How can we have a better road safety response?

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CASR Crash investigation since the 1960s
Crashes through the decades

- 1960s
- 1970s
- 1980s
- 1990s
- 2000s

- Intersection crashes
- Road departure crashes
- Head on collisions

- What is the constant?
- What will we build tomorrow?
Forrest Hwy, WA

- 2009 $760m
- 50-60m wide Xsect
- At grade intersections
- Clear zone principles

- 51 F+SI
- 21 RoR

*A missed opportunity*
Road Users are set up for failure
The philosophical shift

Incremental Gains
Response associated with crash likelihood

Balance between safety and mobility

Deaths & Serious Injuries
Maximise safe mobility

Systemic Change
Response associated with crash consequence

Traditional Approach

Many

New thinking

Zero

Residual
What is the Safe System?

• Interacting Pillars
  – People
  – Roads
  – Vehicles
  – Speed
  – (Post Crash Response)

• Core Principles
  – People will make errors
  – System forgiving of errors and their consequences
  – Shared responsibility
1980s Pacific Hwy bus crashes - Grafton
1980s Pacific Hwy bus crashes - Kempsey
Yet another rural road fatality today ...

Crashes must be regarded as system failures
The breakdown – Harm elimination

• The physics of the system
  – Energy management
  – Forces on the human body
  – The physics we allow to occur in the system

• Expectations of road users
  – Understanding more about errors
  – The reliance placed on human decision making in safety critical situations
  – Our system can be viewed as “setting people up for failure”
Vehicle occupant protection
The reality
Extreme behaviour or System Failure?

- Wundersitz et al. (2011)
  - <10% of non-fatal injury crashes involved extreme behaviour
  - 46% of fatal crashes involved extreme behaviours

- Stigson (2009)
  - Interaction of the system pillars
  - Most potential to prevent harm still lies with road infrastructure
  - Divided roads a key explanatory variable of safety
  - Different perspective if look at crash causation rather than what is causing the injury
Many opportunities, so what are the traps?

• Safety is assumed
  – We do not manage for the best outcomes

• We have unrealistic expectations of road users
  – Still many things we do not really know about regarding complexity of the driving task
  – Even non-compliant and risky behaviour is “normal” in society – design still has a role to play

• Guidelines + Standards ≠ the best safety outcomes
  – Also if cannot meet them do nothing at all

• We do not focus on the consequence of crashes
Key Safe System Considerations

- Speed (as a design variable)
- Mass
- Impact configuration

- Redundancy

- Why the risk?
Redundancy
**How should we regard treatments?**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Treatment</strong></td>
<td>• Road planning, design and management considerations that <strong>virtually eliminate</strong> the potential of fatal and serious injuries occurring in association with the foreseeable crash types</td>
</tr>
</tbody>
</table>
| **Supporting (step towards)** | • Road planning, design and management considerations that **improve** the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injuries occurring  
                                  • Improves the ability for a Primary Treatment to be implemented in the future |
| **Supporting Treatment**  | • Road planning, design and management considerations that **improve** the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injuries occurring  
                                  • Does not change the ability for a Primary Treatment to be implemented in the future |
| **Non-Safe System Treatment** | • Road planning, design and management considerations that are **not expected to achieve an overall improvement in the level of safety** associated with foreseeable crash types occurring  
                                  • Reduces the ability for a Primary Treatment to be implemented in the future |
Treatments

• Primary
  – Roundabouts
  – Signalised Roundabouts
  – Median treatments
  – Continuous barrier systems
  – Safe System Speeds
  – Segregation
  – Grade Separation
  – Removal of points of conflict
  – Reducing exposure

• Supporting
  – Wide Centrelines
  – Sealed shoulders
  – Audio tactile linemarking
  – Safety tables
  – Constraining geometry
  – Speed limit reductions
  – Multiple redundancy
Key Approaches – Rural Roads

• **Continuous lengths of (flexible) barriers** along corridors
  – Wire rope is proven
  – Other systems with emerging potential
  – High levels of DSI safety performance

• **Wide centre lines** are a good interim measure

• **Clear zone is also a hazard**
  – Departures can have large lateral displacements
  – Rollover not managed well
Key Approaches - Intersections

• **Manipulate impact angles**
  – Utilise the best features of roundabout design
  – Avoid 90 degree configurations unless speed is low

• **Guarantee safe interaction speeds**
  – Use fit for purpose vertical deflection
  – Constraining geometry (narrow lanes etc)
  – Radial designs

• **Mass**
  – Is segregation possible?

*Consider dynamic visual obstruction*
*Consider inattentional blindness ("looked but did not see")*
Innovation – Vicroads initiatives
“Tennis Ball”, WA
Key Approaches – Residential areas

• Place making
• Self-explaining roads
• Good European practices to latch on to

• Holistic benefits
  – Safety
  – Emissions and Noise
  – Active Travel and community health benefits
  – Traffic calming
  – Shared ownership of the problem and solutions
## Assessing Safe System alignment

### Table 4.2: Safe System assessment framework for infrastructure projects

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Run-off-road</th>
<th>Head-on</th>
<th>Intersection</th>
<th>Other</th>
<th>Pedestrian</th>
<th>Cyclist</th>
<th>Motorcyclist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AADT; length of road segment</td>
<td>AADT; length of road segment</td>
<td>AADT for each approach; intersection size</td>
<td>AADT; length of road segment</td>
<td>AADT; pedestrian numbers; crossing width; length of road segment</td>
<td>AADT; cyclist numbers; pedestrians</td>
<td>AADT; motorcycle numbers; length of road segment</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Speed; geometry; shoulders; barriers; hazard offset; guidance and delineation</td>
<td>Geometry; separation; guidance and delineation; speed</td>
<td>Type of control; speed; design, visibility; conflict points</td>
<td>Speed; sight distance; number of lanes; surface friction</td>
<td>Design of facilities; separation; number of conflicting directions; speed</td>
<td>Design of facilities; separation; speed</td>
<td>Design of facilities; separation; speed</td>
</tr>
<tr>
<td>Severity</td>
<td>Speed; roadside features and design (e.g. flexible barriers)</td>
<td>Speed</td>
<td>Impact angles; speed</td>
<td>Speed</td>
<td>Speed</td>
<td>Speed</td>
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</table>
Conventional + intersection

60 km/h

80 km/h
Roundabout
Hybrid solution

80 km/h Speed Zone
All entry speeds 40 km/h

Divided Arterial Int (40km/h) - conflict points and corresponding Pr(FSI)
Vehicle technology to the rescue (AEB)?
Take home messages

• We are not making the most of our opportunities
  – Safety outcomes need to be managed not assumed

• Safe System = Harm reduction
  – Use this as the starting point
  – Manipulate speed/mass/orientation to influence crash consequence
  – Back up with redundancy features
  – Expect errors

• Consider the Safe System treatment hierarchy
  – Primary treatments
  – Supporting treatments
  – Non Safe System treatments
  – Tools now exist to assist

• Consider safety by default
  – Go to aspirational Safe System design stereotypes and principles first
  – Put effort into justifying variations that make a scheme less safe
  – (at the moment we do the opposite)
  – Are we sincere about “safe mobility” or “mobility vs safety”?
Austroads publication bringing current Safe System knowledge together

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