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Speeding in urban environments: Are the time savings worth the risk?

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ABSTRACT

Perceived time savings by travelling faster is often cited as a motivation for drivers' speeding behaviour. These time savings, however, come at a cost of significant road injuries and fatalities. While it is known that drivers tend to overestimate the time savings attributable to speeding there is little empirical evidence on how much time drivers genuinely save during day-to-day urban driving and how this relates to speeding-related crashes. The current paper reports on a study to address the lack of empirical evidence on this issue using naturalistic driving data collected from 106 drivers over a period of five weeks. The results show that the average driver saves 26 s/day or 2 min/week by speeding. More importantly, the cost of these time savings is one fatality for every 24,450 h saved by the population on 100 km/h roads in dry conditions and one injury for every 2458 h saved on the same roads. Full speed compliance – and consequently a dramatic reduction in the road toll – could be achieved through almost imperceptible increases in travel time by each driver.

1. Introduction

Speeding is one of the most common driving behaviours despite being one of the largest contributors to road injuries and fatalities. Researchers have found that a common rationale for why drivers speed is the perceived time savings (Peer, 2011) and this frequently colours the debate on appropriate speed limits. For instance, proposed reductions to the speed limit on roads with high rates of speed-related crashes are sometimes rejected on this basis (Svenson and Salo, 2010) as are campaigns for increased enforcement of existing speed limits. Despite this there is little empirical evidence as to how much time is actually saved during day-to-day driving by drivers engaging in speeding behaviour which makes it difficult to counteract this argument. What is known is that improvements in compliance with speed limits would dramatically reduce injuries and fatalities. For instance, Elvik and Amundsen (2000) estimate that, in Sweden, if all drivers were to abide by the speed limit, road fatalities would be reduced by 38 percent and injuries by 21 percent. As a consequence, these 'speeding time savings', are paid for in greater injuries and fatalities.

The current paper reports on a study to address the lack of empirical evidence on this issue. Using naturalistic (Global Positioning System) driving data collected from 106 drivers over a period of five weeks in Sydney, Australia, the amount of time saved speeding during day-to-day driving was determined and subsequently this was related to speeding-related injuries and fatalities that occurred at the same time.

2. Literature review

It is known that perceived time savings forms part of the rationale for speeding behaviour. In a study about drivers' beliefs of speeding, agreement with the statement that speeding "makes me arrive quicker" was one of the strongest predictors of intention to speed and a significant contributor to an attitude of speeding. This was more so than statements about fun, fines, licence suspension and the risk of hitting a pedestrian (Warner, 2006). There is also some evidence that time-pressure as a reason for speeding may not necessarily need to be related to a specific event, such as a late appointment, but may relate more broadly to time pressures felt by drivers (McKenna, 2003). Several studies cited by Peer (2011) found that between 20 and 33 percent of drivers admitted to speeding to get somewhere quicker, some of whom thought the importance of arriving punctually for an appointment was of greater importance than breaking the speed limit. This is also stated by Tarko (2009) who proposed that minimising the time spent driving is a key

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reason for speed choice and is further influenced by the subjective value of time held by each driver.

It has also been well established in the literature that drivers overestimate the travel time savings that occur from higher speeds (Fuller et al., 2009; Peer and Solomon, 2012; Peer, 2010; Svenson, 2009) which, in turn, is associated with higher risks of casualty crashes (Elvik, 2012; Kloeden et al., 1997). For instance, Richter et al. (2006) identified the time saved from (higher) speeds as a benefit to users and therefore a barrier to the acceptance of the role of speeding in road casualties. Peer (2010, 2011) and Peer and Gamliel (2012) have conducted a number of studies on drivers' estimates of time savings from speeding. The results show that drivers significantly overestimate the time saved by speeding with greater differences the higher the change in speed. For example, participants were asked to estimate the time savings for a 50 km trip where the initial speed was 100 km/h and the increase in speed was 10, 20 or 30 km/h. With a speed increase of 30 km/h, the actual time saved is 6.92 min but the mean of the participants' estimates was 11.94 min.

Previous research has looked at the relationship between vehicle speed and casualties and how higher speeds are (in effect) paid for through higher casualty figures. Taylor et al. (2002, 2000) examined the relationship between vehicle speed and crashes using road-based studies and driver-based studies. Overall the authors found 1 mile/h change in average speed was associated with a 5 percent increase in crashes with significant differences between different road types but all in the same direction. They noted, however, that there may be potential disbenefits as a consequence of longer journey times if speeds were reduced. Redelmeier and Bayoumi (2010) used data from the United States driving population to convert crashes into a time value and used this to adjust travel time as the speed increased (or decreased). They found that a reduction in average speed by 3 km/h (from 51 to 48 km/h) resulted in an increase in travel time of 3.6 min but once the resulting crashes were taken into account and converted to a time value of 16.6 min of crash time[1] there was a reduction of daily travel time. In contrast, an increase from 51 to 52 km/h resulted in 22.2 min of crash time and an overall increase of 1 min once crash time was included despite a reduction in observed travel time of 4.6 min. These findings were however derived from average travel behaviour and did not take into account the variations between drivers. They do nonetheless reinforce the message that small reductions in travel time have significant impacts on road safety. This is related to the concept of marginal external costs (MEC) of crashes as studied by Hensher (2006) and Steimetz (2008) which attempt to quantify the crash and travel-delay costs associated with the relationship between speed and crash risk.

Svenson (2008) takes a different approach by taking risk out of the equation and instead surveys participants on perceived time savings which occur as a consequence of increases in mean speed due to changes to road infrastructure. The results show that people have a time saving bias in that they are over optimistic about the time saved by driving faster. Given two alternatives where the first alternative has a lower initial speed and a lower increase in (absolute) speed and the second alternative has a higher initial speed and a higher increase in (absolute) speed, the majority of participants predicted the second alternative would result in greater time savings despite this not being the case for any of the sets presented.

What links all existing research on this topic is the lack of empirical evidence of the amount of time spent speeding and how this relates to the number of road casualties at a population level. If we accept that time savings generally provides positive utility to individuals, it must be established empirically to what extent time savings are accrued by speeding and if this is beneficial once speed-related casualties are taken into account.

3. Data sources and methodology

Two principal sources of data were employed for this research. The driving data used here is drawn from a broader study of driver behaviour (Greaves et al., 2010) from which second-by-second Global Positioning System (GPS) data were collected from 106 drivers over a period of five weeks in Sydney, Australia. Data on crash statistics are sourced from the New South Wales Traffic Accident Database System (TADS).

3.1. GPS driving data

While full details of the GPS data collection effort are provided in Greaves et al. (2010), for the benefit of the reader, a summary is provided here. Drivers were recruited from an online consumer panel with residential locations in six suburbs distributed around Sydney[2] chosen to represent the different types of suburbs in the study area. Drivers ranged from 18 to 65 and were reasonably distributed across age/gender categories other than for young males who proved particularly difficult to recruit (Ellison et al., 2015). Importantly, daily driving distances were comparable to those in the Sydney Household Travel Survey (SHTS) for the population as a whole (for more detail see Greaves et al., 2014) and distribution of speeding behaviour, recognising the impact of the urban study area, was largely consistent with other naturalistic driving studies (Dingus et al., 2006; NSW Centre for Road Safety, 2010). The GPS device was installed in participants' own cars and, crucially, participants were not made aware that speeding was being monitored until after the five week period was over, following a procedure approved by The University of Sydney's Human Research Ethics Committee (HREC).[3] This, together with excluding one week of data preceding the five-week period, reduced the likelihood of the mere presence of the device in the car influencing behaviour. Each second, Doppler speed, latitude, longitude, altitude, date and time were recorded. This information was then matched to a Geographic Information System (GIS) based database of speed limits so that observations where speeding was occurring could be identified. Trip ends were automatically identified using the car's engine status (off/on) and participants accessed a web-based prompted recall survey to provide additional information about each trip including the driver of the vehicle, number of passengers, trip purpose and the number of intermediate stops. For the purposes of this analysis, only trips driven by the primary driver (i.e. the participant in the study) were included, providing a total of 11 million observations or 3049 h of driving across all 106 drivers.

The travel times for the observed behaviour (including speeding) were determined from the GPS information itself and this formed the baseline case. To calculate the time *savings* occurring as a consequence of speeding any observations driven above the speed limit (i.e. driving 62 km/h in a 60 km/h zone) were re-coded to match the speed limit (to 60 km/h in this example). This was done by iterating through each observation in sequential order and verifying if the observed speed was at or below the speed limit. If this was the case, then the observation remained unchanged. In contrast, if the speed was greater than the speed limit then the observation was split into two or more observations each with a

[1] Crash time was a measure of crashes as a unit of time.

[2] The six suburbs were Blacktown, Parramatta, Chatswood, Strathfield, Randwick and Sutherland.

[3] Participants were able to withdraw from the study after the five week period, however, no participants chose to withdraw.