Reducing Risk on Rural Roads

Background

A high proportions of fatal and serious crashes in New Zealand occur on rural two lane roads.

Crash prediction models can assist in evaluating the crash risk, particularly on existing small road sections, and also for evaluating the benefits of changes to road networks.

Aim

To develop crash prediction models for rural two lane (State Highways) that include all the key variables.

Models developed separately for curve and straight elements and for loss of control crashes and head on crashes. Rural intersections have been looked at in other research.

Sample Selection

The criteria for roads to be included in the sample set are:

- State Highway two lane roads (no passing lanes)
- Have a rural speed limit of 100 km per hour
- No narrow bridges, railway crossings or major intersections.

The total length of State Highway in the sample size is 9,054km.

Key Variables

The following variables were used to develop the models:

- Flow (AADT)
- Road length (m)
- Seal width (m)
- Gradient
- Radius (m)
- Roadside hazard (KiwiRAP severity risk weighting)
- Approach speed (km/hour)
- SCRIM and Mean depth texture
- Region (calibration factor)

Roadside hazard variable

The KiwiRAP severity risk weighting was used for this variable, ranging from 0.4 to 2.8. Images below illustrate what these values represent.

No severe hazards present — 0.4

Severe hazards present — 2.8

Curve Element Models

$$\text{Loss of control crashes} = 4.40E-8(\text{Region})(\text{Flow})^{0.75}(\text{Road length})^{1.11}e^{2.7(\text{Gradient})+0.024(\text{Approach speed})+1.42(\text{SCRIM})+43(1/\text{Radius})}$$

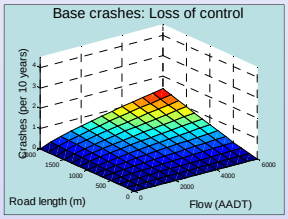
$$\text{Head on crashes} = 1.72E-8(\text{Region})(\text{Flow})^{0.92}(\text{Road length})^{1.1}e^{0.043(\text{Seal width})+6.7(\text{Gradient})+1.6(\text{SCRIM})+59(1/\text{Radius})}$$

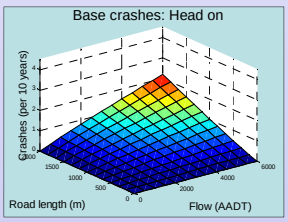
Straight Element Models

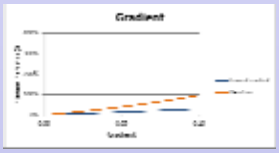
$$\text{Loss of control crashes} = 2.06E-6(\text{Region})(\text{Flow})^{0.74}(\text{Road length})^{0.77}e^{0.052(\text{Seal width})+2.6(\text{Gradient})+0.067(\text{Roadside hazard})+0.63(\text{SCRIM})+1.20(\text{MTD})}$$

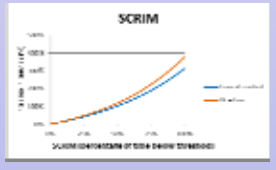
$$\text{Head on crashes} = 7.97E-9(\text{Region})(\text{Flow})^{0.92}(\text{Road length})^{1}e^{0.12(\text{Seal width})+14(\text{Gradient})+1.7(\text{SCRIM})}$$

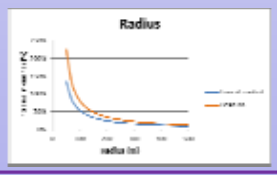
Curve Element



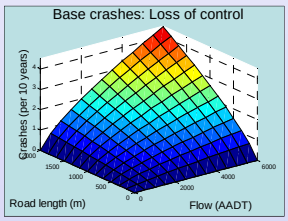


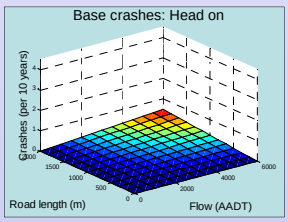


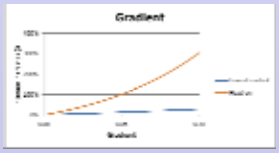


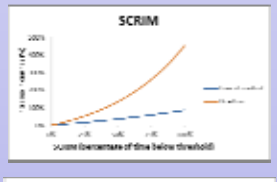


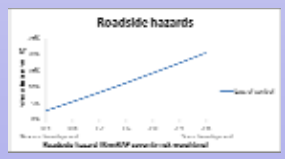
Straight Element

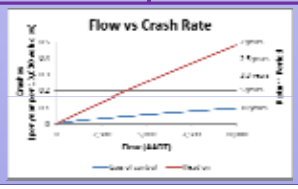






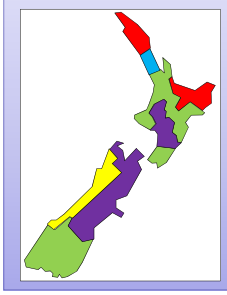






Regions (calibration factor)

Five regions were used in the model development.



Region	Straight		Curve	
	Loss of control	Head on	Loss of control	Head on
Super region 1	1.00	1.00	1.00	1.00
Super region 2	0.89	0.70	0.99	0.95
Super region 3	0.79	0.74	0.93	0.72
Auckland	0.41	0.37	0.48	0.42
West Coast	0.60	0.92	0.81	0.96

Takeaway Message

- Steeper roads have higher crash rates.
- Higher levels of traffic decreases crash rates per vehicle.
- Improving the condition of the road surface can reduce crash rates.
- Tighter curves have higher crash rates.
- Managing the entry speed of curves can reduce curve related crashes.

Authors

Gary Nates, Shane Turner, Rohit Singh

Beca