

The effect of better road delineation: A new method of assessment

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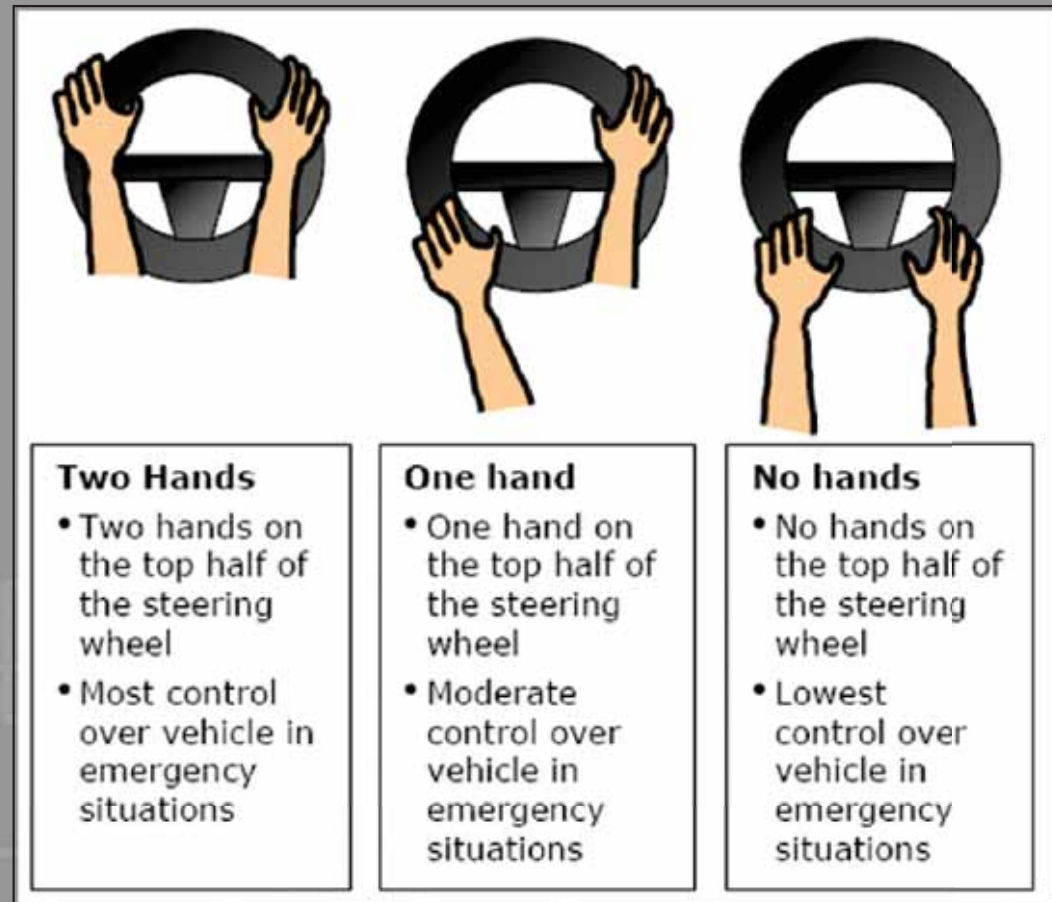
- Background
 - The “Hands-on” measure
 - Delineation and safety
- The delineation project
 - Sites chosen and adapting the method for different conditions
- Dry night brighter roadmarking findings
- Wet day delineation findings
- Implications for road safety and delineation



Acknowledgements:

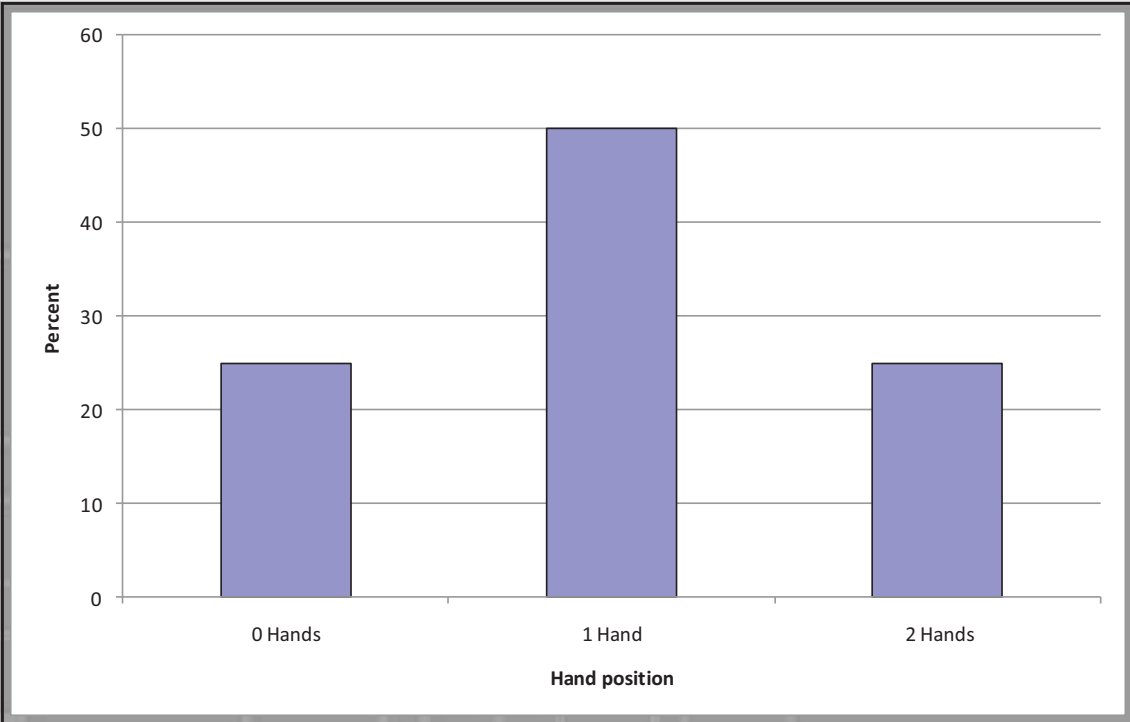
Walton, D., Thomas, J.A., Murray, S. J., & Fourie, M (2011). Improved Delineation: A new method of assessing the effect of better delineation on driving. NZ Transport Agency research report 442.

- The recommended driving position for driving a vehicle is the 10/2 o'clock alignment
- However drivers often deviate from this position. Why?
 - Task complexity of driving a particular section of road
 - Drivers perception of the risk
- Use as an evaluation tool



Key reference:

Walton, D., & Thomas, J.A. (2005). Naturalistic observations of driver hand positions. *Transportation Research Part F. Traffic Psychology and Behaviour*, 8, 229-238.



Hand positions

- Recommended minimum standard of road marking brightness:
 - 100RI (retroreflectivity) in New Zealand
 - 90-130RI range in overseas recommendations (Debaillon et al 2008).
- Previous research estimates incidence of road accidents increase by:
 - 40% at night (Johansson et al 2009)
 - 70% in wet weather (Andrey and Yagar 1993).
- In NZ 16% of injury accidents, and 17% of fatal accidents, occur when it is raining (MoT, 2008)



Comparisons made between:

- Dry day (well-lit) vs dry night (dark)
- Before vs after delineation interventions
- Wet vs dry

Key driver behaviour measures:

- Speed and Headway (TIRTL)
- “Hands-on” (with observers)

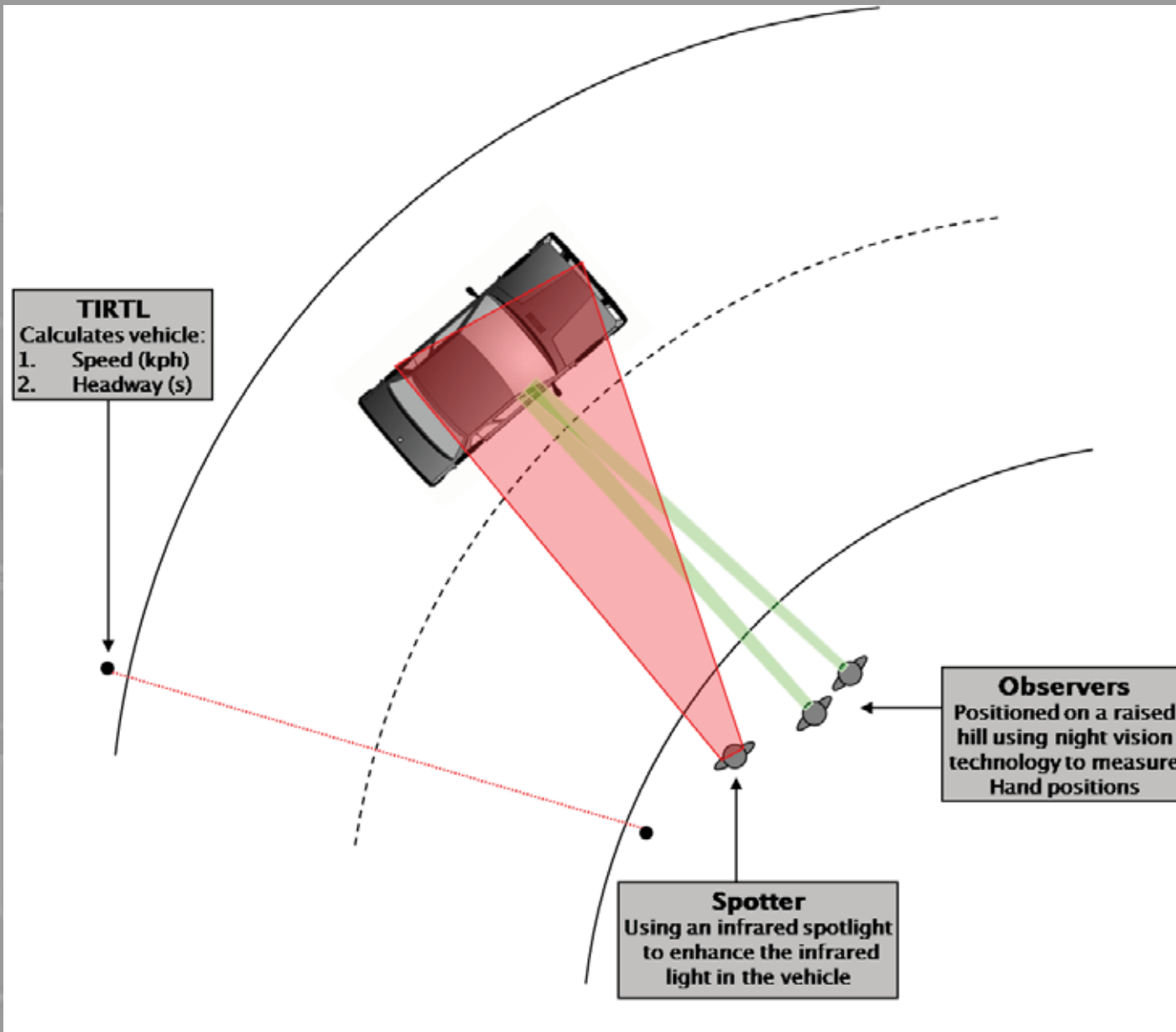


Key question:

Can improved markings demonstrate a shift to the pattern of driving seen in dry, daytime conditions?



Our experiment: Application to delineation





Generation 2 Night Vision Goggles



Hand-held infrared spotlight



Adapting to Night Conditions

Kaitoke SH2 site findings:

- 100kph speed zone, bright roadmarkings (RI 220)
- No detectable difference between night and day conditions

Hypothesis 1: This is because the roadmarkings are performing at a level that replicates a daytime visual environment?

- Poor roadmarking sight (RI 38): 70kph speed zone
- Still found no difference between night and day



Hypothesis 2: There is a change in the profile of drivers during night conditions.

- Urban control sight: Full street lighting and 50kph speed zone
- Found that older drivers were less likely to drive at night compared with day
- Older drivers are more likely to adopt a two hand driving profile



Potential benefit of roadmarkings:

- Greater social inclusion for older drivers?
- Motivation for night driving avoidance (poor visual environment vs no need to drive at night)?



Condition 1: Day vs Night Demography



Road markings before (38RI)



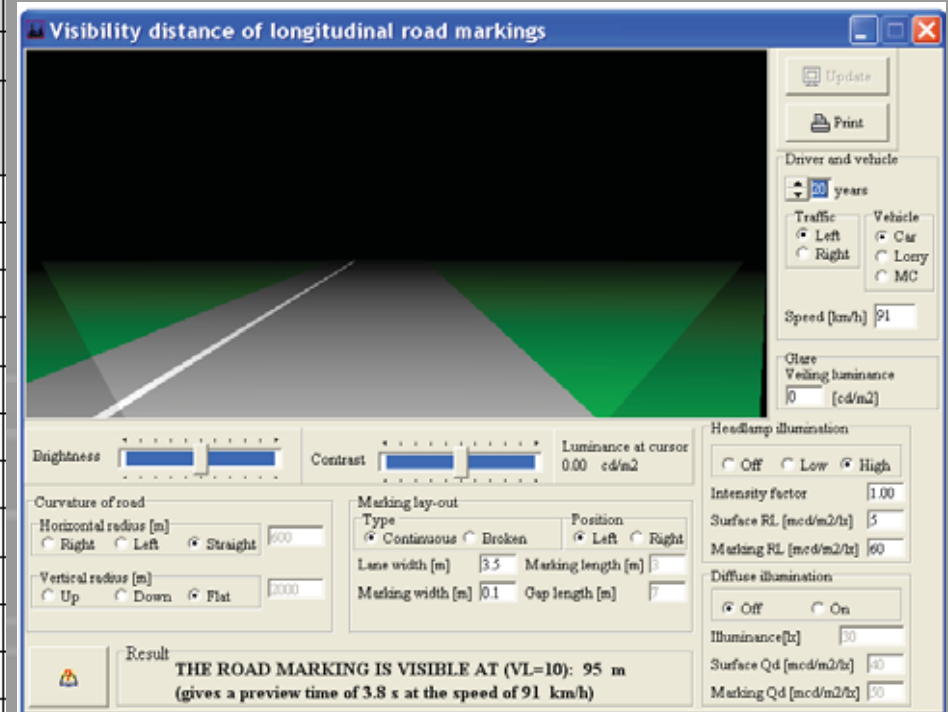
Road markings after (142RI)



Condition 2: Brighter road marking intervention

Average sight distance improvement of 1.6 seconds (or about 35m)

		Alexander Rd (vehicles travelling at 71kph)			
		Before upgrade (38RI)		After upgrade (142RI)	
Headlight condition	Driver age group	Preview time (s)	Sight distance (m)	Preview time (s)	Sight distance (m)
Dipped headlights	16-25	2.8	65	4.1	91
	26-35	2.8	62	4.1	90
	36-45	2.8	62	4.0	89
	46-55	2.7	60	4.0	88
	56-65	2.6	58	3.9	86
	66-75	2.3	51	3.6	79
Full headlights	16-25	3.1	68	5.3	117
	26-35	3.0	66	5.1	114
	36-45	2.9	65	5.0	112
	46-55	2.8	62	4.8	107
	56-65	2.7	60	4.6	102
	66-75	2.3	52	4.0	89
	76-85	1.8	39	3.0	66



Condition 2: Visibility Distance Calculations

Hand positions at night

- Before and after results detected a change towards more comfortable driving conditions.
- 37% improvement towards daytime driving conditions

Speed and headway at night: No detectable statistical change

- Speed: $M = 75.5\text{kph}$ before and $M = 74.2\text{kph}$ after
- Headway: $M = 2.0\text{s}$ before and $M = 1.9\text{s}$ after

Alexander Rd night		Hand position		Total count
		Other	Two hands	
Before upgrade (38Rl)	Observed count	101	45	146
	Expected count	108.23	37.77	146
	% hand position	69.18	30.82	100
	Adjusted residual	-2.07	2.07	
After upgrade (142Rl)	Observed count	91	22	113
	Expected count	83.77	29.23	113
	% hand position	80.53	19.47	100
	Adjusted residual	2.07	-2.07	
Total count		192	67	259



Condition 2: Brighter road marking results

- Rainfall was very heavy (10.2mm/hr)
- Limitations in wet conditions
 - Inter-rater reliability was lower in wet conditions (84.5%)
 - Wet night condition was not tested (night vision limitation)
 - Headway measurement accuracy issues



Wet weather delineation presents a challenging driving environment:

- 53% of drivers with two hands on the top half of the steering wheel
- Average vehicle speeds were significantly lower (by about 9kph)



Dry conditions



Wet conditions



Site view – wet twilight

1. Affordability of roadmarking solutions in dry night conditions
2. Wet delineation is the most difficult driving environment where roadmarking solutions could play a critical role here
3. “Hands-on” as a more sensitive measure (relative to speed or headway)



The hand position measure can be used in the evaluation of any before-after design to any visual or tactile environmental feature in the road corridor including:

- **Perceptual countermeasures** e.g. roadmarking narrowing and other perceptual speed interventions
- **Alterations to sight lines** e.g. edge marker posts or cats eyes



Transverse road markings – Before and after Andrew Martindale