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A comparison of self-nominated and actual speeds in work zones

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ABSTRACT

Despite significant research on drivers' speeding behavior in work zones, little is known about how well drivers' judgments of appropriate speeds match their actual speeds and what factors influence their judgments. This study aims to fill these two important gaps in the literature by comparing observed speeds in two work zones with drivers' self-nominated speeds for the same work zones. In an online survey, drivers nominated speeds for the two work zones based on photographs in which the actual posted speed limits were not revealed. A simultaneous equation modeling approach was employed to examine the effects of driver characteristics on their self-nominated speeds. The results showed that survey participants nominated lower speeds (corresponding to higher compliance rates) than those which were observed. Higher speeds were nominated by males than females, young and middle aged drivers than older drivers, and drivers with truck driving experience than those who drive only cars. Larger differences between nominated and observed speeds were found among car drivers than truck drivers. These differences suggest that self-nominated speeds might not be valid indicators of the observed work zone speeds and therefore should not be used as an alternative to observed speed data.

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1. Introduction

Poor compliance with speed limits is among the most serious and challenging safety issues in work zones (Finley, 2011; Schrock, Ullman, Cothron, Kraus, & Voigt, 2004). Many studies (e.g., Benekohal, Resende, & Orloski, 1992; Benekohal, Wang, Chitturi, Hajbabaie, & Medina, 2009; Brewer, Pesti, & Schneider, 2006; Debnath, Blackman, & Haworth, 2014a; Debnath, Blackman, & Haworth, 2014b; Debnath, Blackman, & Haworth, 2015; Haworth, Symmons, & Mulvihill, 2002; Wang, Dixon, & Jared, 2003) have found poor compliance, often with substantial proportions of drivers exceeding posted speed limits by large amounts. Speeding contributes to work zone crashes (Garber & Patel, 1995), which occur at higher rates compared with pre-work periods and at greater severity levels compared with crashes outside of work zones (Bai & Li, 2011; Khattak, Khattak, & Council, 2002; Pigman & Agent, 1990; Whitmire, Morgan, Oron-Gilad, & Hancock, 2011). Bai and Li (2006) reported that 25% of fatal work zone crashes were primarily caused by speeding or excessive speed for the conditions. Other research (Brewer et al., 2006) found that 42% of all work zone crashes had speed cited as a contributory factor.

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Since speeding is common in work zones and contributes to crashes, it is important to not only collect robust measurements of on-road speeds (by direct observation) but also to gather information regarding what drivers judge to be appropriate speeds and the factors that underlie these judgments and behaviors (by self-report methods). While many studies (e.g., Benekohal et al., 1992; Benekohal et al., 2009; Brewer et al., 2006; Debnath et al., 2014a; Debnath et al., 2014b; Haworth et al., 2002; Wang et al., 2003) have observed speeds in work zones and provided useful insights into the circumstances influencing drivers' on-road speeding behavior, little is known about driver judgments of appropriate work zone speeds. Therefore, the relationship between such judgments and on-road behavior (i.e., observed speeds) has not been fully articulated. Consequently, it remains unknown if self-nominated speeds are a valid indicator of observed speeds and thus can be used, for example, in evaluations of work zone safety interventions as an alternative to observed speeds.

While no studies have comprehensively analyzed the relationships between drivers' self-nominated speeds and speeding behavior in work zones, several studies have done so for non-work zone road sections. In an early Australian study, Fildes, Rumbold, and Leening (1991) examined the relationships between observed speeds, self-reported speeds and attitudes to speeding. Speeds were observed at four sites, with selected vehicles identified by registration number and the drivers then requested to participate in a survey several kilometers downstream from the observation point. Participants were shown photographs of the road section where their speeds were observed and asked several questions regarding their speeds on that section. Driver-nominated speeds were generally close to the vehicle-matched observed speeds. The strength of this research is that the observed speeds could be linked to driver characteristics and survey responses (including nominated speeds) for each selected vehicle.

Similar studies have been conducted in Sweden (Haglund & Åberg, 2000; Åberg, Larsen, Glad, & Beilinsson, 1997). In the study by Åberg et al. (1997), participants generally expressed positive attitudes toward compliance, but the observed speeds revealed that more than half of the sample exceeded the posted limits in a 50 km/h zone. Haglund and Åberg (2000) later replicated that study for 90 km/h zones, again finding that most drivers exceeded speed limits, with strong relationships between observed and self-reported speeds. It was also concluded that the perceived speeds of other vehicles influence individual driver behavior regarding speed limit compliance (Haglund & Åberg, 2000), as previously suggested (Åberg et al., 1997). One important limitation of these studies is that prior knowledge about the posted speed limits might have influenced drivers' answers to questions about safe and appropriate speeds. Such 'anchoring bias', in which respondents tend to anchor their perceptions around known values (which in this case is speed limit), is common in the survey literature (Debnath & Chin, 2009; Fischhoff, Bostrom, & Quadrel, 1993; Weinstein, 1987).

In an Australian online survey (Lahausse, van Nes, Fildes, & Keall, 2010), participants viewed images of different roadways and were asked what speed they would drive at in the scenarios, and then to estimate the actual posted limit, which was not visible in the images. With potential anchoring bias avoided, this study was useful for examining the relationship between anticipated behavior and estimated speed limits. However, as there was no observational measure of vehicle speeds at the sites depicted in the images, the relationship between estimated speeds and actual behavior could not be examined.

In the context of work zones, Bham and Mohammadi (2011) examined driver opinions about the appropriateness of posted speed limits, as well as their self-reported travel speeds. In their survey, 118 drivers who passed through a work zone upstream of the survey location were asked if they felt the posted limit in the work zone was safe. About 80% reported it as safe, however it was not clear from this question whether the posted speed limits were deemed appropriate (i.e., drivers might perceive a speed limit as safe, but consider it unnecessarily low). Drivers were also asked in separate questions to indicate what they thought was the appropriate speed limit and the speed they drove at through the upstream work zones. It was concluded that drivers generally nominated a speed limit based on their own travel speed. It should be noted that drivers were aware of the actual posted speed limit, which is likely to have influenced their travel speeds and may have produced anchoring bias in the overall responses, as noted earlier.

The above discussion identifies two important gaps in the work zone safety literature: (1) it is not well understood how well driver judgments of appropriate speeds match their observed speeds in work zones, and (2) no studies have examined the factors influencing drivers' work zone speed judgments. This paper aims to fill these important gaps by (1) examining the extent to which driver judgments of appropriate work zone speeds are consistent with real world work zone speed observations, and (2) examining how drivers' speed judgments are influenced by their demographic and licensing characteristics. Descriptive analyses were used to compare the self-nominated and real world speeds, while a simultaneous equation modeling approach was employed to model the self-nominated speeds as functions of driver characteristics.

2. Data

Two types of speed data were collected in this study: (1) driver-nominated speeds for two work zone scenarios (depicted in photographic images), collected through an online survey, and (2) speeds observed at the depicted work zone sections. These two types of data and their collection methods are described in the subsequent sections.

2.1. Self-nominated speed data

Self-nominated speeds were collected using an online survey among drivers in Queensland, Australia. Still photographs and brief descriptions of two rural highway work zone scenarios (referred to hereafter as Sites 1 and 2) were shown to survey

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