



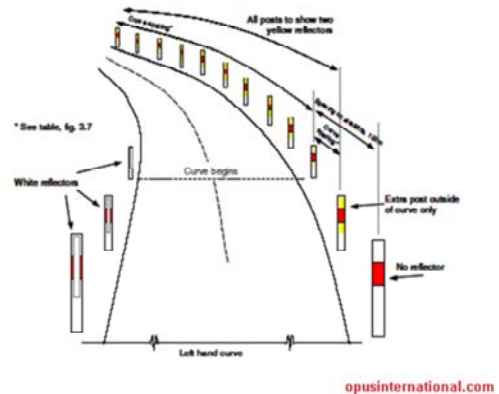
- 73% of fatal crashes occur on rural roads
- Of these almost half occur from loss of control or run off road (more prevalent at curves)

## Why look at this? Best Value Delineation

- The visual environment, technology, and driver behaviour
- RTS5 – Existing Rural Delineation Guide
- One Network Road Classification
- Update to allow for:
  - new insights
  - new materials

Guidelines for rural road  
marking and delineation  
RTS 5

Figure 3.8: Typical layout of edge marker posts



Best value treatments to help drivers navigate our roads – older/tourist/fatigued  
Technology advances – Many different solutions on lower volume roads  
Preview time of the road ahead – make better decisions  
ONRC – Maximise resource Re exposure and traffic volume

## · Background on the delineation hierarchy

- Our delineation hierarchy typically uses (in order):
  - Edge marker posts (EMPs)
  - Centre markings
  - Edgeline markings
  - Raised Reflective Pavement Markers (RRPMs or “cats eyes”)
  - **Wider or specialist markings**



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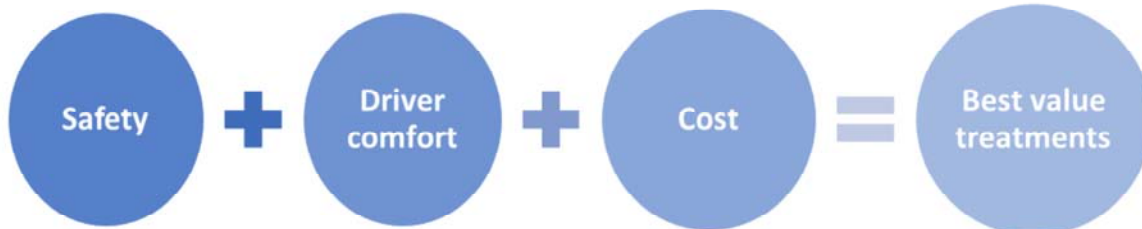
### Balance

- Prioritisation of delineation needs based on a hierarchy
- Targeted delineation/Consolidation/Wet conditions

### Treatment

## · What did we do?

- Took a balanced approach



- **On-road trials:** Based on the evidence, we focussed on:
  - Targeted delineation;
  - Consolidation;
  - Update on wet weather materials
- **Updated Rural Delineation Hierarchy:** Consistent minimum standards (based on new and existing evidence)

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### Balance

- Prioritisation of delineation needs based on a hierarchy
- Targeted delineation/Consolidation/Wet conditions

targeted delineation (to assist drivers in intuitively signalling more difficult parts of the road network)

consolidation (where one configuration with a new product might replace two traditional products), and

better delineation in rain, which is arguably a common poor visibility environment (where crashes are over represented).

## Four On-Road Trials

Trial	Purpose
Targeted Edge Marker Posts (EMPs)	<b>Targeted delineation</b> To test whether this helps drivers intuitively adapt to a change in risk
Baseline: Raised Reflective Pavement Markers (RRPMs) beside traditional edgeline roadmarkings	<b>Device consolidation and Wet weather delineation</b> To produce an improved visibility environment for drivers in wet conditions.
ATP edgeline roadmarkings (no RRPMs)	
Structured edgeline markings (no RRPMs)	



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The treatment conditions provided variation in:

- delineation height
- retroreflectivity
- a continual line vs multiple individual point sources

## · **Background: The use of targeted delineation - Edge-marker posts (EMPs)**

- Removing EMPs on straight sections of road
  - Alignment with Self-Explaining Roads
- Lundkvist (2014) – Finland/Sweden Trials:
  - better speed adaptation at sites with curve only EMPs
  - BUT ... tension with reported user comfort



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## · NZ Driver Feedback

- Public outrage over edge marker post removal (Loss Aversion)
  - “...getting a roasting over its removal of road marker posts, and is being accused of putting cost-cutting ahead of safety.” (Stuff, August, 2012)
- Surveys ran suggested that there is typically a “more is better” philosophy:
  - “*The more markings, the safer the drive. Any lessening of road marking on any road is a backward step.*”
- Driver perception of value via drivers willingness to add to journey time:
  - better delineation at night = 10% added journey time
  - better delineation in wet = 13% added journey time (using a 25 min trip example)



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Small sample, but there could be a saving of up to **\$98 million dollars** in social costs (assuming about 30million hours on rural roads)

## · Edge marker posts (EMPs)

- Unique new finding:
  - Removing EMPs from straight stretches of road had an unexpected increase on speed at night
  - Some evidence of increased risk perception at the curve
- Conclusion:
  - EMPs deliver critical guidance in night-time driving
  - Evenly spaced, and hence, enhance judgement of speed and distance
- Supported by driver feedback:
  - *"I think they still need to be used on the straights to enable you to measure distances."*
- Recommendation
  - EMPs are cost-effective (about 3:1 ratio on straights)
  - Should be used on **all road hierarchies** (on straights and curves)



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## · Background: Wet weather and delineation



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- Crashes
- Driver cognitive workload is higher in rain (e.g. Eye Blinks: A proxy measure of workload – are 3.5 times higher in rain)
- 37% reduction in average preview distance in daytime rain conditions compared with daytime dry (Day = 4.9s to Wet = 3.0s)

## · Wet weather trials



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- SH 57 – Back road between Palmerston North and Wellington
- Moderate rainfall (compare like for like)
- Daytime only
- BUT still found significant changes

## Structured markings in wet conditions

- Structure marking findings:
  - Increased speed in wet day conditions
  - But NOT beyond day dry conditions
- Conclusion:
  - Increased driver comfort due to improved visibility
- Recommendation:
  - Utilise specialist markings like this as a wet treatment solution

	Baseline		Structured markings	
Condition	Dry	Wet day	Dry	Wet day
Speed in kph (standard deviation)	89.87 (9.47)	84.95 (9.02)	89.73 (9.40)	<b>89.15</b> (9.65)

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- Moderate rainfall (compare like for like)
- Daytime only
- BUT still found significant changes

## · RRPMs with traditional markings in wet

- RRPMs findings
  - Provide a significant increase in speed (similar to structured marking)
- Conclusion:
  - Increased driver comfort due to improved visibility
- Recommendation:
  - RRPMs should be used as the first wet weather treatment (due to cost-effectiveness)
  - RRPMs are too critical to consider consolidation (based on an improved marking)

	Baseline		RRPMs		
Condition	Dry	Wet day	Dry	Wet day	Wet night
Speed in kph (standard deviation)	94.78 (7.46)	88.37 (7.71)	95.58 (8.14)	<b>93.99</b> (7.51)	<b>94.95</b> (9.10)

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## • **Audio-tactile markings in wet conditions**

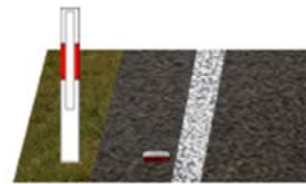
- Audio-tactile findings
  - No significant differences detected
  - Retroreflectivity in wet conditions was very high (BUT the baseline road marking also had excellent retroreflectivity)
- Conclusion
  - The visibility performance of audio-tactile markings in this study was inconclusive
  - NOTE: This is NOT evidence that ATP are not visually effective

	Baseline		ATP Markings		
Condition	Dry	Wet day	Dry	Wet day	Wet night
Speed in kph (standard deviation)	94.78 (7.46)	88.37 (7.71)	92.58 (7.59)	89.02 (7.54)	89.45 (8.16)

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## · Recommendations to make more of our best value solutions




- National guidance for consistent delineation treatments to **ALSO** support self-explaining road designs
- Account for weather, existing road surface, road users, and rapidly emerging technology when considering:
  - Use of new materials and the size/width of devices
- Customers value delineation, and delineation devices are effective. **The minimum thresholds for device use should be lowered.** For example:
  - Lowered thresholds for the use of point source devices (like RRPMs and EMPs)
  - Updating minimum road widths and traffic volumes for road marking solutions



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- Broad but also subtle changes within consistent design standards




## Draft Rural Delineation Hierarchy

<p><b>Level 1</b> All ONRC (including unsealed) All traffic volumes All road widths</p>	<p>Edge marker posts (EMPs)</p> 
<p><b>Level 2</b> All ONRC (sealed) All traffic volumes Min road width 5m</p>	<p>Centre line and Raised Reflectorised Pavements Markings (RRPMs)</p> 
<p><b>Level 3</b> Secondary AADT 500 Min road width 5.5m</p>	<p>Edgeline Markings and RRPMs</p> 

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Consider the conditions and the users when we apply delineation device hierarchies

## Draft Rural Delineation Hierarchy

<b>Level 4</b> Secondary/arterial AADT 1000 Min road width 6.0m	<b>Wider road markings</b> 
<b>Level 5</b> Regional/arterial AADT 2500 Min road width 6.0m	<b>Improved material Edgeline Marking - Structured or ATP marking</b> 
<b>Level 6</b> Regional/arterial AADT 3000 Min road width 6.0m	<b>Improved material Edgeline with existing edgeline</b> 

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# · Acknowledgement

The NZ Transport Agency provided the funding for this work

Our excellent steering group for providing direction

Safer Roads Conference 2017