

The Application of Theory of Planned Behaviours in Predicting Intentions to Speed: Roadwork Zones Versus School Zones

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Abstract: Roadwork and school zones are high risk areas for workers and other vulnerable road users due to the high density of pedestrians, altered road environment and conditions in combination with unsafe behaviours of drivers. Despite a range of government and road safety stakeholder initiatives to educate and discourage illegal driving behaviours in roadwork and school zones, evidence suggests that speeding in these zones is still prevalent. In aiming to better understand illegal and risky driving behaviour in these zones, the current study utilised the Theory of Planned Behaviour as a framework to investigate driver attitudes towards speeding in both school zones and roadwork zones using a sample of 428 respondents. The results of the online study indicated that drivers have safer attitudes in relation to speeding within school zones in comparison to speeding within roadwork zones. Results also indicated that attitude and subjective norms were significant predictors of intention to speed in both zones. However, perceived behavioural control only significantly predicted intention to speed in school zones. This effect was not observed in roadwork zones, suggesting that different mechanisms are in play dependent on the road context. This research has addressed a key gap in the driving safety literature in gaining insight into the opinions of Australian drivers and risky driving behaviour through roadwork and school zones. The results of this research and the implications for road safety stakeholders and future initiatives are discussed. Furthermore, the implication of using the Driver Social Desirability scale in traffic safety literature is also discussed.

Keywords: Speeding, Work Zones, School Zones, Theory of Planned Behaviour, Driving Attitudes, Driving Intentions, Driver Social Desirability

1. Introduction

Previous research has indicated that roadwork and school zones are high risk areas for workers and other vulnerable road users due to the high density of pedestrians, altered road environment and conditions in combination with unsafe driving behaviours [1-3]. In efforts to increase safety in roadwork and school zones, reduced speed limits apply. However, drivers still have a propensity to speed. For example, in Queensland (a state in Australia), the state's road authority reported a total of 38,930 speeding infringements issued to drivers speeding through school zones [4]. The data also showed that more than 60% ($n =$

23,000) of those drivers have exceeded the posted speed limit by more than 13km/h [4]. Speed contributes to crash risk and severity of injury sustained in the event of crash, and injury sustained from a crash is especially dangerous for younger children [5, 6].

Roadworkers are also in a vulnerable position in their work environment. Within roadwork zones, a total of 3,665 "near misses" (whereby no physical harm resulted) were recorded by a private contractor managing a roadwork zone over a 4-year period [2]. Due to the difficulties and inconsistencies with data recording in roadwork zones, it is

believed that incidents and resultant injuries are often underestimated. For instance, Blackman *et al.* [7] found that, for the period of July 2009 to March 2013, workplace health and safety records recorded a total of 820 crashes in the roadwork zones in Queensland while the police-reported crash database only recorded 128 crashes. Unfortunately, speeding through both roadwork and school zones is not unique to Australia. Speeding is one of the most frequently reported risky driving behaviours in roadwork and school zones in other industrialised countries (e.g., US and Canada) [6, 8, 9].

1.1. Dangerous Driving Despite Interventions in Place

Given the vulnerabilities of the workers and children in these road contexts, unsafe driving in roadwork and school zones is a serious concern. Unfortunately, these behaviours seemed to be prevalent, despite government and road safety stakeholder initiatives to educate and discourage illegal and unsafe driving behaviour in general road contexts and particularly within these specific settings. For instance, within school zones, a variety of initiatives have been introduced to discourage speeding behaviours. These interventions include an introduction of engineering controls such as "Slow for SAM" [10] along with enforcement in line with the National Road Safety System key pillars [11]; improvements to consistency of signage and speed restriction times, which include automated flashing lights, across localities to reduce confusion for drivers [12, 13]; and combinations of mass media communication within both the community [14, 15] and directly with parents [16, 17].

Along with initiatives in school zones, similar interventions have been introduced within roadwork zones, such as variable message signs, improving the visibility of the workers and visible active or police enforcement [18, 19].

Available data and research regarding initiatives to improve safer driving in road work zones suggest that existing roadwork control measures can lack effectiveness, with a high prevalence of risky driving behaviours being identified through observational studies [20-22]. While enforcement is considered the most effective method to reduce unsafe driving behaviours, resources are often scarce, and it has been found to exert a limited influence outside of the enforcement areas [23]. Furthermore, drivers report that they recognise the increased crash risks due to their risky behaviours but are rarely deterred by this knowledge [24]. For example, Stephens *et al.* [24] found that some drivers report they break the law while driving if they believe they can get away with it, while many drivers justify their risky behaviours based on their belief that there is no reason to adhere to changed traffic conditions if workers are not visible [7, 22, 25].

In addition to these interventions, previous research indicates that community attitudes support reduced speeds in highly pedestrianised areas such as school and roadwork zones. For example, a recent Australian community attitude survey found that 88% of respondents agree or strongly agreed with the 40km/hr reduced speed limits in "high pedestrian

areas" [26]. However, despite strong community attitudes supporting these reduced speed limits in combination with initiatives such as those listed above, drivers continue to engage in unsafe driving, compromising the safety of vulnerable road users around school and roadwork zones.

1.2. Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) provides a framework for better exploring and seeking understanding the influences on speeding behaviour in both school and work zones. TPB has been widely adopted in road safety literature due to its ability to successfully explain substantial variance in linear models regarding people's intentions to engage in specific driving behaviours [27]. TPB draws on the influence of attitudes, subjective norms and PBC toward the intention to perform a behaviour [28]. The attitude component reflects positive or negative beliefs about the behaviour; subjective norms represent social factors, such as the person's belief about how people important to them would behave or would wish them to behave in the given scenario; and PBC relates to beliefs about a person's self-efficacy and volition to perform the behaviour.

Previous studies have looked at the relationship between TPB variables and speeding [29-31], with some studies reporting up to 47% of the variance in intention to speed being explained by TPB variables [29]. However, these studies have only looked at the application of TPB in explaining speeding in general road contexts (e.g., urban areas). To the authors' knowledge, limited published studies have applied TPB (or related constructs) in understanding speeding in roadwork and school zone contexts.

A qualitative study conducted by Soole *et al.* [25] indicates that different attitudes exist dependent on the road environment, which may consequently impact someone's speed choice. In their study, some participants suggested the need to distinguish between 40km school zones and 40km/h roadwork zones. During the interviews, participants reported to very rarely (and almost never) intentionally speeding in school zones. However, many reported regularly speeding in 40km/h roadwork zones, "particularly when they perceived that the level of work being performed was minimal" (p. 5). This study suggests that TPB can be a useful framework to guide the exploration and understanding of the different factors that could contribute to speeding intentions in both school and roadwork zones.

1.3. Driver Social Desirability

Social desirability bias refers to an individual's tendency to portray themselves in a favourable light [32]. Previous research demonstrates using anonymous responses does not eliminate this effect [33]. Therefore, a measure of driver social desirability such as The Driver Social Desirability Scale (DSDS) [34] is an important consideration in all self-report traffic psychology research. Despite the importance of including the socially desirable responding bias in driving behaviour research, many studies have not included measures

of this construct. Therefore, the current study will include the DSDS as a control to assess its impact on exploring intention to speed in roadwork and school zones.

2. The Current Study

The TPB will be utilised as a framework to guide this research which aims to better understand influences associated with driver behaviour in school and work zones. This research will specifically investigate driver attitudes towards intention to speed in both school zones and roadwork zones. It will also utilise components of TPB, such as attitudes, subjective norms and perceived behavioural control as indicators of driver intentions to speed within both school and work zones. To the authors' knowledge, this study is the first study that investigates risky driving behaviour and comparisons between both school and road work zones within the Australian driving context. The following hypotheses were tested:

Hypothesis 1: It is predicted there will be significant differences in driver attitudes toward intention to speed between roadwork and school zones.

Hypothesis 2: After controlling for demographic variables, driving-related variables, and social desirability, the TPB variables (i.e., attitudes, subjective norms, and PBC) will be significant indicators of intentions toward speeding within roadwork and school zones.

3. Method

3.1. Participants

Participants were recruited via snowball sampling through advertising on social media, a road safety news blog site, and a first-year psychology course (offered course credit for their time) to undertake an online survey. Participants were advised that to be eligible for this study they had to currently hold or have previously held a driver's licence and complete the full survey. Responses were anonymous.

A total of 428 participants responded to the survey; with 95 participants excluded due to ineligibility, leaving 333 participants for final analysis who were aged between 17 and 83 (39.6% male, 60.4% female; $M_{age} = 37.43$, $SD_{age} = 16.98$). Approximately 77% ($n = 254$) of participants reported driving up to 20 hours per week, while approximately 89% ($n = 296$) reported driving mostly in a city or significant urban setting.

3.2. Procedure

An ethics approval was obtained for this research (GU ref no.: 2020/394). Participants, indicating that they were eligible to undertake the online survey were presented with definitions and examples of each of the three behaviours being investigated. A series of subscales, adapted from Castanier et al. [35], measuring participant attitudes; subjective norms; PBC; behavioural intentions; and social desirability was then completed by participants in relation to

the three driving behaviours. Each participant completed all questions related to one driving context prior to answering questions related to the following driving context, with the order of each context presented randomly per participant by the survey software to minimise potential fatigued responding effects.

3.3. Measures

3.3.1. Demographics

Age and Gender. Participants were asked their age in years and were asked to report their identified gender, coded (0) *male*, (1) *female*, or (2) *other*.

Driving Frequency. Participants were asked to choose the response from a list which best matched their average time spent driving per week over the past 12 months, coded (0) *none*, (1) *1-10 hours*, (2) *11-20 hours*, (3) *21-30 hours*, or (4) *more than 30 hours*.

Drive Setting. Participants were asked to choose the response from a list which best matched the driving environment they most frequently drove in over the past 12 months, coded from least to most dense; (1) *rural/remote*, (2) *regional*, (3) *significant urban*, or (4) *city*, with each response anchor containing an example for guidance.

Recent Past Behaviours. Participants were asked how frequently they engaged in each behaviour in the previous six months, coded (1) *never* to (7) *always*.

3.3.2. Theory of Planned Behaviour Variables

TPB subscale measures were derived from road violation research by Castanier et al. [35]. Minor word adjustments were made to suit the roadwork and school zone driving contexts and specific behaviours of interest. Feedback for questions was sought from several content experts for face validity prior to recruitment of participants. One subjective norm item required wording adjustments, resulting in reverse coding to remove double-negative grammar.

3.3.3. Attitudes

Participants were asked to report their beliefs about speeding within each context (e.g., "I believe speeding through a roadwork/school zone is...") using seven semantic difference scales consisting of negative/positive, bad/good, harmful/beneficial, useless/useful, foolish/wise, unpleasant/pleasant, and unsatisfactory/satisfactory. These were scored (1) for *negative beliefs* to (7) for *positive beliefs* about the behaviour. A mean score of the seven items was calculated, where a lower score would suggest the participant disapproved of the speeding behaviour and a higher mean score would suggest the participant approved of the speeding behaviour. Reliability was excellent for both contexts (roadwork $\alpha = .96$; school zone $\alpha = .91$).

3.3.4. Subjective Norms

Participants were asked three questions regarding what people important to them would think about speeding within each context (e.g., "People important to me would want me to speed through a school zone"). Each item was scored (1) *strongly disagree* to (7) *strongly agree*. A mean score was

calculated for each behaviour within each driving context, with lower scores suggesting a person important to the participant would not support or encourage the risky behaviour, while higher scores suggested a person important to the participant would support or encourage the risky behaviour. Initial subjective norm reliability was poor (roadwork $\alpha = .59$; school zone $\alpha = .38$), with principal components analysis indicating deletion of one item would improve reliability for all behaviours within both contexts. Final reliability remained poor following deletion of this item (roadwork $\alpha = .65$; school zone $\alpha = .55$).

3.3.5. Perceived Behavioural Control

Participants were asked three questions to determine how much control they believe they have over speeding in each driving context (e.g., “Whether or not I speed through a roadwork zone/school zone is completely under my control”), scored (1) *strongly disagree* to (7) *strongly agree*. A mean score of the PBC questions was calculated for each risky behaviour and driving context, with lower scores indicating the participant felt less control, while higher scores indicated more control perceived by the participant over each risky behaviour. Initial PBC reliability was poor (roadwork $\alpha = .60$; school zone $\alpha = .61$), with reliability analysis indicating deletion of one item would improve reliability for all behaviours within both contexts. Final reliability was acceptable for research following deletion (roadwork $\alpha = .76$; school zone $\alpha = .76$).

3.3.6. Behavioural Intentions

Participants were asked four questions to assess their intentions to engage in speeding (e.g., “In the next six months, I intend to speed through a school zone”), scored (1) *very unlikely* to (7) *very likely*. Lower scores representing less intention and higher scores representing more intention to spend in each context. Reliability was good to excellent (roadwork $\alpha = .90$; school zone $\alpha = .85$).

3.3.7. Social Desirability

Three items from each subscale of Lajunen *et al.* [34] driver social desirability scale (DSDS) were included within each driving context, original reliability of the scale is acceptable for research. Not all items are required to detect socially desirable responses [33] therefore questions were limited to reduce potential participant attrition. Participants were asked to report how much they agree or disagree with each statement from the driver impression management (DIM) subscale (e.g., “If there were no police control in roadwork zones, I would still obey the posted speed limit”), and the driver self-deception (DSD) subscale (e.g., “I always remain calm and rational when driving through school zones”), scored (1) *strongly disagree* to (7) *strongly agree*. Minor word adjustments were made to reflect the current roadwork and school zone contexts. Lower scores indicating less impression management or self-deceptive, while higher scores indicated more likelihood of impression management or self-deceptive responding. Reliability of the impression management (roadwork $\alpha = .77$; school zone $\alpha = .81$) and self-deception

(roadwork $\alpha = .76$; school zone $\alpha = .80$) subscales were good to excellent. Reliability for the overall shortened DSDS scale was also excellent for each road context (roadwork $\alpha = .86$; school zone $\alpha = .89$).

4. Results

4.1. Assumption Checking

Data were analysed using IBM SPSS Statistics version 28. All items were compulsory for eligibility, and data was not entered manually during this study. Therefore, no missing or erroneously entered data issues occurred. Several multivariate outliers were detected at the in the regression models. Upon inspection of each case however, it was revealed these were unlikely true outliers due to the floor effect of attitude and subjective norms and therefore no cases were removed [36].

Assumptions of normality and homoscedasticity of residuals were also violated for each regression model due to the studentised residual plots showing a fan effect in the regression models. Therefore, the regression models were conducted using 5,000 bias corrected and accelerated bootstrap confidence intervals as this does not rely on normality or homoscedasticity residual assumptions. The bootstrapped confidence intervals were used for the interpretation of the coefficient models.

4.2. Socially Desirable Responding

A preliminary analysis was undertaken to detect potentially socially desirable responding. Means, standard deviations and correlations of the DSDS subscale variables are reported in Table 1. Impression management and self-deception were strongly negatively correlated with focal variables within each of the regression models; suggesting there was a general tendency by participants to respond in a socially desirable manner. Despite the general tendency to respond in a socially desirable manner, no responses were two standard deviations or more above the DIM or DSD means and therefore no participants were removed from the analyses due to socially desirable responding [34]. However, the DSDS was still included with the control variables with the first step of the regression model to assess its impact on the outcome variables.

4.3. Hypothesis Testing

4.3.1. Roadwork and School Zones Attitude Comparisons Towards Speeding

To test the hypothesis that there will be significant differences in driver attitudes toward speeding between roadwork and school zones, a paired samples t-test was conducted. A significant difference was found, $t(332) = 10.05$, $p < .001$, with attitudes towards speeding in school zone ($M = 1.28$, $SD = .56$) is lower than roadwork zones ($M = 1.72$, $SD = 1.01$; see Figure 1). The effect size was medium, Cohen's $D = .55$.

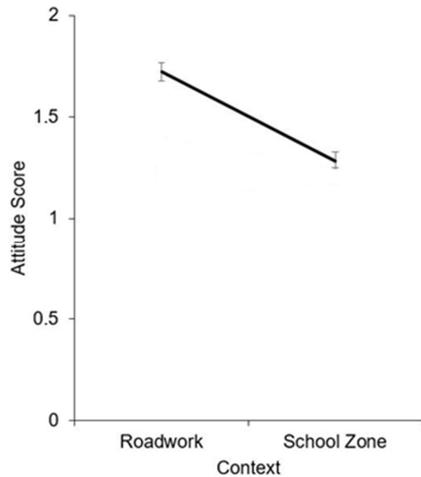


Figure 1. Differences in Attitudes Towards Speeding between Roadwork and School zones.

Note. Lower scores suggest safer attitudes. Error bars represent ±1 standard error.

4.3.2. Regression Analysis Testing of the TPB

Hierarchical multiple regressions with bootstrap sampling of 5,000 samples were utilised to test the hypothesis that attitudes, subjective norms, and PBC will be significant indicators of intentions toward engaging in speeding within roadwork and school zones. Control and additional variables (i.e., age and gender, driving frequency, driving setting, past behaviours and social desirability) were included in the first step for each regression model. TPB focal variables of attitudes, subjective norms, and PBC were included in the second step.

Descriptive statistics and zero-order correlations specific to each regression model are reported, with speeding intentions presented in Table 1. The TPB focal variables of attitudes, subjective norms, and PBC were strongly positively correlated with intentions of speeding for both roadwork and school zones. Except for drive setting, no significant correlations were observed between the controlled variables and intention to speed between the two driving scenarios. Albeit small, a positive and significant correlation was found between drive setting and intention to speed through roadwork zones. As the

driving region becomes more urban, there is a higher score of intending to speed through roadwork zones. However, investigation on this relationship was further explored using one-way ANOVA and no group differences were found, $F(2, 332) = .82, p = .440, \eta^2 = .01$.

4.3.3. Roadwork Zone Speeding Intentions

Table 2 shows the variables that predicted the intention to speed across the two driving scenarios. The control variables in the first step significantly explained intentions to speed through a roadwork zone, $F(6, 326) = 65.54, p < .001$ and through a school work zone, $F(6, 326) = 37.15, p < .001$.

Among the controlled variables, past speeding behaviour and social desirability were the only consistent significant predictors across both models. Positive associations for past speeding behaviour were found for the two models. Past behaviour accounting for the largest variance, with 22.6% of the unique variance found in the intention to speed through roadwork zones, while explaining 24.0% of the unique variance found in the intention to speed through school zones. For social desirability, negative associations were found for both models, with 6.8% of the unique variance found in the intention to speed through roadwork zones, while explaining 1.9% of the unique variance found in the intention to speed through school zones.

Age was also found as a significant predictor among the controlled variables, but only within the school zone scenario, showing a positive association (as opposed to the negative association found in the bivariate correlation analysis).

The TPB variables accounted for 13.4% and 16.6% of the additional variance in intentions to speed in roadwork zones and school zones, respectively. Across the two models, attitude was a strong, if not the strongest, predictor of intention with significant positive associations observed. Attitudes accounted for 7.0% and 5.2% of unique variance found for intention to speed through roadwork zones and school zones, respectively. Subjective norm was also found to be significant predictor of intention to speed in both road contexts (roadwork $sr^2 = 2.5\%$; school zone $sr^2 = 3.9\%$), albeit, accounting for a smaller unique variance compared to attitude. PBC only significantly predicted intention to speed through school zones, not through roadwork zones.

Table 1. Descriptive Statistics and Correlations Among Measured Variables Related to Speeding Intentions Through Roadwork and School Zones.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	M	SD
1. Age	-	-.32***	.05	.18**	-.24***	.13*	.16**	-.03	-.11*	-.18***	-.08	37.43	16.98
2. Gender	-.32***	-	.03	-.05	.07	-.01	-.04	-.09	.11*	-.10	.02	-	-
3. Driving frequency	.05	.03	-	-.02	-.08	-.01	-.02	-.07	-.05	-.08	-.03	-	-
4. Drive setting	.18**	-.05	-.02	-	-.01	.02	.05	.05	-.03	.04	.00	-	-
5. Past behaviour	-.15**	.02	-.12*	-.09	-	-.48***	-.38***	.41***	.35***	.33***	.62***	1.70	0.78
6. DIM	.11*	-.01	.06	.10	-.56***	-	.77***	-.40***	-.31***	-.30***	-.48***	6.13	1.08
7. DSD	.19***	-.06	-.04	.08	-.30***	.72***	-	-.23***	-.23***	-.20***	-.28***	5.99	1.06
8. Attitudes	-.03	-.07	-.13*	-.03	.52***	-.51***	-.28***	-	.44***	.38***	.68***	1.28	0.56
9. Subjective norms	-.20***	.06	.01	-.12*	.43***	-.45***	-.36***	.44***	-	.28***	.52***	1.61	0.99
10. PBC	-.14**	-.06	-.13*	.03	.39***	-.37***	-.24***	.38***	.34***	-	.37***	3.59	1.89
11. Intentions	-.07	-.03	-.07	-.14*	.69***	-.66***	-.35***	.68***	.57***	.41***	-	1.47	0.89
M	37.43	-	-	-	2.10	5.58	5.76	1.72	1.97	4.02	1.79		
SD	16.98	-	-	-	0.99	1.24	1.09	1.01	1.22	1.76	1.19		

Note. School zones appears above the diagonal; roadwork zones appear below the diagonal. DIM = driver impression management. DSD = driver self-deception. PBC = perceived behavioural control. * $p < .05$, ** $p < .01$, *** $p < .001$. Greyed out cells indicate a statistically significant correlation.

Table 2. Hierarchical Multiple Regression of Speeding Intentions Through Roadwork Zones versus School Zones.

	Intention to speed through roadwork zones				Intention to speed through school zones			
	Adj. R^2	ΔR^2	β	sr^2	Adj. R^2	ΔR^2	β	sr^2
Step 1	0.54***				0.395***			
Age			0.06	0.3%			0.08*	0.5%
Gender			-0.04	0.1%			0.00	0.0%
Driving frequency			-0.01	0.0%			0.01	0.0%
Drive setting			-0.07	0.4%			-0.01	0.4%
Past speeding behaviour			0.55***	22.6%			0.57***	24.0%
Social desirability			-0.68***	6.8%			-0.16**	1.9%
Step 2	0.67***	0.13***			0.56***	0.17***		
Age			0.07	0.4%			0.08*	0.5%
Gender			-0.01*	0.0%			0.03	0.0%
Driving frequency			0.01	0.0%			0.03	0.1%
Drive setting			-0.07*	0.5%			-0.02	0.0%
Past speeding behaviour			0.34***	7.1%			0.39***	9.8%
Social desirability			-0.15**	1.5%			-0.05	0.2%
Attitudes			0.34***	7.0%			0.28***	5.2%
Subjective norms			0.19***	2.5%			0.23*	3.9%
PBC			0.05	0.2%			0.11*	0.9%

Note. PBC = perceived behavioural control. Significant testing was carried out with BCa Confidence Intervals with 5,000 bootstrap samples.

* $p < .05$, ** $p < .01$ *** $p < .001$.

5. Discussion

The first aim of the present study was to explore driver attitudes toward three risky driving behaviours between two specific contexts of roadwork and school zones. The second aim of this study was to assess the relationship that attitudes, subjective norms, and PBC have on intentions to engage in risky driving behaviours within both roadwork and school zones.

The results provided support for Hypothesis 1 and indicated that drivers have safer attitudes in relation to speeding intentions through school zones in comparison to speeding through road work zones. These results offer preliminary evidence that drivers may be less likely to engage in speeding through school zones in comparison to road work zones. The current results also provide further evidence to Soole *et al.*'s [25] qualitative findings, that situational contexts such as road types have an impact in one's speed choice and that people have different attitudes towards roadwork and school zones. It is possible that, indeed, drivers may experience a sense of confusion or consider it an inconvenience to slow down when no work or workers are immediately apparent.

Furthermore, it is possible that the initiatives aimed at discouraging speeding in school zones may have positively influenced driver attitudes. In contrast, changing driver attitudes toward speeding in work zones may require further investigation and development. For example, reduced speed limits in school zones clearly indicate specific time so the day when children and pedestrians are mostly likely to be in and around roads. However, roadwork reduced speeds are more likely to apply at all times while the road infrastructure is being developed, regardless of whether workers are present or not.

Regarding Hypothesis 2, the results provided partial support. The results indicated that past behaviour is the strongest predictor of intention to speed through school zones

and road work zones. These results may suggest that drivers' intention to speed are strongly influenced by previous behaviours. It is possible that individuals have sped previously in these zones and have not been caught or have experienced an unsafe event. These past behaviours provide a self-serving bias influencing unsafe driving intentions. Furthermore, social desirability was a significant predictor for intention to speed in both contexts.

Participants who have a higher tendency to answer in a socially desirable matter are less likely to report intention to speed, regardless of the road context. This effect was particularly strong within roadwork zones, with social desirability bias still a significant predictor even after the addition of the TPB variables in the model. These results underline the importance of assessing social desirability responding in self-report surveys and using it as a control variable or for further analysis.

Not surprisingly, attitude and subjective norms were the only TPB variables that significantly predicted intentions to speed for both roadwork and school zones, after the controlled variables. Consequently, these results suggest that if drivers have either an attitude that it is ok to speed then drivers are more likely to have intentions to speed through both roadwork and school zones. Subjective norms as being a significant predictor for both road contexts suggest that if participants believe that people would disapprove of their speeding behaviour, they would not speed through school zones or road work zones. These results also suggest that road safety interventions aimed at influencing driver intentions regarding speeding through roadwork and school zones are likely to be most effective if they address attitudes and subjective norms.

Interestingly, the results also demonstrated that PBC significantly predicted intention to speed through school zones. However, this effect is not observed in road work zones. These results may indicate that, in road work zones, drivers may feel pressure to not adhere to reduced speed limits in road work zones due to other drivers and consequently remain

travelling at or close to the original posted speed limit. In contrast, speeding within school zones may be considered less socially acceptable and consequently drivers may believe they have more control over their intentions and subsequent driving behaviours.

However, it is important to note that PBC uniquely explained less than 1% of the total variance for both models, suggesting it was the least important TPB variable regarding risky driving intentions among the participants. Previous research has found mixed results for PBC within risky driving literature [37]. A meta-analysis conducted by Notani [38] found PBC is a better predictor of intentions when the behaviour being studied is internal (i.e., taking a test) rather than external (i.e., driving a motor vehicle); and, when PBC is measured on a belief rather than at a global level (as was conducted within this study), presenting a potential limitation of this study. Taken together, the findings within this hypothesis support research involving the TPB as a theoretical basis investigating risky driving within roadwork and school zone contexts. The results of each variable of interest suggest road safety stakeholders should consider tailoring road safety approaches specifically toward addressing underlying beliefs and changing social norms for maximum effectiveness.

5.1. Limitations and Future Research

Poor item loading was identified across each behaviour and context for subjective norm and PBC items. The reliability of subjective norms remained poor despite the deletion of one item and therefore this should be considered when interpreting these results. An acceptable alpha level was obtained through the deletion of one PBC item. Castanier et al. [35] reported an excellent alpha reliability level for subjective norms and PBC, however, the current study produced poor reliabilities for these constructs. The poor alpha reliabilities indicate a potential limitation of global measures of TPB focal variables. Future researchers should consider this and use belief-based measures which may increase alpha reliability after identifying common themes, via a qualitative pilot study, relevant to participants within the roadwork and school zone contexts [37].

Causal inferences were not possible through this cross-sectional research and therefore it was not possible to test the predictive ability of intentions, PBC and the additional variables on actual behaviours. Furthermore, the lack of support for differences across age may reflect university students being a major participant group, which may not be generalizable to all young drivers.

Given the results of this research, future research could be explored through driver interviews to better understand the factors that may contribute to differences between driver attitudes and intentions between speeding in either school or road work zones. In addition, these results demonstrate that although some positive changes appear to have occurred in relation to speeding in school zones, there is more work required, particularly in regard to speeding in roadwork zones.

Future research could investigate cognitive aspects such as

emotions and cognitive associations relating to determine why driver attitudes differ between speeding behaviour in school zones in contrast to road work zones. Future research could also investigate the possible emotions underlying these differences which may further assist road safety stakeholders marketing and education campaigns encouraging drivers to reduce speeds across both of these speed zones.

The current study also showed that socially desirable responding should be considered in traffic psychology research. Socially desirable responding highlights the importance of future research refining survey measures while including technology to observe and measure actual behaviours. Whilst technology is improving that will provide greater access to naturalistic observational studies, driving simulators may currently offer the best method of testing the predictive ability of the TPB regarding some risky driving behaviours. Other avenues which should be explored following this research includes qualitative studies to understand why differences in attitudes exist between the roadwork and school zone contexts to inform road safety stakeholders.

There are also a number of practical implications of these results. Roadwork zones are an extremely dynamic environment with multiple stakeholder movements and at other times appear to be uninhabited. Driver's emotions and consequently attitudes during uninhabited road work zone times may impact upon driver decision making toward speed. There is a further need to advocate for continued improvement around signage and driving safety processes and speed management associated with road work zones.

5.2. Conclusion

The current research has addressed a key gap in the driving safety literature by gaining a better understanding of the opinions of Australian drivers in relation to risky driving behaviours through roadwork and school zones. The importance of this research cannot be understated as improvements in road safety have been consistently observed in school zones, yet similar achievements are not reflected in official roadwork data or the reviewed literature. While the predominant factors influencing road safety improvements in school zones are likely due to additional resources regarding engineering and enforcement, this research has identified another potential influence through psychological factors in the form of attitudes and social norms.

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