NZ TRANSPORT AGENCY
WAKA KOTAHI

High risk intersections - making sense of safe systems in practice

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Safer Journeys

New Zealand Government

The *Safer Journeys* Safe System Vision

A safe road system increasingly free of death and serious injury

Safe system approach requires a fundamental cultural and ethical shift in thinking

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Why we need a different approach

Our current road transport system is not as safe as it could be.

International research suggests that even if all road users complied with road rules, fatalities would only fall by around 50% and injuries by 30%.

If everybody obeyed the road rules, New Zealand would still have many deaths and serious injuries on the road each year.

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Rotorua Rail crash example

Fatigue caused driver to crash.

The horizontal rail caused the fatality

Four Safe System principles

Human fallibility	· 1 - People make mistakes and crashes are inevitable
Human vulnerability	· 2 - The human body has a limited ability to withstand crash forces
Shared responsibility	· 3 - System designers and system users must all share responsibility for managing crash forces to a level that does not result in death or serious injury
All of system approach	· 4 - It will take a whole-of-system approach to implement the Safe System in New Zealand

High-risk intersections within Safer Journeys

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Priority Area: Safe Roads and Roadsides

FIRST ACTION

Focus safety improvements programmes on high risk rural roads and [high risk urban intersections]
High Strategic fit for funding

Focus on Fatal and Serious Crashes (Head on, run off Road, Intersections)

High -risk intersections guide

High-risk rural roads guide

High-risk motorcycle routes guide

Priority Area: Safe Speeds

Further Action

The challenge of a safe system

- The focus on deaths and serious injuries
- Identifying high risk locations
- Crash types that result in deaths and serious injuries
- How do countermeasures affect crash severity
- Crash prediction models and crash severity / casualties
- Prioritising – strategic fit
- Safety Audit

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High Risk Intersections Guide

Drafted by Beca, TERNZ and Ableys.

- Covers urban and rural intersections.
- Similar structure to HRRRG.

Technical working group includes LA reps to ensure:

- Addresses the safety risks for local road intersections
- Countermeasures are appropriate to those needs.

- Challenge around identifying high risk intersections

- Out for consultation - comments due 14 May.

Structure of HRIG

Section 2	Strategic Context
Section 3	Crash Priorities
Section 4	Identifying HRI
Section 5	Understanding the issues
Section 6	Intersection Countermeasures
Section 7	Programme, Monitoring and Evaluation
Appendices	Detailed tables, countermeasures and references

Safe Speed Thresholds

Roads with possible conflicts between vehicles and unprotected users	30-40 km/h
Intersections with possible side-on conflicts between vehicles	50 km/h
Roads with possible frontal conflicts between vehicles	70 km/h
Roads with no likelihood of frontal or side-on conflicts between road users	100 km/h

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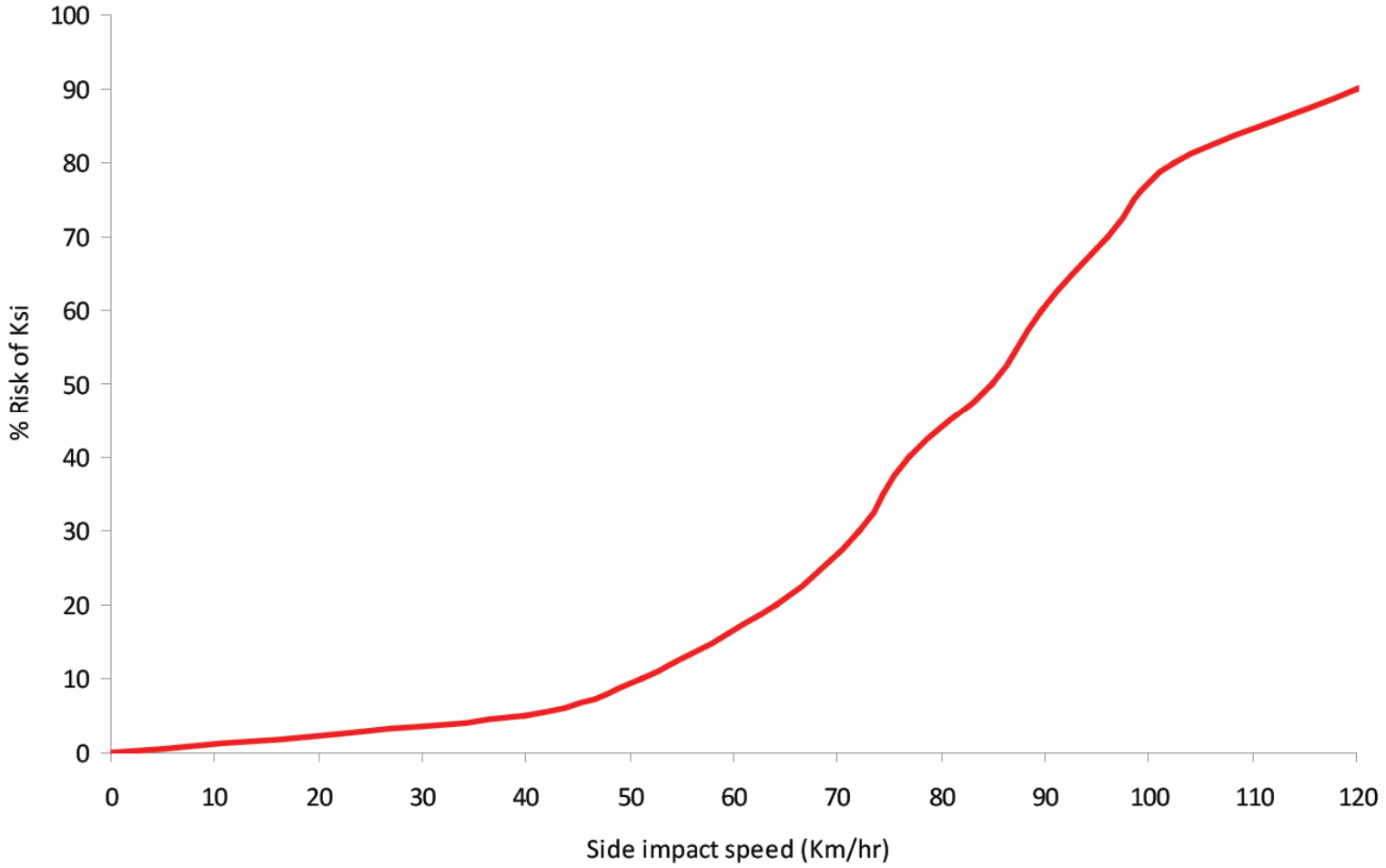
Severity by Side impact speed

Figure 2-2: F&S crash risk relationship for car v car side impact speeds



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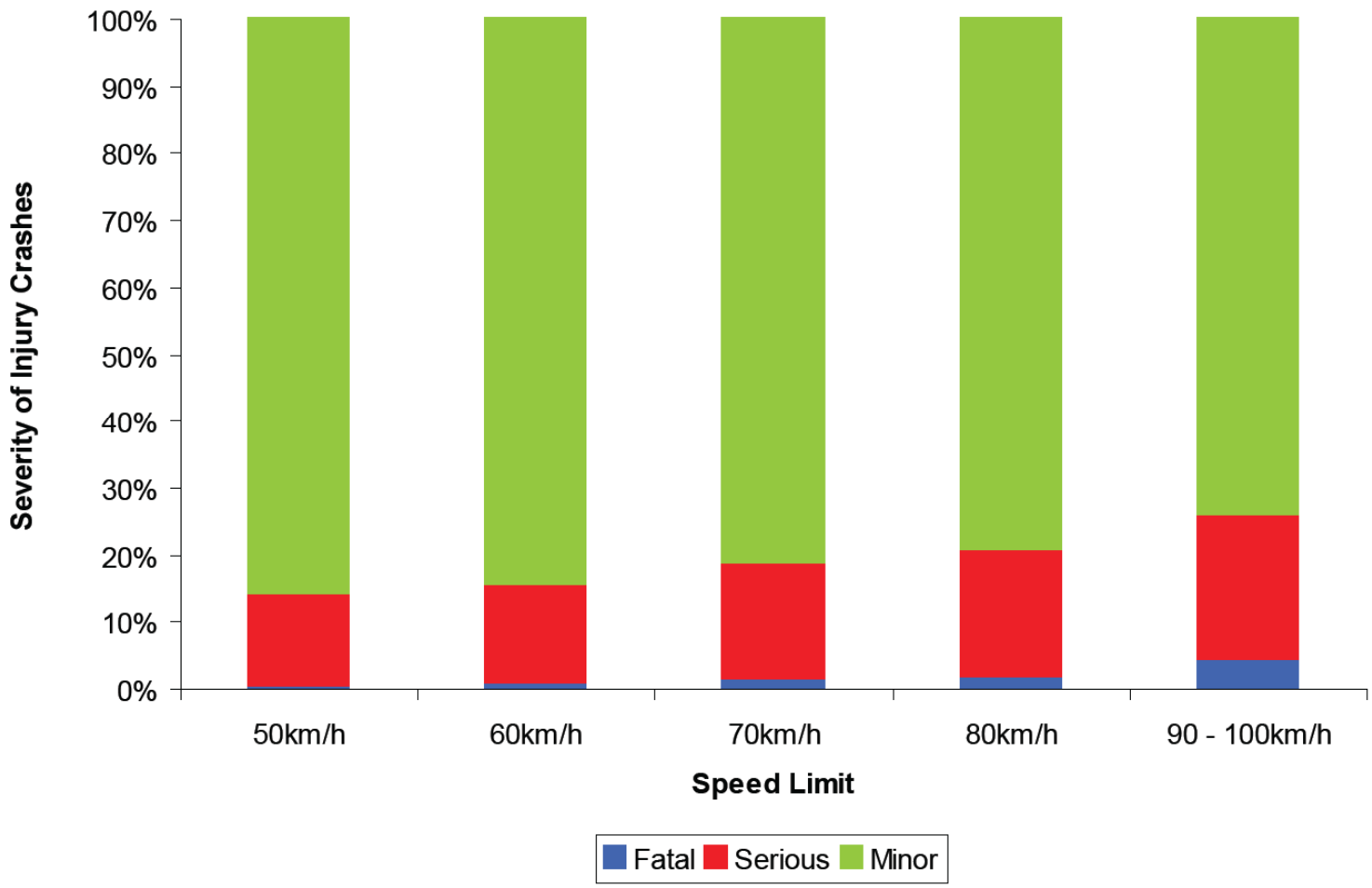
Severity by Speed limit

Figure 3-4: Severity of injury crashes at intersections in New Zealand by speed limit



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Main crash types - urban

Table 3-1: Composition of key crash movement types by intersection form in urban speed environments

	Type B	Type C	Type D	Type G	Type H	Type J	Type L	Type N	Other
Traffic signals									
Roundabout									
Priority crossroads									
Priority T&Y intersections									
Uncontrolled									

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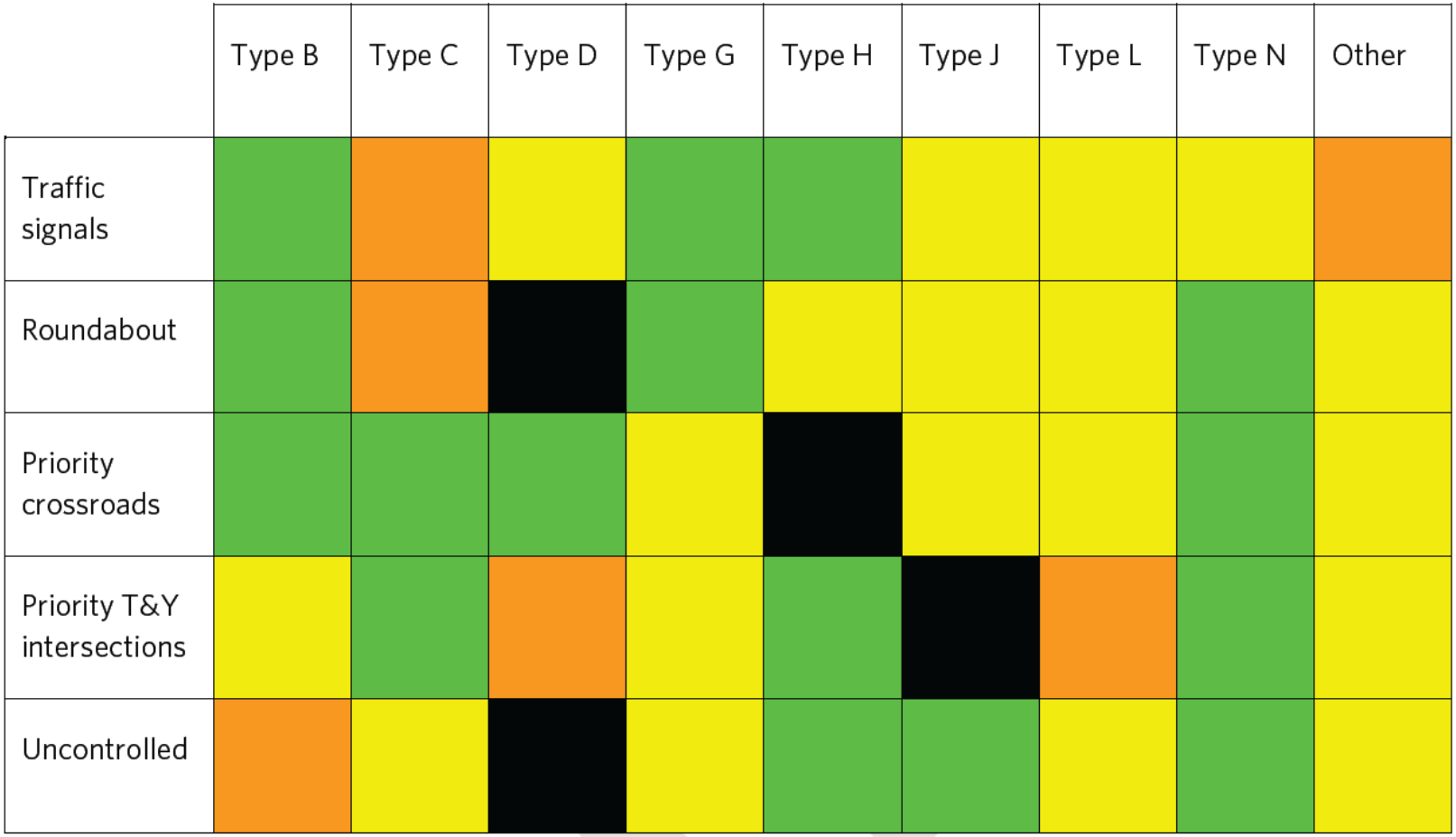
Main crash types - rural

Table 3-2: Composition of key crash movement types by intersection form in rural speed environments



	Type B	Type C	Type D	Type G	Type H	Type J	Type L	Type N	Other
Traffic signals									
Roundabout									
Priority crossroads									
Priority T&Y intersections									
Uncontrolled									

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What is a HRI? – collective risk

High-risk intersections are intersections with a higher than normal risk that someone will die or be seriously injured in the future.

Because of small crash numbers at any one intersection, a high-risk intersection is only tentatively defined in a short list, and needs to be confirmed by further analysis:

- An intersections where the **fatal and serious crash rate** (personal risk) **or crash density** (collective risk) **is high** compared with other intersections

- There are three metrics for F&S crash rates:
- Reported F&S crashes: 3 in five years or five in ten years.
- Reported Injury crashes * severity factors. 1.2 in five years.
- Injury crash prediction models * severity factors 1.2 in five years.

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HRIs – Personal risk and LOSS

- Where there are enough crashes to permit a valid calculation, personal risk – or risk per person using the intersection can be assessed. We have also set thresholds for these.
- We cannot perform this analysis globally at present because we do not have automatic access to the traffic flow data.
- Once we have the flow data we can also use crash prediction models to compare the reported crashes with those that we would normally expect for an intersection of that type with that amount of traffic. We call this the Level of Safety Service (LOSS).
- We can use a similar method to compare the potential for improvement by changing to a different form or control type.

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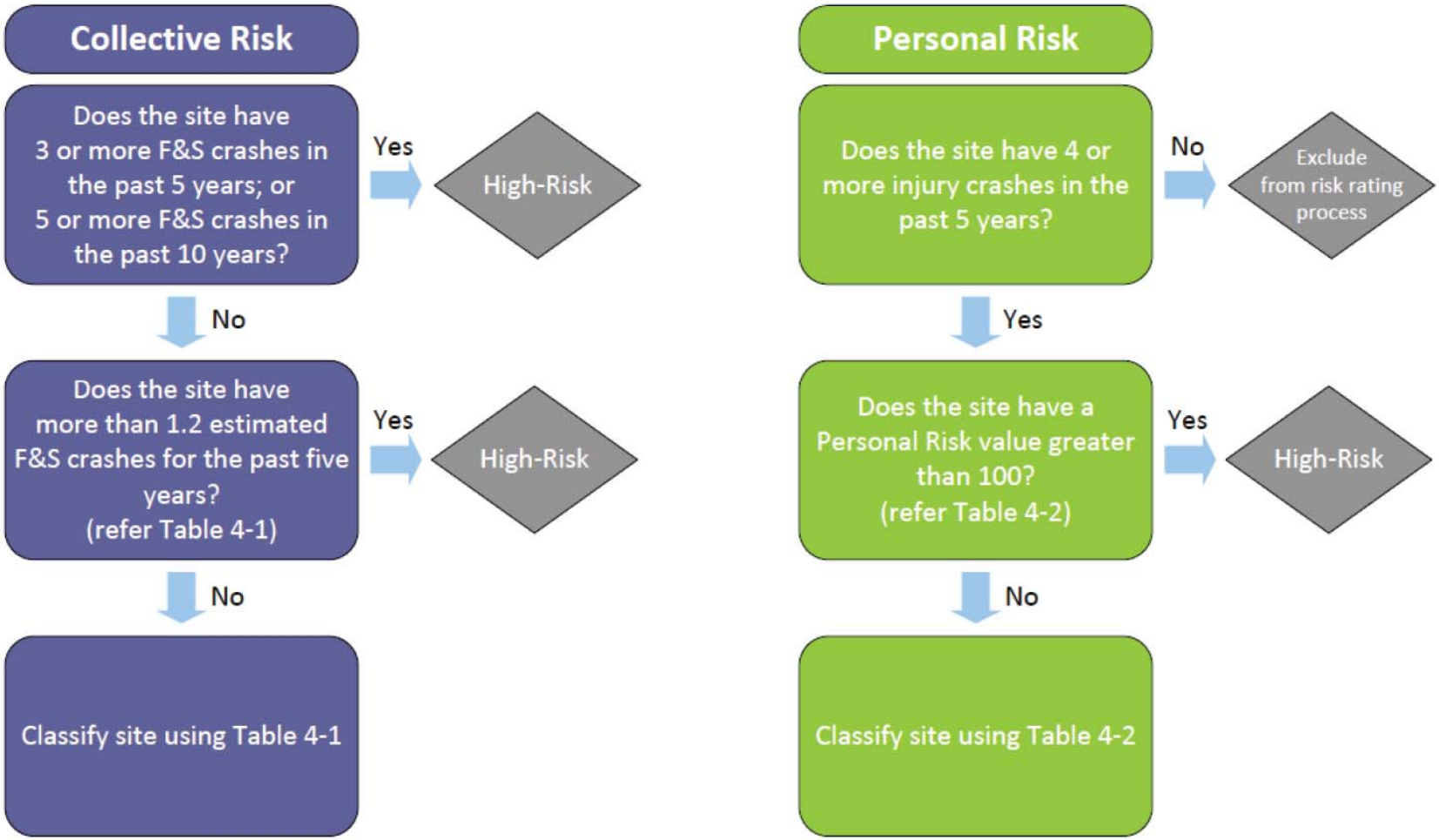
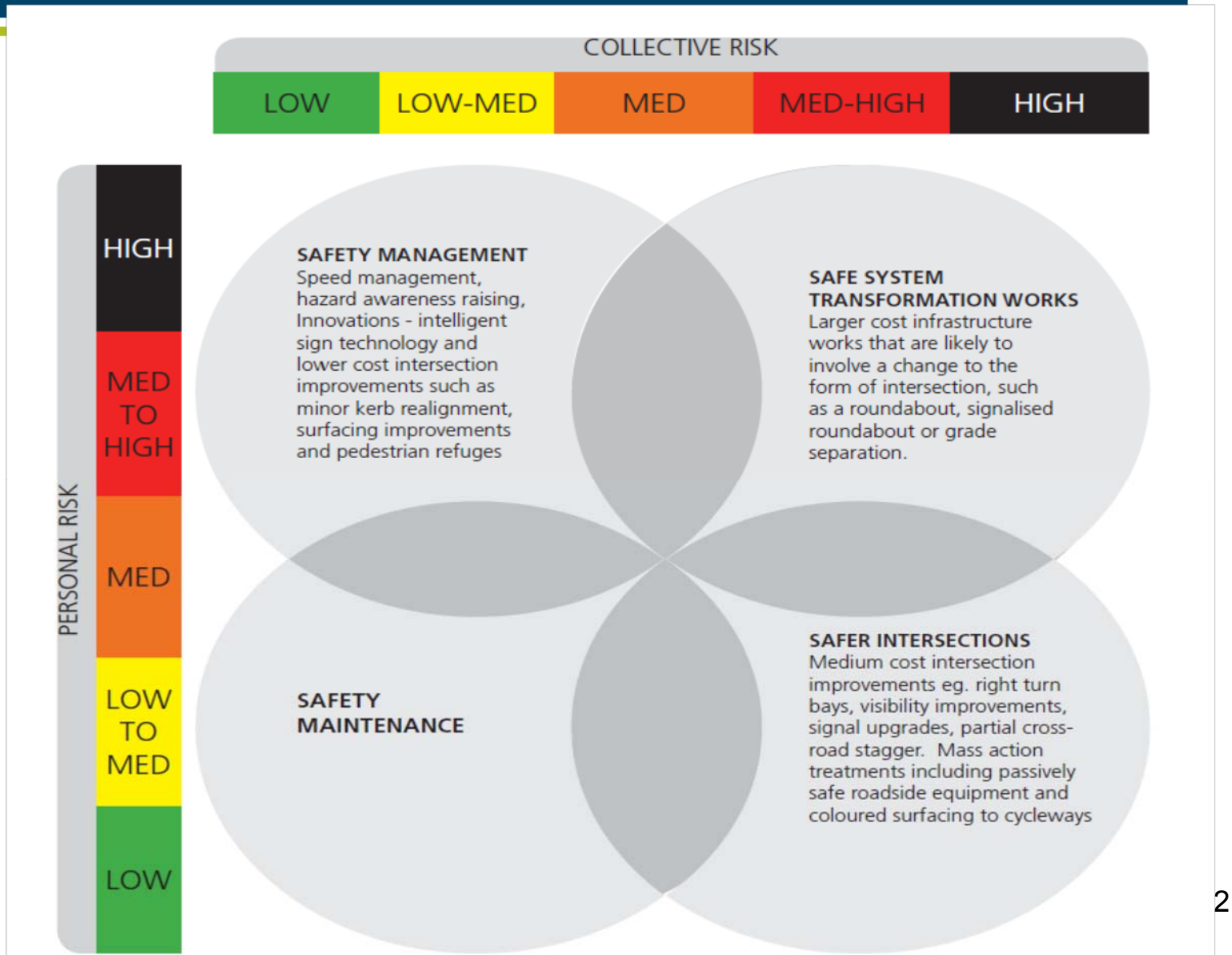
What is a high risk intersection?

Figure 4-1: Process for assigning risk ratings to intersections



Treatment Philosophy Strategy



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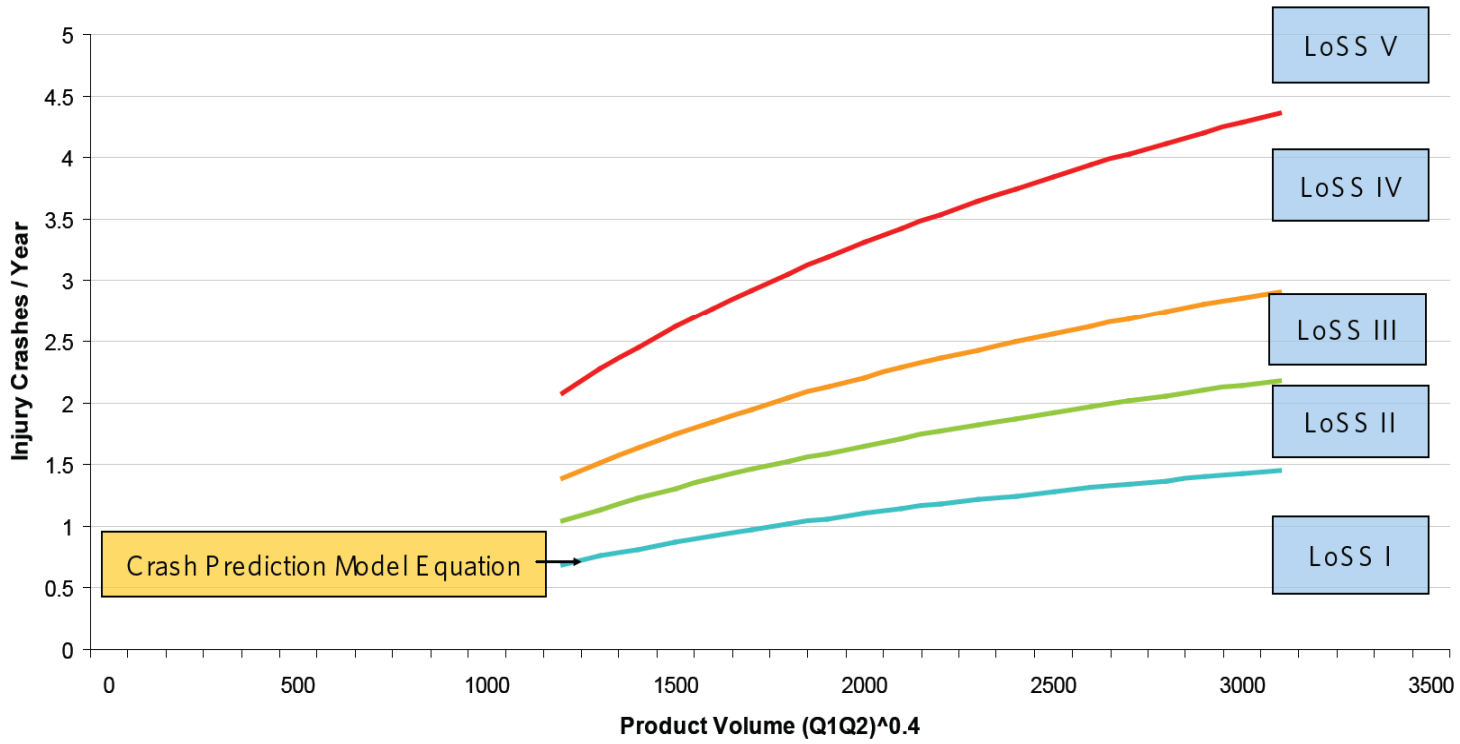
Level of Safety Service

Figure 4-2: LoSS bands for urban signalised crossroad intersections



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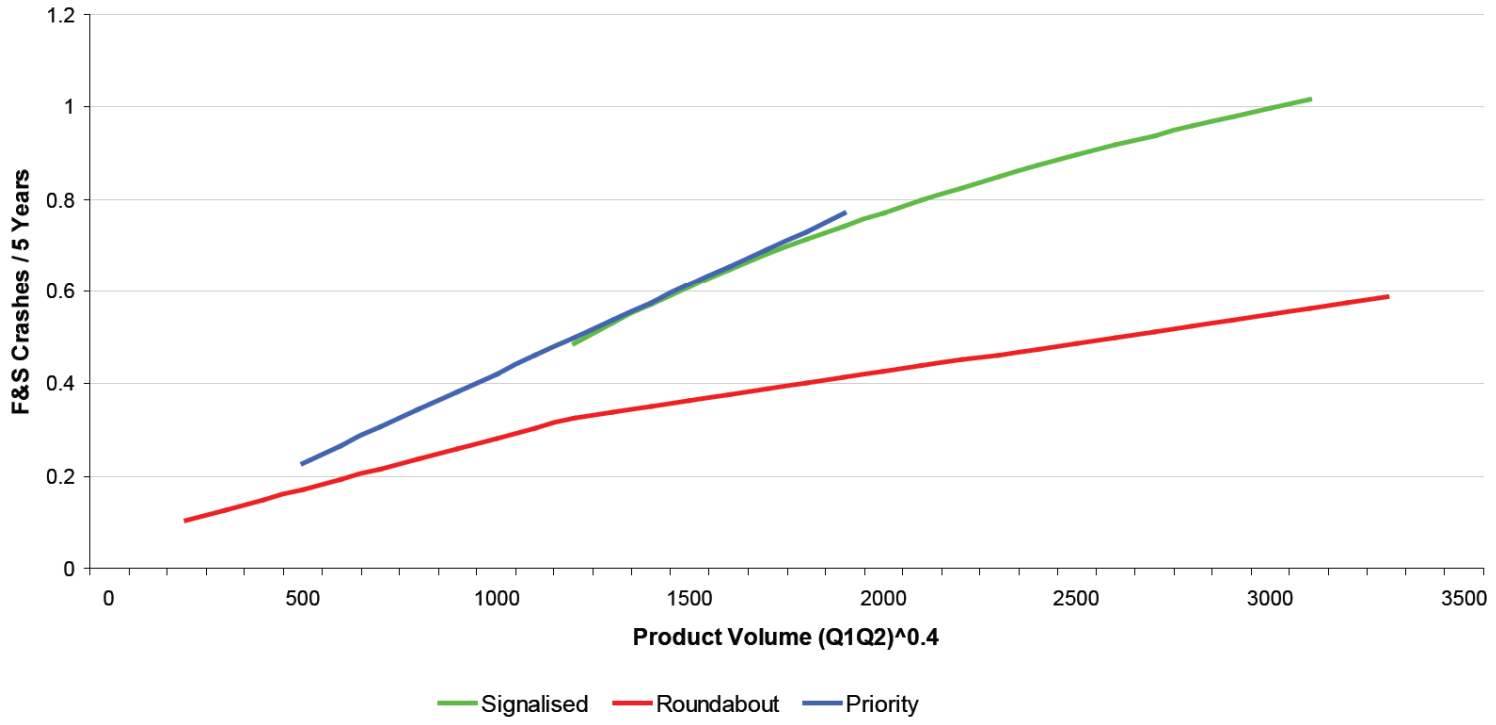
Comparing intersection types

Figure 6-2: Flow range and crash relationship for various methods of control at urban crossroad intersections



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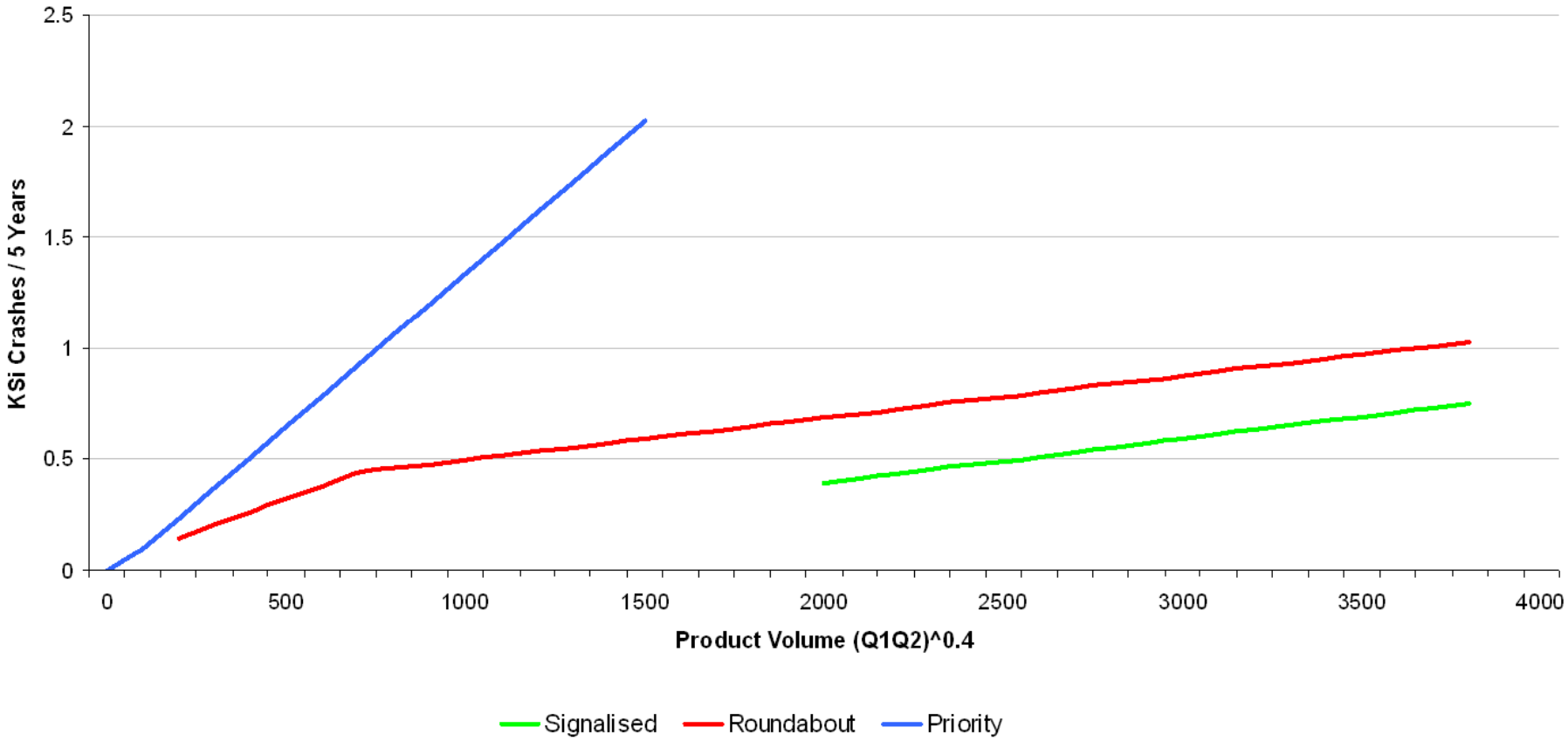
Comparing intersection types

Figure 6-4: Flow range and crash relationship for various methods of control at rural crossroad intersections



Treatment Examples – State Highway 1 / SH 5 intersection, Tirau

This intersection has the worst F&S crash history on the State Highway network.

Having 9 F&S crashes and 16 injury crashes in 5 years.

Using updated data to find collective and personal risk calculations; SH 2 is a High Collective Risk and a High Personal Risk.

Using the treatment philosophy strategy shows that this intersection deserved consideration as a transformational treatment.

We would normally expect at theses traffic volumes at a priority T junction, only 1.3 injury crashes in 5 years.

The intersection LOSS performance compared to that predicted at a priority T junction is 12 so there is a huge potential to achieve a reduction.

There is evidence that low cost measures have had some effect - but nowhere near enough.

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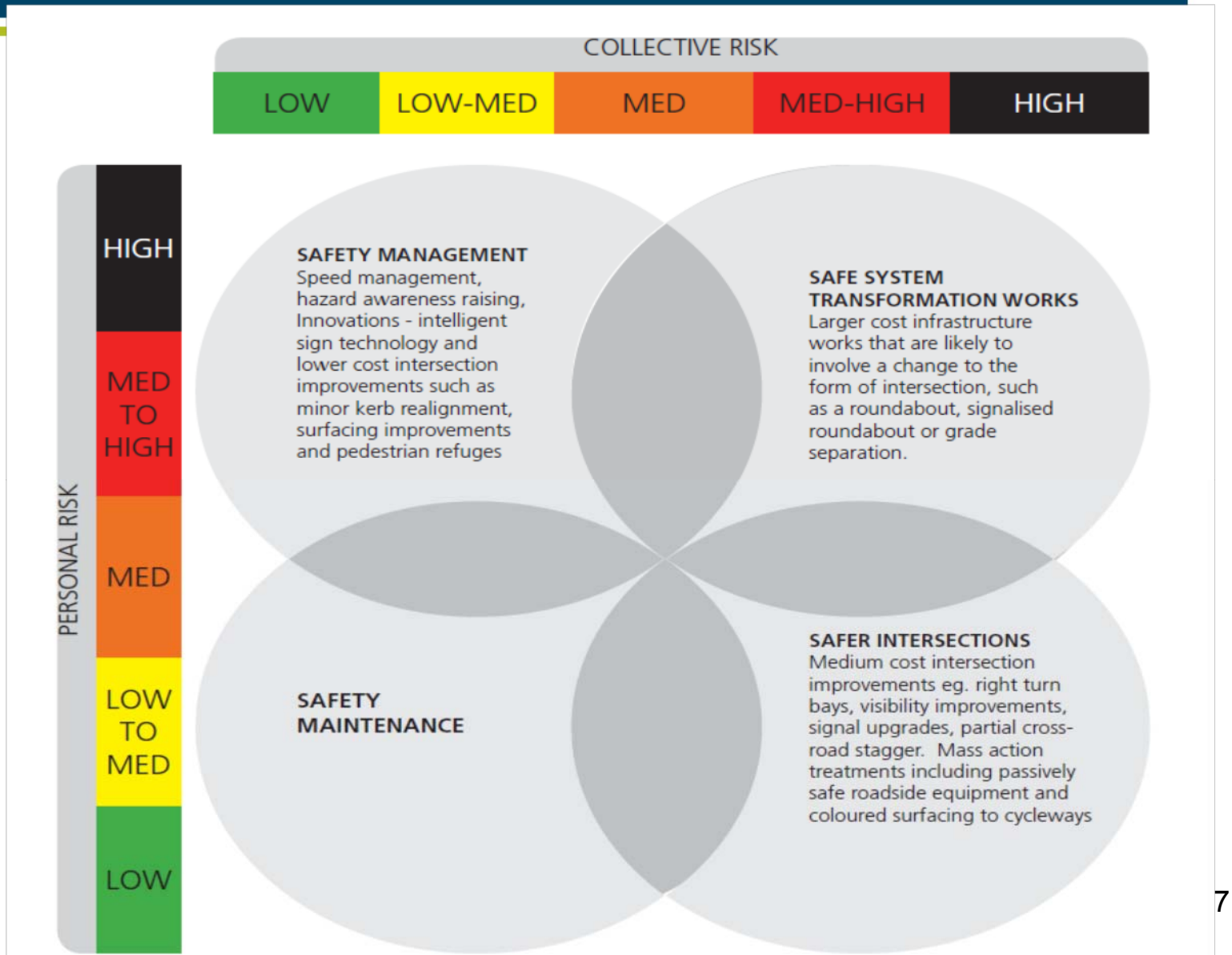
SH1 / SH 5 Tirau Treatment Philosophy



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Countermeasures – Treatment Philosophy

Safety Maintenance;

Signs, signals, markings, vegetation control, visibility, surface condition,

Safety management (low cost)

Speed management, hazard warning, minor kerb realignments, improvements to signal phasing, signs, markings, visibility, islands.

Safer intersections (medium cost):

Turn bays, islands, realignments, signal upgrades, passive furniture / clear zones, coloured surfaces.

Transformation

Roundabout, grade separation, signals.

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Countermeasures – What have we learnt?

Channelisation can backfire.

Seagulls have an increased crash risk – but seagull roundabouts appear to be exceptionally safe.

However rural roundabouts – not as good record as expected due to hazards on left of some exits.

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Countermeasures – What have we learnt?

Turn lanes mixed blessing

Left turn lanes - reduce low severity rear ends but left turners are visibility block – increase risk. Also speed up vehicle into driver's door.

So increase high severity crashes to reduce low severity type.

Likewise right turn bays at cross roads – reduce rear ends but increase crossing crashes and severity.

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Countermeasures – What have we learnt?

Pedestrians and cyclists:

Where pedestrians or cyclists cross a traffic stream – vulnerable due to traffic speed.

Where traffic is turning or emerging from a side road, typically speeds are slower – but still severe if a heavy vehicle is involved.

Half of urban pedestrian and cyclist deaths involve a heavy vehicle.

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Countermeasures – What have we learnt?

Rural intersections:

Priority cross roads are by far the worst – very high risk and high severity.

Roundabouts best - if exits clear zoned.

Rural signals need careful design and phasing - but can be low risk.

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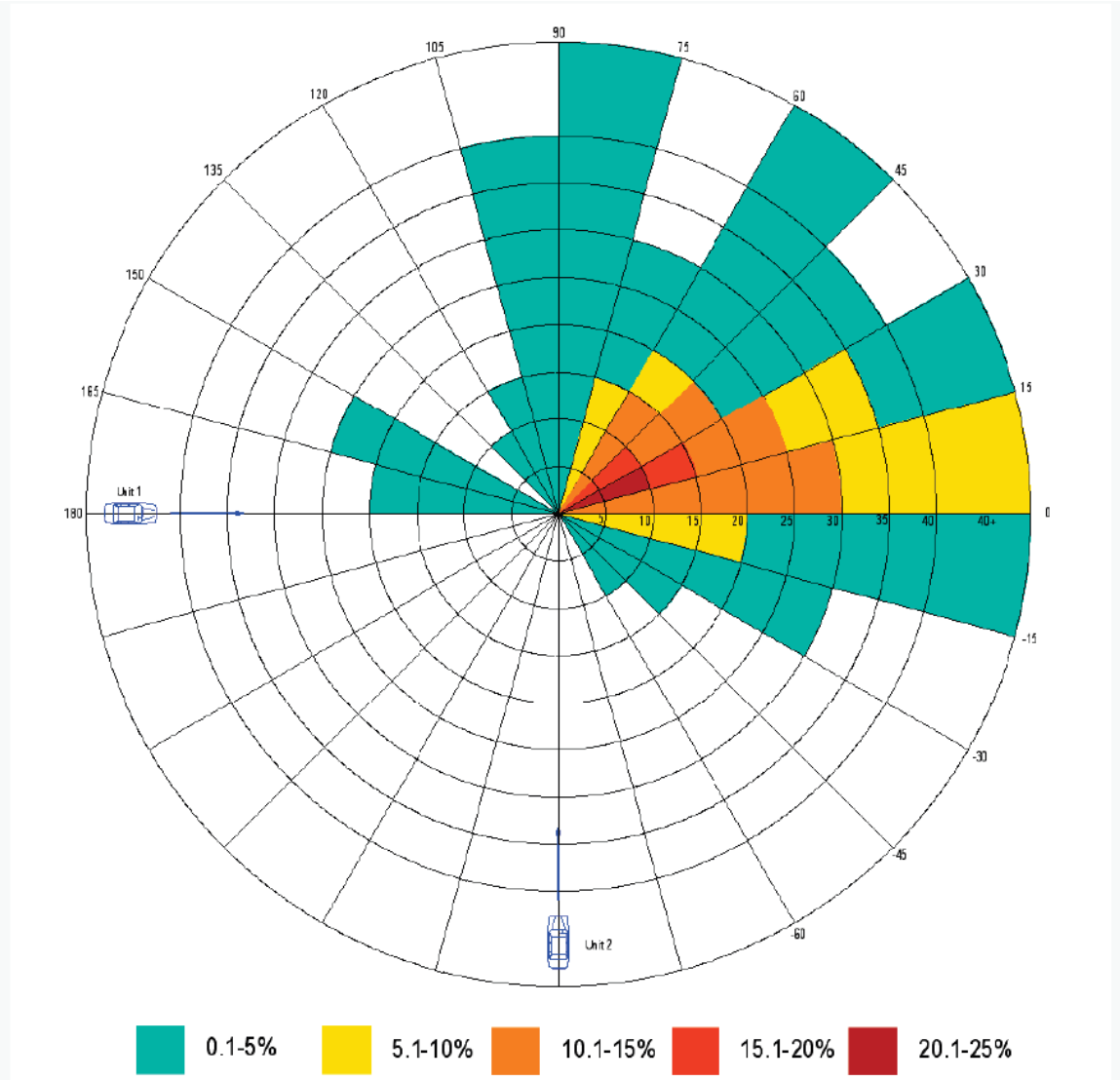
Countermeasures – clear zones



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Programme, monitoring and Evaluation

Once routes and measures have been identified a suitable programme of implementation is important, along with a system to monitor the effectiveness of these countermeasures.

In summary:

1. identify the benefits or rather the effectiveness of the various treatments
2. identify the most effective packages of treatments
3. assess the levels of funding that may be required to achieve various levels of crash reduction
4. ‘prove’ that funding has been spent wisely.

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How are we responding to the challenge?

The focus on deaths and serious injuries

- Using F&S crashes or estimating using severity ratios

Identifying high risk intersections.

- Using injury crash data and estimating F&S from typical severities. No risk assessment tools equivalent to KAT

Crash types that result in deaths and serious injuries

- More focus on severe crash types e.g. side impacts, pedestrians and cyclists.

Considering how countermeasures affect crash severity

- Roundabouts, barriers and clear zones

Crash prediction models and crash severity / casualties

- Still requires development – using typical severities.

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Addressing the design of the system

Einstein:

"It is not possible to solve problems using the same kind of thinking that was used to create them."

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Thank you