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Safer Driving – The Road to Success

The Effects of Safety Cameras on Drivers

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Britax

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1. Why catch speeders? The role of illegal speed in crash severity and frequency.

Speed kills by increasing crash severity. The laws of physics inexorably dictate that the higher the speed at impact, the more energy must be absorbed by hard metal, soft flesh and brittle bones. Speed at impact will be a function of pre-incident speed and of the time and distance available to take avoiding action (braking and steering). Reducing speeds (and increasing separation e.g., headway or following distance to the vehicle in front) will allow more time for the avoidance of intersecting trajectories.

Illegal speed elevates crash frequency. Drivers who report having been penalised for speeding in the previous three years are more likely to report also having been accident-involved during that period. Table 1, from Stradling et al (2002), shows that 35% of a large sample of English car drivers who had been penalised for speeding in the previous three years reported also having been accident-involved, compared to 22% of those who had not been penalised, indicating that the kinds of drivers who have been recently caught for speeding are over 50% (59%) more likely to have also been recently crash-involved. This finding suggests that being detected speeding is a good indicator of a car driver's risk potential.

Table 1. Self-reported speeding offences and crash-involvement in the previous three years

		Speeding Offences last 3 years	
		None	1 or more
Accidents last 3 years	None	78%	66%
	1 or more	22%	**35%**

More generally, drivers who break the speed limits, violate other rules of the road and who seek thrill when driving pose greater risks to themselves and to other road users. Table 2, from Stradling et al (2002), shows a number of measures of speeding behaviour and aggressive driving that were associated with elevated crash-risk in a large sample of English drivers.

Table 2. Risky road behaviours and crash history

	3 Year Crash History
3 Year Speeding Offences	Elevated crash risk
Normal Speed Choice	Elevated active crash risk
Preferred Speed Choice	Elevated active crash risk
Highway Code Violations	Elevated crash risk
Aggressive Violations	Elevated crash risk
Thrill-Seeking	Elevated active crash risk

The speed at which 'you normally drive' and the speed at which 'you would prefer to drive', across a number of different road types and level of thrill-seeking while driving predicted active, though not passive, crash involvement. Those who do, and those who would like to, drive fast and those who seek thrill from driving are more likely to run into other road users and to suffer loss of control crashes.

In addition, drivers who had been crash-involved in the previous three years scored significantly higher not only on speeding offences but also on Highway Code violations and aggressive violations compared to those who reported no crashes. This was true for both active accidents and passive crashes. The tendency to violate the rules of the road was indexed by responses to the most recent form of the Manchester Driver Behaviour Questionnaire (DBQ: Lawton et al, 1997a,b: Parker et al, 1998; Stradling and Meadows, 2000), a twenty item scale consisting of 12 violation and 8 error items. Factor analysis produces two violation factors – Highway Code and aggressive violations – plus an error factor (Stradling et al, 1999). Highway Code violations include speeding, close following, racing from traffic lights and drink-driving. Aggressive violations include showing anger and annoyance to another driver. Errors include failures of judgement (e.g., misjudging an overtaking gap) and failures of observation (e.g., failing to see a 'Stop' sign).

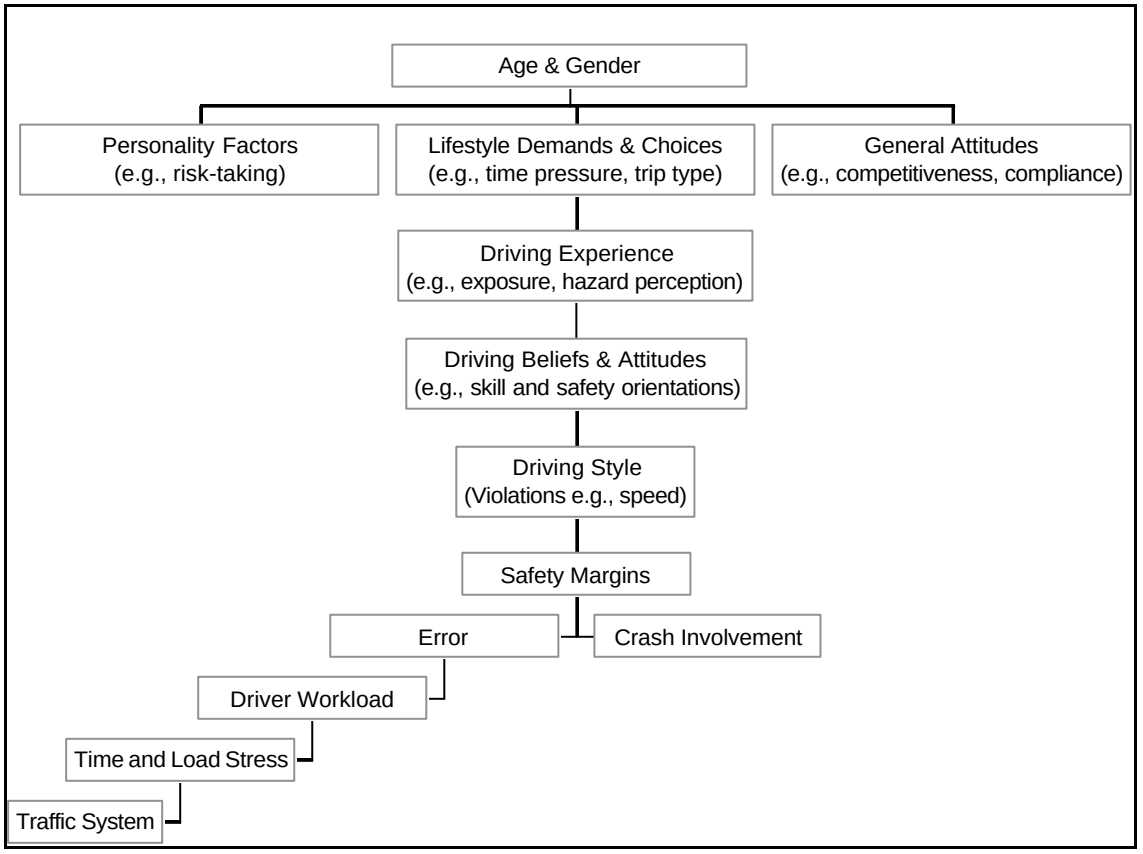
High violators show an elevation on both active accidents ("I hit ...") and passive accidents ("I was hit by ...") (Meadows, 1994; Parker et al, 1995) - a distinction between crash types introduced by West (1995). That is, high violators are not only more likely to run into others, but to put themselves in situations where others run into them.

Thus, the kinds of drivers who speed are 'crash magnets'. Speed at impact kills and speeders are more likely to crash. Speed reduction may be achieved by modifying roads or vehicles to reduce the opportunities for speeding, or modifying drivers and their trip agendas to reduce the inclinations and pressures to speed, or by increasing the likelihood of detection and penalty for speeding.

2. A Model of Car-driver Crash Involvement

Figure 1 shows a descriptive model of the person and system influences on frequency of crash-involvement. The model posits a 'violation route' (from the top down) and an 'error route' (from the bottom up) to a crash.

Figure 1. A model of person and system influences on crash involvement



In the model peripheral factors influence more proximal factors. For example, age and gender make documented differences to the factors below them. Age, gender and all the factors below them have links to crash involvement which are documented in the research literature.

The model suggests that violations directly influence safety margins and that driving with reduced safety margins makes the driver vulnerable to error by any of the parties in a road traffic situation as a result of which trajectories may intersect unless remedial action (braking, steering) is taken. Recent work also suggests we may now begin unpacking the ways in which the ever increasing demands of a traffic system grinding towards gridlock increase time and mental load stress and thus driver mental workload, in turn increasing the likelihood of error.

The core of the formulation is that:

- Violations (e.g., speeding, close following, running red lights, drink-driving, aggressive driving, etc.) are a part of the expressive component of driving.
- Violations reduce safety margins, thereby increasing the likelihood of both active and passive crash involvement.
- Excessive mental workload demands promote errors which may take advantage of reduced safety margins, such that
- Violation + Error = Crash.

3. Speed Camera Study: General Deterrent Effects

Speed cameras are intended to reduce casualties by reducing accidents by reducing speeds at specific high-risk locations. Use of speed cameras to supply an evidential basis for prosecution was made possible by Section 23 of the UK Road Traffic Act 1991. This Act provided that photographs from an approved automated speed camera may be used as evidence without the corroboration of a police officer in prosecuting drivers for exceeding speed limits. The UK national Cost Recovery for Safety Cameras project differs markedly from past speed camera initiatives in financial terms. Previously revenue from court fines and fixed penalties (currently £60) went directly to the UK central government exchequer. Neither the local traffic authorities, who purchase and house the cameras, nor the police, who operate them, nor the courts, who administer the collection of fines and Fixed Penalty Notices, were able to cover their costs from fine revenue. Now the money from additional cameras will go to the local authorities, the court and the police and will be reserved ('hypothecated') for investment in local road safety and casualty reduction measures.

Nu-metric survey equipment was used to compile traffic statistics for each of five new 30 mph sites in the Glasgow area once every three months, beginning in April 2000. This equipment records the number of vehicles, and the speed each vehicle travelled at, over a 24 hour period. Nu-metric surveys are conducted for 24 hours from noon until noon the following day. All surveys are conducted on a weekday, with surveys at different sites on different days. Research access to this data was made possible by Strathclyde Police Traffic Department who conducted the Nu-metric surveys.

April 2000. Baseline

At this time the new sites had been identified for speed camera installation. Nu-metric surveys were carried out with no camera casings, cameras, road markings or warning signs present. When this survey was conducted the sites had been chosen for the cameras but the camera casings had not been erected. Therefore the study was able to record the baseline traffic speeds before any deterrents were introduced. There was nothing at any of the locations to indicate to passing drivers that these were chosen speed camera sites. Speed camera warning signs must be present within one mile of any fixed, automatic speed camera. No new speed camera warning signs were erected in respect of the six new camera sites as all were within the statutory distance of existing signs.

July 2000. Camera housings only

By this time when the Nu-metric survey was conducted the camera casings were in place, consisting of a grey metal pole with grey metal box on top. No white line calibration road markings were present on the road, no new warning signs had been erected. There were no cameras in any of the new sites, therefore there were no camera flashes to indicate to drivers that a camera might be present (neither active cameras nor 'dummy' cameras which flash when speeding vehicles pass but take no photograph to record the offence).

October 2000. Camera housings plus gridlines

At this time camera casings and white line road markings were in place at all five new 30 mph sites. No new warning signs had been erected. Live cameras had been in four of the sites for between 1 and 15 days before the Nu-metric surveys were conducted. This means that speeding drivers would have experienced the camera flashing as they passed, but due to the length of the process for issuing prosecution letters, few Notices of Intention to Prosecute – specific deterrents - would have reached offending drivers by the time of this Nu-metric survey.

There were no substantial differences in traffic flow - and thus in the opportunity for speeding - between the three measurement times. Table 3 summarises the results.

Table 3. Effects of gradual installation of site furniture on speeding behaviour

Date of measurement	Condition	% of speeding vehicles at 30mph sites
April 2000	Baseline	64%
July 2000	Camera housing only	37%
October 2000	Camera housing + grid lines (+ cameras)	23%

Summary. The study used Nu-metric data on traffic flow and vehicle speed to chart the general deterrence effects of installation of speed cameras at five 30 mph sites. When baseline measures were taken in April 2000 64% of vehicles were exceeding the posted limit. Three months later, in July 2000, after speed camera housings had been installed but before they became operational, only 37% of vehicles were exceeding the speed limit. After a further three months, in October 2000, by which time white roadway gridlines had been added and the cameras had just begun operating (flashing), this figure had fallen to 23%. The installation of fixed-site speed cameras at five 30mph sites in Glasgow had reduced the number of speeding motorists from two-thirds to one quarter over a six month period.

4. Speed Camera Study: Specific Deterrent Effects

To gain an understanding of the impact on drivers of receiving a speeding ticket a questionnaire was sent to drivers who had been detected by speed cameras. Questionnaires were sent to 2,880 recipients of a Conditional Offer letter produced from speed cameras in Glasgow over a two month period, February and March 2001. 510 usable questionnaire (18%) were returned.

Three-quarters (73%) of those receiving speeding tickets were aged between 25 and 55. 37% were female, and 63% male. UK national figures show 42% of those holding a driving licence are female and 58% male, with the average female driver doing a lower average annual mileage. Only 2% of the males in receipt of speeding tickets were in the 'boy racer' age group between 18 and 24 years of age.

Three quarters of drivers who received speeding tickets were currently in employment, less than 5% were unemployed. They were from wealthy rather than poor households, 20% were from households with an annual income of over £50,000. 92% were driving cars rather than other vehicles and the majority of respondents were driving large cars, with one third of the females and half of the males driving cars of 1.8 litres or above.

Over half of the survey respondents were not familiar with - not frequent or regular users of - the site where they were caught speeding. Only a quarter of those caught speeding on Glasgow City roads had Glasgow City home postcodes. Drivers from the outskirts of the city and the rest of the Strathclyde region constituted 57% of those caught. 9% of drivers receiving tickets were from the remaining Scottish regions and 7% had English home postcodes.

Respondents were asked about their emotional reaction on receiving the letter informing them of their speeding offence. The responses indicated that receiving a speed ticket can be a highly emotional experience. 81% of respondents reported strong feelings, while only 12% discussed their experience with no reference to emotions. The most frequent emotion mentioned was anger. 45% of all respondents reported feelings of anger. While this anger was mostly at the system and the situation, there were a significant number of these angry respondents (29%) who were annoyed with themselves.

Write-in responses revealed a range of reactions to the receipt of a speeding ticket. Some expressed their anger and frustration:

> ‘I am really mad - no speed limit signs up - how are people to know what the limits are?’
> ‘I was frustrated and annoyed as I am not a speed merchant’
> ‘Shock, fear, concern about my driving licence, followed by annoyance and anger to myself for committing the offence’
> ‘I was totally angry at myself for paying money for a stupid mistake’

some reported an initial shock:

> ‘My first reaction was one of dismay’
> ‘I received the ticket and my first reaction was dread’
> ‘I personally felt gutted’

whilst a small but finite number reported effects over and above those changes to driving behaviour which the issue of a speeding ticket seeks to achieve:

> ‘I felt physically sick, extremely upset and more than extremely worried. I had visions of being in jail’
> ‘Since the offence I am not the driver I was. I only drive now when I have to’.

For some drivers the desired effect was reported:

> ‘The punishment was deserved and it has made me make sure I keep to the speed limit wherever I go’
> ‘I consider myself a competent, confident and safe driver but being caught and having to pay a fine has made me rethink - I have noticeably slowed down’

while others were affronted by the perceived inequity of the punishment and the attack on their self-image as a driver:

> ‘The punishment was very unfair considering how careful a driver I am’
> ‘It made me feel that I was not a good driver, which I am’.

Some indicated they were now sensitised to their speed at camera locations:

> ‘I certainly drive more slowly along the street with the camera that caught me last time and I am more careful to look out for speed cameras’
> ‘I didn’t know the road and I didn’t know to look out for the speed camera at this point’

whilst others announced themselves unremediated by the experience:

> ‘I drive my car the exact same way as I do not believe that the speed I was driving at was reckless or dangerous’.

Speed Sensitive and Camera Sensitive Drivers

In addition, respondents rated their agreement with a number of attitude items. These responses were factor analysed. Amongst the factors was one which grouped together items telling of speed sensitivity, another labelled as camera sensitive.

Table 4 displays the variables for the two factors and shows the level of agreement (Strongly Agree plus Agree) with each item.

Table 4. 'Since I got the ticket ..'

Speed Sensitive	% Agree
I keep more of a lookout for speed limit signs	80
I pay more attention to my speed while driving	74
I look at my speedometer more often	73
I drive more carefully	58
*I drive more slowly	56
I allow more time for journeys	36
Camera Sensitive	**% Agree**
I keep more of a lookout for speed cameras	79
*I slow down when passing any speed cameras	74
I take extra care when driving past the camera at which I was caught	66

These initially appear to be encouraging levels of agreement. However, cross-tabulation of two core attitude items (shown as * in Table 4) and then of scale scores derived from the two factors, shows three separable groups: those who now drive more slowly, necessarily including driving slowly past cameras (41 - 56%); those who only slow down at cameras and are not driving more slowly otherwise (30 - 32%); and those doing neither (14 - 15%). These results are summarised in Tables 5 and 6.

Table 5. 'Since I got the ticket ..'

		I slow down at cameras		
		Yes	No	
I drive more slowly	Yes	44%	12%	56%
	No	30%	14%	
		74%		

Table 6. 'Since I got the ticket ..'

		Camera Sensitive		
		Yes	**No**	
Speed Sensitive	**Yes**	41%	13%	54%
	No	32%	15%	
		72%		

Three groups were identified: those who were more speed sensitive and had slowed down in general (best estimate 41% - 56%); those who had become camera sensitive and were concerned only to avoid further detection (best estimate 31% - 32%); and those who did neither (best estimate 14% - 15%) and whose speeding behaviour remained unchanged.

SUMMARY

Those who drive fast are more likely to have recently been crash-involved. In common with other driving violations, speeding reduces a driver's safety margins. The presence of speed camera housings slows drivers down - they have a general deterrent effect and constrain on-road speeding behaviour. Issuing speeding tickets produces aversive emotion and has mixed specific deterrent effects even in the short term, with half of drivers sensitive to their speed and driving more slowly, one third only slowing down for speed cameras, and one sixth reporting themselves unremediated and not slowing down at all two months after receiving their ticket.

REFERENCES

Lawton, R., Parker, D., Manstead, A.S.R., and Stradling, S.G. (1997a) The role of affect in predicting social behaviours: The case of road traffic violations. **Journal of Applied Social Psychology**, 27, 1258-1276.

Lawton, R., Parker, D., Stradling, S.G., and Manstead, A.S.R. (1997b) Predicting road traffic accidents: The role of social deviance and violations. **British Journal of Psychology**, 88, 249-262.

Meadows, M.L. (1994) `Psychological Correlates of Road Crash Types', unpublished PhD Thesis, University of Manchester.

Parker, D., West, R., Stradling, S.G. and Manstead, A.S.R. (1995) Behavioural traits and road traffic accident involvement. **Accident Analysis and Prevention**, 27(4): 571-581.

Parker, D., Lajunen, T. and Stradling, S.G. (1998) Attitudinal predictors of interpersonally aggressive violations on the road. **Transportation Research Part F: Traffic and Transport Psychology**, 1, 1-14.

Stradling, S.G., & Meadows, M.L. (2000) 'Highway Code and aggressive violations in UK drivers'. Global Web Conference on Aggressive Driving Issues at http://aggressive.drivers.com.

Stradling, S.G., Meadows, M.L., and Beatty, S. (1999) Factors Affecting Car Use Choices'. Transport Research Institute, Napier University: Edinburgh.

Stradling, S.G., Meadows, M.L. and Beatty, S. (2002) Characteristics of speeding, violating and thrill-seeking drivers. In J.A.Rothengatter, R.D.Hugenin (Eds) Traffic and Transport Psychology. Oxford: Pergamon.

West, R. (1995) 'Accident Script Analysis'. Contractors Report CR343. Transport Research Laboratory: Crowthorne.

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