Driver views on safety at roadworks

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Abstract

Poor compliance with temporary speed limits is a common contributing factor in roadway work zone crashes. Despite the wide range of measures used to encourage compliance, speeding remains a major challenge in work zone traffic control. As part of the major study into safety at Queensland roadworks conducted by CARRS-Q and industry partners, an online survey was conducted to study the perceptions and experiences of drivers regarding roadworks, speed choice and related safety concerns. Survey participants (N=410) were asked to view photographs of 12 roadwork sites (shot from a drivers' perspective without revealing the speed limits), to nominate the speed they thought they would drive at through work zones, and to rate from 1 to 5 separate levels of perceived risk to workers and to their own vehicles. The survey sought further information on topics including recall and effectiveness of public safety messages, perceived effectiveness of common roadwork safety measures, and demographic characteristics. Participants were also invited to express their concerns regarding any general or specific issue related to driving through roadworks. The current paper provides a descriptive summary of key findings from the survey, drawn from preliminary analyses of both quantitative and qualitative data, demonstrating the depth of data and its value for improving knowledge on driver perceptions and speed choice at roadworks. The survey is the first study of driver perceptions of roadwork risks and hazards to include an assessment of self-nominated speeds which can be compared with actual observed speeds at the same roadwork sites.

Introduction

Poor compliance with temporary reduced speed limits is a prominent factor in crashes at roadworks (Debnath, Blackman, & Haworth, 2014a, 2015). Other notable factors include inattentive and distracted driving and disregarding traffic controls, all of which can occur in the context of speeding as well as independently. Research on driving behaviour, speed limit compliance, and the effect of roadwork safety measures draws heavily on historical crash data analyses and observational studies. This provides an essential and logical starting point for description of the roadworks safety problem, but there are important limitations to these approaches. Specifically, crash data analyses and observational studies generally provide only limited insight into the underlying reasons for observed events and behaviours (with some exceptions such as identification of impaired driving, for example). In the case of speeding, while the behaviour can often be identified and linked to crash causation, drivers' motivations to speed have not been thoroughly examined. One finding in the literature is that roadwork speed limits do not always seem credible: drivers will often react to seeing workers but may not react to signage alone. In the current study, the *Driver Experience of Roadwork Survey* was conducted to enhance our understanding drivers' behaviour by examining their perceptions, beliefs and experiences regarding roadway work zones.

Method

Survey aims and design

The aims of the survey were to (1) identify factors influencing choice of speed through worksites, (2) examine participants' assessment of risk to their vehicles and to workers, and (3) examine the influence and effectiveness of a range of safety measures.

In survey section 1, participants viewed randomly ordered photographs of 12 scenarios taken from a driver's perspective at 9 different worksites (Appendices, Figure 1). The photographs depicted various roadway and worksite characteristics, including highways, arterial and minor suburban roads, day and night works, dry and wet conditions, and varied alignments. To allow them to place the roadwork scenarios within a broader driving context, participants were informed about the general roadway characteristics including the number of lanes, divided or undivided, rural or urban, and whether it was a suburban road/highway/motorway. Some scenarios included workers and/or machinery in the foreground or middle ground while others depicted little or no apparent activity. All scenarios operated under reduced speed limits, from 20 km/h to 60 km/h, which were not revealed to participants. Participants nominated the speed they thought they would drive at through each worksite and also rated on scales of 1 to 5 the perceived likelihood of damage to their vehicle and injury to a worker.

Section 2 examined the influence on speed choice of 12 work zone items which were later classified into four categories: Regulatory/enforcement; Informational; Visibility/conspicuity; and Physical. These categories drew on work by Debnath, Blackman and Haworth (2012) in which most of these items have previously been discussed in similar groupings. Participants answered the question ('how likely are the following items to affect your speed at roadworks?') on a five point scale for each item in random order. The 12 items were selected based on relevance to the local context and the literature. Items were deemed locally relevant if used in Queensland work zones or if drivers could be expected to be familiar with their use in another context (increased fines or demerit points during holiday periods, for example). Following section 2, participants were invited to 'comment on any aspect of roadwork safety that you feel is important and is not covered in the survey'.

The final survey section sought demographic information on participant characteristics, providing the ability to control for those characteristics in statistical analyses, and an indication of sample representativeness.

Participation

Recruitment

The survey was administered online for 17 weeks commencing 8 October 2013. Selection criteria sought Queensland residents with a current driver licence who drove at least weekly and had not been employed in roadworks/traffic control. Participants were recruited through advertising on the CARRS-Q website, group email distribution, media coverage and snowballing techniques. Participants were also recruited through the CARRS-Q InSPiRS research panel (Independent Survey Panel in Road Safety), consisting of 850 members of the public who had agreed to participate in CARSS-Q research. Of these, 373 panellists who met the survey selection criteria were invited to participate.

Participant characteristics

The survey was completed by 410 participants, including 99 InSPiRS panel members and 311 members of the general public. Participant characteristics are presented in Appendices, Table 1. The overall sample suggests that younger drivers (17-24 years) were slightly underrepresented compared to Queensland licence holders, balanced by a slight overrepresentation of drivers aged 25-59 years. Geographically, in terms of Australian remoteness categories the sample was distributed fairly evenly compared with Queensland's population (Outer regional participants were slightly overrepresented). The sample was less representative in terms of household income and occupancy; compared with ABS census data, higher income households and two-person households were overrepresented, while low income and single person households were underrepresented. The characteristics of panel versus non-panel participants differed significantly on several variables

including age, gender, household size and income. The sub-samples were thus biased although when combined the overall sample was more representative of the Queensland population.

Results

Mean nominated speeds and compliance rates for the 12 roadwork scenarios are presented in Appendices, Table 2. Male participants nominated significantly higher mean speeds than females for 8 of the 12 scenarios. For 4 of the 12 scenarios, younger participants nominated higher speeds while older participants nominated lower speeds compared to those aged 25-59 years. Mean nominated speeds also differed according to panel membership for 3 scenarios, with non-panel participants tending to nominate slightly higher speeds. Reflecting to a large extent the mean nominated speeds, compliance rates were generally lower for scenarios with lower speed limits. Mean ratings of the likelihood of damage to (a) participants' vehicle and (b) injury to a worker are shown in Appendices, Table 3. Responses on average suggest that vehicle damage and worker injury were considered similarly unlikely. While younger participants and males appeared slightly more optimistic on these measures the differences were not statistically significant.

Approximately 71% (n=288) of participants recalled seeing or hearing a public awareness or education campaign about roadworks in the previous five years. Television was the most commonly reported delivery mode (67.0%), followed by radio (14.9%), billboard (8.7%) and newspaper (5.6%). In terms of perceived effectiveness, most participants reported that the recalled message was somewhat effective (53.8%) or very effective (14.9%) in making them think about safety around roadworks. About two thirds (65.6%, n=189) reported that the message actually influenced their driving at roadworks. Of those, the message caused them to pay more attention (33.3%), drive slower (15.9%), or both (48.1%).

The likelihood of 12 different work zone items to effect participants' speed choice has been previously reported (Blackman, Debnath, & Haworth, 2014a), showing that the visible presence of workers and/or police was significantly more likely to encourage compliance than any other item, including the threat of enforcement and increased penalties. This finding is consistent with the literature, particularly regarding police presence as a highly effective speed reduction measure. The finding on the influence of visible work activity (Blackman, Debnath, & Haworth, 2014b) was strongly supported by comparison of two (60 km/h) scenarios in which the presence or absence of activity was the only clearly discernible difference; significantly lower speeds were nominated for the 'activity' scenario (41.7km/h) compared with the 'no activity' scenario (53.5 km/h), a pattern that persisted irrespective of age, gender or panel membership.

The invitation to comment on 'any aspect of roadwork safety that you feel is important and is not covered in the survey' was useful in raising issues important to drivers which may not be prominent in the literature. As reported in Blackman et al. (2014b), the apparent lack of work activity frequently encountered by drivers at roadworks was thought to encourage complacency and disregard for reduced speed limits. Of those who commented on any issue (N=206), 56% raised concerns about this apparent phenomenon. Encouragingly, the need to address this problem has been formally recognised in Queensland (TMR, 2014), with the road authority promoting action to improve the credibility of roadwork speed limits. There was some explicit recognition that hazards may remain at vacant sites, however this was very limited. Among a range of other concerns raised by participants were calls for education and awareness campaigns, including from those who themselves appeared to misunderstand some traffic control measures:

> *Public doesn't understand that when the worker plate on a roadworks speed sign is missing, it means that no one is on site, and the last speed sign is still active, e.g. 80km/h through roadworks on a Sunday, hit a 60km/h sign with no worker plate in it, it is still 80km/hr. There is no public awareness with this rule… people slow down creating hazards*

On the strength of this and other comments, further efforts to improve drivers' knowledge and awareness may indeed be warranted, though traditional education campaign formats may have only limited impact (Debnath et al., 2012, 2014b).

Main limitations of the study include the potential for self-report bias in survey responses, the potential for participants to misinterpret some aspects of the scenarios presented as still images, and an underrepresentation of Queensland's youngest drivers in the survey sample.

Conclusion

The *Driver Experience of Roadwork Survey* was the first of its kind in Australia to examine driver perceptions around safety at roadworks including factors influencing speed choice. Quantitative data was supplemented with qualitative material in the form of open-ended comments, enabling a deeper, more meaningful interpretation than would have been possible with quantitative material alone. In terms of practical implications, the study supports recent moves by authorities to improve roadwork speed limit credibility, while also highlighting the ongoing need to improve driver awareness. While this paper has presented a descriptive analysis, further analyses are to be conducted examining speed choice and its relationship with multiple environmental and driver factors in the 12 survey scenarios.

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Appendices

Figure 1. 12 scenarios in Driver Experience of Roadwork Survey

Table 1. Driver Experience of Roadwork survey participant characteristics

Characteristic	Non-Panel N	Non-Panel %	Panel N	Panel %	All N	All %		
Age	23	7.5	-	0.0	23	5.7	**QLD Licence holders (2013)**	
17-24							396751	12.03
25-59	248	81.3	40	40.8	288	71.5	2142293	64.96
60>	34	11.1	58	59.2	92	22.8	758614	23.01
Pearson Chi Sq sig	<0.001							
17-20	3	1.0	-	0.0	3	0.7	169968	5.15
21-24	20	6.6	-	0.0	20	5.0	226783	6.88
25-29	48	15.7	-	0.0	48	11.9	307302	9.32
30-39	79	25.9	4	4.1	83	20.6	616463	18.69
40-49	64	21.0	9	9.2	73	18.1	641107	19.44
50-59	57	18.7	27	27.6	84	20.8	577421	17.51
60-74	34	11.1	52	53.1	86	21.3	589856	17.89
75>	-	0.0	6	6.1	6	1.5	168758	5.12
Valid total	305	99.9	98	100.0	403	100.0	3297658	100.0
Missing	6		1		7			
Gender								
Male	174	56.9	44	44.4	218	53.8	1734354	51.4
Female	132	43.1	55	55.6	187	46.2	1640470	48.6
Valid total	306	100.0	99	100.0	405	100.0	3374824	100.0
Missing	5		-		5			
Pearson Chi Sq sig	0.031							
ASGS location							**QLD ERP (2012)**	
RA1 - Major Cities					149	57.6	2824102	61.9
RA2 - Inner Regional					47	18.1	923908	20.3
RA3 - Outer Regional	NA		NA		58	22.4	672561	14.7
RA4 - Remote					5	1.9	79900	1.8
RA5 - Very Remote					-	0.0	59588	1.3
Valid Total					259	100.0	4560059	100.0
Unknown					151			
Household Income (wk)*							**ABS census (2011)**	
Up to 29,999 (<577)	10	3.6	14	18.2	24	6.8	323813	22.96
30,000 – 49,999 (577-961)	20	7.3	11	14.3	31	8.8	265694	18.84
50,000 – 79,999 (962-1538)	54	19.7	15	19.5	69	19.7	246137	17.45
80k – 99,999 (1539-1923)	49	17.9	13	16.9	62	17.7	182880	12.96
100k – 149,999(1924-2885)	68	24.8	19	24.7	87	24.8	249975	17.72
150,000 or more (>2885)	73	26.6	5	6.5	78	22.2	142048	10.07
Valid total	274	100.0	77	100.0	351	100.0	1410547	100.0
Unknown/missing	37		22		59			
Pearson Chi Sq sig	<0.001							
Household occupants**							**ABS census (2011)**	
1	25	8.3	17	17.2	42	10.4	353560	22.8
2	127	41.9	62	62.8	189	47.0	551518	35.6
3	56	18.5	9	9.1	65	16.2	249508	16.1
4	69	22.8	9	9.1	78	19.4	236221	15.3
5	20	6.6	2	2.0	22	5.5	102980	6.7
6	6	2.0	-	0.0	6	1.5	53592	3.5
Valid total	303	100.0	99	100.0	402	100.0	1547379	100.0
Missing	8		-		8			
Pearson Chi Sq sig	<0.001							

*Income data sourced from http://profile.id.com.au/australia/household-income?WebID=120 NB: ABS income category ranges do not match exactly those used in survey. Collapsed into 6 categories of weekly income, they are: Up to $599; $600-$999; $1000-1499; $1500-1999; $2000-2999; $3000>

**Census household data sourced from http://profile.id.com.au/australia/household-size?WebID=120

ASGS = Australian Statistical Geography Standard. ERP = Estimated resident population.

Table 2. Mean nominated speeds and compliance rates for roadwork scenarios*

	Scenario											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Speed limit km/h	***60***	***40***	***40***	***60***	***40***	***60***	***40***	***40***	***20***	***40***	***40***	***60***
Mean speed	57.73	42.14	53.34	41.25	36.14	41.73	43.13	40.39	34.82	39.85	42.95	53.53
Non-panel	58.8	42.68	54.09	41.88	36.09	41.67	43.53	40.63	34.92	39.33	43.28	54.42
Panel	54.39	40.45	51.01	39.29	36.31	41.92	41.87	39.65	34.49	41.46	41.92	50.76
t-test sig**	.011	NS	NS	.039	NS	NS	NS	NS	NS	NS	NS	.035
17-24	63.70	45.87	58.26	43.70	36.30	44.13	46.52	43.48	37.17	39.78	47.61	55.65
25-59	58.44	42.81	54.48	41.49	35.89	41.55	43.52	40.94	34.72	39.77	43.36	54.06
60>	53.15	38.97	48.32	39.40	35.98	41.36	40.98	37.72	34.57	39.46	40.27	51.03
Oneway sig	0.001	0.003	0.001	NS	NS	NS	NS	0.027	NS	NS	0.003	NS
Male	59.79	43.37	54.08	42.32	37.50	42.22	44.38	40.60	35.05	41.24	44.04	54.93
Female	55.13	40.67	52.43	39.97	34.36	41.02	41.76	40.11	34.63	38.13	41.60	51.71
t-test sig**	.002	.014	NS	.030	.009	NS	.022	NS	NS	.037	.018	.032
Compliant %	78.1	72.5	37.4	98.0	85.3	97.5	67.6	77.4	16.7	71.9	71.5	85.5
Non-panel	75.3	71.4	36.5	98.1	85.4	97.4	67.6	76.9	17.2	73.6	71.8	84.1
Panel	86.9	75.8	40.4	98.0	84.8	98.0	67.7	78.8	15.2	66.7	70.7	89.9
Chi Sq sig	0.016	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
17-24	73.9	56.5	13.0	100.0	87.0	100.0	56.5	69.6	8.7	78.3	47.8	82.6
25-59	76.0	71.9	36.5	97.9	86.5	97.6	68.1	76.4	17.4	73.6	71.9	84.7
60>	88.0	79.3	47.8	98.9	84.8	96.7	70.7	83.7	16.3	67.4	78.3	89.1
Chi Sq sig	0.043	NS	0.006	NS	NS	NS	NS	NS	NS	NS	0.015	NS
Male	74.3	65.1	35.3	97.2	82.6	96.8	63.3	74.8	15.1	69.3	67.0	83.0
Female	82.9	81.3	40.1	98.9	89.3	98.4	72.7	80.7	18.2	75.4	77.5	88.8
Chi Sq sig	0.037	0.001	NS	NS	0.054	NS	0.043	NS	NS	NS	0.018	NS

*Actual speed limits were not revealed to participants. **Equal variances assumed

Table 3. Reported likelihood of vehicle damage/worker injury while driving through roadworks*

	Scenario											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Speed Limit	***60***	***40***	***40***	***60***	***40***	***60***	***40***	***40***	***20***	***40***	***40***	***60***
Likely damage**	1.88	2.08	2.02	2.23	2.43	2.90	2.00	2.64	2.09	2.60	1.81	2.38
Non-panel	1.88	2.06	2.00	2.22	2.44	2.95	2.02	2.69	2.08	2.61	1.81	2.39
Panel	1.90	2.11	2.09	2.25	2.39	2.74	1.95	2.52	2.13	2.56	1.80	2.32
17-24	1.83	1.91	1.96	2.26	2.22	2.74	1.83	2.48	2.09	2.70	1.65	1.96
25-59	1.91	2.11	2.01	2.27	2.49	3.03	2.02	2.68	2.09	2.65	1.83	2.47
60>	1.78	2.00	2.04	2.07	2.30	2.50	1.95	2.55	2.09	2.39	1.77	2.18
Male	1.77	1.90	1.94	2.10	2.26	2.70	1.89	2.53	2.00	2.40	1.69	2.26
Female	2.01	2.28	2.12	2.37	2.63	3.12	2.12	2.78	2.19	2.82	1.95	2.51
Likely injury**	1.90	2.18	2.79	2.32	2.26	2.62	2.43	2.27	2.51	2.24	2.25	1.87
Non-panel	1.90	2.19	2.84	2.30	2.30	2.66	2.45	2.29	2.52	2.25	2.28	1.87
Panel	1.90	2.16	2.62	2.40	2.15	2.51	2.36	2.22	2.46	2.22	2.15	1.87
17-24	1.74	1.87	2.74	2.13	1.96	2.57	2.26	2.09	2.35	2.04	2.04	1.52
25-59	1.92	2.25	2.87	2.35	2.35	2.69	2.46	2.31	2.54	2.32	2.29	1.92
60>	1.85	2.03	2.53	2.27	2.09	2.39	2.35	2.18	2.41	2.05	2.13	1.82
Male	1.75	1.99	2.58	2.12	2.03	2.43	2.24	2.09	2.36	2.01	2.04	1.78
Female	2.07	2.41	3.03	2.56	2.54	2.83	2.64	2.48	2.68	2.52	2.48	1.99

*Rated 1 (Highly unlikely) to 5 (Highly likely); **t-test = Not statistically significant (NS)