

Modelling Safety and Mode Shift impacts of Speed Management

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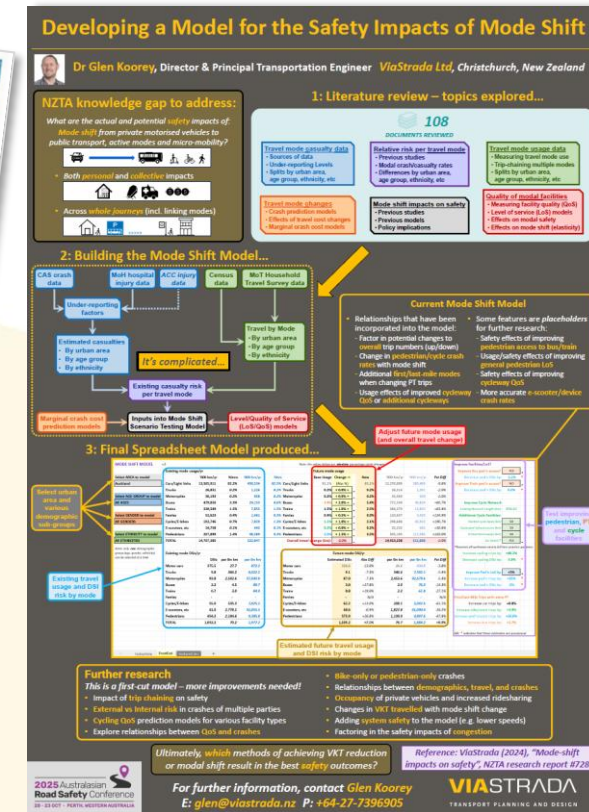
Background: Mode-shift impact on safety

- Previous research for NZ Transport Agency
 - [NZTA Research Report #728](#) (2024)
 - Presented as a Poster at ACRS 2025

- Research aim:

- *Determine the actual and potential **safety impacts** of achieving **mode shift** from private motorised vehicles to public trpt, active modes and micro-mobility, in conjunction with making changes to the **overall volume of travel** by all modes*

- Excel model developed to enable various mode-shift scenario tests
 - Calculate likely changes in amount of travel (VKT) and casualties (DSIs)
 - A good initial pilot model...



Mode shift v Safety: How to improve the model?

- Not all potential factors identified were built into this initial model:
 - Investigating likely changes in **average trip lengths** when people change modes
 - Investigating typical **vehicle-occupancy** factors for private/public motor vehs, to allow for increased person-kilometres travelled (PKT) without increasing VKT
 - Identifying and separating out casualty figures for active mode crashes/falls involving and *not* involving motor vehs (e.g. **slip/trip, hit object, etc**)
 - Safety & mode-shift effects of **introducing lower speed limits** to urban areas
 - Present a range of possible high and low values (i.e. **error margins**)
- Trptn Group NZ funded research to explore these factors further
 - We developed an updated (v4) model (Nov '25 – Mar '26)
 - Of particular interest was the effect of speed management on safety / mode shift...

Model updating method

- Main tasks involved:
 - Extract and apply data on **trip journey lengths** for different modes / locations
 - Extract and apply data on **ave veh occupancies** for different modes / locations
 - Identify and separate out active mode casualty numbers **with/without motor vehs**

*In each case, a **range** was estimated to produce an **error margin** of values*

- For the speed reduction estimate work:
 - Road data obtained for each main NZ urban area from **NZTA MegaMaps** database
 - Data included: length, volume, road type/use, posted limit, mean observed speed
 - ➔ For each speed limit: total **length**, total **VKT**, average **free-flow speed**

*This data was then used to estimate existing/potential **relative risk** scores*

Speed Limits and Relative Risk



- Elvik's (2013/19) exponential model was used to find the change in DSIs expected on a road when there is a change in speed:

$$\text{Estimated DSIs After} = \text{Estimated DSIs Before} \times e^{(\text{Speed After} - \text{Speed Before}) \times \text{exponent}}$$

- For serious/fatal injuries, *exponent* = **0.06**
- Previous research by Elvik *et al* (2004) shows
*For each **10 km/h** of speed limit decrease, an associated **~2.5 km/h** decrease is observed in mean operating speeds*
- We have assumed a default **3 km/h** estimate and a range of **2.5-3.5 km/h**
- Developed a Speed Risk model that calculates **relative risk** of all roads from their **average free speed** vs a **20 km/h** base speed



e.g. For a street with ave speed of **26.0 km/h**, relative risk = $e^{(26-20) \times 0.06} = \mathbf{1.43}$

Calculating Weighted Risk scores

For roads of *each* speed limit: 30 40 50 60 70 80 100

Speed Management		for Christchurch streets/roads		
Enter details below for new sections of road with speed management				
Current Spd Lim	Roads (km) at Spd Lim	Change (km)	New Spd Lim	Traf. Calming?
100	1.5	0.0	80	NO
80	37.5	0.0	60	NO
70	18.8	0.0	60	NO
60	180.3	30.0	50	YES
50	892.6	200.0	40	YES
40	281.2	100.0	30	YES
50	892.6	500.0	30	YES

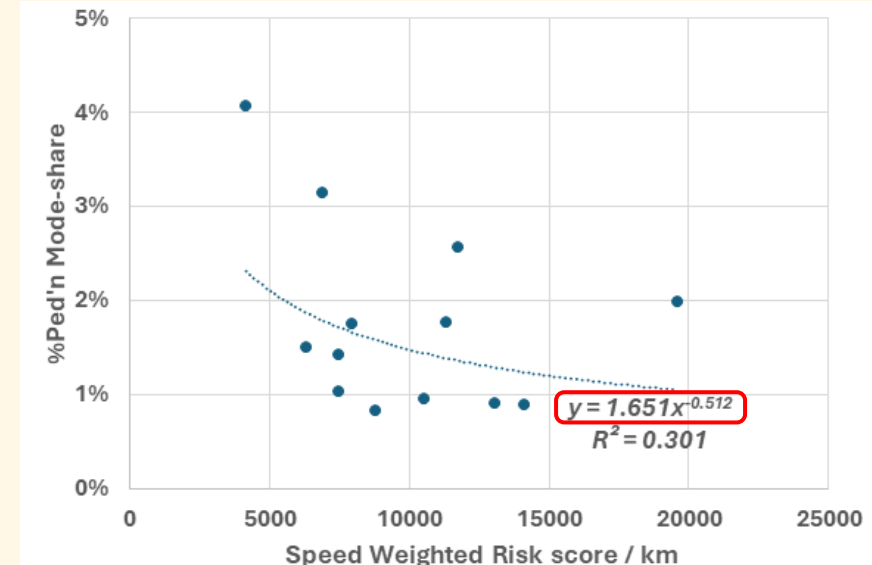
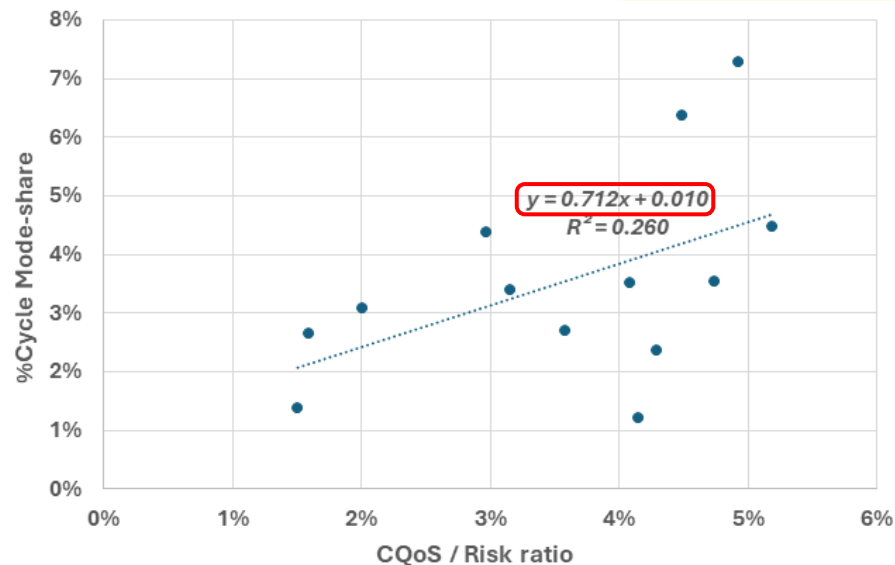
Relative risk (based on ave spd) × Total VKT = ‘weighted risk’

- Sum{*weighted risk at each speed limit*} = **existing total weighted risk**
- Users can then enter in the model the **length** of roads they would like to **change** from an existing speed limit to a **new** speed limit
 - New **changed free speed** of the changed roads is calculated
 - New weighted average using VKT → **new average free speed**
 - New **relative risk** for each length of changed road calculated (from Elvik)
 - Sum{*New relative risks × VKT*} = **new total weighted risk**
 - *{New total weighted risk} / {Existing total weighted risk}* = **scaling factor for DSIs**
- E.g. Existing TW Risk = 10,000,000 → New TW Risk = 9,000,000
 - Scaling factor = **0.900** – i.e. a **10% reduction in DSIs**

Mode shift effects of Lower Speeds

Previous research suggests that **reductions** in posted speed limits typically results in a **greater take-up** of Active & Public Trpt modes – *how much?*

- For cycling:
 - Compared {Cycling Quality of Service} / {Speed-Change weighted risk} vs {Cycling mode share} across NZ
- For walking:
 - Compared {Speed-Change Weighted Risk/km} vs {Walking mode share} across NZ



Overall findings – Lower Speeds vs Active Modes

- **Cycling:** While the relationship is slightly weak, some indication of cycling increases when road speed risk & cycle-friendliness both improve
 - *For every **1%** (absolute) increase in **CQoS/Weighted-Risk** ratio, there is likely to be a corresponding absolute increase in cycling mode share of **0.6-0.8%***
- **Walking:** Again, relationship is somewhat weak, there is some indication of increases in walking when distance-adjusted road speed risk reduces
 - *For every **1%** (absolute) decrease in **Weighted Risk/km**, there is likely to be a corresponding proportionate increase in walking mode share of **0.4-0.6%***

*NB: Also identified a 4-6% increase in **PT** Modes from 1% WR/km decreases*

Conclusions: The updated mode-shift / safety model has found some promising findings from speed mngmt effects on safety and mode shift

- *But more work needed to confirm the indicative relationships found*

Thank You!

Any questions?

For more information about this project, scan the QR Code link below:

