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

Jared Thomas, Darren Walton, Stephen Murray, Martin Fourie

Central Laboratories, Opus International Consultants
Health Sponsorship Council
University of Canterbury
Contact: jared.thomas@opus.co.nz
• 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:
• 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:
Hand positions

The diagram shows the distribution of hand positions during driving. It indicates that the most common hand position is with one hand on the wheel, followed by no hands and then two hands. The data is represented in a bar chart.
• 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?
Night Conditions Procedure

**TIRTL**
Calculates vehicle:
1. Speed (kph)
2. Headway (s)

**Observers**
Positioned on a raised hill using night vision technology to measure hand positions.

**Spotter**
Using an infrared spotlight to enhance the infrared light in the vehicle.
Adapting to Night Conditions

Generation 2 Night Vision Goggles

Hand-held infrared spotlight
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 2: Brighter road marking intervention

Road markings before (38RI)  Road markings after (142RI)
### Condition 2: Visibility Distance Calculations

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

#### Table: Visibility Distance of Longitudinal Road Markings

<table>
<thead>
<tr>
<th>Headlight condition</th>
<th>Driver age group</th>
<th>Before upgrade (38RI)</th>
<th>After upgrade (142RI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Preview time (s)</td>
<td>Sight distance (m)</td>
</tr>
<tr>
<td>Dipped headlights</td>
<td>16-25</td>
<td>2.8</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>26-35</td>
<td>2.8</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>2.8</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>2.7</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>56-65</td>
<td>2.6</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>66-75</td>
<td>2.3</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>76-85</td>
<td>1.8</td>
<td>39</td>
</tr>
<tr>
<td>Full headlights</td>
<td>16-25</td>
<td>3.1</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>26-35</td>
<td>3.0</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>2.9</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>2.8</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>56-65</td>
<td>2.7</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>66-75</td>
<td>2.3</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>76-85</td>
<td>1.8</td>
<td>39</td>
</tr>
</tbody>
</table>
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: $M = 75.5$ kph before and $M = 74.2$ kph after
- Headway: $M = 2.0$ s before and $M = 1.9$ s after
Condition 3: Wet vs Dry Site

- 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)
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