

Welcome back to the CAREC “Road Safety Engineering” Workshop

- for professionals in
Kazakhstan

Module 4

**INVESTIGATING HIGH CRASH
FREQUENCY LOCATIONS**

Thursday 21st October 2021





INVESTIGATING HIGH CRASH FREQUENCY SITES (BLACKSPOTS)

(ELIMINATING HIGH CRASH LOCATIONS FROM YOUR ROADS AND HIGHWAYS)

Objectives of this module:



- To introduce the *process* of investigating a hazardous location
- To emphasise the need for good crash data
- To encourage you to be “detectives” or “doctors” in this important work
- To show some examples of recent blackspot investigations

Eliminating hazardous road locations

- The road plays a role in road safety
- We can identify blackspots and black lengths – maybe not “perfectly”
- Good crash data is essential
- We can investigate blackspots – carefully and thoughtfully – day and night
- Engineers can install logical, low-cost countermeasures
- Crashes can be reduced – Police and engineers working together
- And we must not build new blackspots! (that’s road safety audit – later in workshop)

- Road user error is the major contributing factor to road crashes.
- But it is easier for road users to make an error on a “bad” road (with poor alignment, inadequate signing, lacking traffic control).
- It is also easier for more serious injuries after an error on a road with unsafe roadsides (trees, poles, unsatisfactory barriers).
- Remedying such defects is an economical and effective way of reducing the cost of road trauma in your country.

YOU CAN
SAVE LIVES



WHAT IS A BLACKSPOT?

- A blackspot is any site with many casualty crashes
- Casualty crash means a fatal crash, or a crash in which at least one person is injured (serious or slight)
- Intersections, short lengths, or curves = blackspot
- Road length of 1km = black length

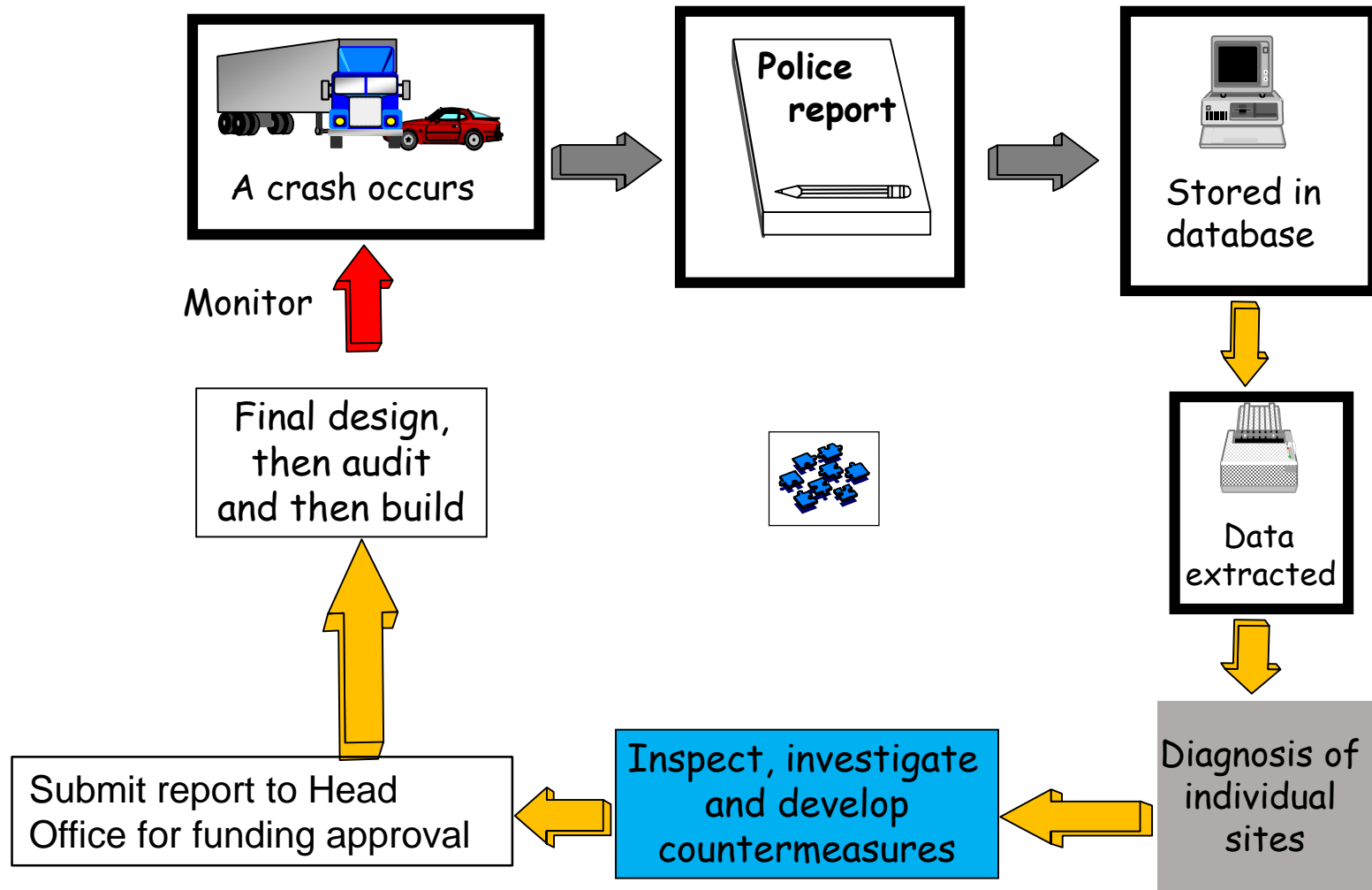



What is a Blackspot ?

When the Victorian blackspot program started in 1980, a location needed 12 casualty crashes in 3 years to be a “blackspot”.

Today it is 3 casualty crashes in 5 years.

There has been great success over 40 years (an 85% reduction in crashes according to our definition)





Police
gather.....

Date/time/location/directions
Names/addresses/ages/sex of
all involved
Alcohol/drugs
Vehicle types/registration
Injury levels
Any other information
needed to prosecute the
offender
More

Best international
practice is when Police
record the crashes, store
the crash data in a
database, and share it
with government
stakeholders

Engineers need good crash data



Engineers do need to know:

Where the crash happened (accurately), when it happened (day/night)

The road users involved (direction, type)

Conditions at the time – rain, wind, fog, snow, sun

Engineers need *good* crash data

Engineers do not need:

Names, addresses of people involved

Vehicle registration details

Police prosecution information (alcohol,
speed or drugs)

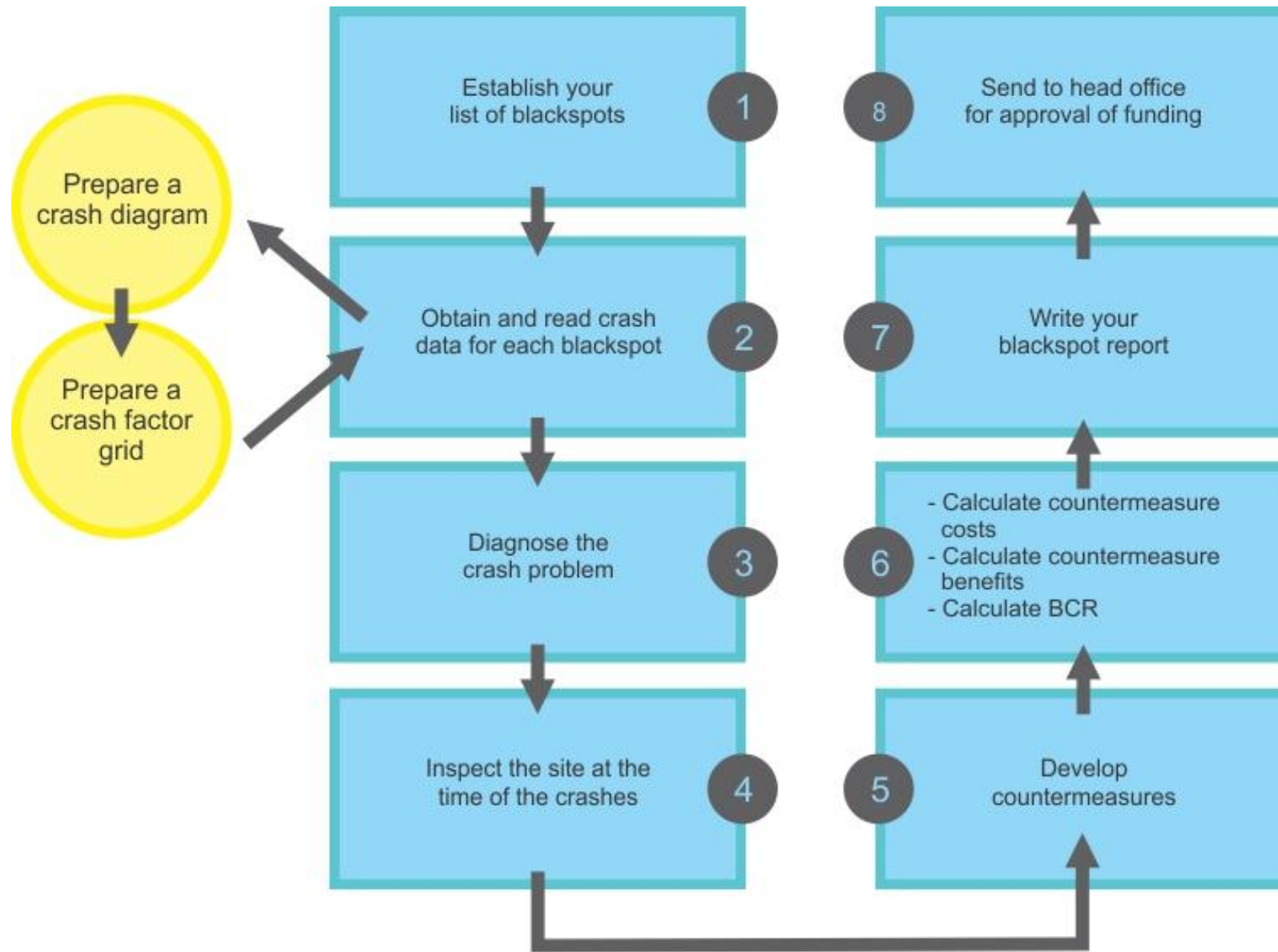




Police investigate a serious crash in detail.

But engineers look for patterns in the crashes at a site.

- Gain a “picture” of the crash history of the site.
- Work with Police – ask them for details of the crashes that may not be written in the reports.



Steps in the blackspot process

1 Decide your list of blackspots

How?

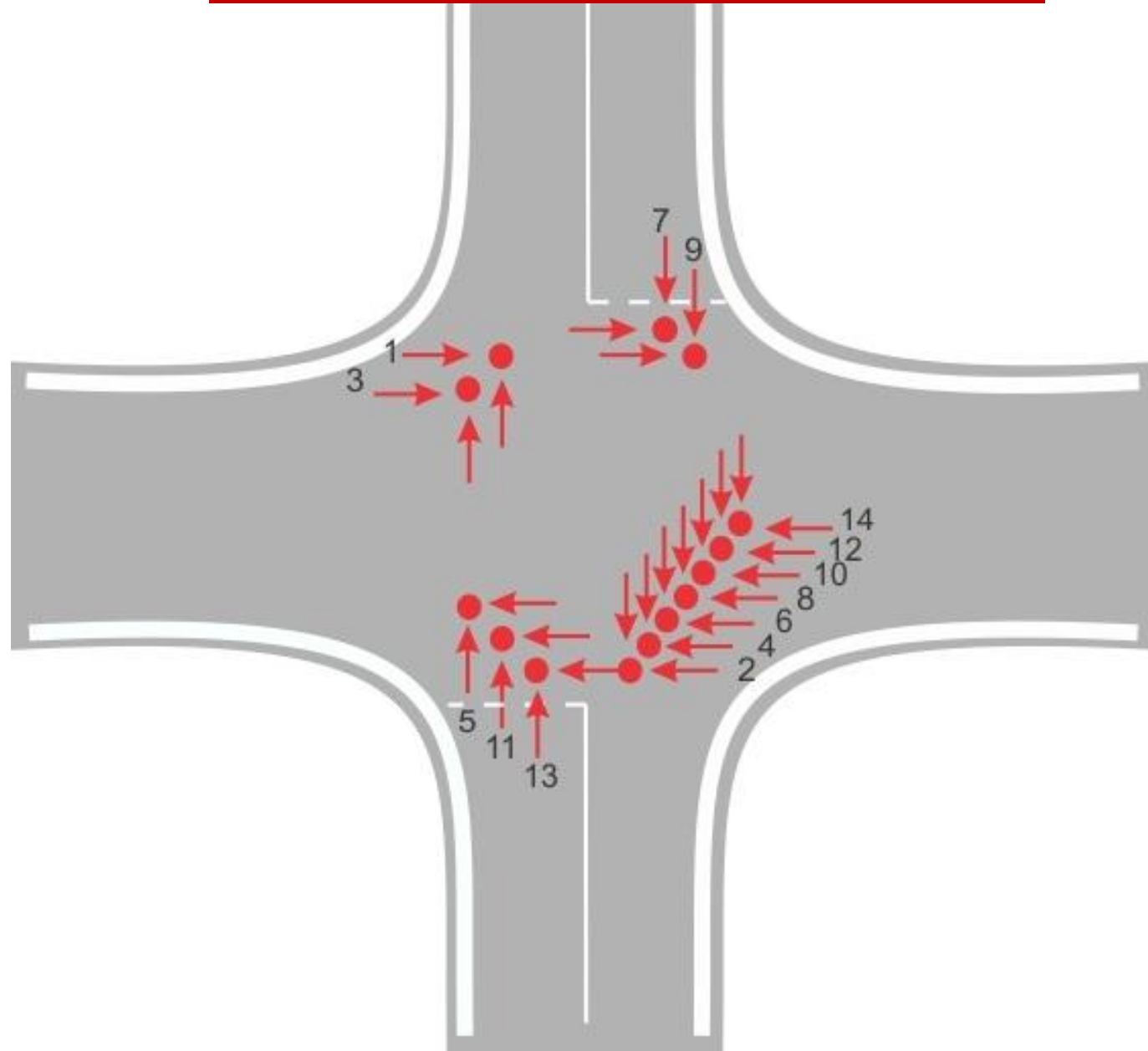
- National level, state or city level
- Locations with most fatalities?
- Locations with most crashes?
- A point system 10 for F, 5 for SI, 1 for PD.
- Always have more sites than you can fund as some will not be able to be changed.

2 Draw a collision diagram

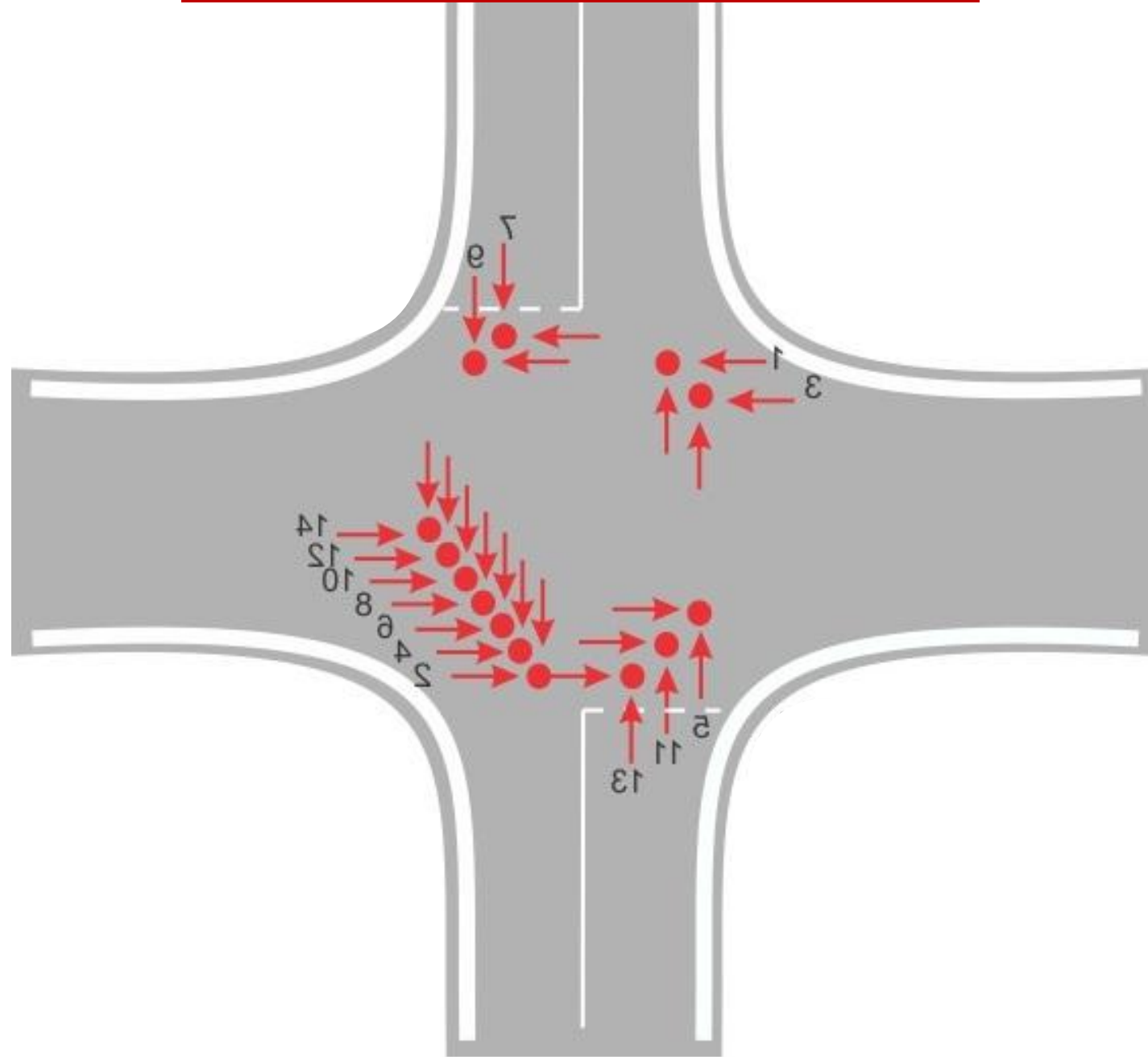
- Make a rough draft first
- For each vehicle – draw an arrow to show its direction
- Show pedestrians, cars, trucks, buses differently
- Show the point of impact accurately



Draw a Collision Diagram (& Crash Factor Grid)



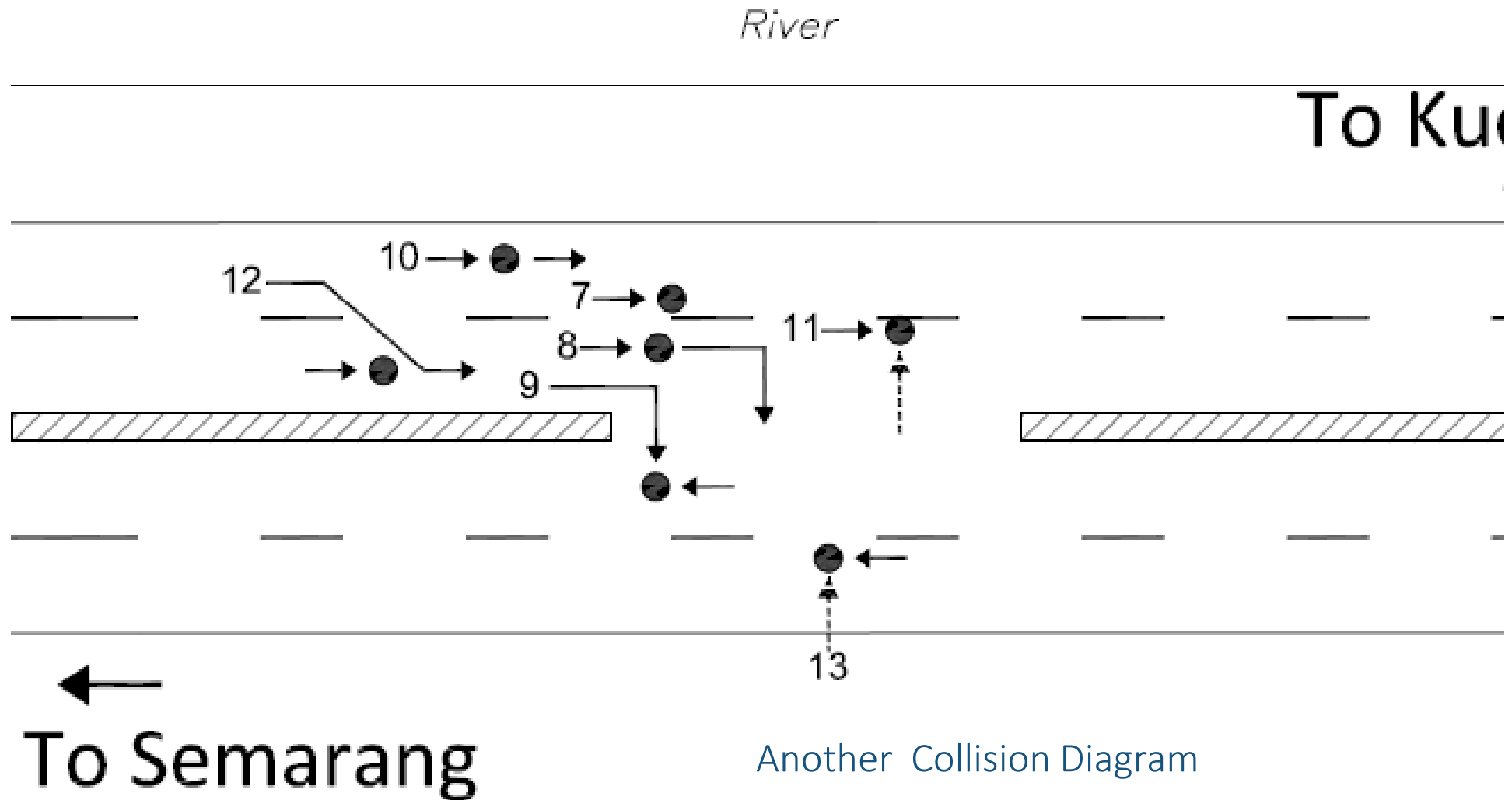
Draw a Collision Diagram (& Crash Factor Grid)



Engineers look for
patterns in the crashes
at a blackspot



SEMARANG - KUDUS KM 18.7



2 Draw a crash factor grid (Matrix)

- Microsoft Excel or similar.
- Pen and paper is also OK.
- For each crash – summarise the details in one column.
- Add rows if extra information is known from the Police reports.

An example of a Crash Factor Matrix

Accident Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Date: day: month	1307	0409	1912	0806	0307	0711	3012	2702	0305	2407	1804	2105	1406	2008
Date: year	17	17	17	18	18	18	18	19	19	19	19	19	19	19
Day of week	Sat	Wed	Thu	Sun	Thu	Fri	Tue	Fri	Sun	Fri	Sun	Fri	Mon	Fri
Time of day	1700	1855	1530	1900	1345	2145	1900	1220	1800	2000	1845	1610	1735	1855
Severity	3	3	2	3	2	4	3	3	4	2	3	2	2	3
Light conditions														
Road Conditions	W	W	D	D	D	D	D	D	D	D	D	D	W	D
DCA Code	101	101	101	101	101	101	101	101	101	101	101	101	101	101
Object 1	Car	Car	Car	Car	Car	Car	Car	Car	Car	Car	Car	Car	Van	Car
Object 2	Car	Car	Truck	Car	Car	Car	Car	Truck	Car	Car	Car	Car	Car	Car
Object 3					Car			Car			Car			
Direction 1	N	S	N	S	N	S	S	S	S	S	N	S	N	S
Direction 2 (& 3)	E	W	E	W	W,E	W	E	W,N	E	W	W,E	W	W	W
Other														

Figure S.1: Standard accident-type codes for coding accidents (DCA's) in Australia

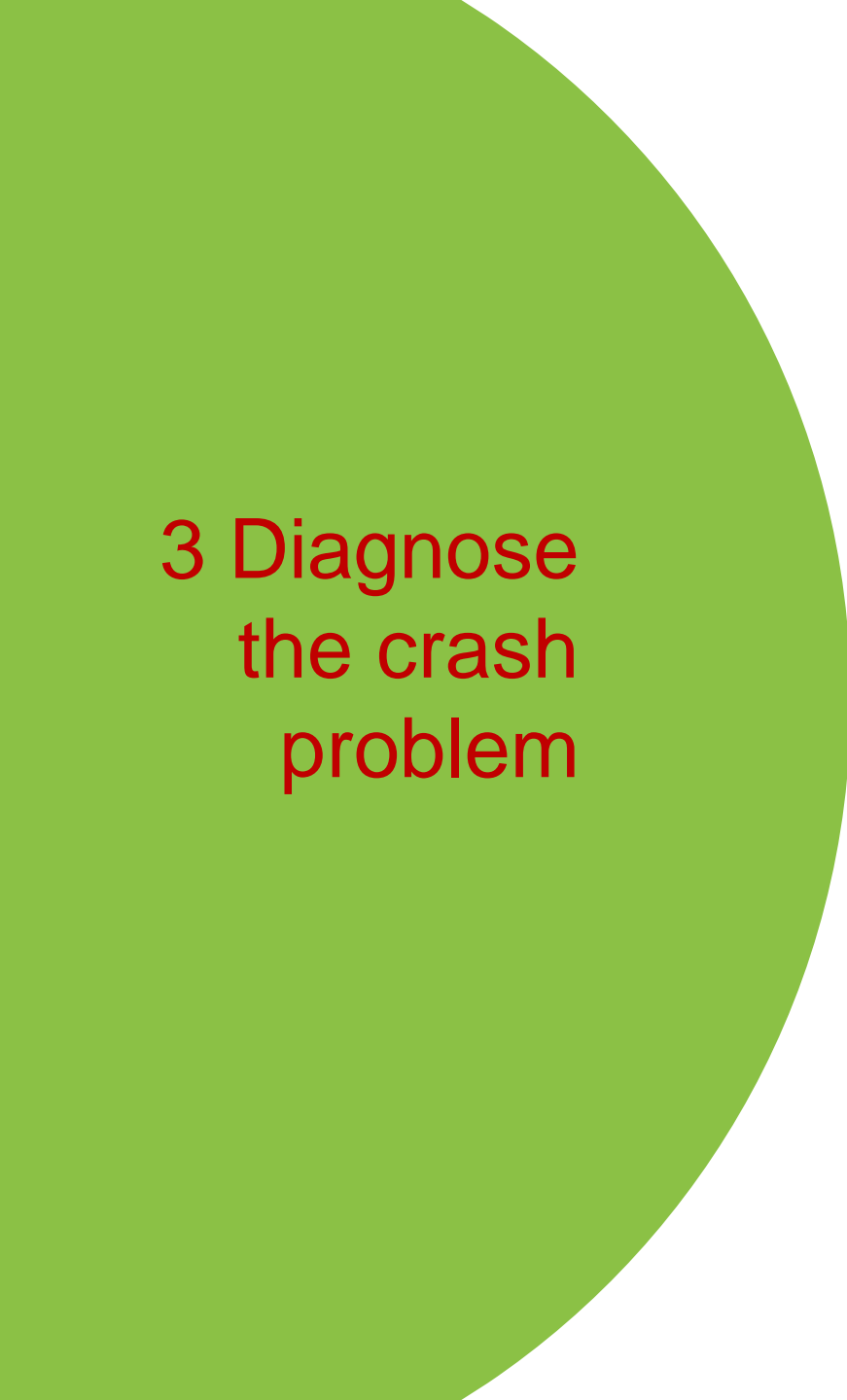
00	10	20	30	40	50	60	70	80	90
PEDESTRIAN on foot, in toy/drum approaches	INTERSECTION vehicles from adjacent approaches	VEHICLES FROM OPPOSING DIRECTIONS	VEHICLES FROM ONE DIRECTION	MANOEUVRING	OVERTAKING	ON PATH	OFF PATH, ON STRAIGHT	OFF PATH, ON CURVE	MISCELLANEOUS & PASSENGERS
OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER
NEAR SIDE 001	THRU-THRU 101	HEAD ON 201	REAR-END 301	LEAVING PARKING 401	HEAD ON 501	PARKED 601	OFF CARRIAGEWAY TO LEFT 701	OFF CARRIAGEWAY OFF RIGHT BEND 801	INFROM VEHICLE 901
EMERGENCY 002	RIGHT-THRU 102	THRU-RIGHT 202	LEFT-REAR 302	PARKING 402	OUT OF CONTROL 502	DOUBLE PARKED 602	OFF CARRIAGEWAY TO RIGHT 702	OFF CARRIAGEWAY LEFT BEND 802	
FAR SIDE 003	LEFT-THRU 103	RIGHT-LEFT 203	RIGHT-REAR 303	PARKING VEHICLES ONLY 403	PULLING OUT 503	ACCIDENT OR BROKEN DOWN 603	LEFT OFF CARRIAGEWAY INTO OBJECT 703	OFF CARRIAGEWAY OFF RIGHT BEND 803	HIT TRAIN 903
PLAYING, WORKING, LYING, STANDING ON CARRIAGEWAY 004	THRU-RIGHT 104	RIGHT-RIGHT 204	U-TURN 304	REVERSING IN TRAFFIC 404	CUTTING IN 504	CAR DOOR 604	RIGHT OFF CARRIAGEWAY INTO OBJECT 704	OFF CARRIAGEWAY OFF LEFT BEND 804	HIT RAILWAY CROSSING FURNITURE 904
WALKING WITH TRAFFIC 005	RIGHT-RIGHT 105	THRU-LEFT 205	LANE SIDE SWIPE 305	REVERSING INTO FIXED OBJECT 405	PULLING OUT REAR END 505	HIT PERMANENT OBSTRUCTION 605	OUT OF CONTROL ON CARRIAGEWAY 705	OFF CARRIAGEWAY ON CARRIAGEWAY 805	HIT ANIMAL OFF CARRIAGEWAY 905
FACING TRAFFIC 006	LEFT-RIGHT 106	LEFT-LEFT 206	LANE CHANGE - RIGHT 306	LEAVING DRIVEWAY 406	OVERTAKING- RIGHT TURN 506	HIT ROADWORKS 606	LEFT TURN 706		PARKED VEHICLE RAN AWAY 906
DRIVEWAY 007	THRU-LEFT 107	U-TURN 207	LANE CHANGE - LEFT 307	LOADING BAY 407		HIT TEMPORARY OBJECT ON CARRIAGEWAY 607	RIGHT TURN 707		VEHICLE MOVEMENTS NOT KNOWN 907
ON FOOTWAY 008	RIGHT-LEFT 108		RIGHT TURN 208	FROM FOOTWAY 408		TRAFFIC ISLAND 708	TRAFFIC ISLAND 708		
STUCK WHILE BOARDING OR ALIGHTING 009	LEFT-LEFT 109		LEFT TURN 209			HIT ANIMAL 609			
			PULLING OUT 310			LOAD HITS VEHICLE 610			

A code for classifying crashes by type

3 Diagnose the crash problem



- A patient visits a doctor and tells the doctor about his illness.
- The doctor does not just guess about his illness – he does not want to treat the patient for a sore arm when he has a heart problem.
- You are like a doctor – diagnosing a “sick” part of your road (a blackspot).
- The blackspot cannot speak – you must look, listen, read crash data, speak with Police, ask locals.
- This takes time, skill, and logic.
- You want to give your patient the correct medicine!



3 Diagnose the crash problem

Examine the Collision Diagram and the
Crash Factor Matrix

Look for patterns?

Day time vs night time?

Wet vs dry?

Type of crash - head on, or run-off-
road, pedestrian etc

Type of road user?

Direction of travel?



4 Inspect the
site – at the
time the pattern
of crashes
happened!

If crashes happened at night, inspect at night!
Put yourself in the shoes of those involved.
Ask yourself why did they have their crash?
..... why did they have their crash?

- 
- A group of seven people, including men and women, are standing on a wide, gravel-covered road in a rural, mountainous area. They are dressed in casual summer clothing like t-shirts, shorts, and caps. In the background, there are several small houses, some with red roofs, and a line of tall, thin trees. The landscape is hilly and arid, with mountains visible in the distance under a blue sky with scattered white clouds. Two cars are parked on the left side of the road. Overlaid on the bottom half of the image is a list of three bullet points in white text.
- Inspect the site day and night. Assess likely causes for the patterns.
 - You are a doctor – diagnose your patient to prescribe the best medicine!
 - You may NOT get it right immediately. Keep trying!



Be logical

Recommend only countermeasures that will reduce the crashes
(For example, if crashes happened mainly during daytime, do not install street lighting as a countermeasure)

And do not replace the nearby barrier simply because it may be old or rusty, unless it played a direct role in the crashes)

\$ are always limited – so look first for low-cost options.

When you are on-site.....

- Get a good “feel” for the location – the topography, the type of traffic, its speed, its volume
- Keep asking – why do a few people have crashes here each year, but thousands do not?
- What is missing? What is misleading?
- Be logical!



5 Develop countermeasures – discuss them with colleagues

Keep your ideas simple

Use low-cost options wherever possible

Persevere – some sites are difficult, but
most locations will be open to low-cost
countermeasures



Your list of low-cost countermeasures

- Signs – warning, regulatory, direction
- Line marking
- Delineation
- Shoulder sealing
- Roadside hazard removal (or shielding)
- Geometric changes
- Opening sight lines (benching, cut vegetation)
- Speed limits
- Traffic signals
- Roundabouts
- Lighting

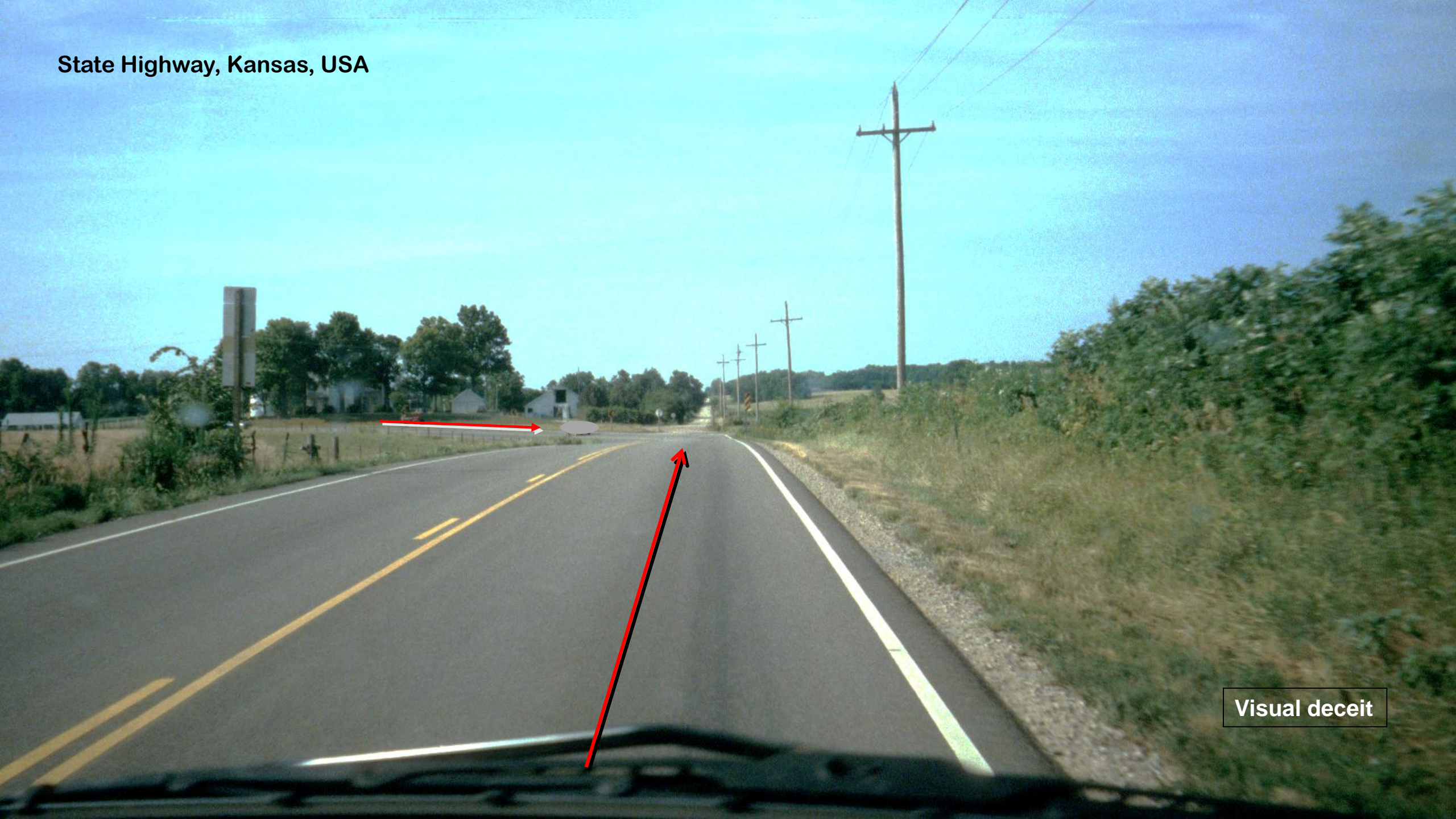




- Look for “visual deceit”
 - Not all drivers/riders see the road the same way.
 - Try to look at the road as others “might”

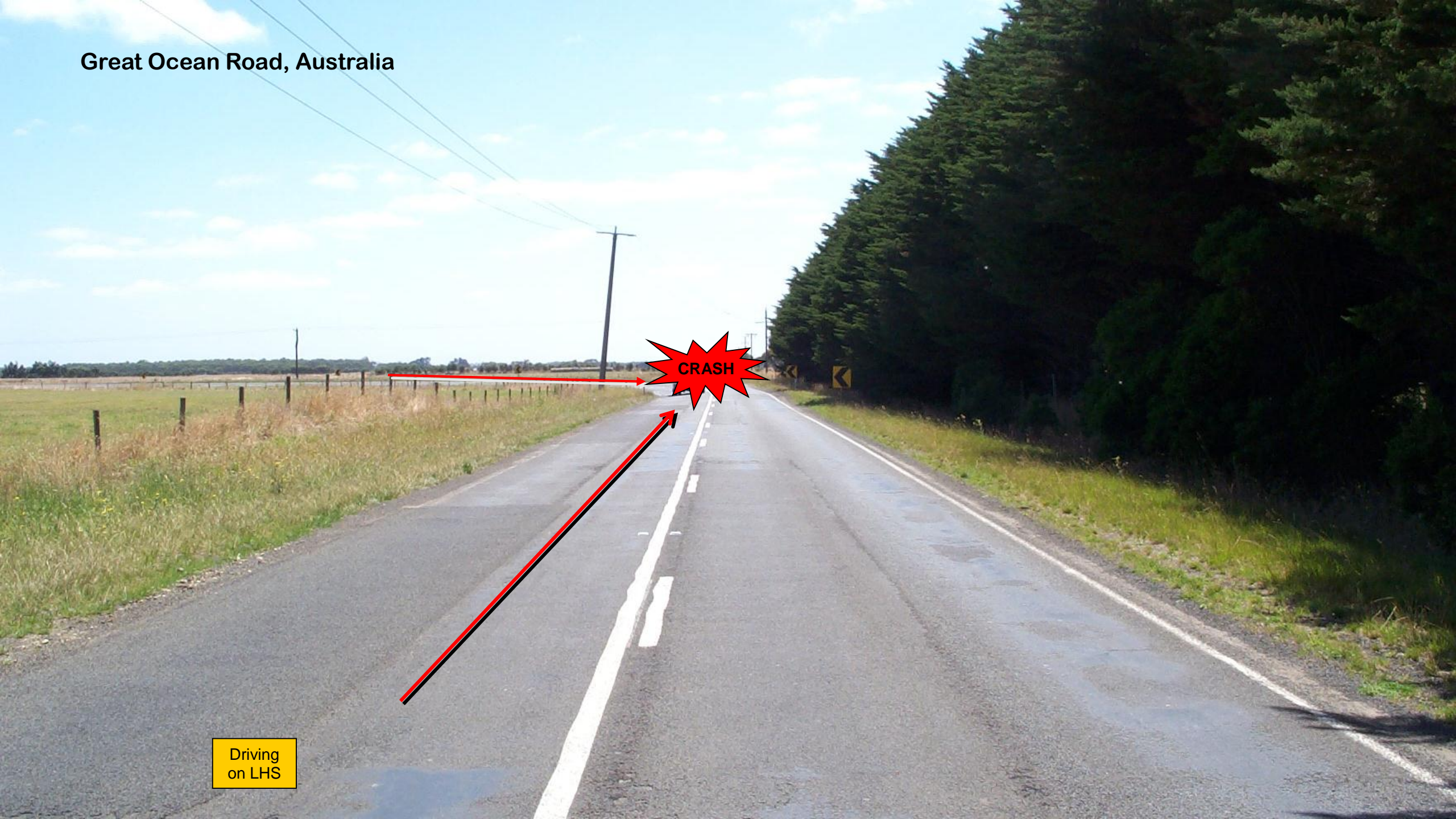
Tips for your site inspection
(NOTE: some crashes have nothing to do with the road!!)

State Highway, Kansas, USA



Visual deceit

Great Ocean Road, Australia



CRASH

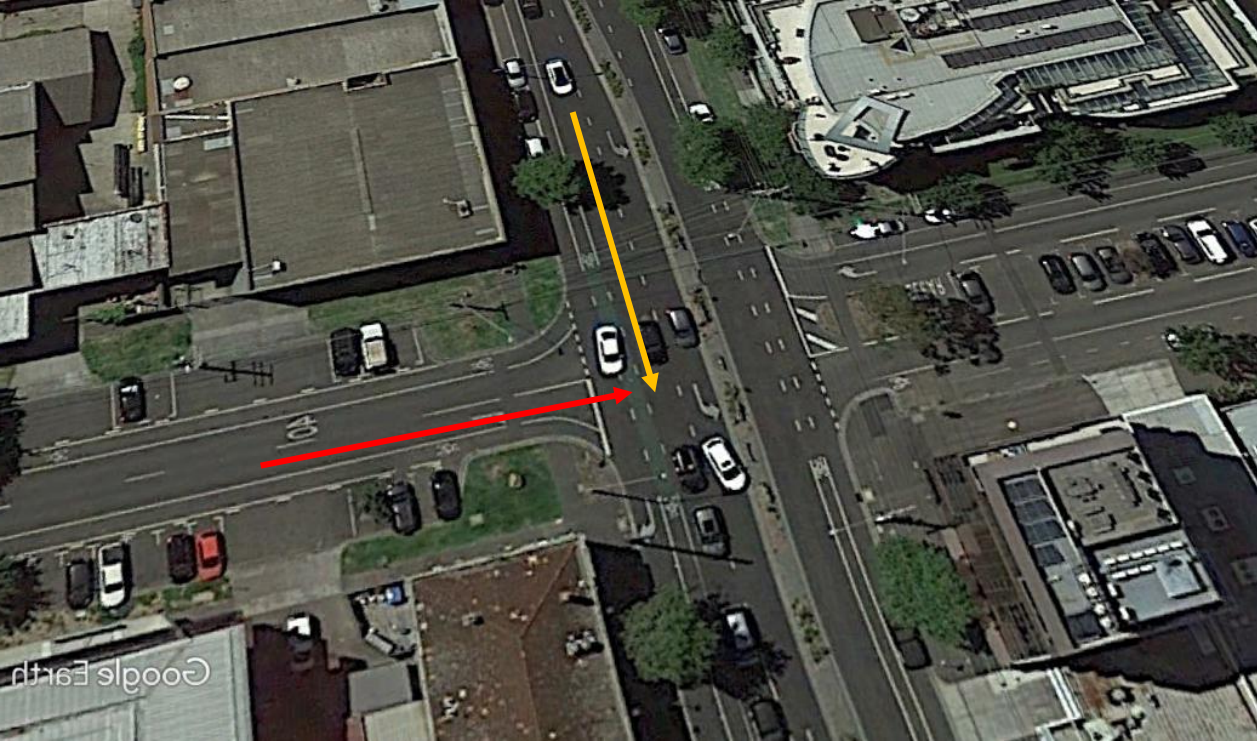
Driving
on LHS



A FEW TIPS FOR YOUR SITE INSPECTION

(SOME CRASHES HAVE NOTHING TO DO WITH THE ROAD!!)

- With intersection right angle crashes – you need to decide if the crash is an *overshoot* or a *re-start*.
- Why?
- Because your countermeasure(s) may be quite different.



The truck failed to
give way.
But why?
Was it overshoot,
or re-start?



Overshoot – the driver did not know the intersection was there

- Improve Approach Sight Distance
- Make intersection more conspicuous
- Advance warning signs
- Advance direction signs
- Duplicate GW or Stops
- Lighting (only if crashes are at night)
- Roundabout or traffic signals

Re-start – knew intersection was there, slowed, maybe stopped, but selected a “wrong” gap

- Improve Safe Intersection Sight Distance
- Maximise sight lines
- Reduce speeds
- Geometric changes
- Cut trees/grass – improve sight distances
- Reduce speed limits
- Reverse the traffic control at the intersection (risky)
- Roundabouts or traffic signals

6 Finalise a preliminary design, and calculate a benefit/cost ratio for your recommendations



WHY?

There will be competition for funding within a national blackspot program.

The national road authority will need to rank all the sites so that funds are spent on those sites that will return the “best value” to your country.

These will be economic decisions.

How will *you*
determine
benefits and
costs?

- 1 You need to know the benefits to be gained from your countermeasures (in \$)
- 2 You need to know the cost of the countermeasures (in \$)
- 3 You then calculate the benefit/cost ratio

BCR

To
determine
benefits and
costs

Costs are easy!

But how do we calculate the benefits to be gained (in \$).

Benefits = the number of crashes we expect to save, times how much would each one costs your country.

A TOUGH QUESTION!

Who has heard of
crash reduction
factors?

	Treatments	Crash Reduction Factors	Treatment Life
	INTERSECTION		
	New roundabout	85%	20
	Modify roundabout (approach deflection)	55%	20
	New traffic signals	45%	20
	Convert intersection signals to roundabout	30%	20
	Staggered T low volume (<2000 AADT of through road)	70%	20
	Removal of Y-intersection	85%	20
	Splitter islands/median, urban	20%	20
	Splitter islands rural, low volume	45%	20
	Line marking to improve intersection definition	10%	5
	Improve sight distance (remove/relocate obstruction)	50%	20
	Improve signage	30%	15
	Rumble strips on approaches	30%	5
	Install Stop signs	30%	15
	Install signs	30%	15
	Change to Stop signs	5%	15

How to determine benefits and costs?

1. Establish your countermeasures
2. Get the Crash Reduction Factor
3. This is the *highest CRF* of those that apply to your treatments
4. Agree on a crash cost (\$) for your country
5. Calculate the benefits of the countermeasures (\$)
6. $CRF \times \text{number of crashes saved} \times \$ \text{ value for each crash}$

How to determine benefits and costs?

7. Calculate the cost of the works (\$)
8. Calculate the benefit/ cost ratio
9. Include this BCR in your report
10. Head Office will approve funding to the highest BCR's first – working down the list until the annual budget is committed.

NOTE: Funding is approved on the basis of BCR's – not the cost.

EXAMPLE OF CALCULATING THE BENEFIT COST RATIO

To work out the BCR we need to know the benefits (in \$) of the countermeasures, and the cost (in \$) of the countermeasures.

- An intersection blackspot with many right-angle crashes
- Some in day, some at night
- You believe it is a re-start (gap acceptance) problem
- You check traffic counts and recommend a roundabout – CRF's indicate it will save 85% of crashes for next 20 years
- The roundabout will cost \$1,800,000 USD

Benefits – look at a table that shows the Crash Reduction Factor for each countermeasure

What percentage of crashes at the blackspot will be reduced if we construct a roundabout as the treatment for an intersection crash problem?



	Treatments	Crash Reduction Factors	Treatment Life
	INTERSECTION		
	New roundabout	85%	20
	Modify roundabout (approach deflection)	55%	20
	New traffic signals	45%	20
	Convert intersection signals to roundabout	30%	20
	Staggered T low volume (<2000 AADT of through road)	70%	20
	Removal of Y-intersection	85%	20
	Splitter islands/median, urban	20%	20
	Splitter islands rural, low volume	45%	20
	Linemarking to improve intersection definition	10%	5
	Improve sight distance (remove/relocate obstruction)	50%	20
	Improve signage	30%	15
	Rumble strips on approaches	30%	5
	Install Stop signs	30%	15
	Install signs	30%	15
	Change to Stop signs	5%	15

Crash reduction factors based on real experience from the Victorian (Australia) blackspot program since 1980



PAVEMENT WORKS	%	YEARS
Road reconstruction	25%	20
Duplication short length	30%	20
Install raised median	30%	20
Add median strip	20%	20
Widen pavement	10%	20
Construct overtaking lane	25%	20
Add lane	10%	20
Widen road for Right Turn lane	50%	20
Widen road for Left Turn lane	15%	20
Lane widening - 0.3m	5%	20
Lane widening - 0.6m	12%	20
Widen shoulder not seal - 0.3m	3%	20
Widen shoulder not seal - 0.6m	7%	20
Widen shoulder not seal - 1m	10%	20
Widen shoulder and seal - 0.3m	4%	20
Widen shoulder and seal - 0.6m	8%	20
Widen shoulder and seal - 1m	12%	20

Crash reduction factors based on real experience from the Victorian (Australia) blackspot program since 1980

DELINEATION

Reflectorised guideposts	30%	20
Advance Curve Warning signs - static	20%	15
Advance Curve Warning signs - vehicle activated	75%	15
Install chevron signs (CAMS) - normal	35%	15
Install chevron signs (CAMS) - electronic	50%	15
Painted centrelines	30%	5
Tactile centrelines	40%	5
Painted edge lines	25%	5
Tactile edge lines	35%	5
Barrier lines	30%	5
Raised reflectorised pavement markers (RRPM)	20%	5

ROADSIDE HAZARD MANAGEMENT

Wire Rope Safety Barrier (WRSB)	45%	20
Guardrail	35%	20
Median barriers (any type including centreline WRSB)	20%	20
Guard rail at culvert	25%	20
Guardrail for bridge end post	20%	20
Crash Cushions	15%	20

PEDESTRIANS & CYCLISTS

Refuges, Channelisation, Kerb extension	30%	20
Pedestrian signals	25%	15
Bicycle paths, threshold treatments	10%	20
Upgrade pedestrian signals	20%	15
Pedestrian overpass	10%	20

MOTORCYCLISTS

New roundabouts	75%	20
Intersection signal remodel	50%	15
Fully Controlled Right Turn	55%	15
Shoulder sealing	50%	20

STREET LIGHTING

Provision of street lighting general	25%	15
Improve lighting at intersections	25%	15
Improve lighting at roadway segment	25%	15
Improve lighting at PEDESTRIAN CROSSING	40%	15
Improve lighting at railway crossing	10%	15



Benefits – you
need a table that
shows the Crash
Reduction Factor
for each
countermeasure

- 20 reported crashes in 5 years
- A roundabout will reduce 85% (17) of these crashes
- 20 years = $4 \times 17 = 68$ fewer crashes
- Each casualty crash in Kazakhstan = \$400,000 USD (approx.)
- $68 \times \$400,000 = \$27,200,000$ benefits in 20 years

Benefit/ Cost Ratio BCR

- Benefits of a roundabout = \$27,200,000 USD
- Cost of the roundabout = \$1,800,000 USD

$$\text{BCR} = 15.11$$

(This is an excellent BCR and almost certainly will receive funding approval in most countries)



7 & 8 Write the blackspot report; send it to H/O for approval of funds

- 7 Write your blackspot report – use a template.
- 8 Send the report to Head Office for approval for funding
- 9 Once approved this site goes into the Annual Works Program. Ensure to implement the agreed countermeasures(s).

Head office will apportion funds down the list according to BCR.

This is why it is vital to aim for low cost, high benefit countermeasures – to get a high BCR and to maximise funding possibilities

Reminder of the steps in the blackspot process

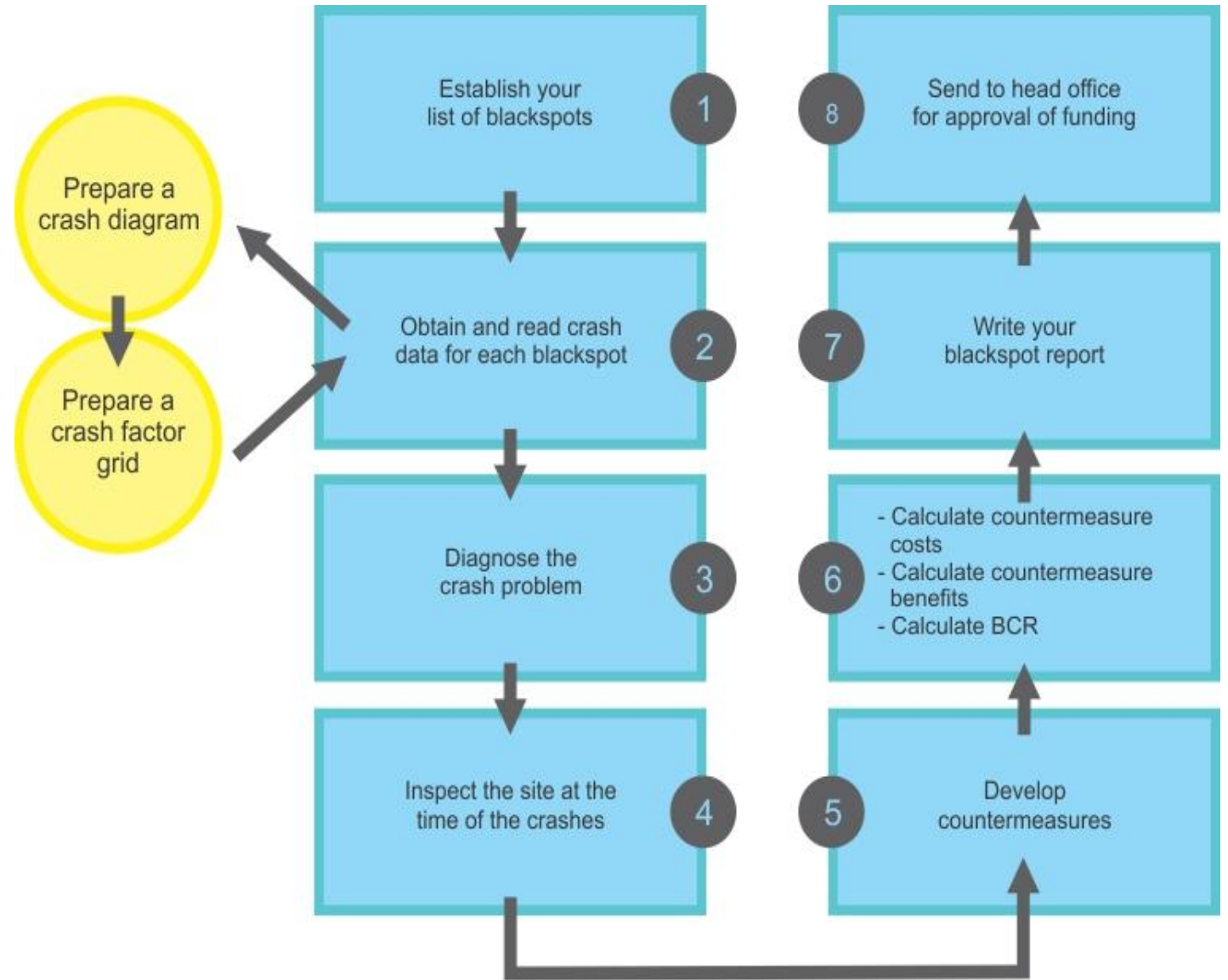


Figure 4.1 Steps in a Blackspot Investigation

YOUR BLACKSPOT HOMEWORK

Two blackspots –

1 Urban arterial, pedestrian crash problem, right side driving

2 Rural Y-junction, right side driving

Select just one – investigate it, and then report your recommendations



YOUR BLACKSPOT HOMEWORK

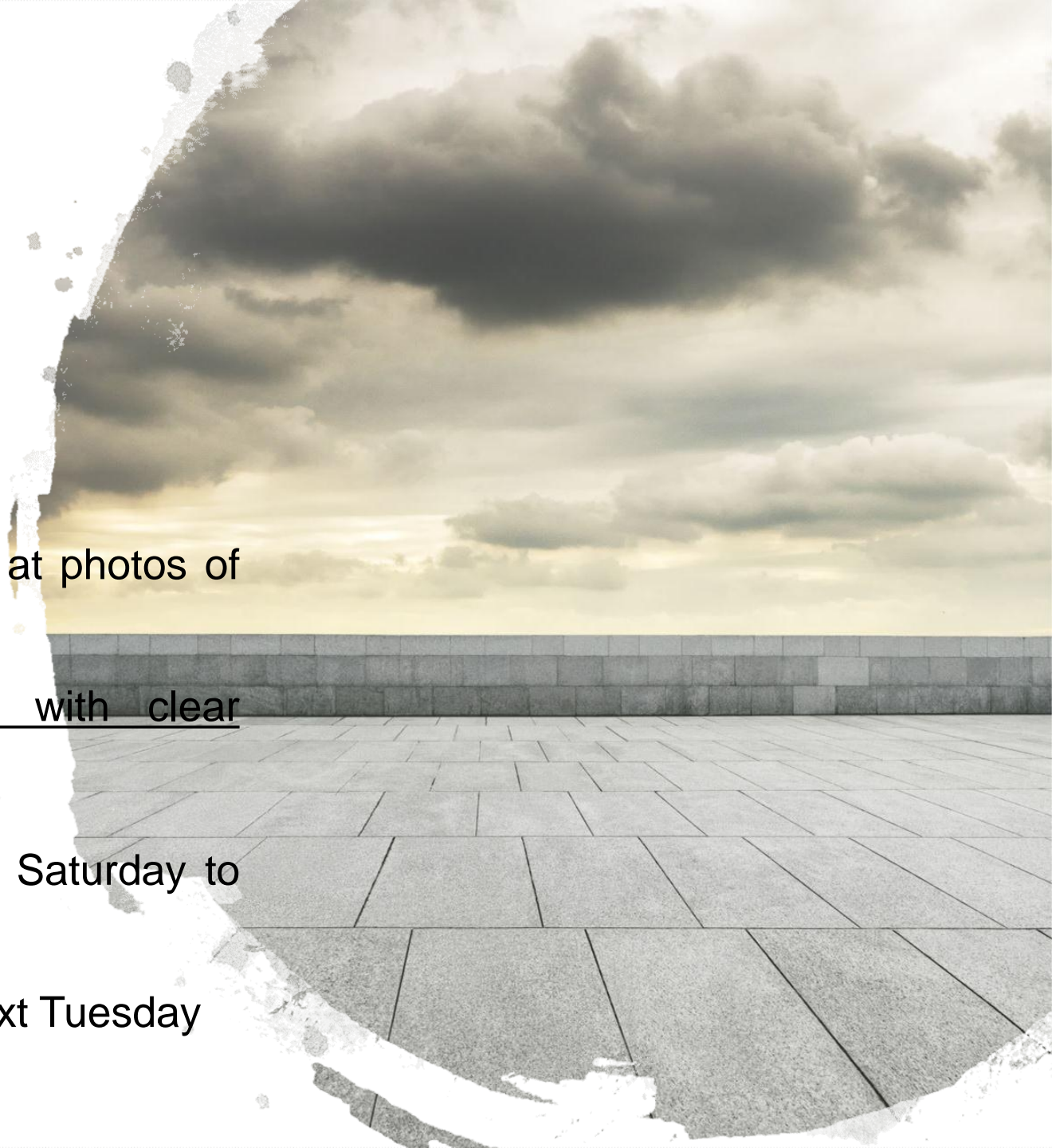
Investigate one site only.

Examine the crash data (look for patterns), look at photos of the sites, be a detective (or a doctor).

Prepare a one-page crash treatment report with clear recommended treatments, and a BCR.

Email your one-page report (in English) by 5pm Saturday to the Moderator.

Feedback will be given at the start of Module 5 next Tuesday





Homework Option 1

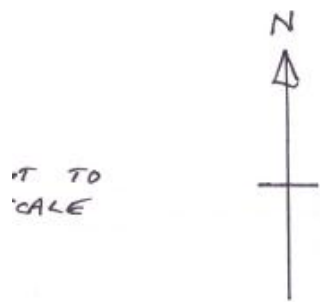
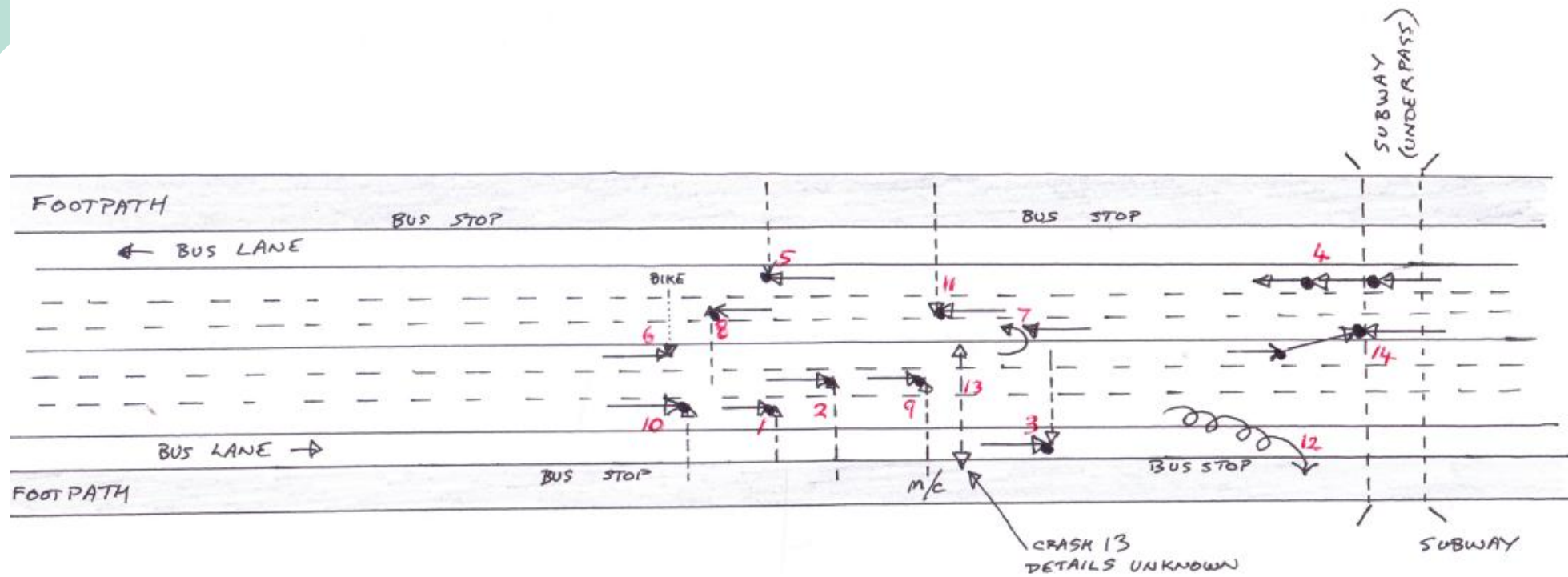
Urban arterial pedestrian collision problem. 14 crashes in past 3 years. Mainly at night.



Image © 2020 Maxar Technologies

Google E

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	N	W	S	S	W	N	S	N	S	N	?	?
DIRECTION VEH.3				E										W
OBSERVATIONS	ALC	ALC	SPEED					ALC & SPEED				SPEED		U TURN



COLLISION DIAGRAM FOR PEDESTRIAN BLACKSPOT



Pedestrian blackspot



Eastern approach



Eastern approach



Eastern approach



ДАВЛАТ БЕГАЗАНД БОД
ТОЧИК ИСТОНИ ОЗОДИ МАН

Чай дарун релаксат

Чай дарун релаксат

Чай дарун релаксат

Чай дарун релаксат

Чай дарун релаксат

83-456-95-05

ТАРЗҚО АЗ
15%

Western approach



Western approach



Western approach

The subway is
under here



The subway is
under here



The subway is
under here



The subway



The subway



▼ Search

Almaty, Kazakhstan

Search

ex: pizza near NYC

[Get Directions](#) [History](#)

Almaty



► Places

▼ Layers

- ☐ Primary Database
- ☐ [New Layers](#)
- ☐ Borders and Labels
- ☒ Places
- ☐ Photos
- ☐ Roads and Transportation
- ☐ 3D Buildings
- ☐ Weather
- ☐ Gallery
- ☐ More
- ☐ Borders and Labels (Outdate...
- ☐ Places (Outdated)



HOMWORK OPTION 2
Y-JUNCTION BLACKSPOT

Image © 2021 Maxar Technologies

Google Earth

Imagery Date: 6/26/2021 43°27'38.41" N 76°42'38.52" E elev 0 m eye alt 1.00 km



HOMEWORK OPTION 2
Y-JUNCTION BLACKSPOT



HOMEWORK OPTION 2
Y-JUNCTION BLACKSPOT

12 casualty crashes in 3 years



HOMEWORK OPTION 2
Y-JUNCTION BLACKSPOT

12 casualty crashes in 3 years

Figure 2.1: Standard accident-type codes for definitions for coding accidents (DCAs) in Australia

	00	10	20	30	40	50	60	70	80	90
	PEDESTRIAN on foot, in toy/pram	INTERSECTION vehicles from adjacent approaches	VEHICLES FROM OPPOSING DIRECTIONS	VEHICLES FROM ONE DIRECTION	MANOEUVRING	OVERTAKING	ON PATH	OFF PATH, ON STRAIGHT	OFF PATH, ON CURVE	PASSENGERS & MISCELLANEOUS
	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER
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4	 PLAYING, WORKING, LYING, STANDING ON CARRIAGEWAY 004	 THRU-RIGHT 104	 RIGHT-RIGHT 204	 U-TURN 304	 REVERSING IN TRAFFIC 404	 CUTTING IN 504	 CAR DOOR 604	 RIGHT OFF CARRIAGEWAY INTO OBJECT 704	 OFF LEFT BEND INTO OBJECT 804	 HIT RAILWAY XING FURNITURE 904
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SEVERITY	1	2	2	3	1	2	2	1	1	2	1	3
LIGHT CONDITION												
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CRASH TYPE	202	202	202	301	202	202	001	202	301	802	202	102
VEHICLE 1	CAR	CAR	BUS	BUS	CAR	M/C	CAR	CAR	CAR	TRUCK	M/C	CAR
VEHICLE 2	BUS	TRUCK	TRUCK	CAR	M/C	BUS	PED	CAR	M/C	?	TRUCK	CAR
VEHICLE 3										?		
DIRECTION VEH.1	E	E	S	S	S	S	S	E	N	NW	E	E
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12 crashes in 3 years

5 fatal crashes (8 lives lost)

5 serious injury crashes (12 people injured)

2 minor injury crashes

Estimated cost of these 12 crashes

➤ 8 deaths x \$600,000 (fatalities)

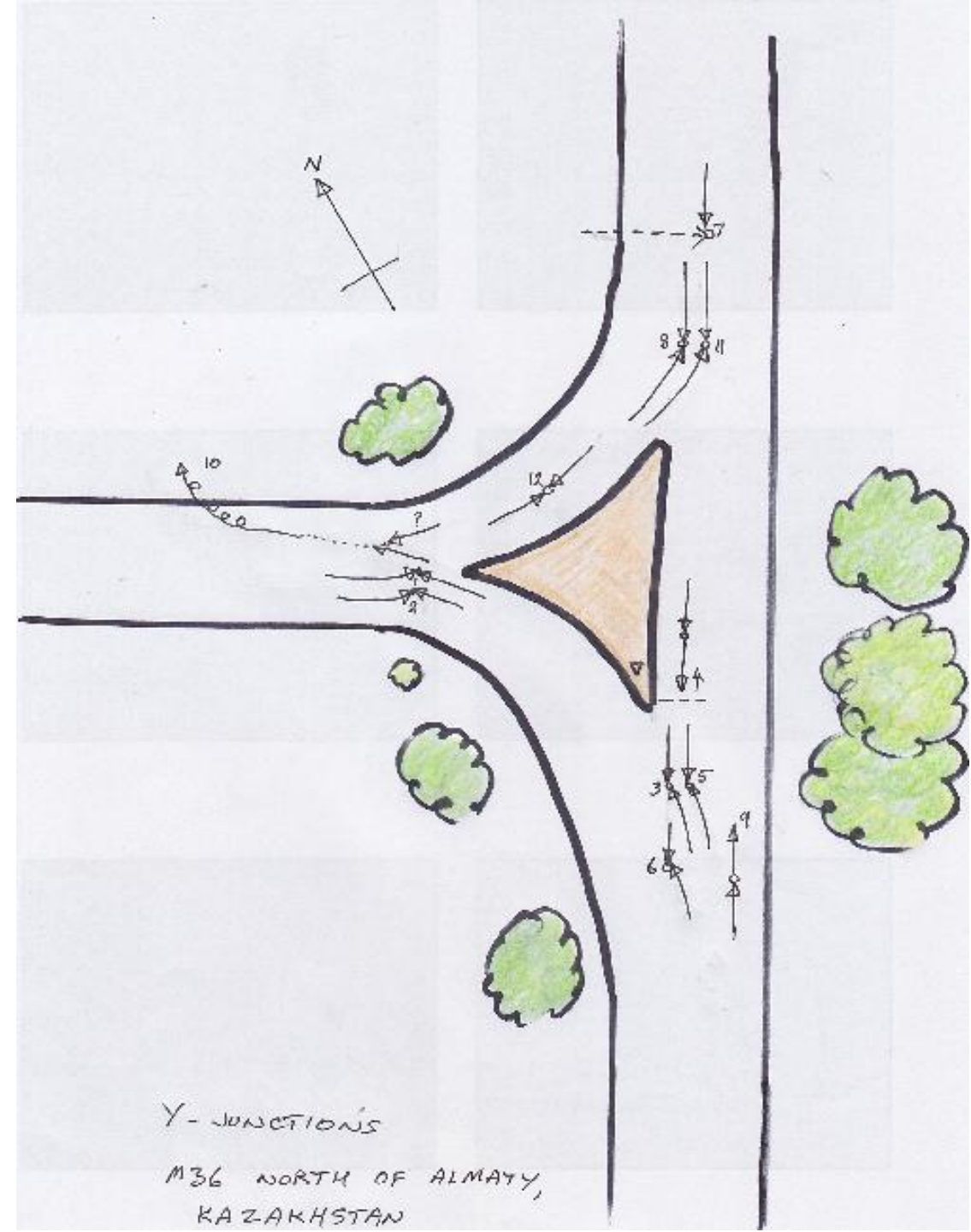
➤ 12 injuries x 0.25 x \$600,000

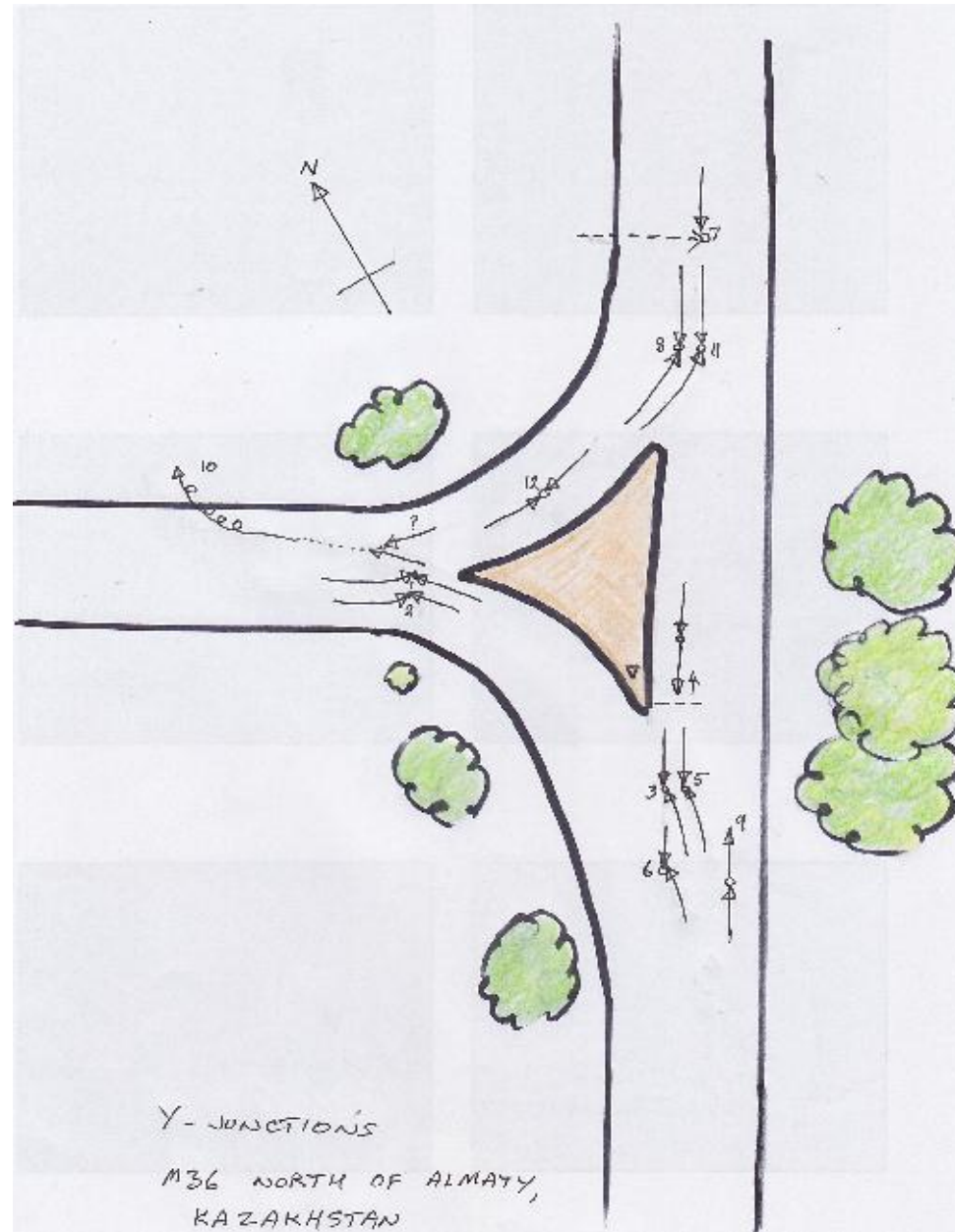
TOTAL \$6,600,000 in 3 years or av. \$2,200,00 pa.

What patterns do you see?

What will you recommend?

What is the BCR?





Y-JUNCTION BLACKSPOT ON M36



Y-JUNCTION BLACKSPOT ON M36



Some recent blackspots

1. A village on a newly improved highway
2. A wide arterial road
3. A rural Y junction
4. A suburban cross road intersection



1 VILLAGE BLACKSPOT

Six pedestrian fatalities, many other
serious casualty crashes in 2 years





Image © 2019 DigitalGlobe

Google Earth









КАДУЧИ
KADUSHI

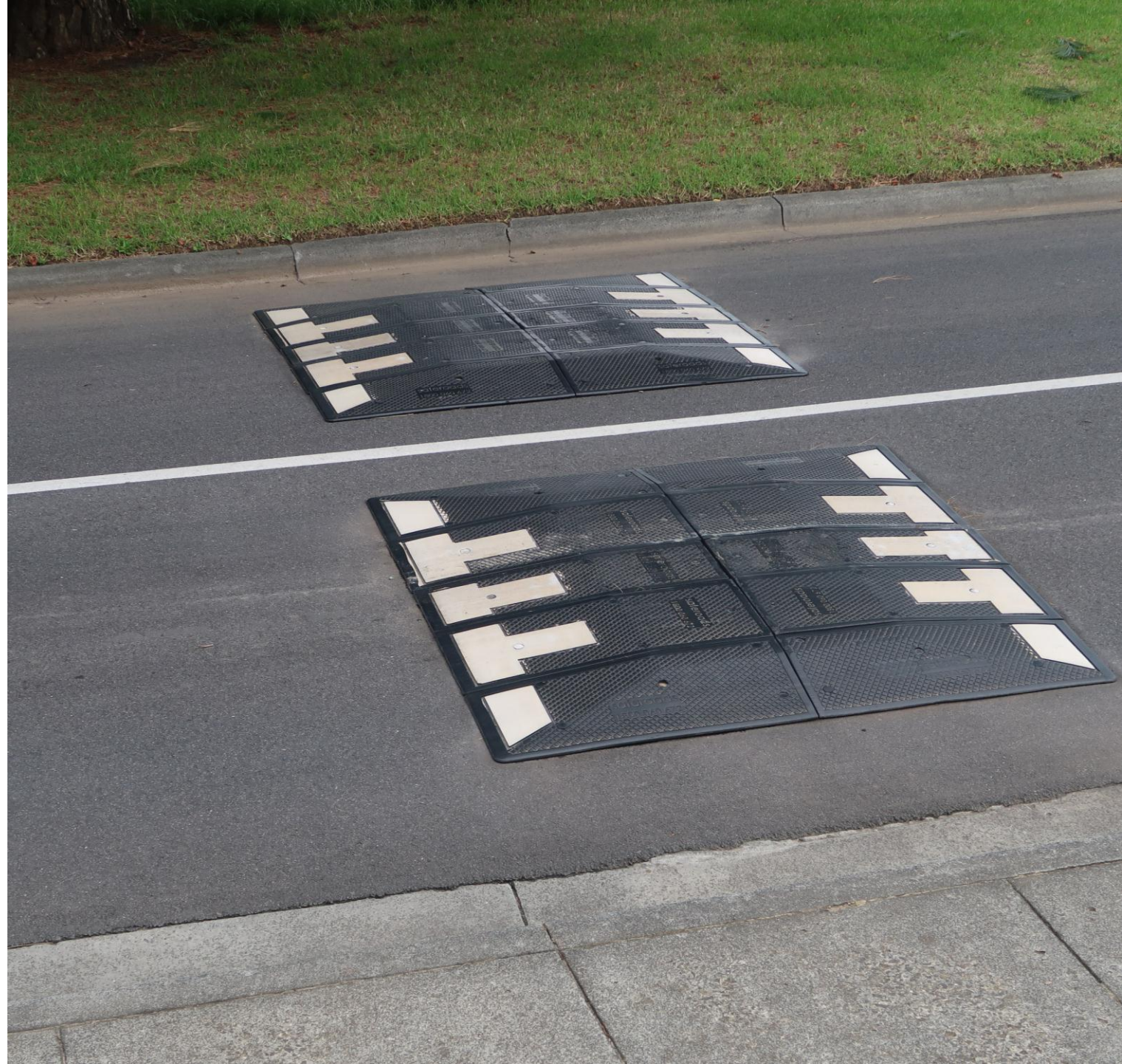




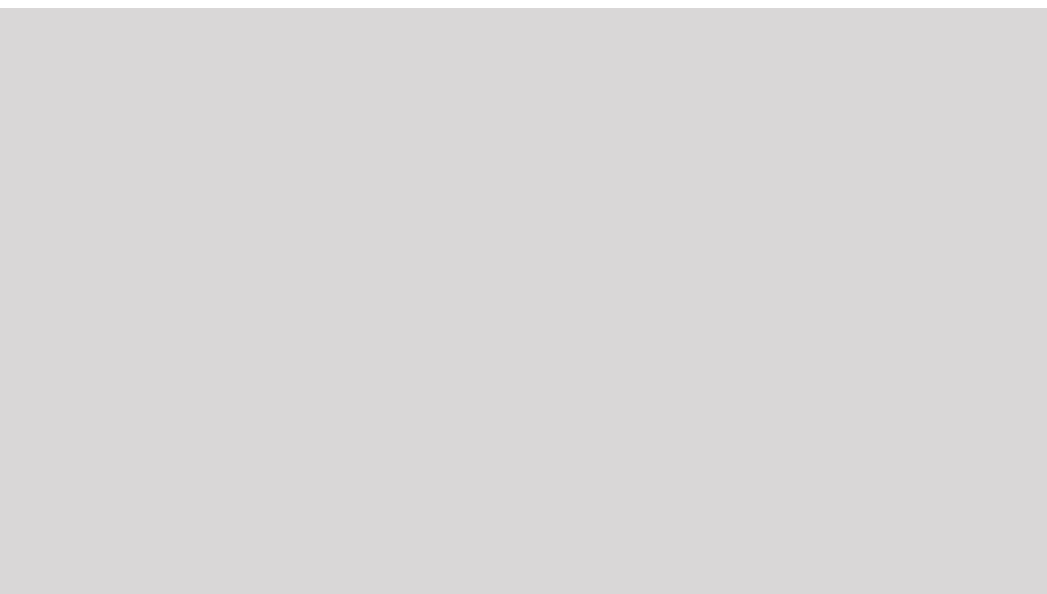
- What are your thoughts about this blacklength?
- What treatments do you support?

My recommendations:

- Large gateway signs each end of village
- 40km/h speed limit
- Flat top road humps each 100m, with kerb extensions
- Zebra Crossings only on humps near mosques, schools







Crash reduction factor 30% for 20 years

Crash savings = \$2,675,000

The humps, sealing, signs and line marking will cost \$225,000

Benefits = \$2,675,000

Costs = \$225,000

BCR = 11.9

This project will be compared with all other blackspots in the country – those with the highest BCR's will be treated first. The others will wait for next year.....

BCR



A wide-angle photograph of a multi-lane highway in Ulaanbaatar, Mongolia. The road stretches into the distance, flanked by green hills and mountains. On the left side of the road, there is a tall, modern building and a residential area with colorful houses. On the right side, there is a large open field and some industrial structures. The sky is clear and blue. The text "2 Airport Road, UB — pedestrian black length" is overlaid in the center of the image.

2 Airport Road, UB —
pedestrian black length



11 pedestrian fatalities in one year. All at night. Many intoxicated



Several signalised crossings and three Zebra crossings



Too few crossing points, and inconsistent control



What can we do – at modest cost?

Think about all your customers:

senior citizens - 19% of pedestrian fatalities are over 65 years



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



intoxicated - 43% of night time pedestrian fatalities $\geq 0.15\%$ BAC



.....plus the disabled



My recommendations:

Make all crossings signalised –
for consistency

Separate phases for each
carriageway

Pedestrian push buttons

Flood lighting at each crossing



3 Y-JUNCTION BLACKSPOT



Six fatalities, 14 serious casualty crashes in 5 years



3 Y-JUNCTION BLACKSPOT

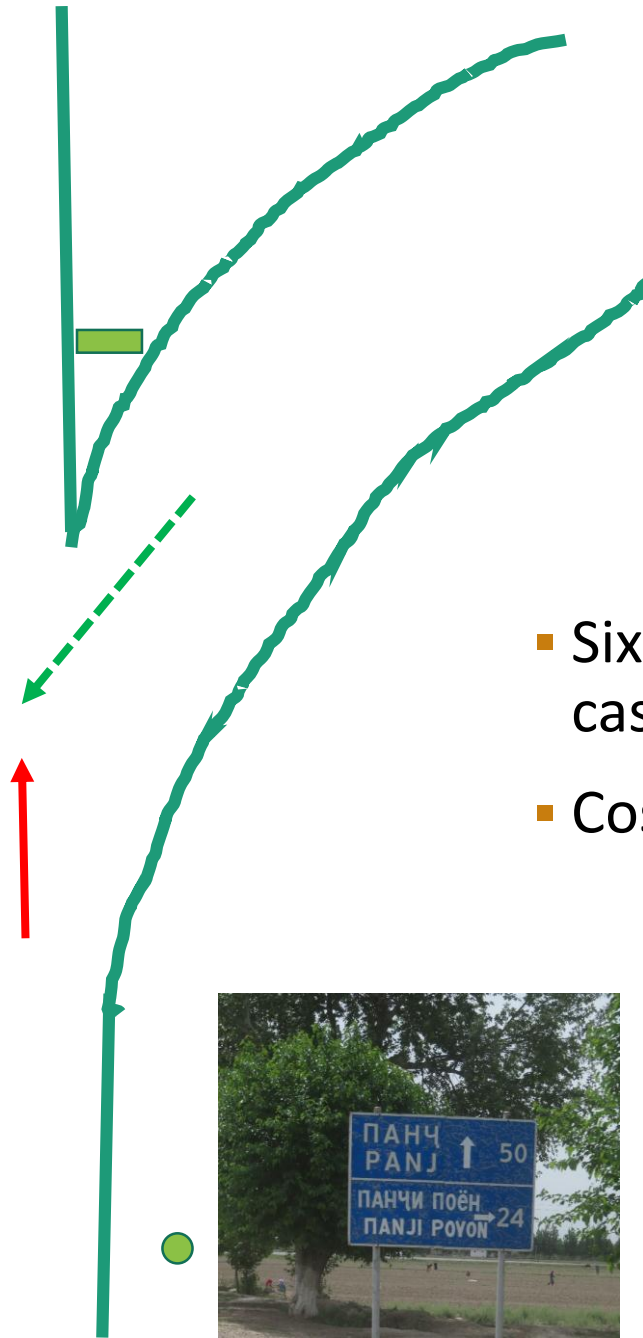


**Current situation of intersection:
Isoev-Panj Road & Isoev-Dusti Road**



3 Y-JUNCTION BLACKSPOT

Six fatalities, 14 serious
casualty crashes in 5 years



COLLISION DIAGRAM

- Six fatalities, 14 serious casualty crashes in 5 years
- Cost \$3,500,000 for 5 years

















- What are your thoughts about this blackspot?
- What treatments do you support?

I recommended a two-stage package of treatments

Stage 1

- Install new diagrammatic advance direction signs on all three approaches informing road users of the destinations in each direction.
- Install oversized (900mm) “Intersection” warning signs on both approaches of the NH.
- Install a tactile centre line and edge lines on national highway.
- Install duplicate Give Way signs and line marking facing minor road traffic.
- Install an advance warning sign “Give Way Ahead” on the minor road.
- Pave all shoulders through the intersection at least 1.5m wide for at least 200m each side of the intersection.

Quick, cheaper, easy to get installed!

Stage 2

- Square up the minor road to intersect with the NH at a T-junction.
- Widen the NH and construct channelisation on it to give physical separation of NH traffic through the junction, including a sheltered left turn lane for traffic turning from the NH to the minor road. (See typical layout).
- Install lighting at the intersection.

Needs design, maybe land acquisition,
longer to get installed!



**Standard T-Junction design
Isoev-Dusti road & Isoev-Panj Road**



Treatments	Crash Reduction Factors	Treatment Life
INTERSECTION		
New roundabout	85%	20
Modify roundabout (approach deflection)	55%	20
New traffic signals	45%	20
Convert intersection signals to roundabout	30%	20
Staggered T low volume (<2000 AADT of through road)	70%	20
Removal of Y-intersection	85%	20
Splitter islands/median, urban	20%	20
Splitter islands rural, low volume	45%	20
Linemarking to improve intersection definition	10%	5
Improve sight distance	50%	20
Improve signage	30%	15
Rumble strips on approaches	30%	5
Install Stop signs	30%	15
Install signs	30%	15
Change to Stop signs	5%	15

Stage 2

Crash reduction factor 85% for 20 years

Crash savings = \$11,900,000

The removal of the Y junction, signs,
lines plus lighting will cost \$925,000

Benefits = \$11,900,000

Costs = \$925,000

BCR

BCR = 12.9

This project will be compared with all other blackspots in the country – those with the highest BCR's will be treated first. The others will wait for next year.....



Summary

- Road safety engineering reduces road trauma
- Perseverance is often needed
- Be a “detective” (or a doctor), your “patient” cannot speak
- Aim for countermeasures with high BCR’s
- Road safety engineering is the last “safety net” when enforcement, education and publicity have failed
- We have a responsibility to investigate thoroughly, to spend funds wisely and to protect all road users

Any questions
before your
homework?



YOUR BLACKSPOT HOMEWORK

Two blackspots –

1 Urban arterial, pedestrian crash problem, right side driving

2 Rural Y-junctions, right side driving

Select just one – investigate it, and then report your recommendations



YOUR BLACKSPOT HOMEWORK

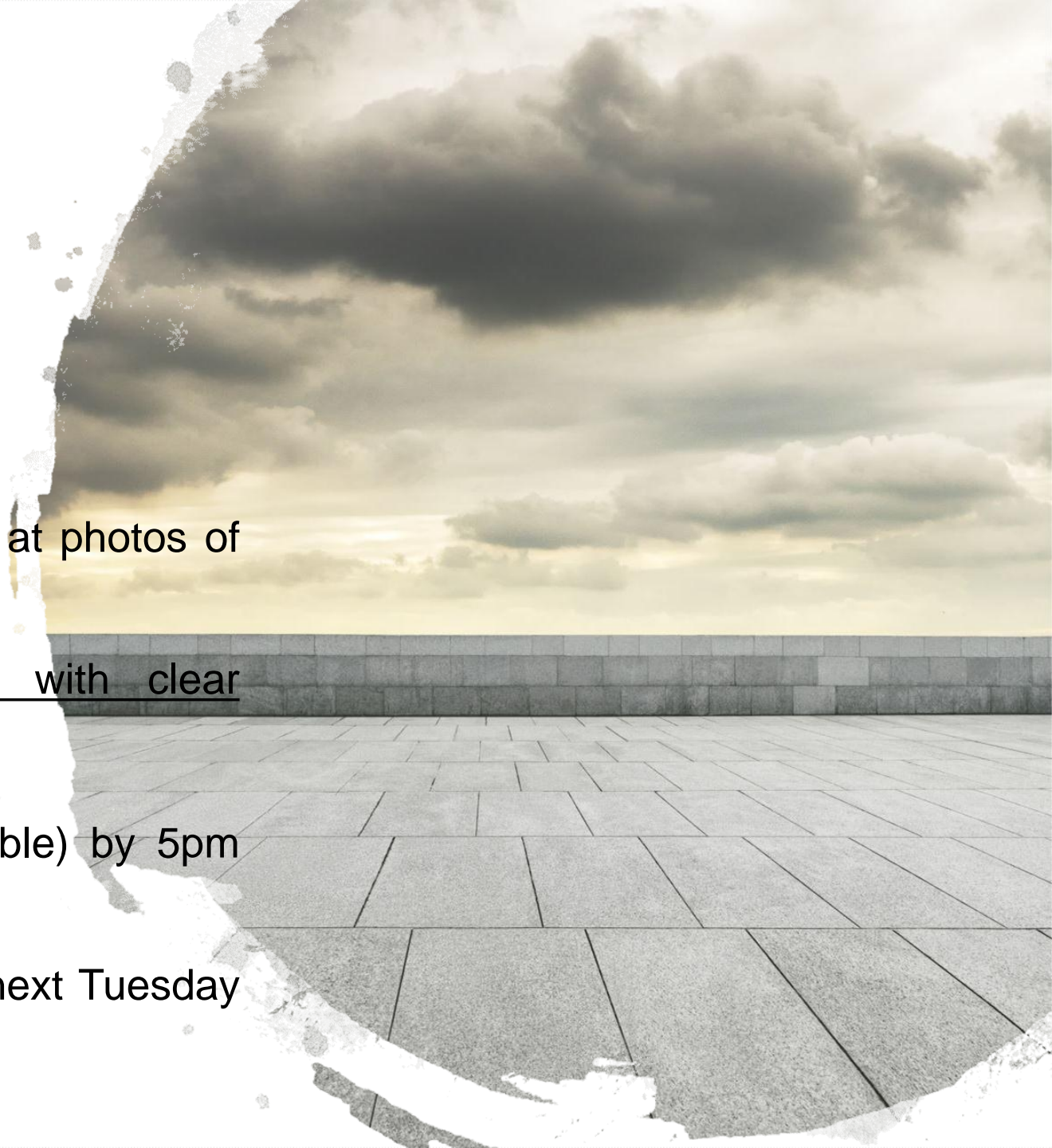
Investigate one site only.

Examine the crash data (look for patterns), look at photos of the sites, be a detective (or a doctor).

Prepare a one-page crash treatment report with clear recommended treatments, and a BCR.

Email your one-page report (in English if possible) by 5pm Saturday to the Moderator.

Feedback will be given at the start of Module 5 next Tuesday
26th October





Homework Option 1

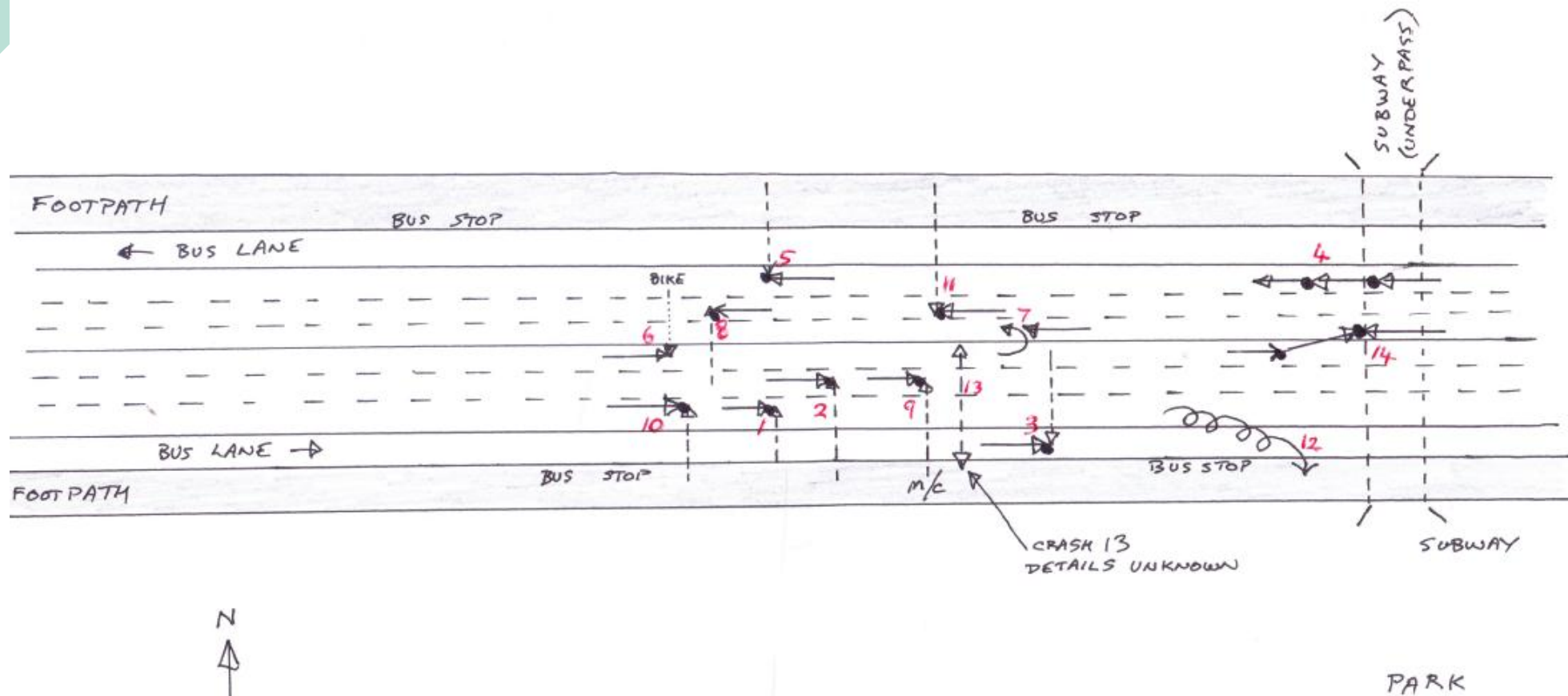
Urban arterial pedestrian collision problem. 14 crashes in past 3 years. Mainly night time.

Figure 2.1: Standard accident-type codes for definitions for coding accidents (DCAs) in Australia

	00	10	20	30	40	50	60	70	80	90
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8	ON FOOTWAY 008	RIGHT-LEFT 108		RIGHT TURN S/S 308	FROM FOOTWAY 408			MOUNTS TRAFFIC ISLAND 708	MOUNTS TRAFFIC ISLAND 808	
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10				PULLING OUT 310			LOAD HITS VEHICLE 610			



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	N	W	S	S	W	N	S	N	S	N	?	?
DIRECTION VEH.3				E										W
OBSERVATIONS	ALC	ALC	SPEED					ALC & SPEED				SPEED		U TURN



COLLISION DIAGRAM FOR PEDESTRIAN BLACKSPOT



Pedestrian blackspot



Eastern approach



Eastern approach



Eastern approach



Western approach



Western approach



Western approach



Western approach

The subway is
under here



The subway is
under here



The subway is
under here



The subway



The subway





HOMEWORK OPTION 2
Y-JUNCTION BLACKSPOT



HOMEWORK OPTION 2
Y-JUNCTION BLACKSPOT

12 casualty crashes in 3 years

CRASH NUMBER	1	2	3	4	5	6	7	8	9	10	11	12
DATE	12/3	14/5	11/7	29/1	28/3	1/4	5/9	8/2	31/4	26/6	10/8	7/9
DAY OF WEEK	SUN	FRI	WED	WED	WED	SUN	WED	SAT	MON	TUES	SUN	SAT
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SEVERITY	1	2	2	3	1	2	2	1	1	2	1	3
LIGHT CONDITION												
ROAD CONDITION	WET	DRY	DRY	DRY	DRY	WET	DRY	WET	DRY	WET	DRY	DRY
CRASH TYPE	202	202	202	301	202	202	001	202	301	802	202	102
VEHICLE 1	CAR	CAR	BUS	BUS	CAR	M/C	CAR	CAR	CAR	TRUCK	M/C	CAR
VEHICLE 2	BUS	TRUCK	TRUCK	CAR	M/C	BUS	PED	CAR	M/C	?	TRUCK	CAR
VEHICLE 3										?		
DIRECTION VEH.1	E	E	S	S	S	S	S	E	N	NW	E	E
DIRECTION VEH.2	N	N	NW	S	NW	NW	E	S	N	?	S	W
DIRECTION VEH.3												
OBSERVATIONS			SPEED	SPEED						MAY HAVE BEEN ANOTHER VEH INVOLVED	SPEED	



12 casualty crashes in 3 years

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5 fatal crashes (8 lives lost)

5 serious injury crashes (12 people seriously injured)

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Estimated cost of these 12 crashes

➤ 8 deaths x \$600,000 (fatalities)

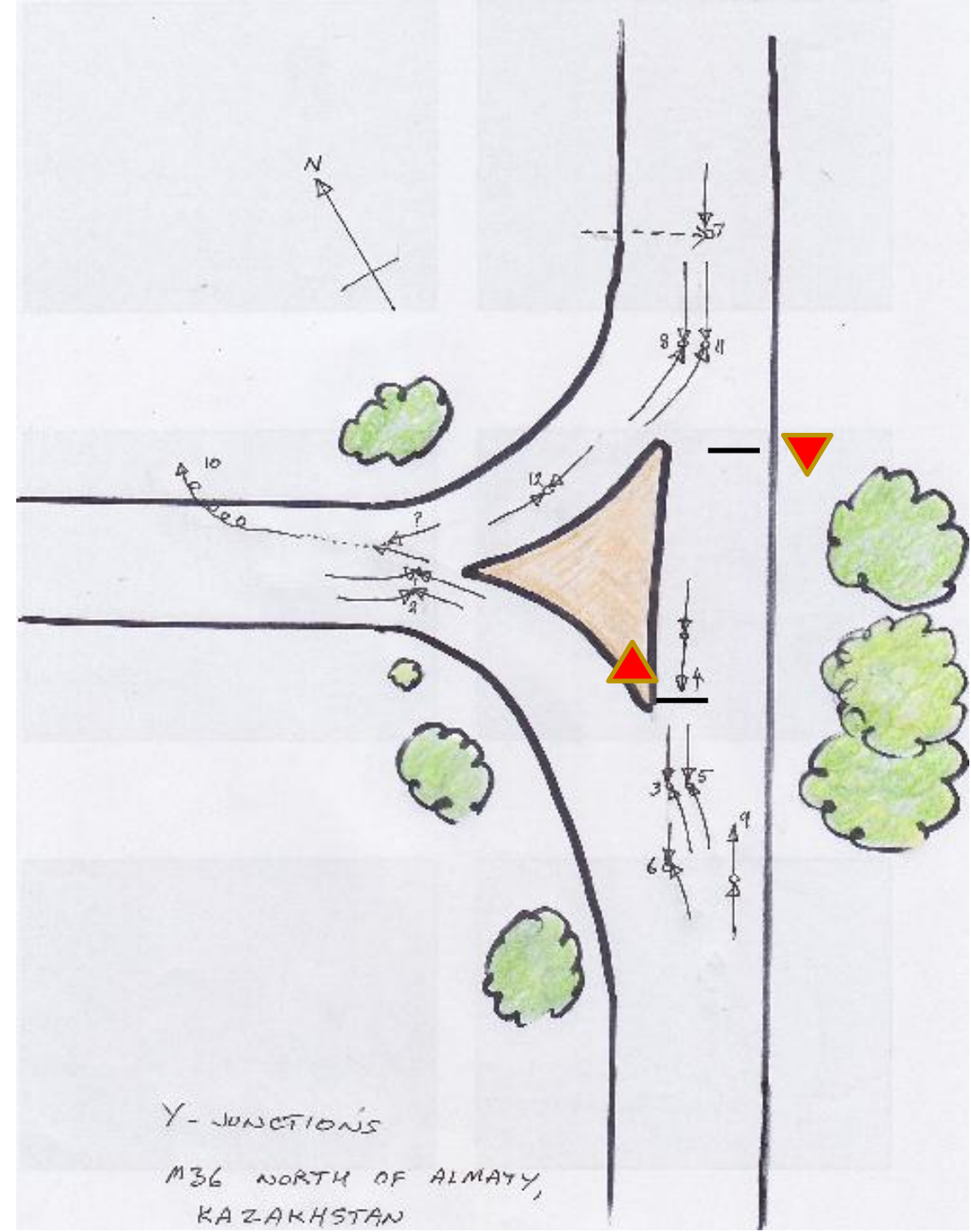
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TOTAL \$6,600,000 in 3 years or av. \$2,200,00 pa.

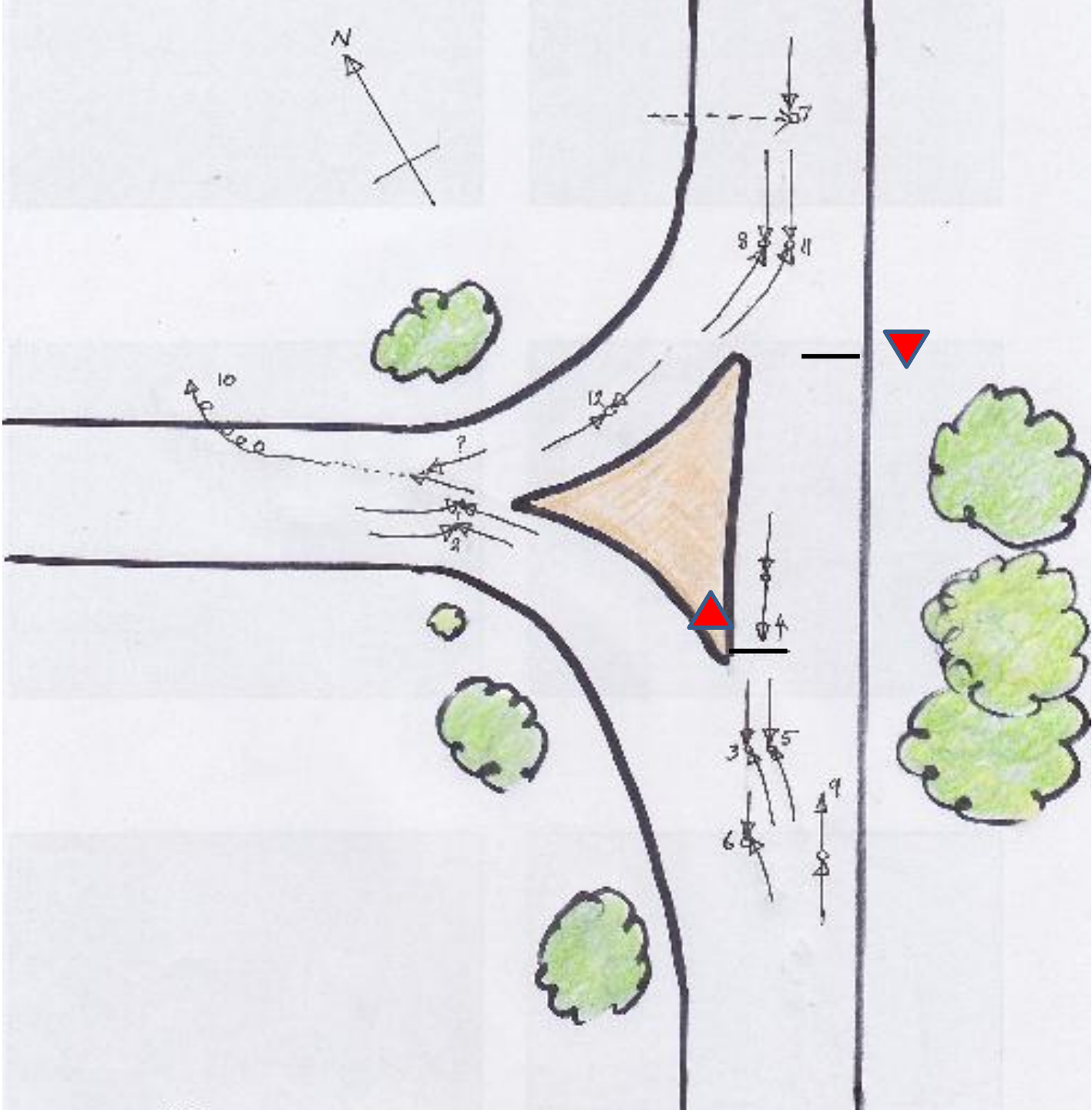
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What will you recommend?

What is the BCR?



Y-JUNCTION BLACKSPOT
ON M36



Y-JUNCTION BLACKSPOT ON M36



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VEHICLE 3										?		
DIRECTION VEH.1	E	E	S	S	S	S	S	E	N	NW	E	E
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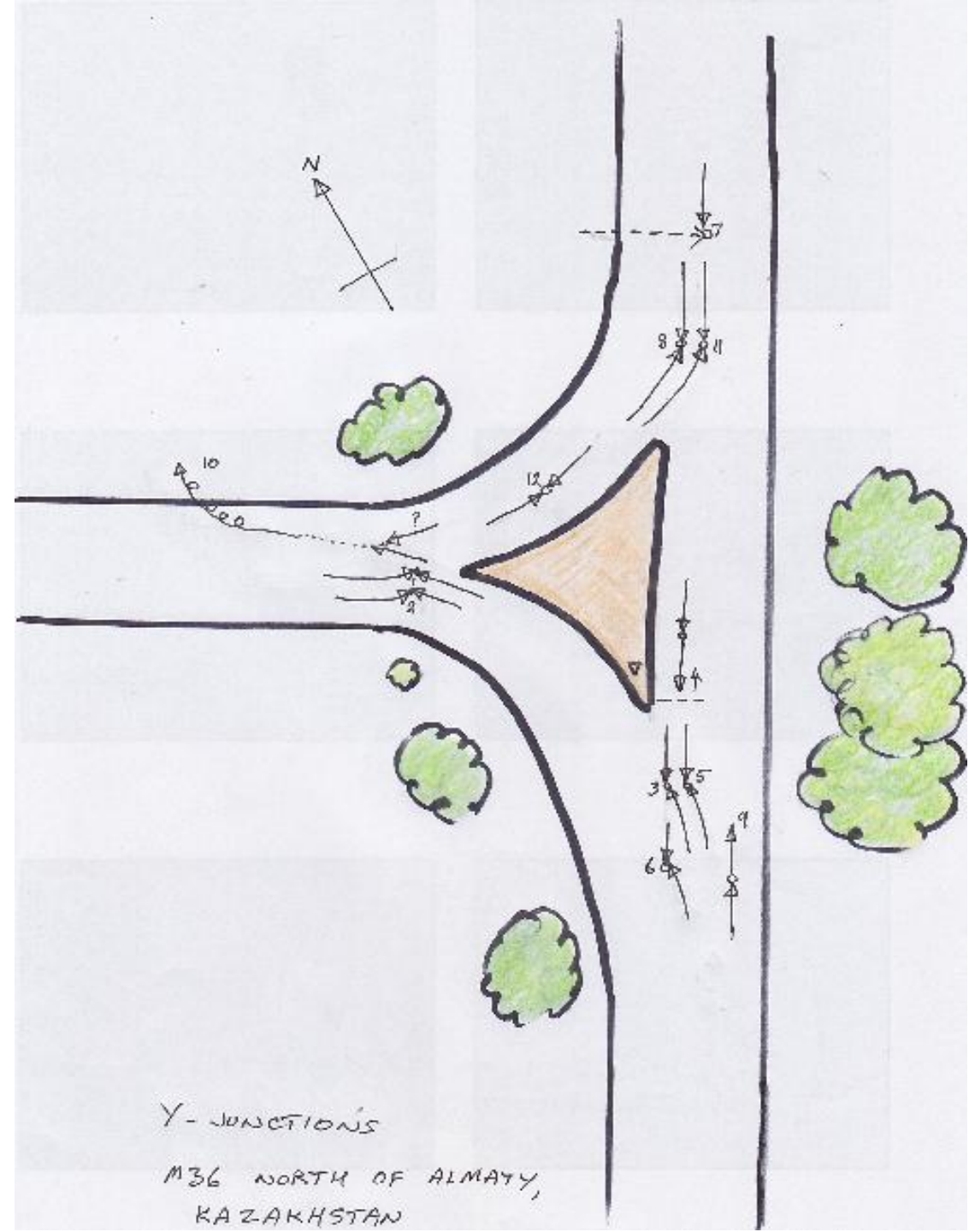
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What is the BCR?

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Email your one-page report (in English if possible) by 5pm Saturday to the Moderator.

Feedback will be given at the start of Module 5 next Tuesday
26th October



I look
forward to
your
questions

