Quantifying the contribution of low-level speeding to trauma in Victoria

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Abstract

Low-level speeding (driving at up to 10 km/h above the limit) is deemed to be the major contributor to speeding-related casualty crashes in Victoria. Understanding the size of the trauma problem that could be attributed to low level speeding is important for honing speed enforcement and public education strategies. In this study, we attempted to estimate the proportion of casualty crashes occurring on Victorian roads that could be attributed to low-level speeding. Almost 350,000 vehicle traveling speed recordings collected by covert mobile speed cameras across Melbourne Metro and regional Victoria, and within 40, 50, 60, 70, 80, 90, 100 and 110 km/h zones were compiled. The casualty crash risk formulae developed by Kloeden et al. (1997; 2001; 2002) were used to estimate the casualty risks associated with various levels of speeding. These risk levels were then combined with the survey speed data to estimate the size of the casualty problem due to low-level speeding. Vehicle traveling speeds showed that 9.5% of Victorian drivers violated the speed limit. Among these speeders, 94.9% were low-level speeders. Our analyses showed that 79% of speeding-related casualty crashes in Victoria could be ascribed to low-level speeding, while excessive speeding (21+ km/h above the limit) is likely to contribute to only 4.3% of speeding-related casualty crashes in Victoria. The results of this study justify the emphasis placed on low level speeding by the enforcement regime and public education campaigns. They also highlight the need to continue to raise the public awareness of the dramatic, cumulative consequences of low-level speeding in the community.

Introduction

There is a strong causal relationship between speed and road safety outcomes (i.e., crash occurrence and injury severity) (Elvik et al., 2004). According to the Victoria Police data, speeding was the sole or a contributing factor in almost 27 per cent of fatal crashes in Victoria in 2013. Notably, speeding behaviour is widespread. The surveys conducted by the Transport Accident Commission (TAC) show that only 45 per cent of Victorian licence-holders aged 18-60 stated that they never travel at or above the speed limit if they have the opportunity (SRC, 2013). However, considering the tendency of fast drivers to understate their normal speeds (Corbett, 2001), this 40 per cent can well be an overestimation.

The previous research into the relationship between the speed of individual vehicles and crash involvement shows that the risk of involvement in a casualty crash rapidly increases by speed (Kloeden et al., 1997, 2001, 2002; Fildes et al., 1991). Consequently, high-level speeding (21+ km/h above the limit) is significantly riskier than low-level speeding (up to 10 km/h above the limit). However, cumulatively, low-level speeding is deemed to be a larger safety problem than excessive speeding as there are more drivers speeding at lower levels than at excessive levels (Doecke et al., 2011). TAC research shows that almost 70 per cent of drivers drive up to 10 km/h over the limit at some time during the year (SRC, 2011). Furthermore, a recent French study shows that while the proportions of high-level and very-high-level speeding have dropped dramatically in recent years, possibly because of targeted enforcement and public education campaigns, the proportion of low-level speeding has decreased much more slowly (Viallon and Laumon, 2013). We believe that similar slow reduction in the proportion of low-level speeding is the case in Victoria. The main reasons are that, firstly, TAC research shows that low-level speeding is almost twice as more socially acceptable as excessive speeding in Victoria (Nieuwesteeg, 2012). Secondly, speeding is related to beliefs that minimise the perception of risk (Forward, 2010). For example, many Victorians do not believe that exceeding the speed limit by a 'small' amount (i.e., by up to 5 km/h) is speeding, and therefore, dangerous (Lahausse et al., 2010). Perceiving speeding as a low-risk behaviour increases the chances of drivers speeding (Fildes et al., 1998), therefore, it can be deduced that, unless some actions are taken, low-level speeding is going to remain a significant road safety problem.

In terms of the cumulative effects of low-level speeding, the comparatively lower risks associated with speeding at lower levels when multiplied by a noticeably higher number of low-level speeders is likely to result in more casualty crashes than high-level speeding. A study conducted in New South Wales shows that speeding up to 10 km/h over the speed limit contributes to around 43-67% of speeding-related fatal crashes (Gavin et al., 2010). Kloeden et al. (2002) showed that nearly 60% of the casualty crash risk could be avoided by eliminating speeding up to 15 km/h over the speed limit in urban environments. Also, Doecke et al. (2011) showed that if the speeds of all vehicles on the road were lowered by 1 km/h, the potential consequent reductions in casualty crashes that are attributable to the low-level speeding band (1-10 km/h above the limit) is two times larger than the contribution of the medium-level speeding band (11-20 km/h above the limit).

All the above converge to the hypothesis that low-level speeding has a drastic impact on road safety in Victoria. This research attempted to identify the size of the low-level speeding problem and its potential contribution to casualty crashes due to speeding in Victoria. It should be noted that by speeding-related casualty crashes we mean those casualty crashes where the travelling speed prior to the crash is above the speed limit.

Method

Size of low-level speeding problem – speed surveys

Historically, two main methods are used to investigate the size and levels of the speeding problem: observation (Viallon and Laumon, 2013) and self-report (Corbett, 2001) studies. The previous research has raised some justified concerns about the validity and accuracy of self-reported speed values (Corbett, 2001), while observed speed values tend to more faithfully represent the distribution of speed across the roads network (Fildes et al., 1991; Harrison et al., 1998).

Speed camera data has been widely used in Victoria and overseas to represent observed distribution of speed (Elvik, 1997; Hoareau et al., 2006). However, as Fildes et al. (1991) pointed out, it is essential that the observation be carried out, covertly, to counter the speed irregularities that occur in the vicinity of overt observation sites. Therefore, data acquired from covert mobile speed cameras are preferred to those acquired from fixed speed cameras.

The Victoria Police Traffic Camera Office (TCO) runs mobile speed cameras at approximately 2,000 locations in Victoria to address speeding across its wide roads network, and target areas with a high crash risk and speed-related problems. The collected speed data is compiled and stored by the Infringement Management and Enforcement Services office at the Department of Justice (DoJ), and was the data source used for the purposes of this research.

There are some caveats for using the DoJ's mobile speed camera data. Mobile speed cameras, because of their more covert nature, are more likely than fixed speed cameras to capture normal behaviour of the passing motorists. However, it is likely that some motorists notice mobile speed cameras and adjust their speeding behaviour. Also, the mobile speed camera sites, even though standing at 2,000 sites, might not fully represent all Victorian roads. However, these data were the only presently available data for these research purposes.

A randomised sample of observed speed recordings were acquired from the DoJ for 2013 (349,023 speed recordings). It should be noted that the sample was selected from observation sessions where the traffic volumes were inside one standard deviation from the mean traffic volume for the site. This is to avoid speed readings during abnormally dense or sparse traffic situations. Random sample sizes were based on a one percent sample size of the sessions that were available inside the standard deviation from the mean traffic detection volumes. However, if the number of vehicles that was detected was less than 5,000 then the sample size was increased, accordingly. Also, due to the nature of the raw log file source data, if there were multiple sessions occurring at the same site on the same day, then all sessions were included into the speed profile data. Table 1 shows the stratification of the sample across various speed limits in Melbourne Metro and regional Victoria.

Table 1. Stratification of the randomised sample of observed speeds detected by mobile speed cameras across Victoria's roads network

		Speed limit (km/h)							
		40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	**Size**	8,563	13,451	105,101	34,889	37,312	21,507	24,371	9,990
	%	100%	1%	1%	1%	1%	10%	1%	10%
Regional	**Size**	NA*	6,942	10,475	9,392	18,665	66,44	30,046	11,675
	%	NA	5%	1%	10%	5%	20%	1%	1%

* There were no sites available for a regional 40 km/h speed zone.

The distribution of the observed speeds in 60 km/h speed zones in metro areas is shown in Figure 1, as an example of the collected data. As can be seen, 87 per cent of the detected speeds were below the limit and some drivers were observed to drive up to 75 km/h over the limit, at 135 km/h.

A comprehensive analysis of the data is presented in the Results section, where the average and stratified size of the speeding problem and the contribution of each level of speeding are discussed.

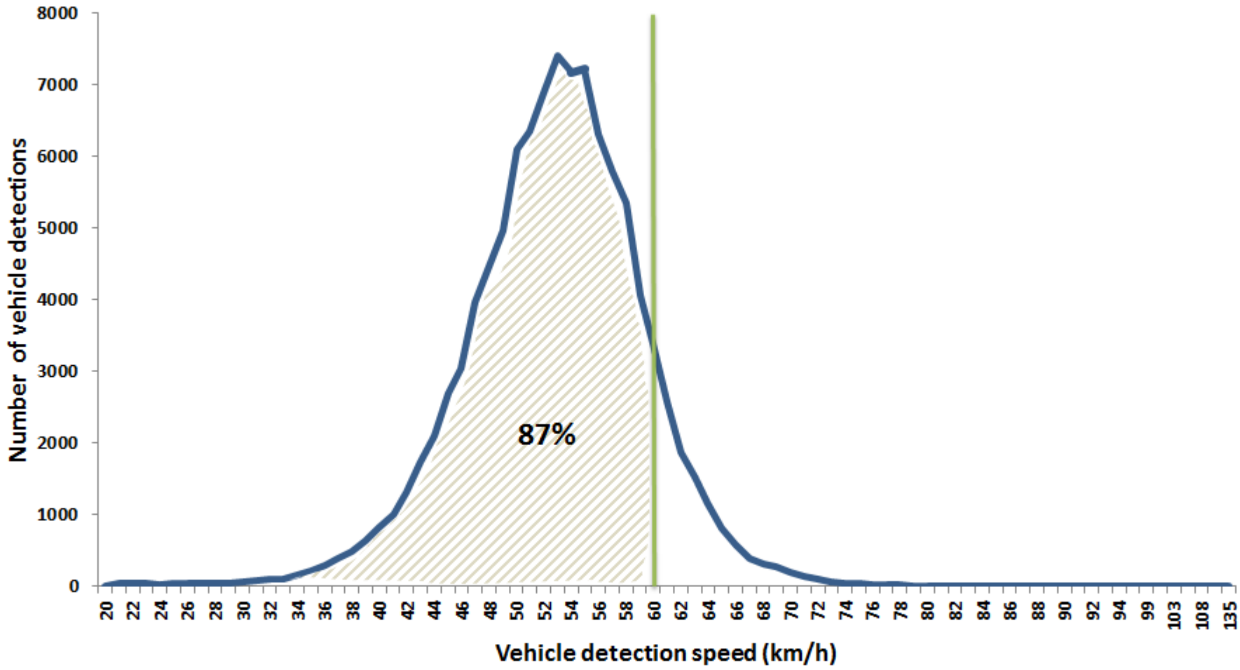

Figure 1. Distribution of observed speeds in 60 km/h zones in metro areas

Estimation of the contribution of different levels of speeding to casualty crashes

The ideal way to investigate the contribution of low-level speeding to casualty crashes due to speeding is collecting accurate, comprehensive data on the cause of the crash and the travelling speed of the involved vehicles. Using this data the size of the low-level speeding problem and its contribution to speeding-related road trauma could be readily ascertained. However, apart from those crashes that are investigated under in-depth crash investigation studies such as the Enhanced Crash Investigation Study (ECIS), such detailed speed data is not collected for casualty crashes in Victoria, and to the best of our knowledge, nowhere else, globally.

Therefore, we resorted to the alternative method which is relying on models that estimate the relationship between travelling speed and casualty crash involvement. In this method, after the distribution of speeders (in this research, the number of speeders observed within each level of speeding in the sample) is determined, the casualty crash involvement risks for each speeding level are estimated, using the models. Afterwards, the number of casualty crashes that are likely to be caused by each speeding level is computed by Equation 1. The contribution of low-level speeding to the pool of speeding-related casualty crashes is consequently determined by dividing the number of low-level speeding casualty crashes by the number of all speeding-related casualty crashes.

$$\begin{aligned}&\mathit{Number\ of\ casualty\ crashes\ for\ speeding\ level\ i}\\&\qquad = \mathit{Casualty\ crash\ involvement\ risk\ for\ speeding\ level\ i}\\&\qquad \times \mathit{Number\ of\ speeders\ observed\ within\ speeding\ level\ i}\end{aligned} \qquad Eq. 1$$

Two main streams of models could be traced back among previous studies, namely, estimation models that relate the risk of casualty crash involvement to a) an individual vehicle's speed, and b) average traffic speed. Among the first group is the models developed in South Australia by Kloeden et al. in late 1990's and early 2000's (Kloeden et al., 1997, 2001, 2002), and the second group are best represented by Nilsson's Power Models developed in late 1970's in Sweden (Nilsson, 1981). Average traffic speed models (e.g. Power Models) do not investigate the impact of individual travelling speeds on the chance of individual vehicles being involved in a crash. Therefore, they are more appropriate for determining the influence of changes in average travelling speeds on aggregate crash and injury rates. In the case of investigating the impact of low-level speeding, we needed to estimate the impact of each individual speeding level on the aggregate speeding-related casualty crashes. Therefore, individual vehicle speed models (e.g. Kloeden's) are more appropriate for the purposes of this research.

The individual speed models are mainly developed through self-report (Fildes et al., 91; Maycock et al., 1998; Quimby et al., 1999) and case-control (Kloeden et al., 1997, 2001, 2002) studies. Self-report studies are dismissed for the potential validity issues associated with them (Corbett, 2001). Kloeden et al. conducted case-control studies that link the estimated pre-crash speeds of crash-involved vehicles (cases) to the speeds of vehicles (controls) that were not involved in a crash but travelling in the same direction, at the same location, time of day, day of week, and time of year.

Kloeden et al.'s formula (2002) developed for 60 km/h speed zones in urban areas were used to assign casualty crash involvement risk to speeding incidents observed on 40, 50, 60 and 70 km/h speed zones. It is conceded that the road/traffic environment on the observed roads can be different from the ones used by Kloeden et al. However, as these speed limit environments have similar infrastructural and vehicle travel patterns, it could be expected that they have similar enough risk characteristics associated with speeding. Equation 2 shows the formula used:

$$Relative\, risk\, of\ (D) = e^{(0.1133374D+0.00281717D^2)}$$

, where D = difference in travelling speed relative to the mean speed.

For speeding risk on 80, 90, 100 and 110 km/h speed zones, Kloeden et al.'s (2001) formula representing the relationship between speed and the risk of involvement in a casualty crash in 80 km/h or greater speed limit zones in rural areas were used. Equation 3 shows the formula:

$$Relative\, risk\, of\ (D) = e^{(0.07039D+00008617.D^2)}$$

, where D = difference in travelling speed relative to the mean speed.

In this project, the relative risks associated with speeding were capped for high-level observed speeds. The main reasons are that, firstly, the Kloeden et al.'s risk models are accurate for speeds up to 20 km/h and 40 km/h over the mean speed for urban and rural areas, respectively (Kloeden et al., 2001, 2002). Secondly, the risks reach a limit at higher speeds, where casualty risk is already very high and cannot increase to a large extent (Gavin et al., 2010). Thirdly, it is hypothesised that drivers who choose to exceed the speed limit by more than 20 km/h are not too likely to be deterred by public education campaigns urging them to slow down (Doecke et al., 2011).

Therefore, while Cameron (2013) raised some caveats about capping the relative risks associated with high speeds and suggested to use the confidence limits for their relative risks, the risk of travelling at 21 km/h over the mean speed in urban areas (37 times of travelling at the mean speed), and at 41 km/h over the mean speed in rural areas (76 times of travelling at the mean speed) were used to cap high-level speeds' risk. Figure 4 shows the relationship between speed and crash rate on urban and rural roads, as estimated by Kloeden et al.'s formulae.

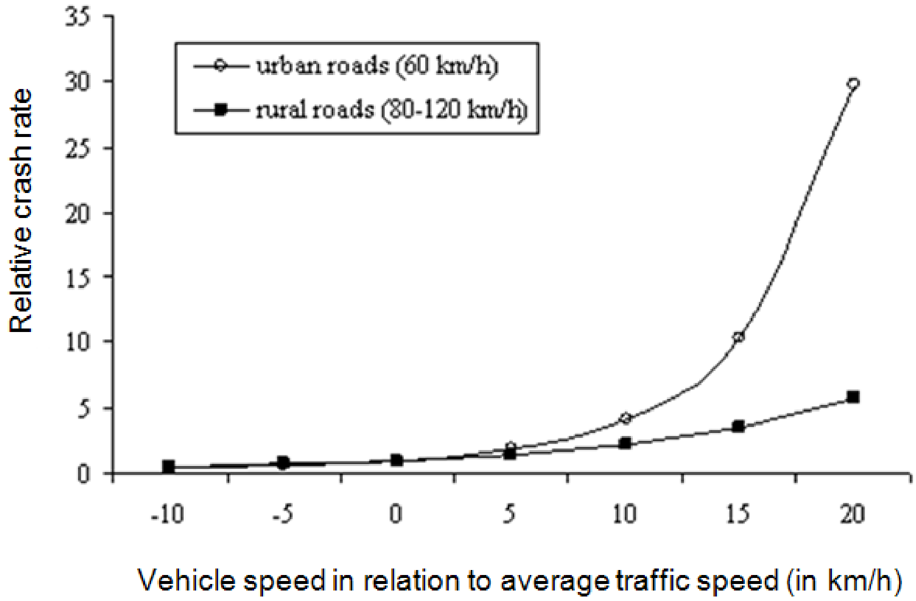

Figure 2. The relationship between speed and crash rate on urban and rural roads

Estimating the average speeding and related casualty crash problems for Victoria

As previously discussed, vehicle travelling speed data were available for various combination of speed limits and area type (metro versus regional). Therefore, the size of speeding, low-level speeding and the attributable speeding-related casualty crashes to low-level speeding could be calculated for disaggregate segments of Victorian roads.

In addition, we also were interested in having an understanding of the average magnitude of these issues for the whole Victorian roads network. In order to calculate the average figure for Victoria, the 2013 data on average daily Vehicle Kilometre Travelled (VKT) for all Victorian arterial roads were used as weighting coefficients. In other words, for example, the size of low-level speeding problem calculated for each 'speed limit-area type' combination was weighted (on the basis of VKT's estimated for each combination) to calculate the magnitude of average low-level speeding in Victoria. Table 2 shows the VKT data.

Table 2. Average daily Vehicle Kilometre Travelled on Victorian arterial roads (billions)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	0.08	0.97	8.83	2.7	7.02	0.72	15.34	6.07
Regional	1.31	7.79	26.17	6.62	13.59	0.58	22.05	0.58

Results and discussion

Size of speeding problem

After averaging the magnitude of the speeding problem across Victoria, it was revealed that 9.5% of the observed vehicles were travelling at speeds above the limit. In other words, at any specific time during the year, almost 10% of the Victorian drivers are likely to speed. Moreover, the magnitude of the speeding problem differed markedly between metro and regional areas. While only 6.1% of metro drivers are estimated to be speeding at any specific time during the year, 11.3% of regional drivers are estimated to do so.

Table 3 shows the proportion of the observed vehicles that travelled above the speed limit and the results of the Z test analyses to assess the difference between the proportions in metro versus regional areas. The highest level of speeding was observed in 40 km/h zones (47.1%, metro). The two lowest observed were in 80 km/h metro zones (2.5%) and in 90 km/h regional zones (5.1%). As can be seen, for the major parts of the network, less or just above 10% of the vehicles were observed travelling above the speed limit. Figure 3 shows the size of the speeding problem for metro and regional areas. We deem that the most plausible reason why the size of speeding is higher in 40 km/h zones is that the mis-match between road environment characteristics and the posted speed is more marked in such zones.

Table 3. Proportion of the vehicles observed to travel above the speed limit (%)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	47.1	21.2	9.5	5.7	2.5	5.6	4.8	6.1
Regional	NA*	23.3	11.6	7.5	7.9	5.1	10	9.7
Z test**	NA	0.00	0.00	0.00	0.00	0.12	0.00	0.00

* There were no sites available for a regional 40 km/h speed zone.

** P-value figures (at 0.05 level)

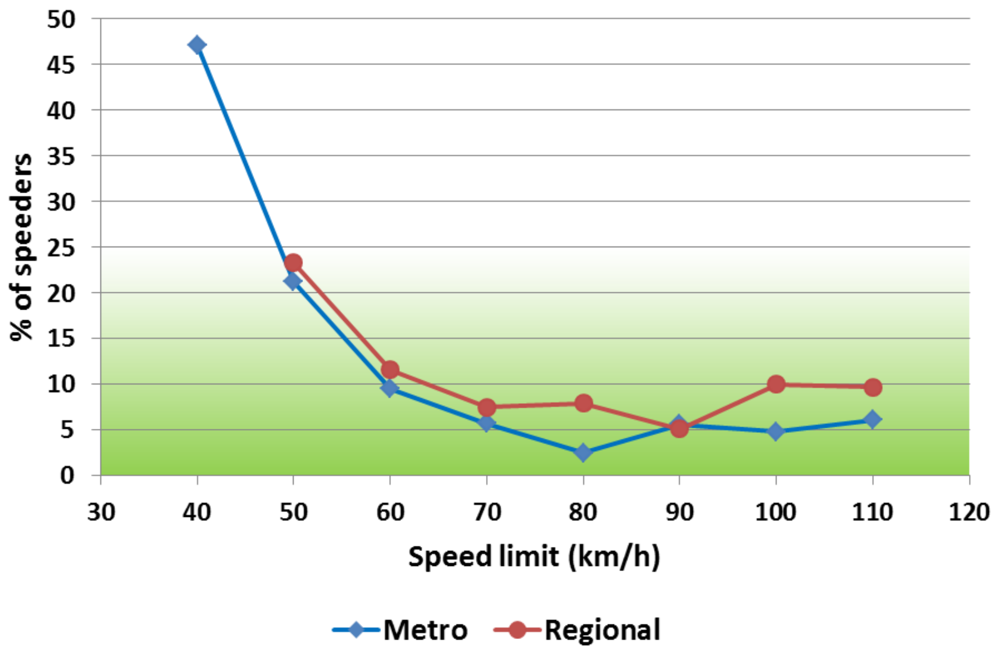

Figure 3. Proportion of the vehicles observed to travel above the speed limit

Proportion of speeders who low-level speed

Table 4 shows the proportion of low-level speeders in various speed zones in metro and regional areas and the results of the Z test analyses to assess the difference between the proportions in metro versus regional areas. As can be seen, the majority of the vehicles observed to be violating the speed limits were speeding at the low-level. In some areas (for example, 100 and 110 km/h zones in both metro and regional areas), almost all speeders were low-level speeders. The results of the Z test analyses show that, except for 70 and 80 km/h zones, no significant difference exists between the size of low-level speeding proportions in metro versus regional areas.

Table 4. Proportion of low-level speeding of all the speeding incidents (%)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	77.4	89.4	94	92.5	96.4	94.2	98.5	99.5
Regional	NA*	91	94	89.2	91.5	96.4	97.8	99
Z Test**	NA	0.09	1.00	0.01	0.00	0.11	0.14	0.27

* There were no sites available for a regional 40 km/h speed zone.

** P-value figures (at 0.05 level)

Figure 4 shows the proportion of low-level speeding of all the speeding incidents in metro and regional areas in Victoria. As can be seen, the proportion of low-level speeders increases by speed limit. This can be explained by the fact that drivers more sensitively define what speeding is in lower speed limits. TAC research has investigated what proportion of drivers define speeding as travelling ‘anything + up to 5 km/h over’ the posted speed (Hennessy et al., 2014). Respectively, 84%, 81% and 69% per cent of drivers did so for 50 km/h, 60 km/h and 100 km/h zones. Moreover, TAC’s social acceptability research (Nieuwesteeg, 2012). shows that a higher percentage of Victorians find driving 10 km/h above the limit “unacceptable” or “very unacceptable” in 60 km/h zones (50.6%) than in 100 km/h zones (36.4%).

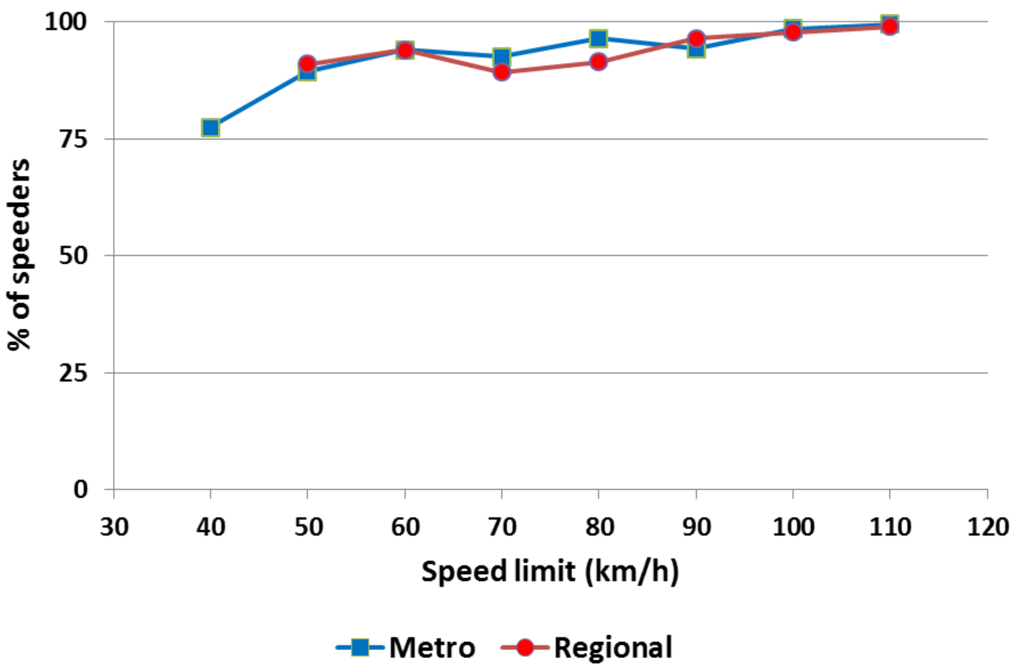

Figure 4. Proportion of low-level speeding of all the speeding incidents (%)

Using the average daily Vehicle Kilometre Travelled on Victorian arterial roads data as weighting coefficients, it was estimated that, on average, 94.9% of Victorian drivers who speed, violate the limit by up to 10 km/h (low-level speeding). The figure for metro drivers is slightly higher than their regional counterparts (96.6% versus 94%, respectively).

Contribution of low-level speeding to trauma

Table 5 shows the proportion of Victorian speeding-related casualty crashes potentially attributable to low-level speeding and the results of the Z test analyses to assess the difference between the proportions in metro versus regional areas. As can be seen, low-level speeding is the potential cause of the majority of speeding related casualty crashes in Victoria, from 57.5 to 98.8% of the problem in Melbourne Metro, and from 59 to 95.9% in regional areas. Also, evidently, low-level speeding plays a more prominent role in casualty crashes in higher speed limit zones. For example, While 57.5% of casualty crashes in 50 km/h metro zones could be attributed to low-level speeding, almost all casualty crashes (98.8%) in 110 km/h metro zones could be ascribed to low-level speeding. The underlying reasons may be, firstly, that low-level speeding rates (as shown in Figure 4) increase by speed limit. Secondly, Kloeden et al. (1997; 2001; 2002) showed that casualty crash rate increases exponentially for individual vehicles that increase their speed and the effect is more marked for minor/urban road compared to major/rural roads. For example, in a 60 km/h zone, the risk of involvement in a casualty crash approximately doubles with each 5 km/h increase in travelling speed over 60 km/h. However, on rural roads, the risk of involvement in a casualty crash doubles when travelling 10 km/h above the average speed and nearly six times as great when travelling 20 km/h above that average speed (Figure 2).

In addition, low-level speeding has a potentially bigger impact on casualty crashes in metro than regional areas. Apart from 50 and 90 km/h speed zones, the proportion of speeding-related casualty crashes contributable to low-level speeding is higher in metro areas (only the difference observed in 90 km/h zones is statistically significant). This may be explained by the higher proportion of low-level speeders in metro versus regional areas (96.6% versus 94%, respectively), which was discussed in the previous sub-section.

Table 5. Proportion of Victorian speeding-related casualty crashes potentially attributable to low-level speeding (%)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	65.3	57.5	72.1	75.6	85.7	82.5	94.5	98.8
Regional	NA*	59	71.7	59.3	72.4	89.4	89.7	95.9
Z Test**	NA	0.33	0.77	0.00	0.00	0.00	0.00	0.00

* There were no sites available for a regional 40 km/h speed zone.

** P-value figures (at 0.05 level)

Using the average daily Vehicle Kilometre Travelled on Victorian arterial roads data as weighting coefficients, it was estimated that, on average, 79% of Victorian casualty crashes related to speeding are attributable to low-level speeding (Appendix A). The magnitude of the contribution is different for different areas. In metro areas, low-level speeding contributed to 86.6% of speeding-related casualty crashes; in regional areas to 74.9%.

There are a few concessions that we would like to make. First and foremost, the ideal way to investigate the contribution of low-level speeding to casualty crashes due to speeding is collecting accurate, comprehensive data on the cause of the crash and the travelling speed of the involved vehicles. This data is not collected in Victoria, and to the best of our knowledge anywhere, globally. Therefore, the estimation models developed by Kloeden et al. in South Australia are used. It should be conceded that some valid concerns are raised by Cameron (2013) in terms of the appropriateness of capping the relative risk of high speeds. However, until sufficient research is conducted to close the gap (that Kloeden’s formulae are not accurate for high speeds) and because the results of our, and similar, research are, mainly, to inform public education campaigns, the method used here could be justified.

Secondly, exposure data on the vehicular traffic volumes to ascertain the average size of the low-level speeding problem and its potential contribution to casualty crashes across the Victorian roads network were available. However, these data were limited to arterial roads. It could be argued that arterial roads’ traffic constitute the major part of the whole vehicular traffic in Victoria. However, there is need for more comprehensive data to cover this gap.

Lastly, as discussed in the Methods section, mobile speed camera data may be biased due to some motorists noticing them and adjusting their speeding behaviour. Also, their operation sites might not fully represent all Victorian roads. To address this possible shortcoming, for future relevant research, it is suggested that VicRoads speed monitoring data be used to complement the mobile speed camera data and provide a more comprehensive picture of driver behaviour.

Conclusions

Speeding is robustly shown to be associated with poor road safety outcomes. Casualty crash rates increase exponentially for individual vehicles that increase their speed. However, while high-level speeders are dramatically more likely to be involved in casualty crashes, the majority of drivers just marginally violate the speed limits (low-level speeding). Therefore, cumulatively, the majority of speeding-related casualty crashes are deemed to be caused by low-level speeding. This is confirmed by the findings of this research, which show that 79% of Victorian casualty crashes related to speeding are attributable to low-level speeding (86.6% in metro areas; 74.9% in regional areas). The findings of this research are also consistent with other similar Australian research (Kloeden et al., 2002; Gavin et al., 2010; Doecke et al., 2011), which are discussed in the Introduction section.

Despite such evidence, speeding enforcement, especially low-level speeding, is denigrated by mass and social media as being a pretext for “revenue raising” (Mooren et al., 2013). There is anecdotal evidence that the Police are reluctant to book low-level speeders and there is an allowance margin above the actual speed limits above which the detected vehicles are booked.

TAC has been actively addressing the low-level speeding problem since 2001 with the launch of the Wipe-Off 5 campaign. The results of such campaigns are shown to effectively enhance Victorians’ awareness of the risks associated with low-level speeding (D’Elia et al., 2007). There is a need to develop similar campaigns in the vein of the previous, successful ones and boost them with the findings of more recent studies such as the Enhanced Crash Investigation Study (ECIS), which commenced in 2013. Concurrently with the current project, TAC are involved in reviewing TAC’s previous surveys and campaigns in order to hone their approach to address low-level speeding with even more effective public education communications.

Considering the high impact of low-level speeders on Victoria’s road trauma, more strict approaches should be considered. TAC, Victoria Police, VicRoads and Department of Justice should put more emphasis and efforts into addressing the incidence and impact of low-level speeding. This could include a focus on communications, enforcement, technology and infrastructure.

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Appendix A: Estimating the average contribution of low-level speeding to casualty crash problem across Victoria

As discussed in the last sub-section of the Methods Section, we were interested in having an understanding of the average magnitude of casualty crash problem related to low-level speeding across Victoria. In order to calculate the average figure for Victoria, the 2013 data on average daily Vehicle Kilometre Travelled (VKT) for all Victorian arterial roads were used as weighting coefficients (Table 2 – reproduced below).

Table 2. Average daily Vehicle Kilometre Travelled on Victorian arterial roads (billions) (reproduced from the Methods Section)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	0.08	0.97	8.83	2.7	7.02	0.72	15.34	6.07
Regional	1.31	7.79	26.17	6.62	13.59	0.58	22.05	0.58

Precisely, the size of casualty crash problem related to low-level speeding calculated for each 'speed limit-area type' combination (Table 5 – partially reproduced below) were weighted, on the basis of VKT's estimated for each combination, to calculate the average magnitude of casualty crash problem related to low-level speeding in Victoria.

Table 5. Proportion of Victorian speeding-related casualty crashes potentially attributable to low-level speeding (%) (reproduced from the Results and discussion Section)

	Speed limit (km/h)							
	40	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Metro	65.3	57.5	72.1	75.6	85.7	82.5	94.5	98.8
Regional	NA*	59	71.7	59.3	72.4	89.4	89.7	95.9

* There were no sites available for a regional 40 km/h speed zone.

Equation below shows the formula used for this purpose.

$$Average\ mangnitude\ of\ casualty\ crash\ problem\ in\ Victoria\ due\ to\ low - level\ speeding = \frac{\sum Casualty\ crash\ problem\ for\ each\ area - speed\ combination \times respective\ VKT}{\sum VKT}$$

The results of these analyses showed that 79% of Victorian casualty crashes related to speeding are attributable to low-level speeding (86.6% in metro areas; 74.9% in regional areas).