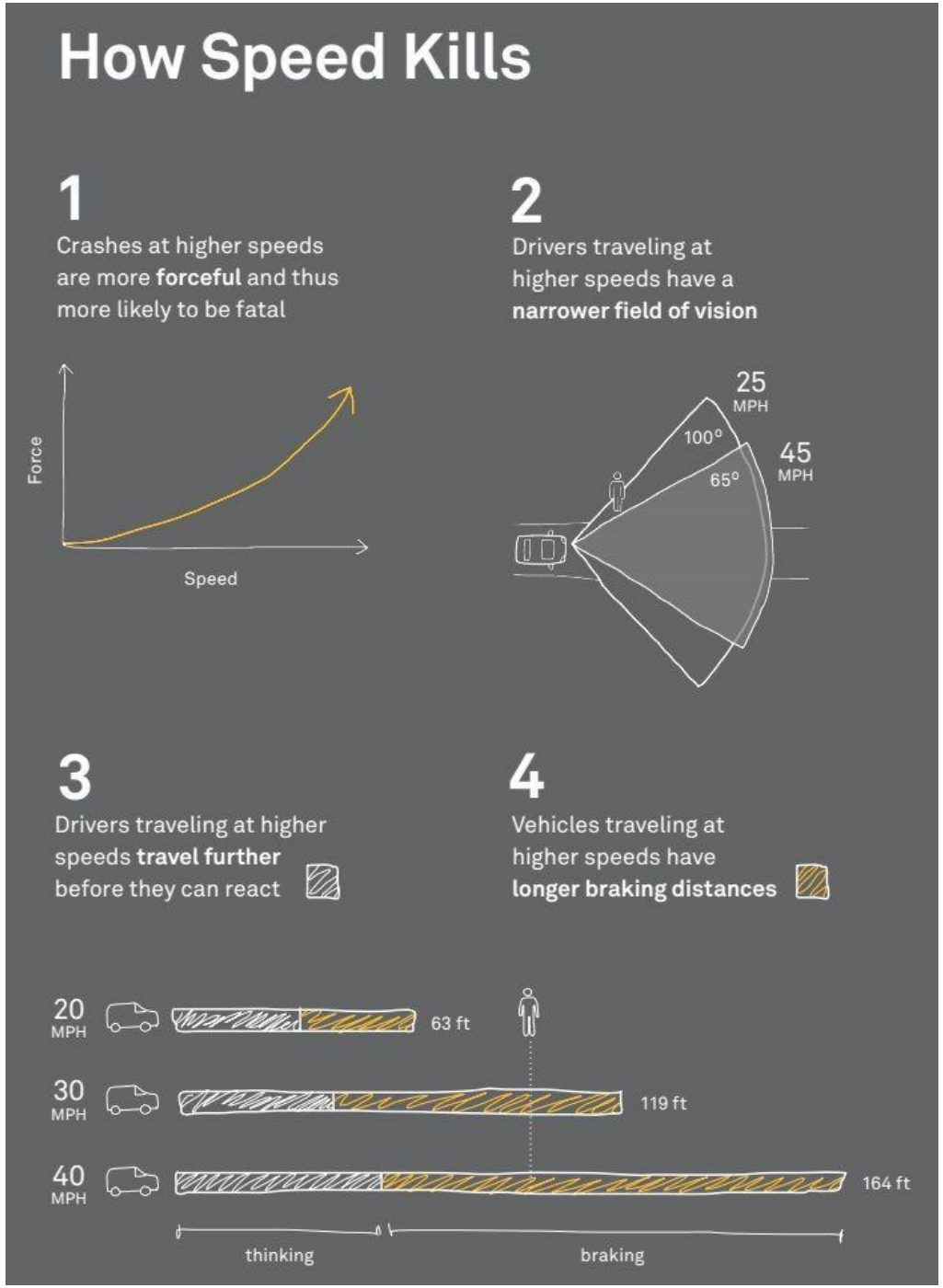
- Applying road design and engineering measures to obtain appropriate speeds,
- Setting speed limits that are safe and reasonable,
- Enforcement efforts (target crash producing speeders and deter speeding),
- Effective messages focusing on high-risk drivers, and
- Cooperation, and leadership of safety stakeholders

More forceful

Narrower field of vision

Travel further distance while reacting

Longer braking distance



Engineers should aim to gain driver/rider trust.
Use regulatory speed restriction signs consistently but NOT for individual curves, crossings, bridges or other locations

Gain driver respect for the speed management regime in your country.

Apply signs consistently, and in pairs.

Maybe 100kmh, or 80kmh on rural roads, 40kmh or less in villages.

Ensure all hazards and crossings and bridges are adequately signed with warning signs and good delineation.

Do NOT use regulatory signs for a “warning” – it brings them into disrepute.

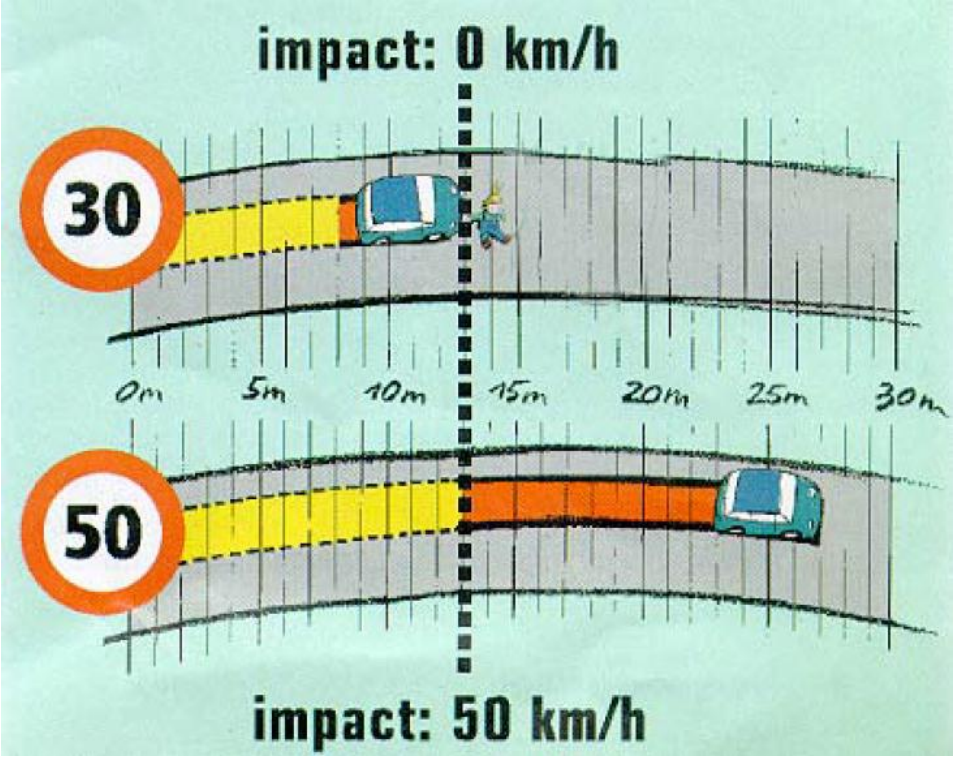

30


30
NESCAFÉ

Advisory speeds can be used on supplementary plates to guide drivers

Recommended Safe System speeds

- Recommended speed limit on urban roads – 30 km/h (except on Urban Arterials)
- Recommended speed limit on rural roads – 70 km/h (rural undivided)
- Recommended speed limit on motorways/highways – 90 km/h (divided)



Traffic calming is the use of infrastructure designed and installed to slow down traffic and to reduce unnecessary through traffic.

- Vertical displacement
- Horizontal displacement
- Signs, lines
- Perimeter treatments
- Surface changes
- All of these.....

HINT: Good traffic calming should make drivers feel like they are intruding into another person's space.....

Visual Measures
Speed Limit changes
Transverse rumble strips
Gateway Sign
Colored Surfacing
Warning Signs
“SLOW” Markings
Enforcement cameras for red light jumping, speeding or both
Physical measures
Reassignment of cross-section
Vertical speed reduction
Chicanes
Stone pitched pavement
Non-engineering Measures
Special landscaping
Streetscape design

NEW SHARED ZONES AND SPEED LIMIT

Slow down and practise physical distancing

From early September, new shared zones and speed limits of 20 kilometres per hour will be introduced on Melbourne's Little Streets.

Cars and bikes must give way to people walking along Flinders Lane, Little Collins Street, Little Bourke Street and Little Lonsdale Street.

New elements such as speed bumps, street furniture and planter boxes will be introduced to slow down cars, make the shared zones safer and provide more space for people to move around the city and maintain physical distancing.

KEY

New shared zones and 20 km/h speed limit


20
SHARED
ZONE
HOTEL
P
QUIST'S
COFFEE SHOP


During the COVID pandemic in Melbourne - 2021
TREND OPTIC
MOUNTFORDS
HAIGH'S
20
SHARED ZONE
CANTURI
CAFFE E TORT
McAndrew Jewellery
314
20

Vertical displacement


Vertical displacement


Vertical displacement

Horizontal displacement

Visual impacts due to line marking

Visual impacts due to line marking

Gateways


BANRAEABA
40
How Fast Are You Driving?
BANRAEABA
40
Iraua Ngkai Butim?

Gateways

But why do we build cars that can travel at 200kmh – and then work hard to restrict speeds?

?

Maybe as a first step we should limit speedometers to 100 - 120kmh?

Thank you.
Your questions are welcome