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Understanding industry views on the facilitators and barriers of using portable traffic control devices at roadworks

Ashim Kumar Debnath[1*], Ross Blackman[1], Sajani Siriwardene[1]

[1]Safe Future Mobility Research Lab, School of Engineering, Deakin University, Australia

*Email for correspondence (Ashim Debnath): ashim.debnath@deakin.edu.au

1 Introduction

Traffic controllers working near live traffic at roadworks are exposed to significant safety risks, with research showing that work zones can increase the likelihood of crashes by up to 33% (La Torre et al., 2017). To mitigate these risks, Portable Traffic Control Devices (PTCDs) such as barriers, variable message signs (VMS), portable traffic lights, and boom barriers are widely deployed worldwide, including in Australia (Finley, 2013; Austroads, 2021). While the Austroads Guide to Temporary Traffic Management (AGTTM) and state guidelines provide direction on their use, coverage of PTCDs in the guidelines is limited. This lack of detail can restrict the effective deployment of PTCDs and contribute to knowledge gaps among traffic management personnel.

The PTCD industry is evolving rapidly, with new technologies continuously being developed to enhance safety, efficiency, and usability (e.g., Almukhalfi et al., 2024; Trout et al., 2013). In response, the Austroads Innovative Temporary Traffic Management Device and Solution Assessment (AITDSA) scheme, launched in 2022, assesses new PTCDs and promotes consistency across jurisdictions. However, despite these initiatives, there remain challenges in adoption, particularly concerning cost, operational reliability, and awareness among facilitators.

Existing literature on PTCDs often emphasises vehicle speed as a primary measure of effectiveness, with most research originating from the United States, where work zone speed limits differ considerably from Australia (Savolainen et al., 2022; Debnath et al., 2013). Beyond speed control, Stop/Slow operations highlight further risks, as human flaggers face high exposure to traffic (Al-Bayati et al., 2023). Accordingly, their use is being phased out globally in favour of portable traffic lights and automated flagger assistance devices (Debnath et al., 2017). Cost remains a barrier to widespread PTCD adoption, with research suggesting that innovative devices may take several years to become cost-effective (Finley et al., 2014).

Despite growing innovation and regulatory support, limited knowledge about the range of PTCDs in use, and the factors influencing their uptake, remains a significant gap. Addressing these challenges is essential to improving temporary traffic management (TTM) safety and ensuring consistent adoption of effective PTCD solutions. To address this significant gap in the literature, this paper aims to retrospectively review the challenges faced by PTCD facilitators to increase the use of PTCDs and propose recommendations to increase the uptake of the use of PTCDs.

2 Methodology

A series of industry consultations (n=12) in a semi-structured focus group discussion (FGD) setup, followed by an online survey (n=42), were undertaken with a total of 54 representatives

from different traffic control companies and local/regional government agencies in New South Wales (NSW).

The collected data from the FGDs were analysed using a mixed analysis approach of thematic analysis and quantitative analysis. Following descriptive analysis of the survey data, an ordered probit regression model was calibrated to further examine the reliability of PTL and portable boom barriers as alternatives for human flaggers. The ratings provided by participants for PTL and portable boom barriers on a scale ranging from very reliable to not reliable were modelled in the regression model as a function of different characteristics of the participants (see Table 1 for a list of the explanatory variables).

Two separate models were calibrated for PTL and portable boom gate to identify how employment characteristics of industry workers influence the perception of reliability of alternative PTCDs for replacing human flaggers.

2.1 Participants

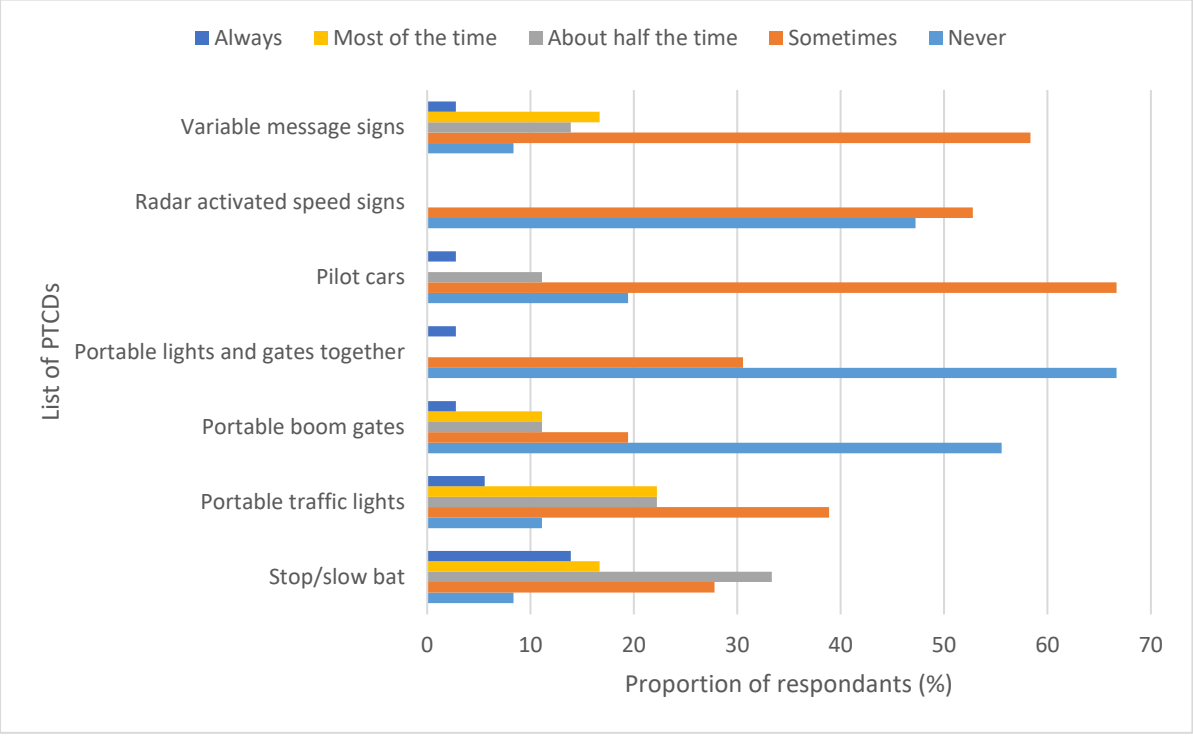
Among the 42 participants who completed the online survey, 76% were male and half of them had more than 10 years of experience in temporary traffic management. Two-thirds of the participants worked as contractors, and a similar proportion were operations managers or site supervisors. Roughly equal proportions of participants had experience of working in urban, rural, and both settings. About 90% reported using PTCDs in their work.

3 Main findings

3.1 Facilitator views on current PTCDs

Based on the FGDs, a list of seven PTCD types was developed for inclusion in the online survey. Survey respondents were asked to indicate how frequently each device is used in their operations. The results are presented in Figure 1.

Figure 1: Frequency of usage of PTCDs



The most commonly used PTCD was the stop/slow bat. With the simplicity associated with the device, around 92% of the respondents noted that the stop/slow bat is being used at least 'Sometimes', with 14% 'Always' using the stop/slow bat. These results suggest that Australia is falling behind in removing human traffic controllers from roads for their safety.

To further evaluate facilitator perceptions, the responses were analyzed using an ordered probit model. PTLs and boom gates were selected for this analysis because they are the two devices most commonly recognized as PTCDs in Australian guidelines (e.g., Austroads, 2021; TfNSW, 2022; TMR, 2023). These devices were also identified by respondents as the most effective alternatives to human flaggers. The regression results, including coefficient values (beta) and their statistical significance at the 90% confidence level, are presented in Table 1.

Table 1: Ordered Probit model results

Characteristics	Description	Beta coefficient	
		PTL	Boom gate
Experience in TTM industry	Up to 2 years	1.25	-0.20
	3-5 years	2.22*	-1.48*
	6- 10 years	1.36*	-0.94*
	Over 10 years	Ref	Ref
Gender	Female	0.54	0.89
	Male	Ref	Ref
Employment category	Local government	0.28	-0.14
	Other	-2.00*	-0.29
	Contractor	Ref	Ref
Work role	Traffic controller/ TGS designer	0.50	1.11
	Other	1.05*	-0.88
	Operations manager/ site supervisor	Ref	Ref
Working hours	Less than 10	0.78	-
	10- 30 hours	-1.14	-
	More than 10 hours	Ref	-
Working environment	Metro/Urban	-	-1.88
	Rural/ Regional	-	-0.67*
	Both Urban and Regional	-	Ref
Frequency of PTCD usage	Never	0.87	-
	Less frequently	1.23*	-
	More frequently	Ref	-
Summary statistics			
	Log-likelihood (at model)	-24.95	-32.77
	Log-likelihood (at zero)	-34.63	-41.11
	Likelihood ratio test results	19.38 (12 df)	16.69 (10 df)
	Akaike Information Criteria (AIC)	77.89	89.54

- Did not remain in the most parsimonious model; * Significant at 90% confidence interval.

The regression results show that perceptions of PTCD reliability are shaped mainly by experience, job role, and work location. Less experienced traffic management personnel tended to view PTLs as less reliable and portable boom gates as more reliable than human flaggers, compared with those having over 10 years of experience. Job role also mattered, where company owners, regional managers, and training course designers were more likely than site supervisors or operations managers to rate PTLs as less reliable. In addition, infrequent PTL users were more likely to perceive them as unreliable.

3.2 Barriers to greater use of PTCDs

The FGDs identified several barriers to PTCD adoption in work zones, including technical problems, logistical and manual handling challenges, high costs, and resistance to change. Technical issues were the most common concern, with frequent device malfunctions such as tilt sensor failures, synchronization delays, and poor maintenance leading to operational disruptions. Logistical burdens, including tracking, transporting, and installing heavy equipment, further discouraged use, particularly for short-term works.

High purchase and operating costs were another major barrier, with clients often unconvinced of the net benefits, and smaller companies reluctant to invest in devices that are not used regularly. Finally, insufficient training and the fast pace of technological change contributed to uncertainty and resistance among traffic controllers.

4 Discussion

PTCDs are increasingly used worldwide to improve safety at roadworks, but Australia lags in adopting new technologies. Although guidelines mandate PTCD use on roads with speed limits above 45 km/h (Austroads, 2021), reliance on human flaggers remains common. Traffic controllers often perceive PTCDs, such as portable traffic lights and variable message signs, as less reliable than traditional methods, particularly among less experienced workers. This highlights the need for targeted education and training to build trust in PTCDs and ensure correct operation.

The effectiveness of PTCDs is also constrained by limited training opportunities and outdated guidelines, which list only a few devices without clarifying their broader applications. This restricts awareness of PTCD benefits and makes the introduction of innovative devices difficult. Stakeholders have suggested adding scenario-based guidance to the Austroads framework to improve clarity and practical use.

To encourage wider adoption, several measures are recommended. Financial incentives, such as tax benefits for companies investing in PTCDs, could ease the cost burden, particularly for smaller firms. Mandatory training programs should be embedded in licensing requirements to improve operator confidence and reduce scepticism. Standardising guidelines and performance expectations across states would also increase consistency and trust.

Manufacturers can support adoption by integrating PTCDs with intelligent transport systems, improving power reliability through solar and battery innovations, and reducing maintenance needs. These technological improvements, combined with government support, industry collaboration, and awareness campaigns, could significantly accelerate PTCD adoption in Australia, leading to safer and more consistent temporary traffic management practices.

5 Conclusions

This study examined the use of PTCDs in Australia, where adoption remains limited compared to other countries. Through a literature review, focus groups, and a survey of 54 traffic control companies, several barriers were identified, including ambiguous guidelines, concerns over reliability, and limited awareness. Participants highlighted the need for clearer and more specific guidelines on device use, improved training for traffic controllers, greater awareness of PTCD benefits, and financial incentives to support investment. Addressing these barriers could encourage wider and more consistent adoption of PTCDs, reducing reliance on human flaggers and enhancing work zone safety.

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