Good Practice in Black Spot Programs

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Aims of this presentation:

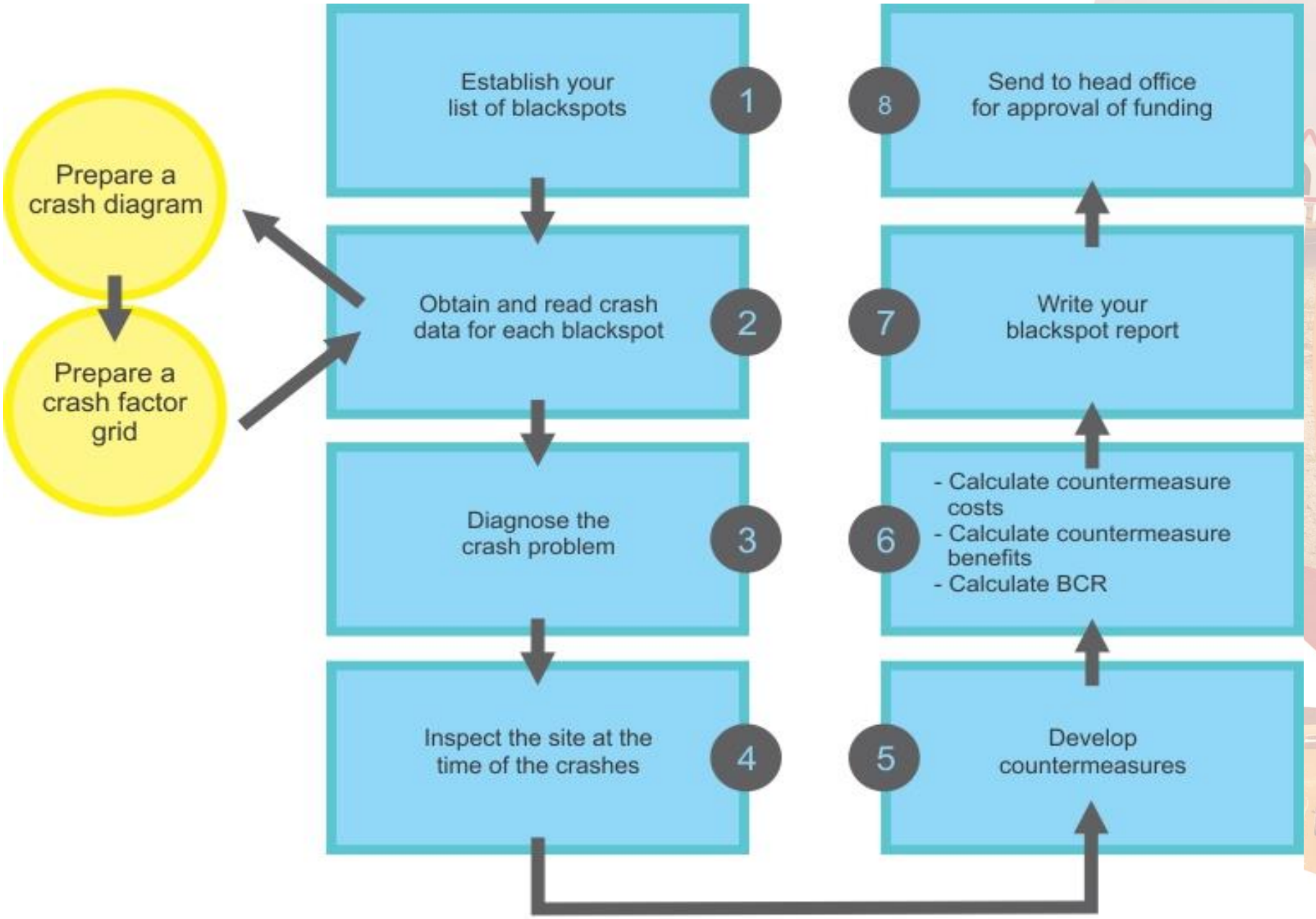
- To outline the steps of crash investigation from an engineer's perspective
- To discuss cost effective countermeasures
- To explore the role the road environment plays in crashes - through some real-life examples
- To discuss blackspot investigation within the CAREC Region

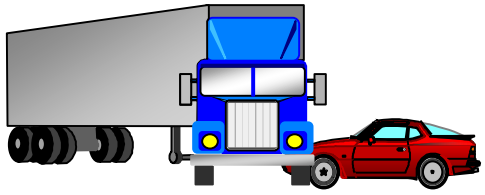
What is a Blackspot ?


A Reactive Process

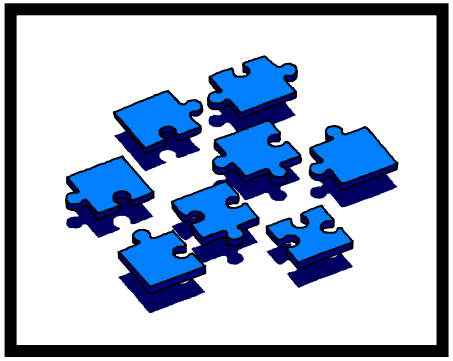
There is a set order in any blackspot investigation - from the time a crash happens through to the time the countermeasure is implemented

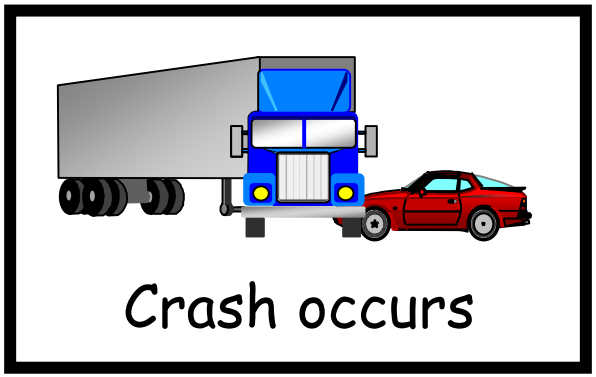
The Blackspot Investigation Process


Prepare a crash diagram
Prepare a crash factor grid
Establish your list of blackspots
1
Obtain and read crash data for each blackspot
2
Diagnose the crash problem
3
Inspect the site at the time of the crashes
4
Develop countermeasures
5
- Calculate countermeasure costs
- Calculate countermeasure benefits
- Calculate BCR
6
Write your blackspot report
7
Send to head office for approval of funding
8

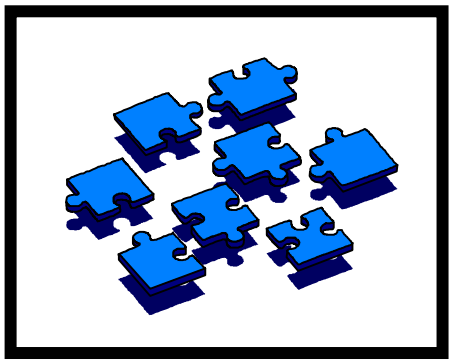


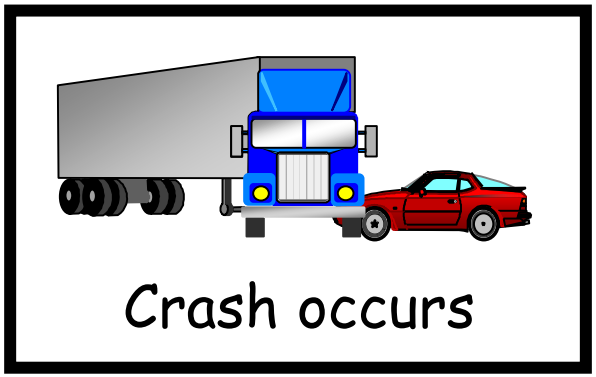
Crash occurs




Crash occurs


Police
report

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Police
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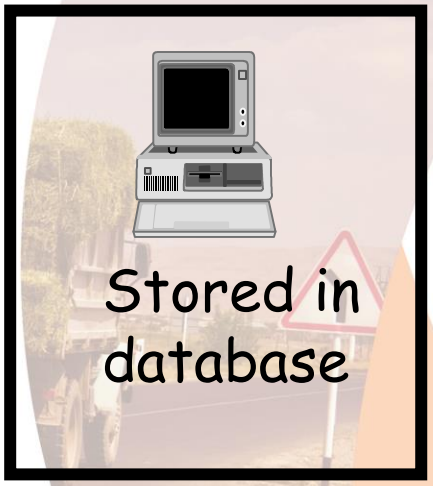
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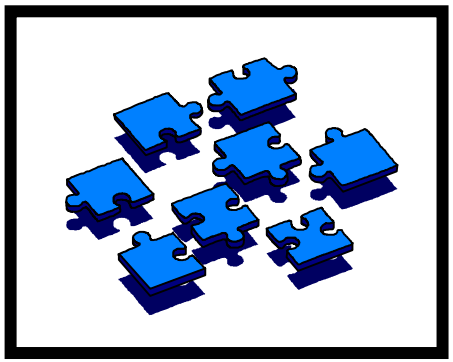

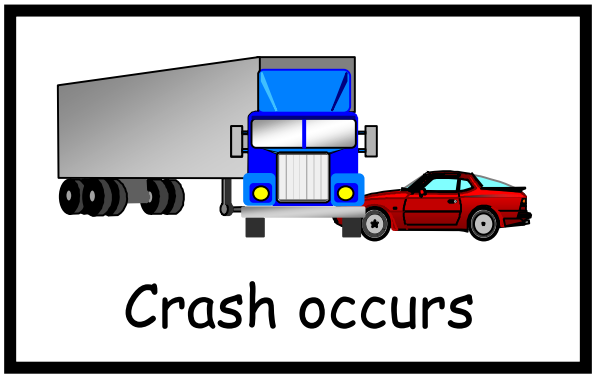
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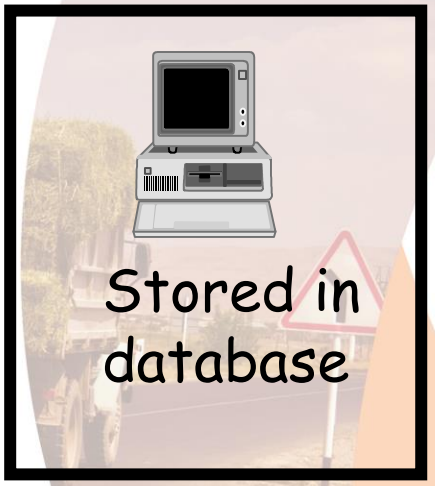
Police
report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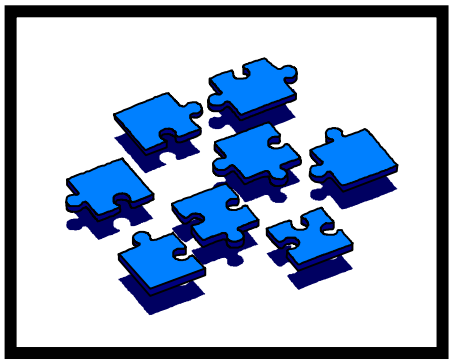

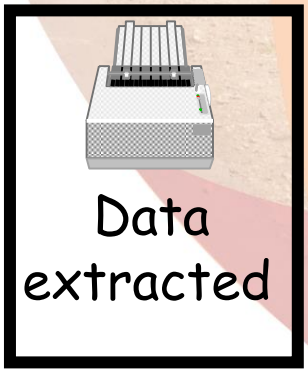
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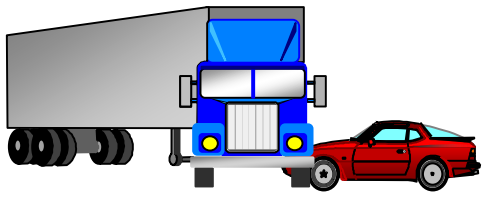
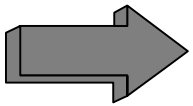
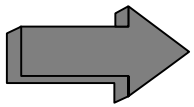
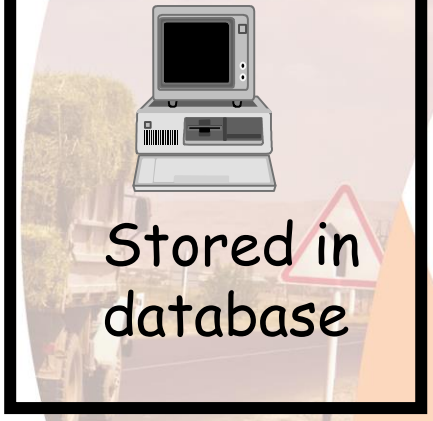
extracted

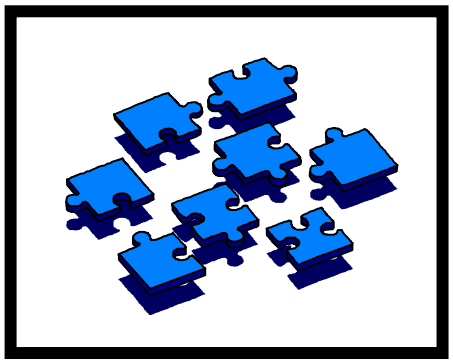


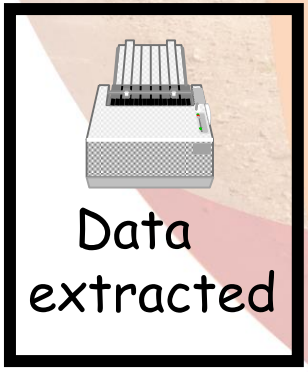
Crash occurs



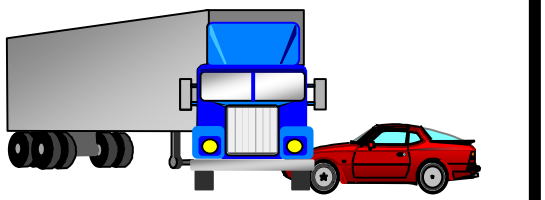








Diagnosis



Crash occurs

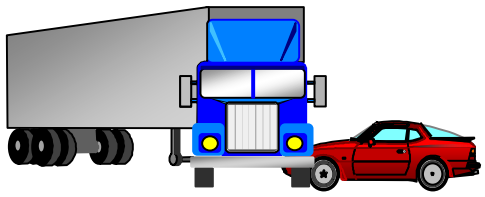
Police report

Stored in database

Data extracted

Diagnosis

develop countermeasures



Crash occurs

Police report

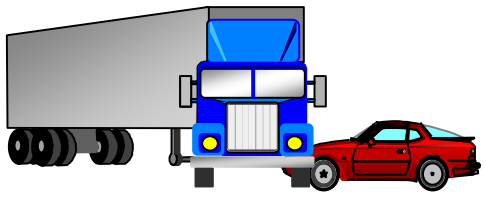
Stored in database

Data extracted

Diagnosis

Develop countermeasures

Design, then audit and then build



Crash occurs

Police report

Stored in database

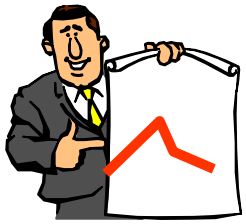
Data extracted

Diagnosis

Develop countermeasures

Design, then audit and then build

Monitor



To treat a high frequency crash site:

Find the location

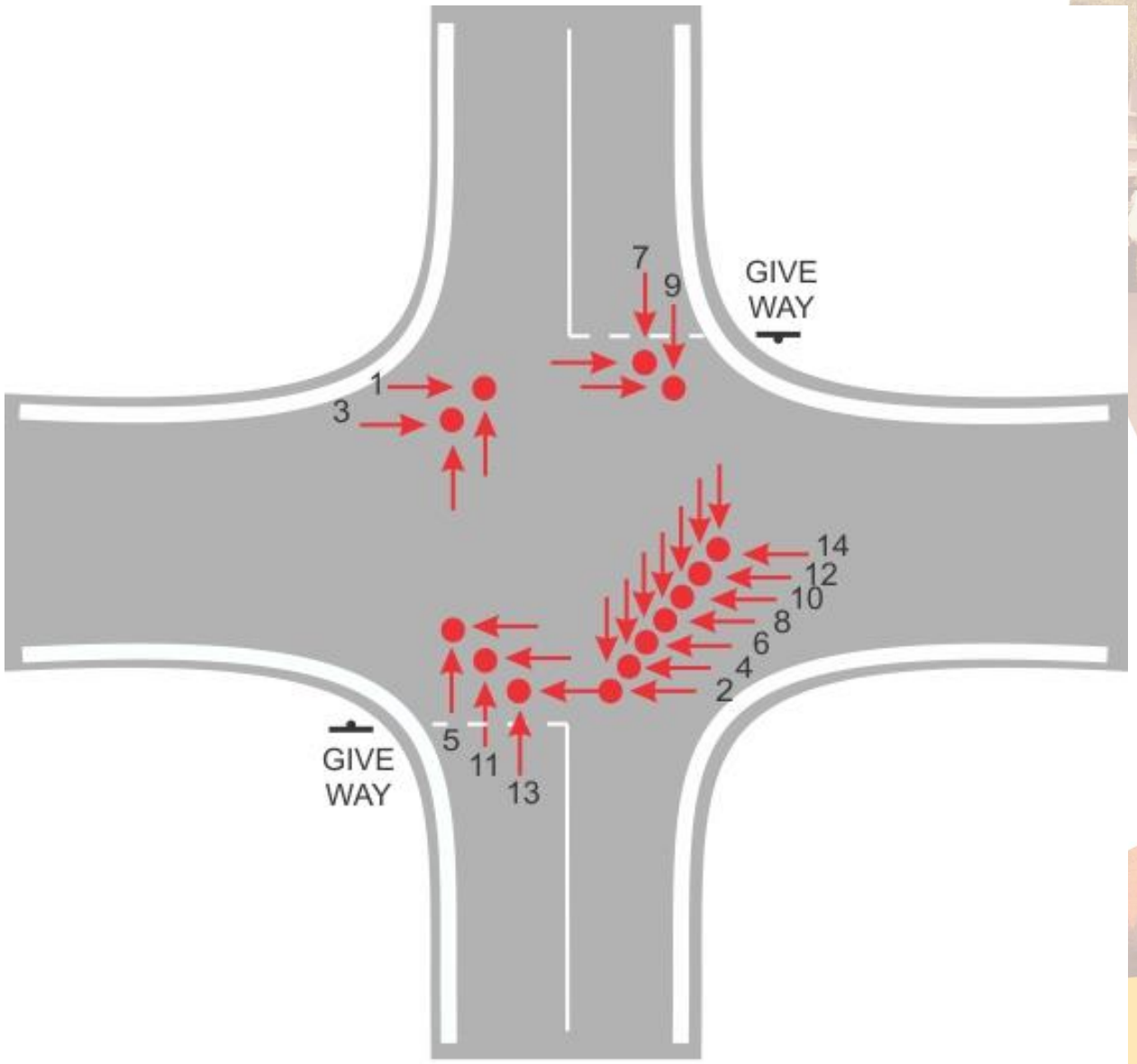
- Identify those locations where it is known there have been many crashes.
- Gather all the Police reports for the site – read them.

For this we need accurate CRASH DATA!!!

Draw a collision diagram

- Easy to do – but messy, so do a rough draft first
- For each vehicle – draw an arrow to show its direction
- Show m/c, pedestrians, cars, trucks, buses differently
- Make sure that the point of impact is accurately shown

An example of a Collision Diagram



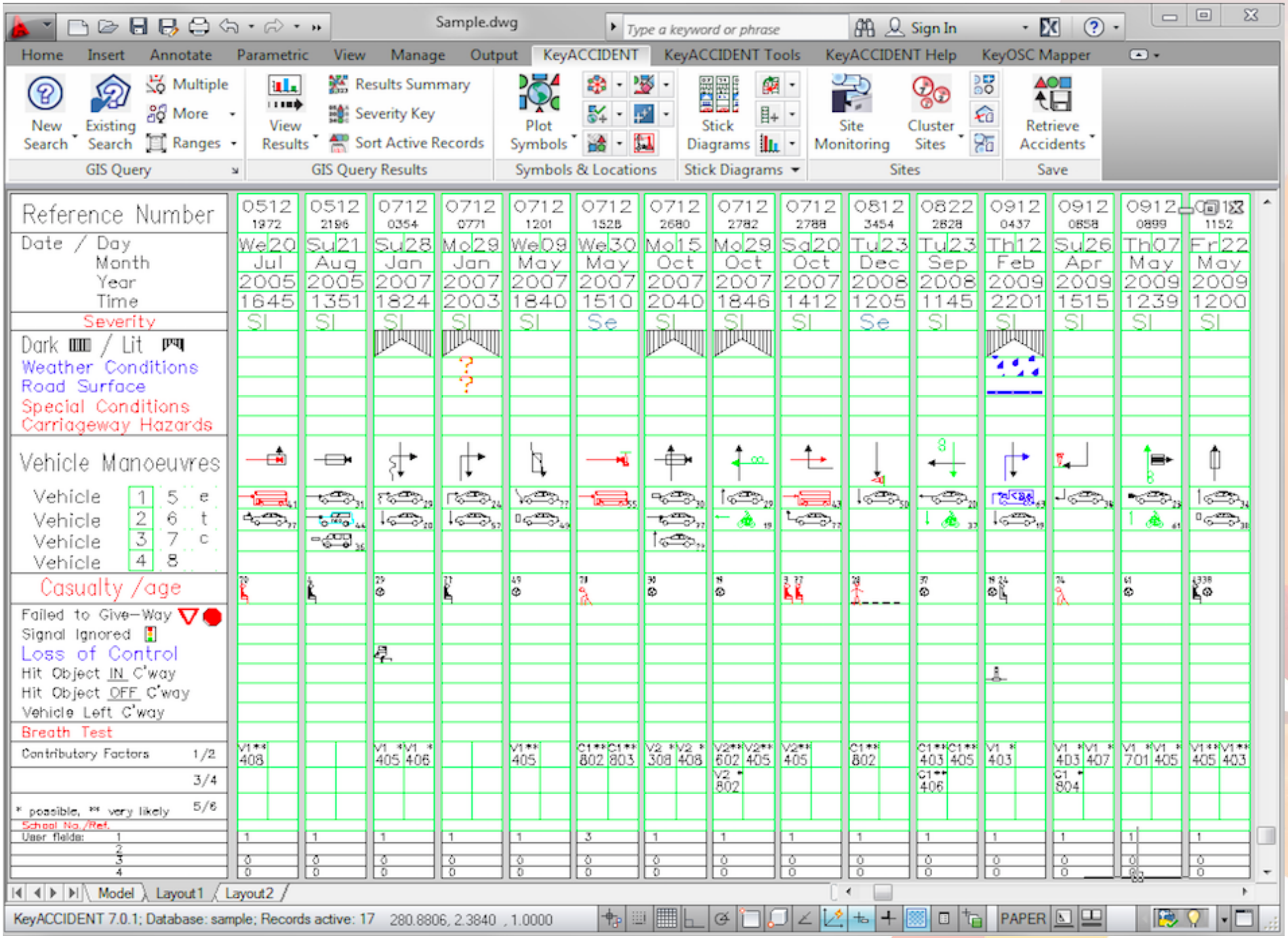
GIS Example

Produce a crash factor grid (Matrix)

- Use **Microsoft** Excel (or paper will do).
- For each crash – summarise all the known 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	96	96	96	97	97	97	97	98	98	98	99	99	99	99
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														


Sample.dwg
Type a keyword or phrase
Sign In
Home
Insert
Annotate
Parametric
View
Manage
Output
KeyACCIDENT
KeyACCIDENT Tools
KeyACCIDENT Help
KeyOSC Mapper
New Search
Existing Search
Multiple
More
Ranges
GIS Query
View Results
Results Summary
Severity Key
Sort Active Records
GIS Query Results
Plot Symbols
Symbols & Locations
Stick Diagrams
Stick Diagrams
Site Monitoring
Cluster Sites
Sites
Retrieve Accidents
Save
Reference Number
Date / Day
Month
Year
Time
Severity
Dark / Lit
Weather Conditions
Road Surface
Special Conditions
Carriageway Hazards
Vehicle Manoeuvres
Vehicle 1 5
Vehicle 2 6
Vehicle 3 7
Vehicle 4 8
Casualty /age
Failed to Give-Way
Signal Ignored
Loss of Control
Hit Object IN C'way
Hit Object OFF C'way
Vehicle Left C'way
Breath Test
Contributory Factors 1/2
3/4
5/6
* possible, ** very likely
School No./Ref.
User fields: 1
2
3
4
0512 1972 We20 Jul 2005 1645 SI
0512 2196 Su21 Aug 2005 1351 SI
0712 0354 Su28 Jan 2007 1824 SI
0712 0771 Mo29 Jan 2007 2003 SI
0712 1201 We09 May 2007 1840 SI
0712 1528 We30 May 2007 1510 Se
0712 2680 Mo15 Oct 2007 2040 SI
0712 2782 Mo29 Oct 2007 1846 SI
0712 2788 Sa20 Oct 2007 1412 SI
0812 3454 Tu23 Dec 2008 1205 Se
0822 2828 Tu23 Sep 2008 1145 SI
0912 0437 Th12 Feb 2009 2201 SI
0912 0858 Su26 Apr 2009 1515 SI
0912 0899 Th07 May 2009 1239 SI
1152 Fr22 May 2009 1200 SI
V1** 408
V1 * 405 V1 * 406
V1** 405
C1** 802 C1** 803
V2 * 308 V2 * 408
V2** 602 V2** 405 V2 * 802
V2** 405
C1** 802
C1** 403 C1** 405 C1** 406
V1 * 403
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V1** 405 V1** 403
Model
Layout1
Layout2
KeyACCIDENT 7.0.1; Database: sample; Records active: 17
280.8806, 2.3840 , 1.0000
PAPER

Look at the Collision Diagram and the Crash Factor Matrix – are there any patterns or trends?

Day time vs night time?

Peak Hours?

Wet vs dry?

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

Type of road user?

Direction of travel?

Inspect the site – at the time that the patterns of crashes have happened!

If night time – inspect at night!!

Put yourself in the shoes of the people who had the crashes.

Ask - Why did they have their crash?

- Inspect site – day and night if necessary.
- Assess likely causes.
- You are like a “doctor “at this stage – diagnosing your patient to prescribe the best medicine!

Inspect the site

- **Review the Collision Diagram**
- **Review the Crash Factor Matrix**
- **Look for things such as “visual deceit”**
- **Use these on-site to decide what countermeasures are needed**

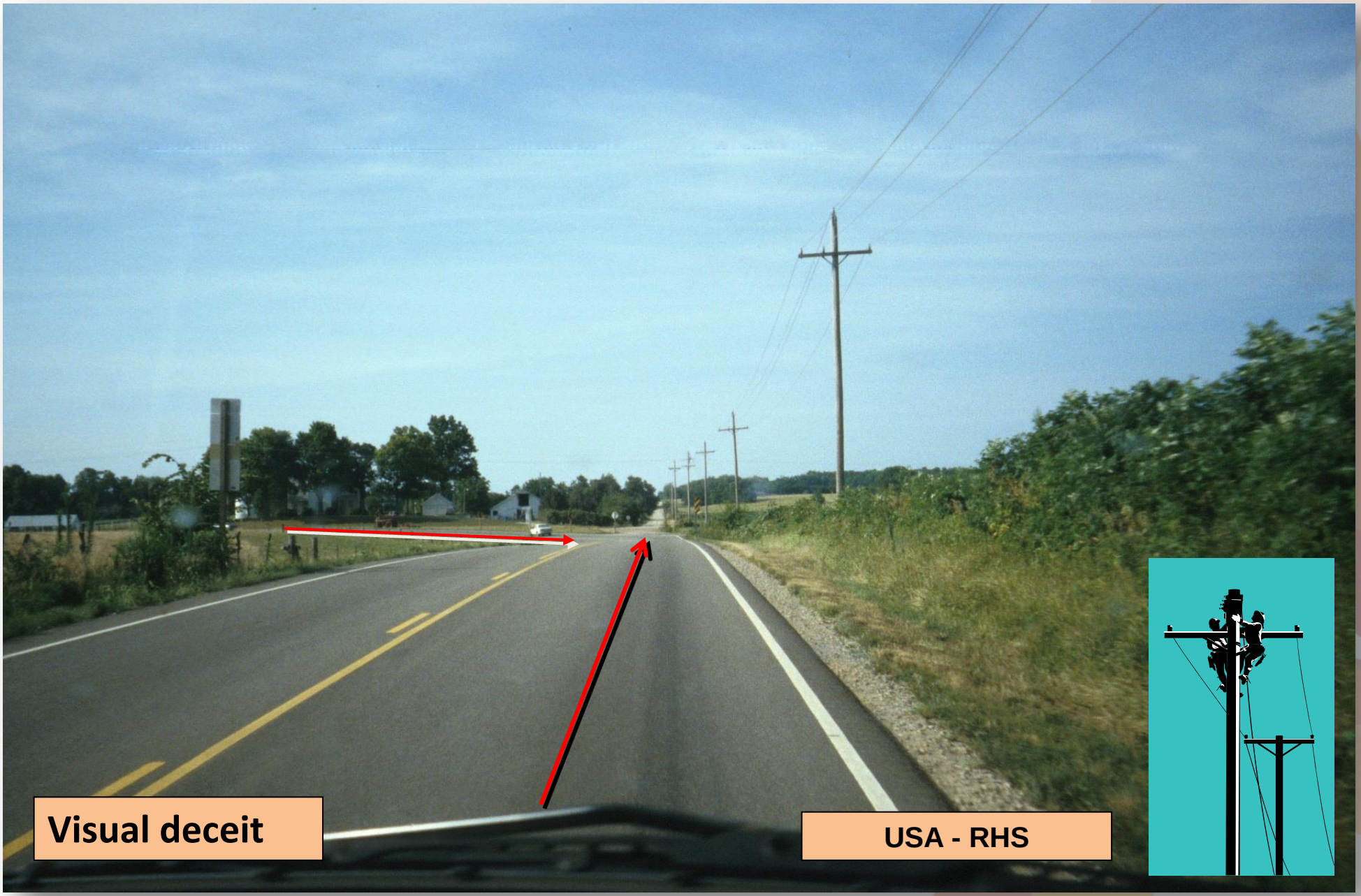
Be logical .....

Only select countermeasures that will reduce crashes!

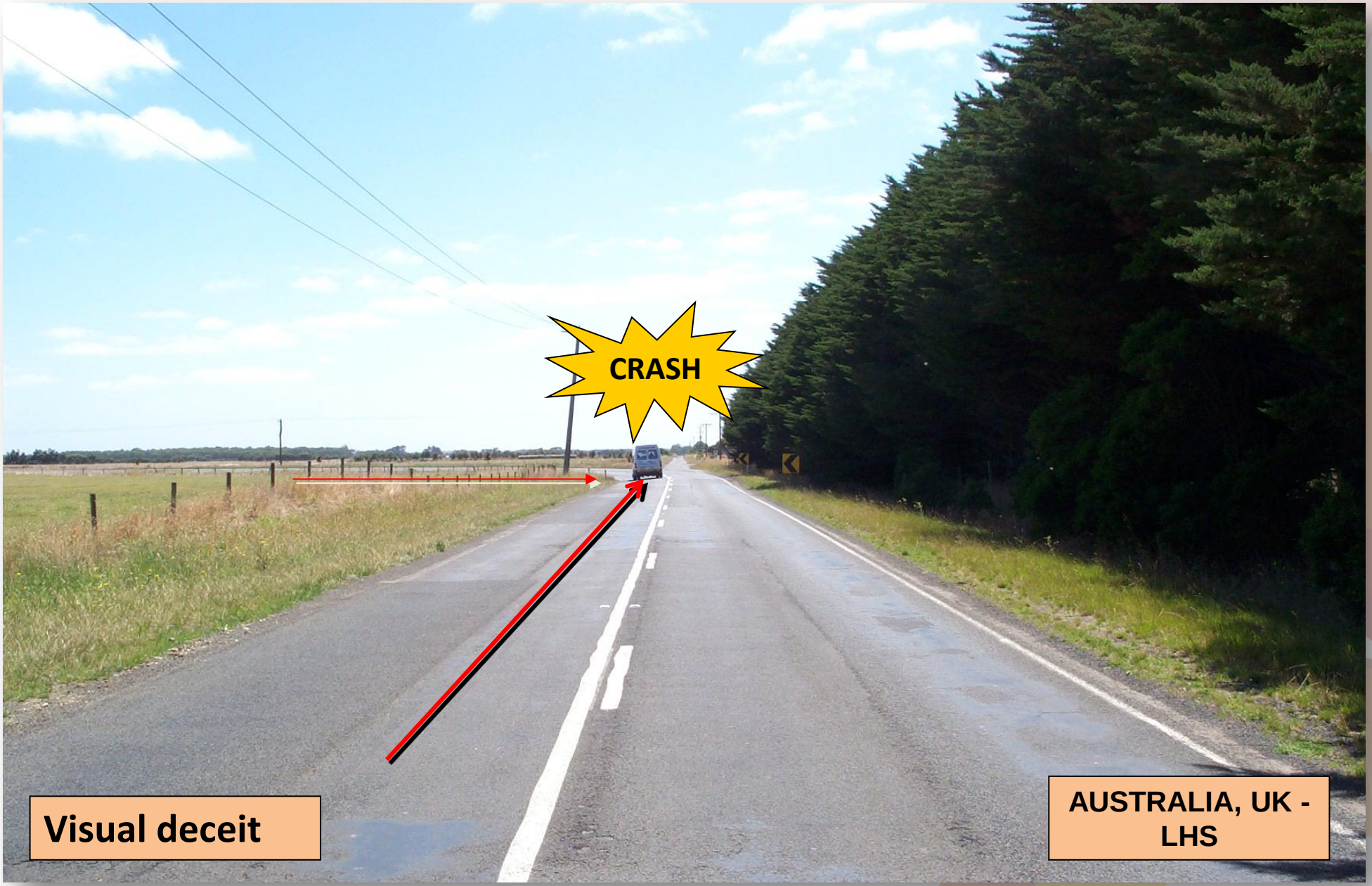
(If crashes happened mainly during daytime, do not install street lighting as a countermeasure).

Money is always limited – always look first for low cost options.

The driver's view is straight ahead!!



The driver's view is straight ahead!!



Develop countermeasures – talk with colleagues, and with Police

Keep simple, keep low cost

Persevere – there will be many locations where suitable countermeasures will be possible.

Get approval for funding and put this into the Works Program

Finalise the design - have the design audited – and then make sure it is built the way you expect.

Decide on low cost countermeasures

- If a patient visits a doctor, the doctor asks about his illness.
- The doctor does not just guess about his illness – he does not want to treat the patient for a headache when he actually has a heart problem.
- You are like a doctor at this stage – diagnosing your blackspot!
- The blackspot cannot speak – you have to look, listen and ask locals.
- This takes time, skill, patience and logic

Decide on low cost countermeasures and think about an incremental approach

Signs – warning, regulatory, direction
Line marking
Delineation
Shoulder sealing
Roadside hazard removal
Pedestrian facilities
Speed limits
Closures, bans, restrictions, prohibitions
Traffic signals – higher cost!
Roundabouts – higher cost!
Lighting

Seek funding

- Countermeasure(s) costs C
- Estimate likely benefits (crash savings) B
- Calculate Benefit Cost Ratio (B/C ratio)
- Write report, include BCR, submit to funding agency
- Rank all sites across your country
- Cost of treatments is straightforward
- **How do we calculate the benefits of treatments?**

Agree a cost for a casualty crash in Tajikistan.
(WHO report can guide you).

Look at a table of Crash Reduction Factors (CRF's), and agree which CRF to use.

Multiply the cost of the crash by the number of crashes you expect to "save" in the life of the treatment.

That figure becomes your benefits $.

Use all BCRs to compare all sites across your country and to decide which to treat first.

Example of Benefits Report – Blackspot Programme

Project no.	Location	No. collisions	No. casualties	Project proposal	Estimated project cost	FYRR
1	Charminster Road, Alma Road Junction	18	18	Change phasing of the traffic signals	£4,000	1578
2	Bear Cross Roundabout	15	21	Narrow lane on roundabout. Lining and signing improvements	£5,000	1263
3	Alma Road, Waterloo Road Junction	8	8	Cut back hedge to improve visibility	£2,000	789
4	St Michael's Roundabout	15	17	Lining and signing improvements	£10,000	631
5	Lansdowne Road, Cavendish Road, Beechey Road Junction	12	14	Install a central island to prevent traffic movements	£10,000	631
6	Merge onto Wessex Way (Eastbound) from Richmond Hill Roundabout	11	17	Move hatching from left to right on the slip road	£5,000	631

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

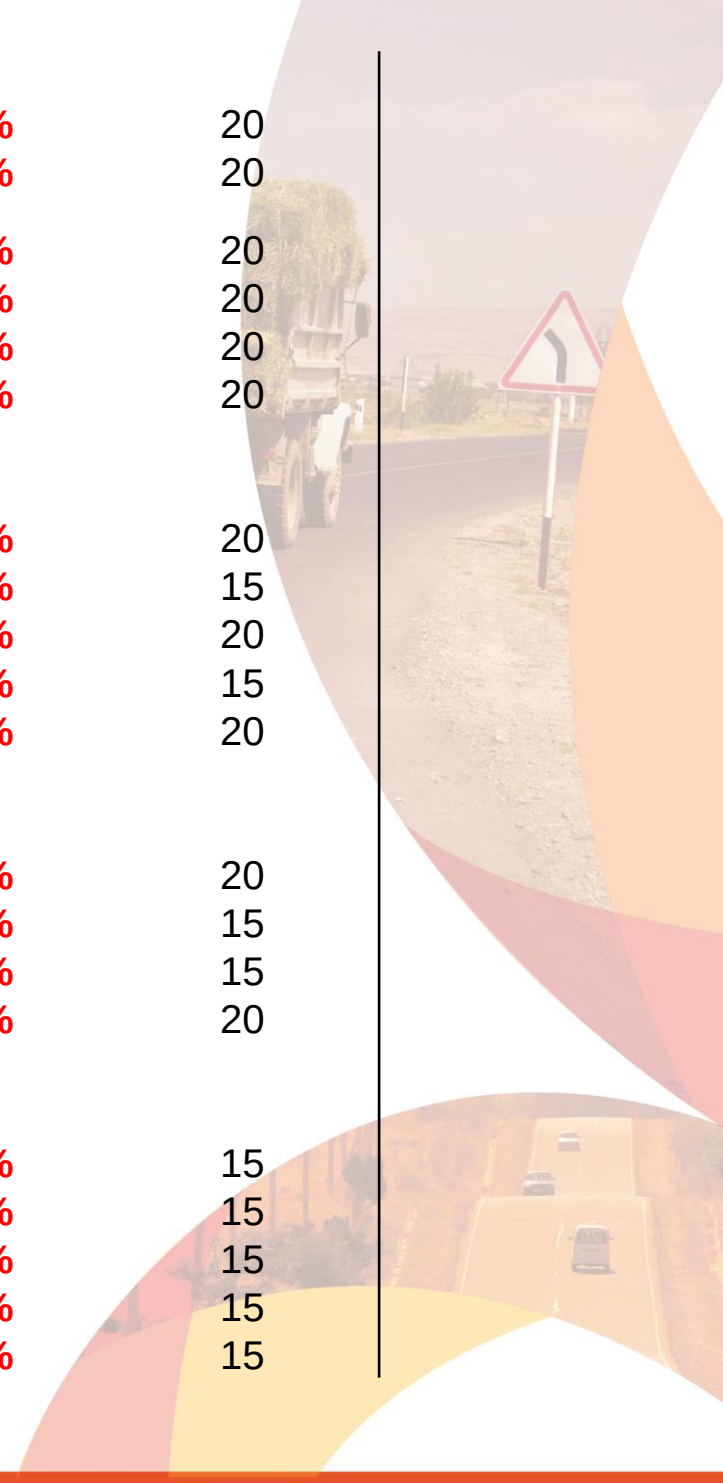
PAVEMENT WORKS	%	YEARS
Road reconstruction	25%	20
Duplication short length	30%	20
Install raised median	30%	20
Add median strip	20%	20
Widen pavement	10%	20
Construct overtaking lane	25%	20
Add lane	10%	20
Widen road for Right Turn lane	50%	20
Widen road for Left Turn lane	15%	20
Lane widening - 0.3m	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	CRF	YEARS
Reflectorised guide posts	30%	20
Advanced Curve Warning signs - static	20%	15
Advanced 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

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

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



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Implement countermeasures

Why do I say that we should be doctors?

One example…

West Midlands

Large roundabout

Single vehicle crashes involving central island

All vehicles were from north

All occurred between midnight and 2am

Draw collision diagram

Inspected during daytime

Night time inspection arranged

Darkness from 4.30pm, hence 7pm was considered OK

No clues either time

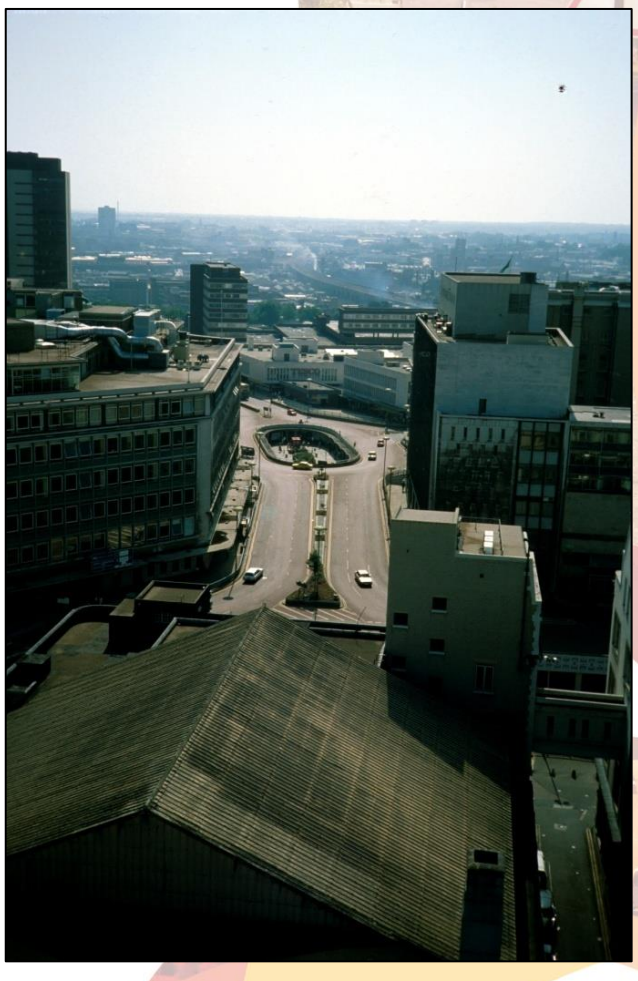
Review the collision diagram

Blame the drunks……

Redesign roundabout

Give up !!!!

Suggest this site was not one of those where the environment contributed



Back to basics

Inspect at the time of the crashes

This meant a midnight inspection in the middle of an English winter

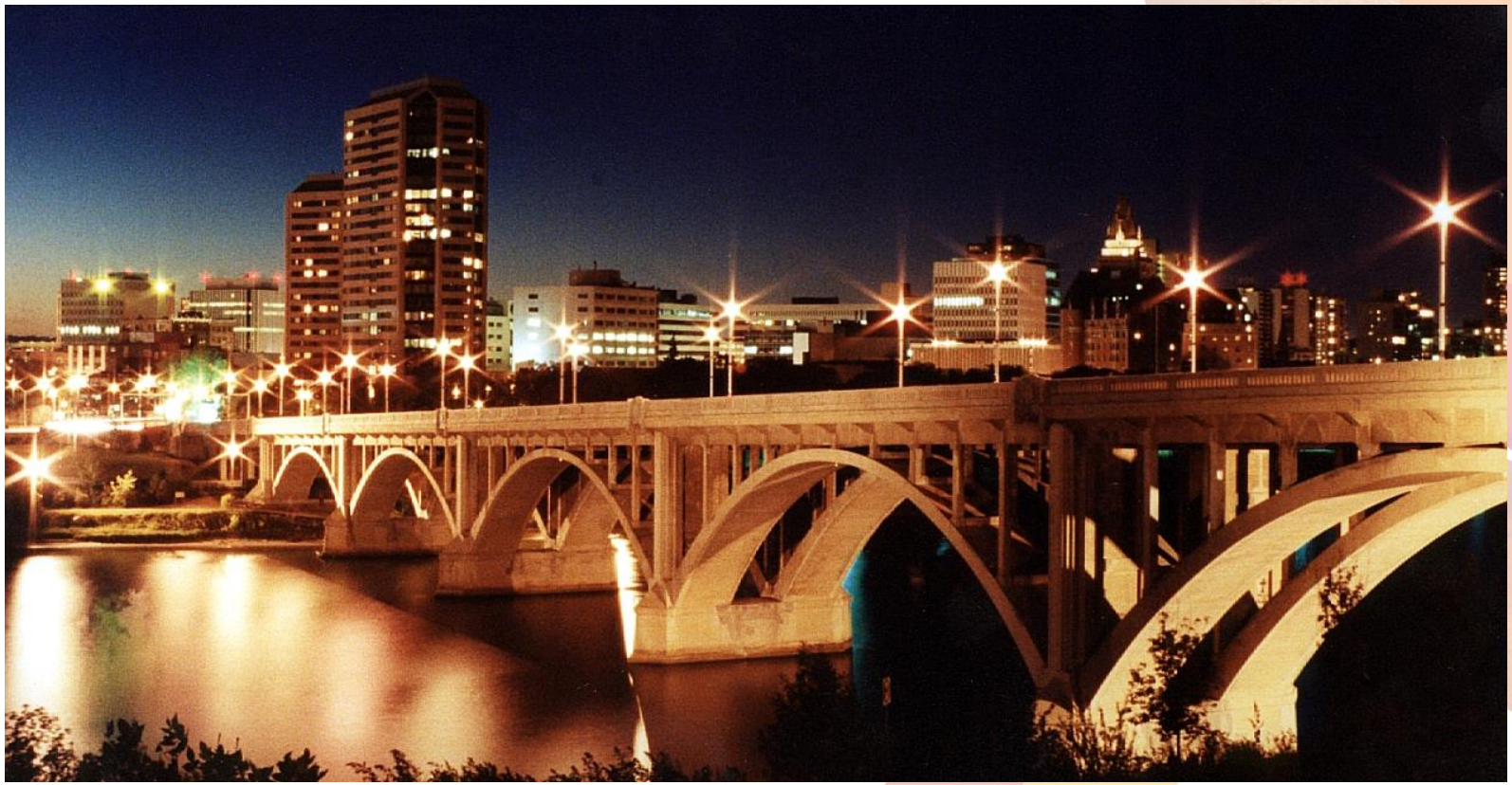
11pm - nothing to report, but high approach speeds

Midnight - half of street lights “off”

Now, some late braking

On driving from the north, “visual deceit”

Roundabout could not be seen !!!

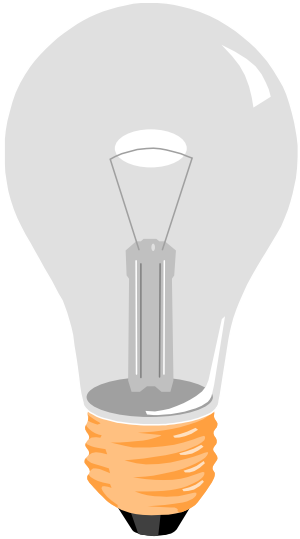


Phone call to electricity supplier

Reprogrammed lights to remain on

Crashes reduced from 5 pa. to under 1 pa.

Very high B/C ratio



SOMETHING TO THINK ABOUT WITH INTERSECTION CRASHES

With intersection right angle crashes – we need to determine if the crash is an overshoot or a re-start

Why? Because our countermeasure(s) may be different

Overshoot – the driver did not know the intersection was there

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

Overshoot **– the driver did not know the intersection was there**

We need to make the intersection more conspicuous

Improve Approach Sight Distance

Make intersection more conspicuous

Advance warning signs

Advanced direction signs

Duplicate GW or Stops

Lighting

Roundabout or signals

Example Overshoot Crash Measures

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

We need to make gap selection easier, better, safer

Improve Safe Intersection Sight Distance

Maximise sight lines

Reduce speeds

Alter the traffic control

Geometric changes

Cut trees/grass

Reduce speed limits

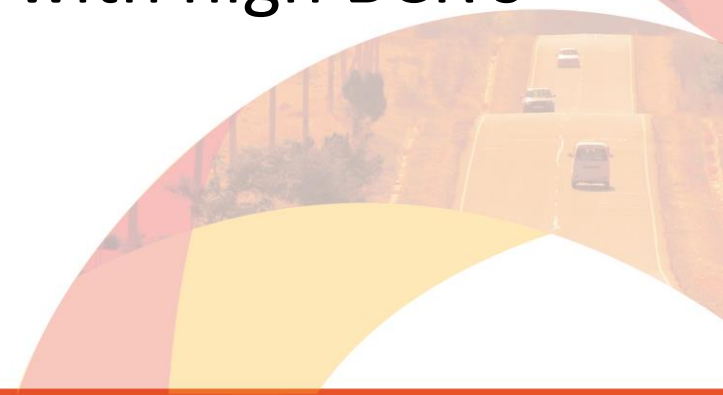
Roundabouts or signals

Summary

Road safety engineering is a profession that can greatly reduce road crashes

Perseverance is often needed

Be a “doctor” (remember your “patient” cannot speak)Always aim for countermeasures with high BCR’s



I look forward to your questions and lets discuss black spot programs in the CAREC Region

Matt Chamberlain
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