

ROAD SIGN CONSPICUITY AND MEMORABILITY: WHAT WE SEE AND REMEMBER

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Introduction

The purpose of this experiment was to evaluate how drivers would respond to the use of static TW-7 signage without the use of preceding attenuating trucks, and to evaluate the conspicuity of the signs in terms of drivers cognitive awareness when approaching static warning, temporary and regulatory signs showing a left lane closure. This static layout is proposed as an alternative to the use of two advance warning attenuator trucks with flashing lights and keep-right sign (Figure 1 (a & b)). Eye tracking assesses where a driver is looking in general, and specifically focusing (fixate) their eyes (Figure 1 (c)), and considering that 90% of the driver's perception and cognitive reaction are through the use of their visual sensory motoric system, eye gaze and fixations locations are an important metric to determine sign perception. If humans do not fixate an object, it generally cannot adequately process the visual information, and therefore cannot accurately respond to visual stimuli if drivers "do not perceive it." It is analogous to not tasting or feeling something, but we may imagine what it might taste or feel like, without actually sensing it physically.

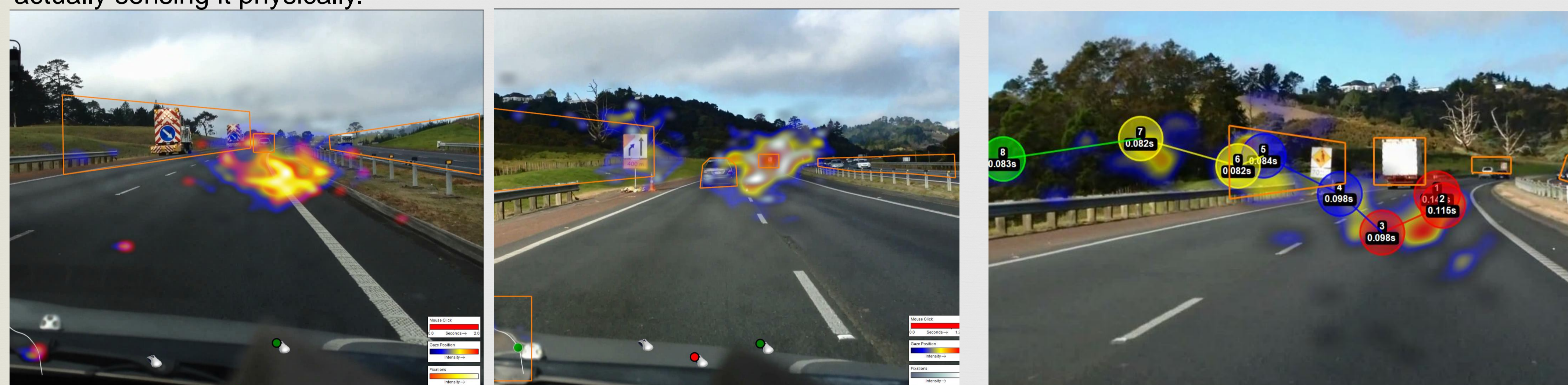


Figure 1: Gaze heat maps (a) near attenuator (b) around TW 7 sign (c) fixations overlaid on gaze heatmap

Methodology

This static layout was installed on SH1 between Albany and Silverdale. Figure 2 shows the typical sign types that were visible to the drivers during the experiment. Successive drive-overs recorded video from the drivers point of view from various lane positions. Video based analysis using SAFEye methodology presented the 4 videos to 32 subjects of which 24 were analysed.

Data Collection: Dash-mounted video camera 1920 x 1080 pixels and Miramatrix S2 eye tracker

Angle of View: The field of view spanned 45° (horz.) and 25° (vert.)

Analysis Metrics: Area of Interest (Figure 3) First time to fixation, Fixation duration, Pursuit fixation duration (figure 4.)

Table 1: Experimental design

Recording	Scenario	Left placement	sign	Right placement	sign
			2-lane		
Left-lane 1	SC3	yes		no	
Right-lane 2	SC4	yes		no	
			3-lane		
Left-lane 1	SC7	yes		no	
Right-lane 3	SC8	yes		no	

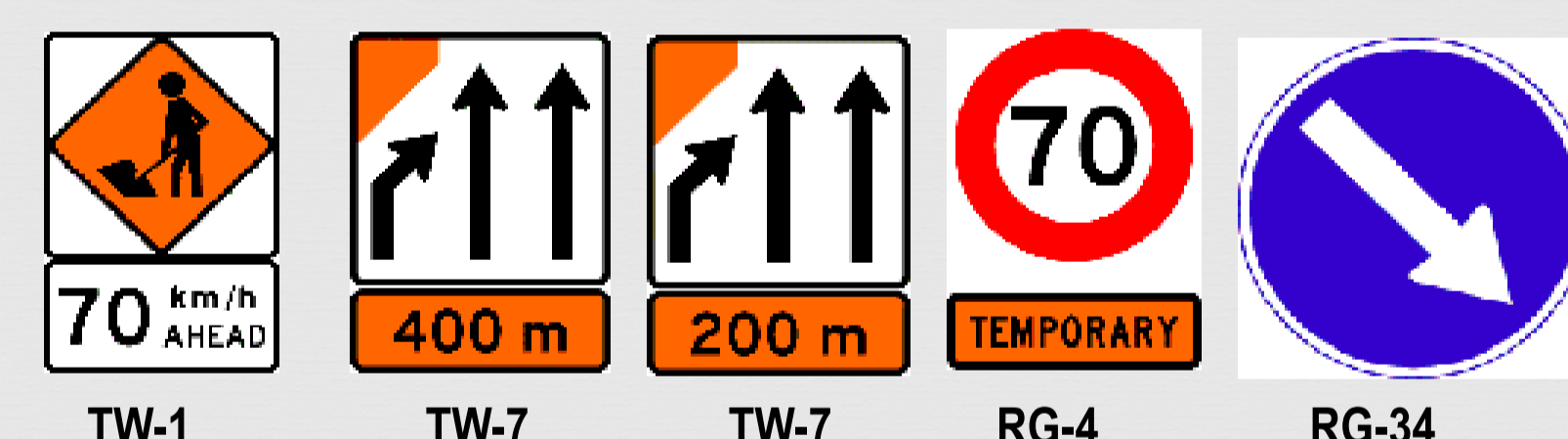


Figure 2 - Sign sequence

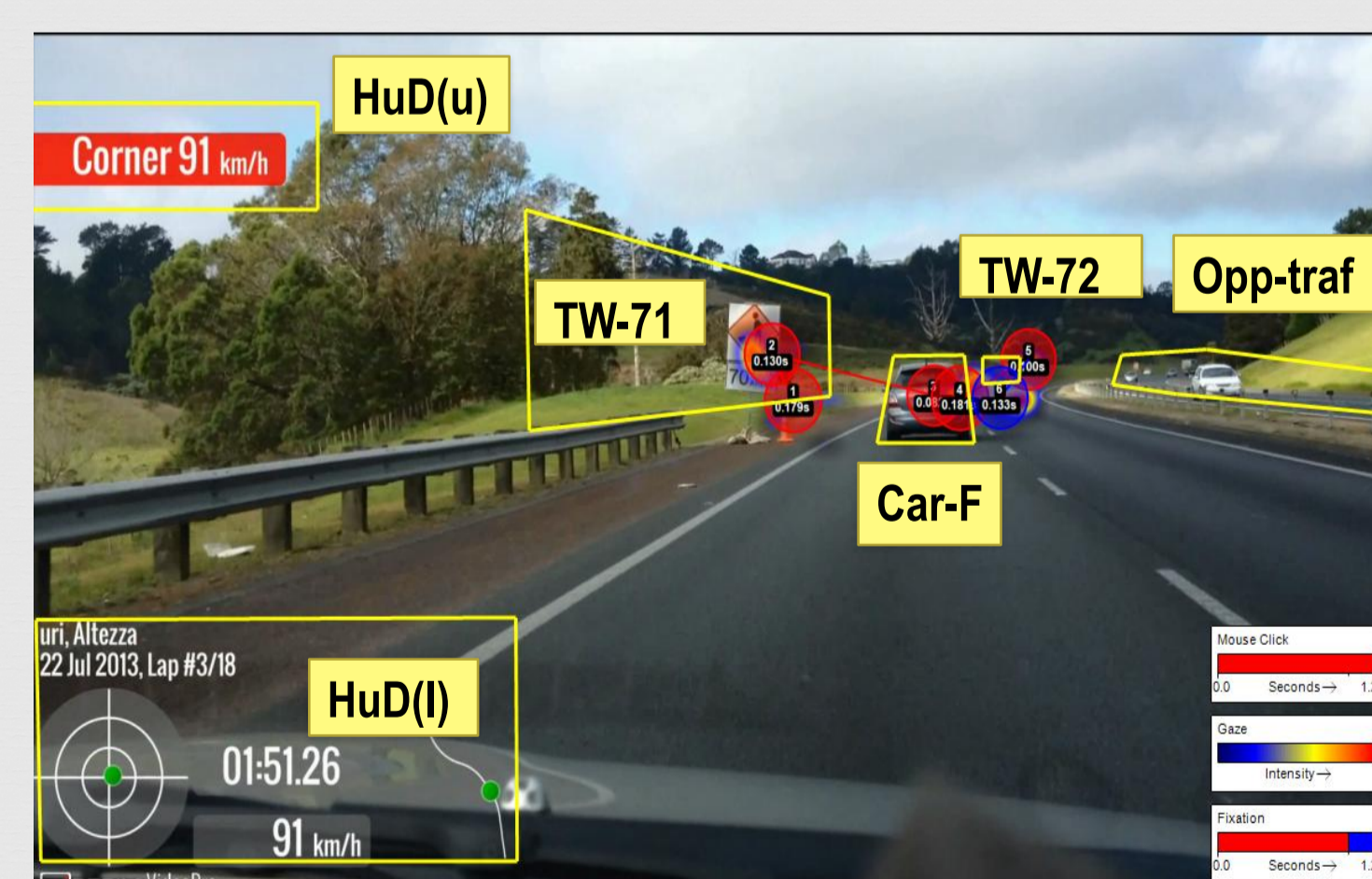


Figure 3: Areas of interest



Figure 4: Pursuit fixations

Analysis Results

- SC3 and 7 with lane changes attracted more fixations in the bottom central area
- SC 4 and 8 without the need for lane changes, recorded less fixations in the bottom parafoveal view. This is consistent with drivers focussing their field of view to the vanishing point

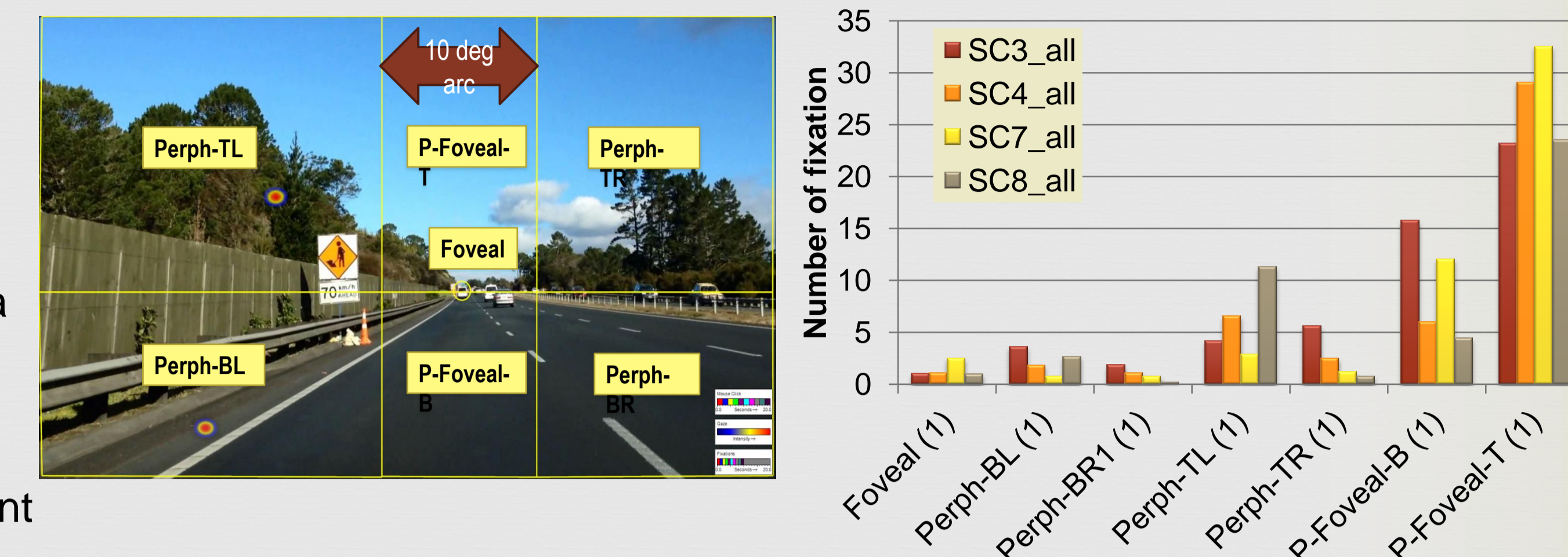


Figure 4: Mean fixation hits in Aoi

Table 2: Mean distance from sign

Time to first	Scenario	Gaze (m)	Fixation (m)
Lane 1 of 2	SC3	113	62
Lane 2 of 2	SC4	114	46
Lane 1 of 3	SC7	100	75
Lane 3 of 3	SC8	119	76
	Mean distance	111	65

- The mean distance from the TW-7 sign to the first gaze or fixation is 111m and 65m respectively.
- These findings are consistent with the way drivers detect signage by first noticing, but not necessarily processing a sign, around the 110 m mark, and then processing the detail around 60 m or 2 seconds later.

Table 3: Percentage that fixated the TW7 sign

Lane and position	Scenario	Time to first gaze or fixation TW-71 (TW-72)		Individual mean fixation duration (ms)	Total fixation dwell time on sign (ms)
		Gaze	Fixation		
Lane 1 of 2	SC3	100%	54% (71%)	155	360
Lane 2 of 2	SC4	92%	38%	148	380
Lane 1 of 3	SC7	96%	79% (96%)	149	450
Lane 3 of 3	SC8	88%	46%	174	390

- The majority of subjects (88-100%) gazed on the first TW-7 sign with little difference between scenarios. (Table 6)
- Fixations for SC3 and 7, which are from the left hand lane in which drivers have to change lanes due to the closure, only 54% and 79% respectively fixated the first TW-7(1) sign, but this increased to 71% and 96% respectively by the second TW-7(2) sign.

As a measure of explicit memory, subjects selected from a list of seven signs which signs (Figure 5) they recognised from the video sequence. Red bars indicate a sign that was absent from the video, whereas the blue bars indicate signs that were present in the video.

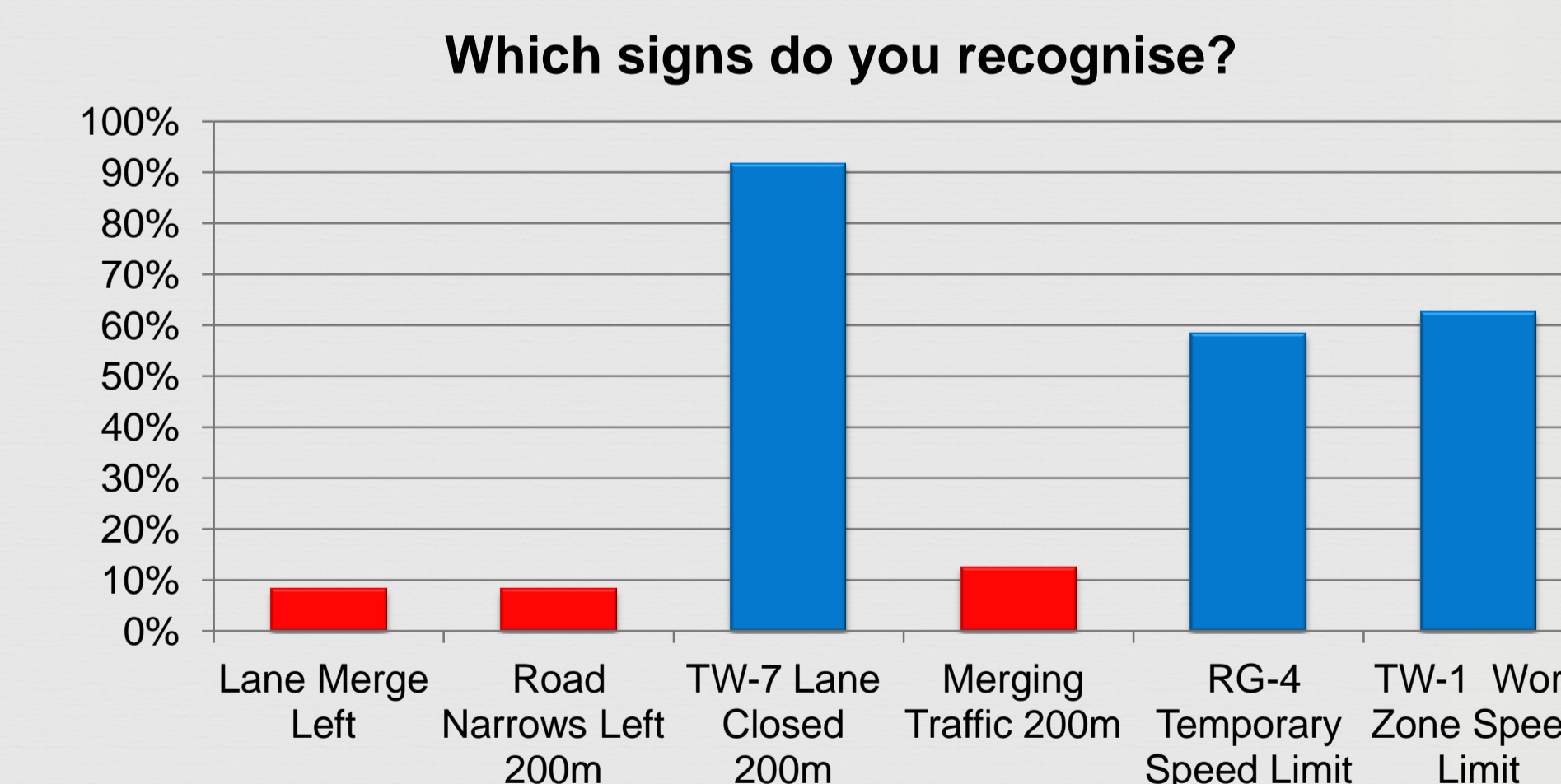


Figure 5: Sign recognition- Explicit memory

Conclusions

- Static lane closure appear to be effective in alerting drivers on the motorway to a lane closure ahead, without the need of additional attenuator trucks.
- Consistent with COPTTM, drivers first notice a static sign about 110m away, and only begin to process its message around 65m from the sign.
- Total mean pursuit fixation durations on the TW-7 sign is around 400ms which is consistent with findings by Underwood et al. (2002).
- 92% correctly identified the TW-7 sign to change lanes when presented with pictures of the sign from the video 32s after the end of the sequence