Safer Journeys and the Safe System Approach

Applicability to Low Volume Roads

Colin Brodie

Lead Advisor: Safety and Environment

NZ Transport Agency
Safer Journeys and the Safe System Approach

• The evolution of Vision Zero
• Safer Journeys and the Safe System
• Understanding Safety Risk on Low Volume Roads
• Safe System Application to Low Volume Roads
NZ road toll and how we compare internationally?

Year to date as at start Sept 2017

At the same time
New Zealand Midnight 04 Sept 2017

Road fatalities per 100,000 inhabitants, 2014

Road fatalities per 100,000 population in 2016: NZ = 7.2
Evolution of Vision Zero
( the embryo of the Safe System approach)

The crash that opened Claes Tingvall’s eyes.

- Car aquaplaned on Sweden E4 motorway in 1995, colliding with a concrete foundation killing 5 young people

- Road authority response:
  - driver’s fault
  - removing the foundation would be tantamount to admitting guilt

Claes’ learning, which he found unacceptable:

- crashes are subject to moralisation
- the cause was always sought in the actions of the victims

He wrote down 3 points
1. Life is more important than anything
2. We are responsible for road safety
3. We know what to do
Vision Zero was Born

1997

“No one shall be killed or seriously injured within the road traffic system.”

Research indicated that even if all road users complied with road rules, fatalities would only fall by around 50% and injuries by 30%.
Vision Zero: Ethics and Principles

Ethics

• No loss of life is acceptable

• A human being is unique. It cannot be substituted or traded with money.

• Traffic Safety should not, as today, be a function of mobility. Mobility should be a function of traffic safety.

Vision Zero’s Three Dimensions

Ethics

• People should not have to die in traffic

Responsibility

• System designers must realise that people make mistakes

Solutions

• Finding combinations that work
Road Traffic Deaths by Type of Road User

50% of all road traffic deaths are among pedestrians, cyclists and motorcyclists.
The Safer Journeys and the Safe System Approach
Safe System Evolution
The Safe System Principles

1. People are fallible
2. Accept we are human
3. Shared responsibility
4. Manage the system

- People are vulnerable
- All of system response
Principle 1 – Human fallibility

People make mistakes and crashes are inevitable

No one performs perfectly 100% of the time
Principle 2 – Human vulnerability

The human body has a limited ability to withstand crash forces

\[ k_e = \frac{1}{2}mv^2 \]
Human Survivability

Risk of being killed

- Pedestrians
- Side-on collision
- Head-on collision

Percentage
- 0%
- 20%
- 40%
- 60%
- 80%
- 100%

Speed (kph)
- 0
- 20
- 40
- 60
- 80
- 100
Principle 3 – Shared responsibility

System designers
- Policy makers
- Planners
- Politicians
- Engineers
- Educators
- Enforcers
- Utility providers
- Retailers

System users
- Drivers
- Passengers
- Cyclists
- Motorcyclists
- Pedestrians
Principal 4 – We need to strengthen all parts of the system
Safe System Roads: RoNS (Minimum 4 star KiwiRAP)

- Waikato: Te Rapa Bypass: Dec 2012
  Ngaruawahia Bypass: Dec 2013
  Cambridge Bypass: Dec 2015

- Tauranga Eastern Link: July 2015

- Christchurch Southern Corridor: Dec 2013

No Fatalities
Safer Journeys priorities and first actions

- Reduction in deaths and serious injuries
- Young drivers
- Motorcycles
- Alcohol and drugs
- Roads and roadsides
Progress against top priorities

Areas of high concern (percentage reduction/increase since 2010)

- Fatal or serious injuries in headon/runoff crashes
- Deaths or serious injuries in alcohol/drug crashes per 100,000
- ACC entitlement claims from motorcyclists
- Drivers (15-24 yrs) killed or seriously injured, per 100,000
- Fatal/serious injuries in speed-related crashes
Death Trends by Local Roads vs SH

DSI trends by road network, 2010-2017
12-month totals

SH  non-SH
Safer Journeys Strategy

Races & Roadsides
1st action plan (11/12)
• Focus safety improvements programmes on high risk rural roads and high risk

2nd Action Plan (13-15)
• Target TOP 100 highest risk intersections
• Extend risk mapping tools
• urban intersections

3rd Action Plan (16-20)
• High risk local urban arterials
• High risk local rural roads

Speed
1st Action Plan
• Public campaigns on Safe Speeds
• Increase speed cameras

2nd Action Plan
• Develop a NZ Speed Management Programme
• Speed demonstration projects

3rd Action Plan
• Start to implement speed management programme (110km/h roads)

Vehicles
1st Action Plan
• Improve awareness of safe vehicles (ANCAP/Right Car)
• Implement Operator Rating system (HV)

2nd Action Plan
• Accelerate exit of less safe vehicles

3rd Action Plan
• Investigate various safety technologies

Safe Use
1st action plan
• Raise young driver age
• Improve motorcycle use safety

2nd Action Plan
• Lower BAC

3rd Action Plan
• Encourage smart and safe choices (including technology)

Overarching: Embed Safe System Approach
Understanding Risk on Low Volume Roads
## Low Volume Roads in the ONRC

### One network road classification - functional classification

<table>
<thead>
<tr>
<th>ROAD &amp; STREET CATEGORIES/Criteria</th>
<th>MOVEMENT OF PEOPLE &amp; GOODS</th>
<th>FUNCTIONAL CRITERIA AND THRESHOLDS</th>
<th>ECONOMIC AND SOCIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Typical Daily Traffic (AADT)</strong></td>
<td><strong>Link</strong></td>
<td><strong>Place</strong></td>
<td><strong>Link</strong></td>
</tr>
<tr>
<td>NATIONAL</td>
<td>15,000</td>
<td>&gt;25,000</td>
<td>R: &gt;250</td>
</tr>
<tr>
<td>REGIONAL</td>
<td>20,000</td>
<td>&gt;35,000</td>
<td>R: &gt;1200</td>
</tr>
<tr>
<td>ARTERIAL</td>
<td>10,000</td>
<td>&gt;15,000</td>
<td>R: &gt;400</td>
</tr>
<tr>
<td>PRIMARY COLLECTOR</td>
<td>3,000</td>
<td>&gt;5,000</td>
<td>R: &gt;300</td>
</tr>
<tr>
<td>SECONDARY COLLECTOR</td>
<td>1,000</td>
<td>&gt;3,000</td>
<td>R: &gt;150</td>
</tr>
<tr>
<td>ACCESS</td>
<td>All other roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW VOLUME</td>
<td>&lt;1,000</td>
<td>R: &gt;200</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Population and traffic volumes are approximate.
Volume (AADT) by ONRC
## Death and Serious Injuries by ONRC and AADT

(Rural Sealed roads only 2102-16)

<table>
<thead>
<tr>
<th>AADT</th>
<th>DSleq</th>
<th>National Strategic (High Volume)</th>
<th>National Strategic</th>
<th>Regional Strategic</th>
<th>Arterial</th>
<th>Primary Collector</th>
<th>Secondary Collector</th>
<th>Access</th>
<th>Grand Total</th>
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<tbody>
<tr>
<td>100</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>12</td>
<td>34</td>
<td>79</td>
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<td>250</td>
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<td>0</td>
<td>0</td>
<td></td>
<td>16</td>
<td>127</td>
<td>115</td>
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<td>258</td>
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<tr>
<td>500</td>
<td></td>
<td>16</td>
<td>11</td>
<td></td>
<td>47</td>
<td>281</td>
<td>18</td>
<td></td>
<td>357</td>
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<tr>
<td>750</td>
<td></td>
<td>16</td>
<td>25</td>
<td></td>
<td>72</td>
<td>189</td>
<td>1</td>
<td></td>
<td>303</td>
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<tr>
<td>1000</td>
<td></td>
<td>1</td>
<td>38</td>
<td></td>
<td>110</td>
<td>106</td>
<td>2</td>
<td></td>
<td>258</td>
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<tr>
<td>1500</td>
<td></td>
<td>1</td>
<td>43</td>
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<td>77</td>
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<td>470</td>
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<tr>
<td>2500</td>
<td>0.5</td>
<td>70</td>
<td>190</td>
<td></td>
<td>240</td>
<td>513</td>
<td>25</td>
<td>1</td>
<td>1040</td>
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<tr>
<td>5000</td>
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<td>1</td>
<td>130</td>
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<td>202</td>
<td>229</td>
<td>192</td>
<td>2</td>
<td>757</td>
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<td>10000</td>
<td>69</td>
<td>233</td>
<td>310</td>
<td></td>
<td>236</td>
<td>68</td>
<td>3</td>
<td>0</td>
<td>919</td>
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<tr>
<td>15000</td>
<td>89</td>
<td>80</td>
<td>133</td>
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<td>62</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>379</td>
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<tr>
<td>20000</td>
<td>63</td>
<td>21</td>
<td>26</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>112</td>
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<tr>
<td>20000+</td>
<td>375</td>
<td>2</td>
<td>4</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>387</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>598</strong></td>
<td><strong>536</strong></td>
<td><strong>926</strong></td>
<td><strong>924</strong></td>
<td><strong>1363</strong></td>
<td><strong>797</strong></td>
<td><strong>217</strong></td>
<td><strong>5364</strong></td>
<td></td>
</tr>
</tbody>
</table>
# Low Volume Access ONRC 2012-2016

## Fatal & Serious Crashes

<table>
<thead>
<tr>
<th>Category</th>
<th>Urban</th>
<th>Rural</th>
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</thead>
<tbody>
<tr>
<td>Fatal &amp; Serious Crashes</td>
<td>177</td>
<td>177</td>
</tr>
<tr>
<td>Number of Objects Struck</td>
<td>147</td>
<td>125</td>
</tr>
<tr>
<td>Single Party Crashes</td>
<td>83</td>
<td>37</td>
</tr>
<tr>
<td>At Fault Young Drivers</td>
<td>66</td>
<td>50</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>35</td>
<td>33</td>
</tr>
<tr>
<td>Motorcyclist</td>
<td>51</td>
<td>53</td>
</tr>
<tr>
<td>Road Factors</td>
<td>56</td>
<td>42</td>
</tr>
<tr>
<td>Speed Too Fast</td>
<td>47</td>
<td>40</td>
</tr>
<tr>
<td>Alcohol &amp; Drugs</td>
<td>37</td>
<td>17</td>
</tr>
<tr>
<td>Bend Loss of Control</td>
<td>111</td>
<td>82</td>
</tr>
<tr>
<td>Straight Loss of Control</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>Poor Handling</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>Cyclists</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Intersection Crashes</td>
<td>36</td>
<td>37</td>
</tr>
</tbody>
</table>
Death and Serious Injury risk

**Collective Risk**
Crash density (rural roads)
Deaths and Serious Injuries per road km

**Personal Risk**
Crash rate (rural roads)
Deaths and Serious Injuries per 100Mvkt

Heavy emphasis on:
- Forgiving infrastructure
- Safe Use messages (markings & delineation)

Increasing emphasis on:
- Safe Use messages (markings & delineation)
- Safe Speeds
- Vehicle crash avoidance technologies
Identifying Risky Locations: Corridors
Identifying Risk Locations
Collective Risk (DSI eq/Km)
Identifying Risk Locations

Personal Risk (DSI eq/ Vkt)
Identifying Risk Locations
Infrastructure Risk Rating (IRR)
Identifying Risky Locations: Curves
66.6% of loss of control crashes occurred on the 20.3% of curves classified as ‘unacceptable’ or ‘undesirable’.
Curve Identification: A GIS Approach:

- Divide centreline into 10m sections
- Calculate rolling average 30m radius
Identifying Curve Risk; Austroads Speed Model

Direction of travel

Direction of travel

Unacceptable
Undesirable
Desirable
No Deceleration
Roadsafetyrisk.co.nz: Out of context curves
Perceptual Counter Measures

- In trial on the Coromandel motorcycling loop
- Influence speed and lane positioning
Alternative Rural Road Markings

- Under consideration for quiet rural roads with active users
- Improves active road user safety?
- 60km/h speed limit?
- Need an RCA willing to trial
Speed Management Framework
### Speed Management and ONRC

<table>
<thead>
<tr>
<th>Classification</th>
<th>Straight open road / urban motorways</th>
<th>Curved open road</th>
<th>Winding open road</th>
<th>Urban (not motorway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>100–110km/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High volume national</td>
<td>Depends on design and safety risk (e.g. divided 4-5 star, grade separated intersections, safety barriers) and factoring in enforcement thresholds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>80–100km/h</td>
<td>60–80km/h</td>
<td></td>
<td>50km/h</td>
</tr>
<tr>
<td>National, Regional, Arterial</td>
<td>Depends on safety risk and whether volumes justify investment to bring the road up to 3 star equivalent, also enforcement thresholds</td>
<td></td>
<td></td>
<td>60–80km/h where safety risk allows, e.g. fewer intersections, mode separation for active users</td>
</tr>
<tr>
<td>Class 3</td>
<td>60–80km/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary and secondary collector</td>
<td></td>
<td></td>
<td></td>
<td>30–50km/h</td>
</tr>
<tr>
<td>Class 4</td>
<td>60–80km/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access and low-volume access</td>
<td>Depending on roadside development, pedestrian and cyclist volumes, whether sealed or not</td>
<td></td>
<td></td>
<td>30km/h if high volumes of cyclists/pedestrians Recognise access and place</td>
</tr>
<tr>
<td>All winding/tortuous</td>
<td></td>
<td></td>
<td></td>
<td>10km/h for Shared Spaces</td>
</tr>
</tbody>
</table>
Megamaps website:
Existing Speed Limits
Megamaps website: Infrastructure Risk Rating
Megamaps website:
Safe and Appropriate speeds

Speed Management Framework

Legend
Safe and Appropriate Speed

- Waikato
- 30
- 40
- 50
- 60
- <80 (Rural only)
- 80
- 100
- 110
Safer Vehicles
Safer Vehicles and Technologies

Vehicle Technologies

Electronic Stability Control

Speed Management Systems

Lane Departure Warning

Detection, Avoidance and Braking Systems
## Why do people die in road crashes \textit{(TERNZ 2016)}

<table>
<thead>
<tr>
<th></th>
<th>Impacts with other vehicles</th>
<th>No impact with other vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average age of victim’s vehicle (years)</td>
<td>Average age of other vehicle (years)</td>
</tr>
<tr>
<td>Rural</td>
<td>15.9</td>
<td>8.4</td>
</tr>
<tr>
<td>Urban</td>
<td>17.0</td>
<td>10.5</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>10.9</td>
<td>10.8</td>
</tr>
<tr>
<td>Total</td>
<td>15.1</td>
<td>9.1</td>
</tr>
</tbody>
</table>

Proportion of fatal or serious injuries among injured vehicle occupants in relation to the age of the vehicle, 2014-2016:

- 0-10 yrs
- 11-19 yrs
- 20+ yrs

Vehicle age
The improvements in occupant protection

https://www.youtube.com/watch?v=azrpgvbOMq4
1. Addressing risk on lower volume roads will require a system response.

2. We need to understand and target to risk.

3. The Safe Roads and Roadsides response will not be 4 or 5 star roads. However there are opportunities low cost improvements at high risk locations.

4. We can engineer Safe Road Use messages to reduce errors, crashes and personal risk through delineation, perceptual measures and awareness campaigns.

5. Safe Speeds offer some of the greatest potential for reducing risk through both speed limits and technologies.


7. We need to think differently and embrace innovation.
Thank You

https://www.youtube.com/watch?v=mFcLUCtUAzc