Outcomes from the South Australian Road Safety Media Evaluation Study

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The impacts of television advertising on road trauma have been debated in South Australia and elsewhere since the early 1990s. Claims that high intensities of television advertising are very effective, and necessary, and that reductions in numbers of serious casualty crashes are immediate, are provocative when set against the general understanding of how television advertising works.

In 1996 the Monash University Accident Research Centre (MUARC) recommended to the SA Government that it should increase funding for road safety, in particular television advertising (Vulcan, Cameron, Mullan and Dyte, 1996). These recommendations were based on research outcomes that underpinned the following assumptions:

- advertising has an effect on road safety outcomes that is statistically independent of levels of enforcement;
- very high levels of television advertising are justifiable;
- there will be an *immediate* response to advertising.

Rather than immediately follow the advice of Vulcan et al (1996), with the corresponding large increases in expenditure, South Australian authorities decided to test these assumptions with their own research including:

1. a re-analysis of the Melbourne data (1983-92) on the effects of advertising on numbers of casualty crashes;
2. a literature review of social persuasion campaigns with an emphasis on best practice in road safety; and
3. a designed study over three years to test for immediate effects of different intensities of television advertising.

The first stage sought to replicate the MUARC findings, reported by Newstead, Cameron, Gantzer and Vulcan (1995), based on the same data that they used in their analysis. The purpose of the re-analysis was to see if their findings could be supported and whether their method of analysis was suitable. White, Walker, Glonek and Burns (2000) subsequently concluded that the recommendations of Vulcan et al (1996) for high levels of advertising could not be wholly sustained, on the grounds that the interpretation of observed effects concerning an essentially dichotomous variable (the introduction and then continuance of television advertising) by Newstead et al (1995) may have lacked statistical rigour. The second and third stages have explored the role that television mass media advertising can play in road safety. This paper provides a summary of the outcomes from the South Australian Media Evaluation Study (MES). It may provide advice to guide appropriate investment in road safety advertising.

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STUDY DESIGN

The MES required careful planning of the form of the study and the methodology for data collection and analysis. The following features of the study design were of special concern and demanded careful attention.

Statistical power

The study design required the identification of a road safety outcome measure with sufficient statistical power. Expert independent statistical advice was sought to determine whether either of the following potential road safety outcome measures had the statistical power to justify conducting a study in Adelaide (*if* the relationship between advertising intensity and numbers of crashes followed the pattern reported by MUARC for Melbourne):

- numbers of casualty crashes occurring at times of the week when proportions of drivers with Blood Alcohol Concentration (BAC) greater than 0.05 mg/L exceeded or equalled 10 percent ('high alcohol hours' - occurring predominantly at night);
- numbers of casualty crashes occurring at times of the week when proportions of drivers with BAC greater than 0.05 mg/L were less than 10 percent ('low alcohol hours' - occurring predominantly during the day).

The advice was that whilst there was theoretically a good chance that statistical testing could determine if advertising against drink-driving has a short term effect on numbers of casualty crashes that occur in 'high alcohol hours', it was unlikely that crash reductions in Adelaide would mirror those in Melbourne. Further, in the Melbourne situation, all casualty crashes contributed to the analysis, whereas in the Adelaide experiment, only a proportion of casualty crashes could be analysed without compromising estimates of the effects of advertising. It was concluded that power would be too low to be acceptable in the Adelaide situation to test immediate effects of drink-drive advertising effectively on numbers of casualty crashes. The analysis indicated that the power situation was even weaker for numbers of casualty crashes in 'low alcohol hours', namely, those more likely to be attributable to speeding.

On-road BAC (after drink-drive advertising) was deemed impractical because of the high cost, financially and socially, of testing the very large numbers of drivers that would be required. On-road speed was regarded favourably, since the use of advertising against speeding, and on-road speed for testing driver behavioural responses, had particular advantages:

- speeds could be measured using automatic equipment at relatively low cost (compared with drink driving) and to a high level of precision;
- drivers of vehicles passing the equipment could be monitored unobtrusively, and in large numbers;
- previous research has empirically linked changes in speed to crash outcomes.

On-road speed was therefore selected as both a sensitive behavioural response variable and a satisfactory surrogate variable for numbers of speed related crashes.

Measuring speeds

To allow full expression of the effects of advertising on speeds, only vehicles whose drivers had the opportunity to select their travelling speed were chosen. A common traffic engineering definition of such 'free speed' vehicles is those with a headway of four seconds

or more to the vehicle in front (Troutbeck 1986). This definition was adopted for the study. A speed associated with such a headway is commonly referred to as the *free speed* of a vehicle. Further, only cars and similar vehicles were included, as these are identified with drivers who are the core of the speeding problem.

The television advertising against speeding was primarily aimed at combating drivers who engaged in lower and medium level speeding at, say, 61 to 75 km/h, though with more emphasis on the upper end of this range. It was necessary to consider how changes in such speeds could be most meaningfully interpreted. Three measures of vehicle speeds were considered important in the context of the experiment, each strongly influenced by drivers with certain speeding characteristics:

1. The mean free speed represents the strictly average free speed of all vehicles passing a certain point on the road. It is a robust measure and, in circumstances where traffic is moving freely, centres on speeds in the 60 to 65 km/h range. There is an amount of inertia involved in altering the mean speed when the advertising thrust would not apply to a substantial proportion of drivers opting for this speed range in favourable locations and, one might expect, for most speeds below this range.
2. The 85th percentile of free speeds represents the speed below which 85 per cent of drivers choose to travel. Alternatively, it is the median speed of the fastest 30 per cent of free speeds. These drivers permit themselves to drive at over 65 km/h (intentionally or not). On Adelaide arterial roads he 85th percentile of free speeds is typically around 67 to 68 km/h. Speeds greater than this 85th percentile speeds are regarded as particularly undesirable.
3. The 95th percentile of free speeds represents the median speed of the fastest 10 per cent of drivers on the road who, typically, choose to drive at over 69 to 70 km/h, the upper end of the range targeted in the advertising. Thus whilst its estimated value, roughly 72 km/h, is more variable than that of the 85th percentile of free speeds, it is directly relevant in the study.

In relating speed to outcome in the event of a crash, it is well established that the higher the speed of impact the more severe the injuries sustained. More recent research indicates that the risk of being involved in a collision also increases as speed increases. Several empirical relationships that have been developed in the research literature link changes in mean traffic speeds with changes in crash and injury rates. While these relationships differ in detail, they provide broadly comparable results.

The results of the study cannot be linked with precision to crash outcomes, as corresponding relationships with free speeds and the higher speed percentiles are not known to have been established. Further research is needed to determine the structure of an advertising campaign that would best integrate short term speed reductions and the way speeds return to normal from them with incremental, long term reductions.

Study aims

The broad aim of the study was to identify changes in on-road free speeds that could be attributed to changes in advertising intensity, from a base level of nil advertising. The study thus sought to establish whether:

1. advertising had an immediate effect on free speeds that was statistically independent of enforcement activity;
2. speeds change according to advertising intensity, and
3. there was justification for using high levels of anti-speed television advertising.

In the first instance the goal was to establish whether speeds could be reduced, through television advertising, in the short term. If this could be demonstrated, the sustainability of such reductions would require further study.

Neither the study itself, nor the associated advertising, were designed to test gradual cumulative effects over the life of the study. Therefore, there could be no outcome which concluded that a long term television advertising 'campaign' effect had been achieved or not.

Study methodology

The overall study methodology needed attention to a number of factors, including:
- nature and intensity of the television advertising
- statistical analysis procedures
- enforcement levels
- speed measurement
- hypothesis determination and testing

A list of potential key variables in relation to the study is shown in Table 1.

Television advertising

Television advertising can be delivered in bursts (also known as waves) lasting days or weeks, or aired at a continuous background level. One measure of advertising intensity is Target Audience Rating Percentage (TARPs); one TARP represents reaching one per cent of an available targeted audience. The TARPs are accumulated over the several airings within the advertising wave and includes duplication in the viewing audience. The higher the TARP score, the more likely an individual has experienced repeat exposure of advertisements in the wave. Campaigns are designed to achieve a specific TARP level but there is considerable approximation involved.

The specification of an advertising campaign takes into account how many TARPs can be purchased and at what intensities the TARPs will be delivered over time. Bursts concentrate TARPs over relatively short periods with gaps between these periods while continuous background advertising spreads the TARPs over a longer period of time. TARPs can be specified for a whole campaign, per month or per week. Campaigns can last for several years, months or weeks and there can be campaigns within campaigns.

The use of TARPs alone does not adequately explain how advertising is planned. Other quantitative assessments of the amount of advertising reaching its target are:
- *frequency* - the number of times an individual is exposed to an advert in the wave or a campaign;
- *reach* - the proportion of the target audience exposed to the advertising at least once in the wave or campaign; and

- *Reach 3+* - the proportion of the target audience seeing the advert at least three times in the wave or campaign.

Table 1 - Potential key variables in the three year study

Design Variables	**Covariates: 'Independent' Variables**	**Intermediate Outcome Variables**	**Final Outcome Variables**
'Fixed' factor: Media (Television) speed advertising: • moderately high (900 TARPS) • moderately low (450 TARPS) • nil (0 TARPS) *'Random' factors*: Year • 1998/99 • 1999/2000 • 2000/01 Month • January • March • May • July • September • November	*Quarterly* • average weekly wage, adjusted for CPI* • cost of petrol, adjusted for CPI *Monthly* numbers employed numbers unemployed unemployment rate enforcement data (intended to be constant) *Weekly/Daily* weather (rain events)	*On-road measured speeds* • free, filtered speeds[#] *Market research* • recall (whether television speed advertising was seen in the last four weeks) • responses to attitudinal questions on speeding and other road safety issues	*Short term influence of television speed advertising* on • implied reduction in numbers of serious casualty crashes through changes in speed parameters • measured numbers of serious casualty crashes

* Consumer Price Index (CPI)
# during the working week, Monday noon to Friday noon; cars only with a minimum headway of 4 seconds

All these measures are determined from meters linked to television sets of a sample of volunteer households and are used to plan and monitor advertising campaigns.

TARPs are simply accumulated, whereas reach relates to individuals. For example, if 20 per cent of a targeted audience saw the advertisement in its first airing and *the same* 20 per cent saw it in the second, the TARPs over the two airings would be 40; but the reach would still be 20 per cent. As TARPs can be accumulated over many airings the TARP value can exceed 100.

Advertising is very complex and the many influencing variables and circumstances make it difficult for universal laws or standards to apply. There are, however, some well accepted advertising industry practices: a minimum intensity to use is 100 TARPs per week; a moderate intensity being 150 to 250 TARPs per week; and over 300 TARPs per week constitutes a heavy intensity. For Reach 3+, the aim in commercial advertising is to achieve as high a percentage as possible in a campaign.

The advertising intensity recommended over the last few years appears well in excess of industry standards. In a recommendation to the WA government (Cameron, Harrison, Vulcan, Pronk, Shtiefelman and Narayan, 1997), the total TARPs rate for all forms of road safety advertising amounted to 2800 TARPs per month for the five years 1998 – 2002. Within this, the component of speed advertising was mainly 1000 TARPs per month.

Another feature of television advertising is that an advertisement, once seen, can have an effect on the viewer that lasts over a period of time. This is known as *adstock* and relates to the period of time that an advertisement continues to have an effect (in terms of awareness measures) after the end of a wave. Typically in advertising, adstock is presumed to have a half-life of five weeks, i.e. the ongoing effectiveness of the advertisement is reduced by half every five weeks. This scenario was taken to apply to the MES study.

Design of the advertising program in the MES study

The audience that was targeted in the study consists of those who choose to drive at between, say, 61 and 75 km/h. Scrutiny of speed and crash records has pointed to the group at the upper end of this range as being predominantly male and young. Therefore the television advertising targeted these groups, though there was wider appeal also. The advertising, which contained a range of presentational styles and message content, was based on the well established principles of deterrence against speeding, the consequences of crashing, and information about the relationship between speeding and crashing.

In order to obtain acceptably independent estimates of effects of advertising intensity in the study (i.e. minimise adstock interference between waves), the waves of advertising had to be at least two months apart. The advertising schedule arrived at could be construed as a campaign but it was specifically designed to satisfy study requirements; it could only assess short-term effects. Within a single wave, the advertising was aired over the period from Wednesday to Saturday, 18:00 to midnight, in each of three consecutive weeks.

Three intensities could be included in the experiment, for the statistical modelling reasons described below. The intensities chosen for the study were based on accepted industry practice: a *moderately high* level at 300 TARPs per week, a *moderately low* level at 150 TARPs per week and, necessarily, a *nil* level (0 TARPs). For convenience, these levels are aggregated over the three weeks and referred to as 900, 450 and zero TARPs respectively.

In the week immediately after each advertising wave (including ‘nil’ waves), on-road speeds were collated (Monday noon to Friday noon) and a quantitative market research survey conducted (Tuesday evening to Friday evening). Such a week constituted a ‘test week’. The six test weeks per year contributed the primary data (on-road speeds and questionnaire responses) used in the study.

Statistical modelling

The study was designed to fulfil a standard statistical model, the balanced ANOVA. Due to the adstock effect restricting the airing of speed advertisements to every second month, the maximum possible number of advertising waves over the three years was 18. This meant that only three levels of intensity could be explored, each with six replicated periods, in a design that was close to minimal for an ANOVA (on theoretical grounds).

The constrictions in this balanced ANOVA meant that further statistical modelling was necessary to explore relationships between on-roads speed and pertinent external variables. These related to rainfall, enforcement and the various aspects of the economy that might affect on-road behaviour. To accommodate these, a formal multiple regression analysis was also carried out on the test week data.

A third analytic approach involved the use of a regression model, similar to that used by MUARC researchers but using monthly and weekly data, *and thus adstock*, for reference, but the results are not detailed in this paper. Full details are available in Woolley, Dyson and Taylor (2001).

External variables, whose inclusion was based on perceived relationships with crashes and/or speed, were used to attempt to explain some of the variation that occurred in the speed model. For example, many studies have found a negative relationship between unemployment rate and crash incidence. The external variables considered for this study included unemployment rate, average weekly earnings, fuel prices, the presence of the GST (variable = 0 before 1 July 2000, = 1 thereafter), hours of speed enforcement and rainfall.

The balancing of the ANOVA design meant that the number of advertising periods at 0 TARPs had to match the number at 450 TARPs and 900 TARPs in each year ('financial year', in this case) as well as in each of six particular months in of the year. The timing of each advertising wave against speeding, and its nominal intensity, is shown in Table 2.

Table 2 Schedule of advertising against speeding over the duration of the study in terms of TARP intensities

Month	1998	1999	2000	2001
January		450	900	0
February				
March		0	450	900
April				
May		900	0	450
June				
July	0	900	450	
August				
September	450	0	900*	
October				
November	900	450	0	
December				

* Rescheduled to October to avoid conflicting with the Sydney 2000 Olympic Games

Speed advertising was televised for the first three weeks of its selected month, immediately preceding the test week. Drink-drive advertising had to continue during the experiment, for ethical reasons, and was specified in the study design. Waves of drink-drive advertising were aired during each alternate month, in between speed advertising waves. The intensity was nominally constant, at level of 900 TARPS per month (although 1000 in December), so as not to confound estimated effects of the anti-speed advertising aired at its three levels. The full schedule is shown in Figure 1.

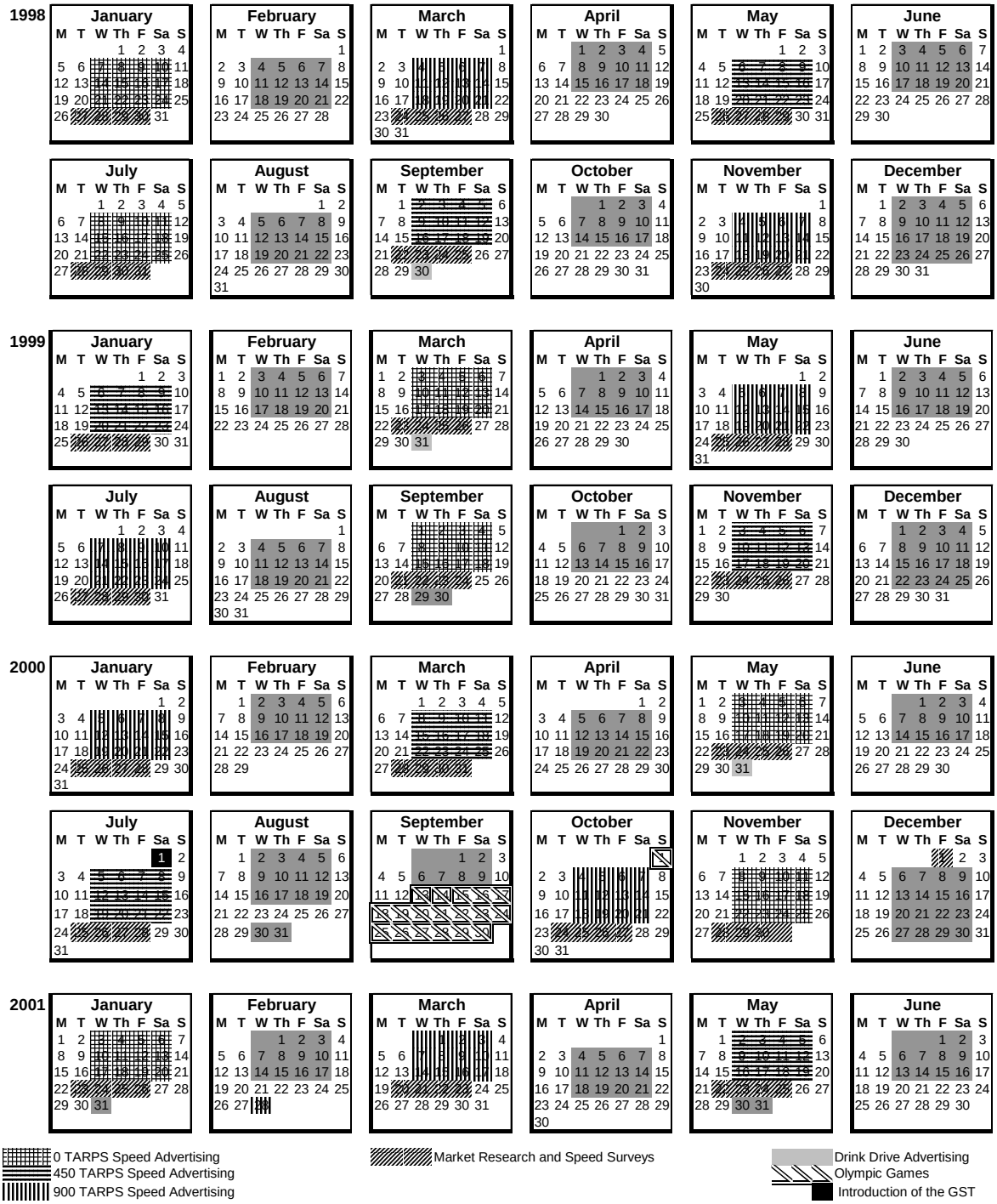

Figure 1 - Advertising schedule and timing of surveys (test weeks) for the study

Note that although television advertising and data collection commenced in January 1998, initial speed data collection problems necessitated the extension of the study into 2001. Only test week data between July 1998 and May 2001 were used in the formal analysis of the study.

To maintain control of advertising times and TARP rates, no free to air advertising was used. Further anti-speed advertising was also conducted via commercial radio supporting the television advertising in the appropriate waves. Thus whilst the program is referred to as

television advertising, there was some radio advertising backup, broadcast from 06:00 to 09:00 and 16:00 to midnight.

Control of enforcement levels

It is recognised that enforcement levels can be very influential in affecting on-road speeds. It was considered that changes in enforcement levels would probably be more influential than changes in advertising levels in determining on-road speeds. Consequently, SA Police were requested to keep their speed enforcement levels and practices as constant as practicable during the course of the study.

Measured speeds

On-road speeds were measured in both median lanes at six locations on the Adelaide metropolitan arterial road network using permanently installed speed measuring equipment (see Figure 2). The study design allowed for the possibility that any two of the sites might prove unsuitable due to unforeseen circumstances and could be omitted, as the results from 10 sites would be sufficient for statistical purposes. This proved to be the case. The locations covered a range of conditions including traffic flow, and geographic and broad socio-economic zones in the metropolitan area. All were located mid-block on dual carriageway roads with two through lanes in each direction, where interference to traffic flow due to major road junctions was minimal and where speeds tended to be highest. Figure 2 shows the basic layout at a location.

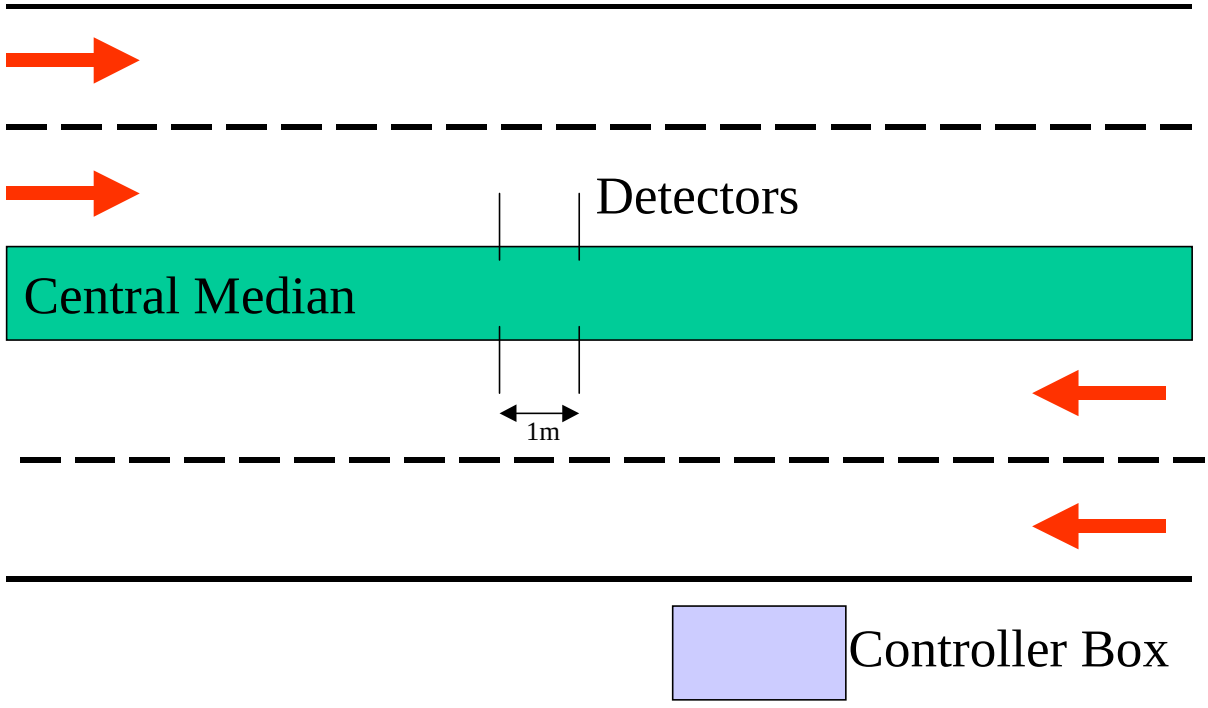

Figure 2 - Schematic of a typical speed measurement location

Traffic was monitored continuously from March 1998 to June 2001 but as mentioned previously, only test week data between July 1998 and May 2001 were used in the formal analysis of the study. Speed data were put through a simple quality control check, and data from one of the six locations were rejected on account of excessive variability at that location,

although they did indicate overall effects that matched the response pattern at the ten sites with acceptable data. Figure 3 shows the time series of mean free speeds at three of the locations over the three year study period.

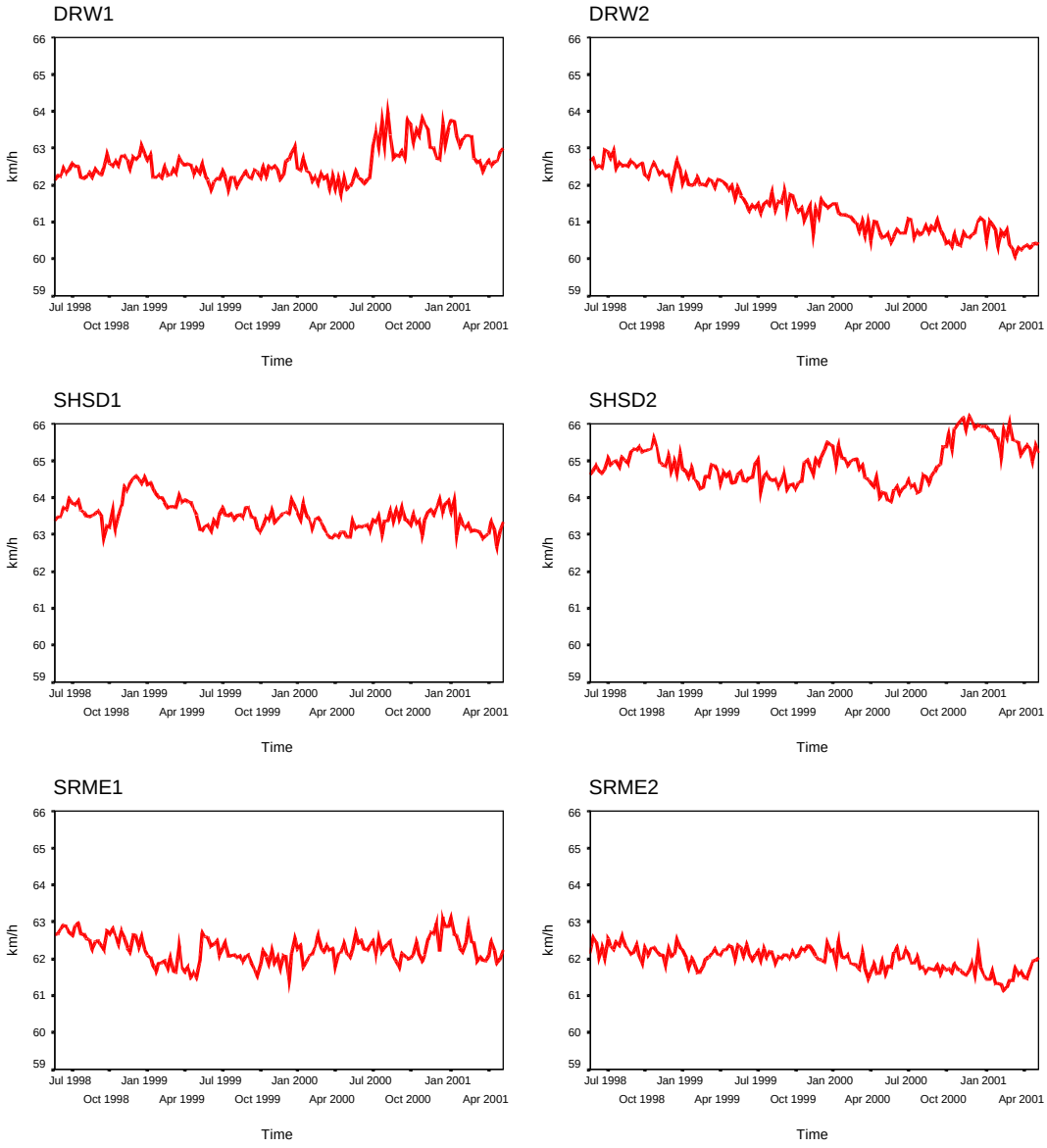

Figure 3 Examples of per site time series of mean free speed (all graphs have the same vertical scale)

Summary data for each speed parameter (mean, 85th and 95th percentiles of free speeds) were calculated separately for each direction at the five contributing sites for each test week. These summary values were averaged to provide a composite estimate for each parameter in each test week. These estimates were taken to be broadly representative of free speeds, on the Adelaide metropolitan arterial road network, which would be susceptible to advertising against speeding. They formed the key outcome variables for formal statistical analysis.

Hypothesis determination and testing

Two hypotheses were to be tested. The first was to test whether advertising against speeding affects speeds at all, in the short term. The second was whether different intensities of advertising affect speeds differently, in the short term. The following structure for hypothesis testing was thus set up at the beginning of the study:

Null hypothesis 1: On-road free speed after television advertising (averaged over the nominal rates of 450 and 900 TARPs) did not differ from that after no advertising.

and

Null hypothesis 2: On-road free speed after television advertising at, nominally, 450 TARPs, did not differ from that after, nominally, 900 TARPs.

Taking a conservative stance, two-tailed testing of hypotheses was used throughout, to allow for possible changes in either direction. Thus, for example, whilst it is hoped and expected that advertising would encourage drivers, as a group, to slow down, it is not inconceivable that a reaction to advertising could also be for drivers to increase their speed. Hypotheses were tested at the five per cent error rejection level.

An *overall* outcome for each hypothesis was sought, combining the testing for each of the three speed parameters, since the testing was not independent. The three speed parameters are inter-related but with different emphases. This meant that, overall, the hypothesis testing was strongly influenced by the higher end of the free speed spectrum.

As discussed previously, TARPs constitute an approximation and although the study design was specified in terms of 450 and 900 TARPs, the *actual* intensities measured over the whole study, averaged 537 and 925 TARPs for these intensities respectively. These labels are used henceforth.

Thus the first null hypothesis was used to test, separately, the value of each speed parameter after nil advertising against its averaged value following the two other advertising intensities. The second null hypothesis was used in testing each parameter's value after 537 TARPs against its value after 925 TARPs.

Quantitative surveys of intermediate outcome indicators

Following each wave of anti-speed advertising, a random selection of 400 drivers was surveyed by telephone on questions relating to speeding. The purpose of the surveys was twofold. Firstly, it established an ambient level of self-reported response against which the study was conducted. Secondly, it would indicate whether links could be identified in the causal chain from seeing advertising to changing on-road behaviour.

Sampling quotas included more drivers 30 years of age or younger than over 30, in order to reflect the emphasis in the study on the perception that younger drivers choose higher speeds.

Results

As indicated above, two null hypotheses were tested for on-road free speeds. Firstly, that speeds under conditions of no television advertising are the same as speeds under conditions of some (537 or 925 TARPs) advertising. Secondly, following some advertising, that the actual level of advertising made no difference; in other words, 537 and 925 TARPs had the same effect on speed. Further, note that the possible speed effects were measured through three speed parameters: mean, 85th percentile and 95th percentile.

The effect of speed advertising on overall free speeds (km/h), based on analysis of composite test week values, is shown in Table 3 for each of the three speed parameters, and for both the null hypotheses being tested. Table 3 includes results for two of the three types of analyses undertaken – it does not include the results of the time-series analyses of monthly or weekly data. The values in the table relating to regression analysis of test week data have been adjusted for the effects of external variables. The external variables generally contributed to reducing variation in the speed variables but did not materially affect the estimated changes in speed.

Table 3 Results of hypothesis testing using two alternative methods of statistical analysis

	Null hypothesis #1				**Null hypothesis #2**			
	ANOVA		**Regression***		**ANOVA**		**Regression***	
Parameter	estimate km/h	hypothesis	Estimate km/h	hypo-thesis	estimate km/h	hypo-thesis	estimate km/h	hypo-thesis
Mean Speed	**-0.09**	**NS *(p<0.1)***	**-0.10**	**NS *(p<0.2)***	+0.09	**NS *(p<0.2)***	+0.08	**NS**
85th speed percentile	**-0.14**	**rejected p<0.05**	**-0.17**	**NS *(p<0.1)***	+0.11	**NS *(p<0.2)***	+0.07	**NS**
95th speed percentile	**-0.25**	**rejected p<0.05**	**-0.30**	**rejected p<0.05**	+0.11	**NS**	+0.06	**NS**

* Note that in the regression analyses, the measured TARPs rates per wave were used. In the ANOVA nominal TARPs rate was used as a categorical variable.

In relation to null hypothesis #1, the justification for using a two tailed test for testing the overall effect of advertising is that there is no clear expectation for advertising to increase or reduce speeds. The reader who judges this to be unrealistic (too conservative: speeds could only be reduced or left unchanged) can apply a one tailed test to null hypothesis #1 whereby this hypothesis for the mean free speed percentile was marginally rejected at the five per cent level.

With respect to null hypothesis #1, and taking mean free speed as an example, the presence (versus absence) of advertising produced an estimated reduction of 0.09 km/h with the ANOVA model and 0.10 km/h with the regression model (Table 2). Speed reductions were appreciably greater for the 85th free speed percentile and, particularly, the 95th free speed percentile. Taken together, the outcome is that those who drive somewhat faster than the body of drivers had reduced their speed significantly immediately following advertising, whilst other drivers had reduced their speed by a smaller amount, if at all.

With respect to null hypothesis #2, mean free speed after 937 TARPs was about 0.09 km/h *higher* than after 537 TARPs for both the ANOVA and regression models. This effect was repeated with the other two speed parameters.

Whilst these changes in speeds are small they represent *mass* speed parameters and small changes in these parameters have meaningful effects on projected crash numbers.

The speed estimates (km/h) from the ANOVA model are shown in Table 4.

Table 4 Overall ANOVA estimate for each free speed parameter at the three advertising intensities, km/h

Speed parameter	Nil TARPs	537 TARPs	925 TARPs	Effect of 537 TARPs	Effect of 925 TARPs
Mean speed	62.64	62.51	62.60	-0.13	-0.04
85th speed percentile	67.57	67.38	67.48	-0.19	-0.09
95th speed percentile	71.89	71.58	71.70	-0.31	-0.19

The finding of only a substantially smaller speed reduction after 925 TARPs compared with that after 537 was not envisaged when the study was planned. It *points to* an unforeseen outcome: a maximum speed reduction effect within the range of TARP levels investigated.

This finding makes it unlikely that high intensities of television advertising are useful, in the short term, in the area of improving road safety through advertising against speeding.

An estimate of the extent of the reduction in mean free speed immediately following advertising was the reduction measured at a moderately low intensity, which was 0.13 km/h (the estimated reduction at 537 TARPs using the average of the estimates in the ANOVA and regression analysis). This acknowledges that the rejection of null hypothesis #2, and the direction of the difference found, implies that the speed parameter estimates after 925 TARPs should not contribute materially to the estimate of the maximum effect.

While general perceptions may demand a change of perhaps five km/h as being relevant from the point of view of an individual driver, it still remains the case that the level of the reduction demonstrated in the study (0.27 km/h in the 95th percentile speed) is not trivial in the context of predicting a reduction in numbers of casualty crashes.

Television advertising at moderate intensity with supporting enforcement can reduce on-road speeds in the short term and, by extension, road trauma. The effects on trauma are likely to be quite modest but worthwhile. Given that, following advertising, the fastest speeds decreased appreciably more than the mean speeds, and these speeds are associated with much higher crash rates (Kloeden, McLean, Moore and Ponte, 1997), this confirms the assessment of effectiveness.

As already mentioned, no long term 'campaign' effect of advertising could be assessed in the study because any long term changes in speed might be caused by extraneous variable(s) that changed over time[2].

[2] During the course of the study, the Goods and Services Tax (GST) was introduced close to the beginning of the third year of the study. Due to the significance of this tax on the economy, the research team decided to include this as a dichotomous variable. The reduction in sales tax on new cars and consequent increased sales may have affected driving behaviour. The overall falling trend in mean free speed recorded over the duration of the study more than offset any short term influence of this effect ($p < 0.1$).

Intermediate outcome indicators

Interviewees revealed that 52 per cent of them 'saw' Government speed advertising when there was none; 60 per cent claimed to have seen advertising in the 537 TARP waves; and 69 per cent in the 925 TARP waves.

There were few indications that *self-reported* opinions were affected after waves with advertising. *Stated* tolerance towards active enforcement limits was not affected in the short term by advertising though it declined in the last year of the study. Likewise, advertising did not favourably affect *stated* values regarding a number of other speeding issues.

Comparison with industry practice

Table 5 shows current industry practice measures against those observed in the study. The study indicated that current recommended levels may be excessive in the context of speed advertising, using Reach 3+ as the critical advertising parameter. However, the speed outcomes were consistent with current industry recommendations in relation to TARP levels. This does not accord with current recommendations given by Cameron et al (1997).

Table 5 Performance of the MES for three-week waves compared with industry standards

	Reach (1+)	Reach (3+)	Frequency (average number of exposures)	TARPs (per week)
Industry standard		maximise	3+	150 to 250
537 TARPs	83%	65%	6	matched
925 TARPs	88%	77%	10	excessive

This study has shown that Reach 3+ of approximately 65 per cent and an average frequency of about six was effective in changing speeding behaviour in the short term.

It is emphasised that the television and radio advertising did not constitute a conventional anti-speed advertising campaign. Over the three years of the study there was a long term observed reduction in mean speed. This improvement may have been assisted by the advertising conducted as part of the study.

LITERATURE REVIEW ON MASS MEDIA

A literature review on mass media advertising was also conducted as a part of MES, with particular emphasis on best practice in road safety. This review is given in Woolley (2001). The underlying basis for the review was to address:

- what is considered best practice in road safety mass media television advertising; and
- what can be learned from the commercial product advertising industry in relation to extent of current knowledge, accepted practices and industry standards.

The review revealed that few road safety mass media campaigns were planned using a suitable model of behavioural change or social persuasion, for example the Behavioural Theorists' Workshop model (Elliott, 2001). Where road safety mass media campaigns have been demonstrated to be effective there were underlying behavioural modification frameworks and/or the advertising played a supporting role to police enforcement. There are many misconceptions about the power of mass media that lead to ineffective outcomes of advertising campaigns.

This is evident even in the professional world of product advertising where there is much debate about how advertising actually works. At present, there is division of opinion on how to get best value for the advertising dollar. Current debate seems to suggest that there is no one universal formula which can be applied as circumstances between different products and markets differ so greatly.

The principles of commercial product advertising and social persuasion advertising are quite different. The former relies on channelling an existing motivation to purchase a specific brand of product when there is a need to purchase the product; the latter must produce the motivation in the first place and then channel it in the desired direction.

Outcome research has also had difficulty proving beneficial effects of mass media advertising due mainly to the difficulty in conducting controlled experiments and isolating influencing variables. Long term assessments are particularly difficult as the longer the period of time, the more likely it appears that confounding variables could influence the outcome. It should be noted that this is not unique in road safety and a similar situation exists for driver education and training.

The literature suggests that the use of high intensities of advertising can be counterproductive and subject to wearout (the outcome) and tedium (the symptom) - the loss of effectiveness of an advertisement with repeat exposures. There is little consensus on 'how much (advertising) is enough' but many in the industry support the notion of gaining a minimum of three exposures and maximising reach 3+ in a campaign.

There also appears to be conflicting evidence whether messages with threat appeals involving high levels of emotion and 'shock tactics' are highly effective. Most prominent social scientists caution against their use as such material is difficult to develop and can be counterproductive.

The literature indicates that there is a role for mass media advertising in road safety but it must support other activities (such as enforcement) and realistic expectations must accompany it. There is consensus that it is highly unlikely that advertising alone will lead to behavioural change.

DISCUSSION AND CONCLUSIONS

This study was conducted because of doubts raised within South Australia and elsewhere about the MUARC recommendations for high levels of road safety television advertising, which were based on MUARC research.

The outcome of the South Australian MES was that television advertising was shown to have an immediate effect on speed behaviour statistically independent of enforcement. The reduction in mean free speed was small (around 0.13 km/h) but statistically significant.

The study outcomes do not support the view that intensive levels of advertising are justifiable as the TARP intensity effect on speeds dropped off at some level below 925 TARPs (per three weeks). The findings appear to support current advertising industry practice.

In summary, the following conclusions may be drawn:

Effects of advertising on speeds

1. Anti-speeding road safety advertising alone, at moderate intensity, and against a background of steady enforcement, can reduce on-road speeds in the short term by small amounts.
2. Faster drivers reduced their speed significantly following advertising whilst the main body of drivers reduced their speed little.
3. Very high television advertising intensities (900 TARPs or more over three weeks) are unlikely to be useful. A moderate rate, averaging around 500 TARPs, over three weeks, appeared sufficient to achieve worthwhile short term reductions in speed in terms of their extension to road trauma.

Intermediate performance indicators

4. *Stated* tolerance towards enforcement limits was not affected in the short term by advertising.
5. Advertising did not favourably affect *stated* values regarding most other speeding

Mass media review

Current best practice in mass media social persuasion points to the following:

6. Mass media does have a role to play in road safety but is unlikely to produce *large* behavioural changes in isolation.
7. Mass media should play a supporting role to other campaign elements (e.g. enforcement).
8. Campaigns aimed at behavioural change have a higher chance of success if designed within suitable social persuasion frameworks.
9. The use of 'shock tactics' and strong emotion, if used at all, should be used with extreme caution.
10. Expectations of mass media should be realistic; mass media should be used for: agenda setting, helping to form beliefs, reinforcing existing beliefs and behaviours.

FURTHER ANALYSES

It became evident to the researchers that further methods of analysis applying a different method to control extraneous variables can be used. These were proposed before the specified analyses presented here were carried out and time constraints did not permit their inclusion in this report. Preliminary investigations suggest a weakening of the TARPs effect beyond that of the analyses reported here, though still significant ($p < 0.01$). These results are tentative, however, and will be subject to further scrutiny.

The speed reduction found in the study indicates that the projected effect on numbers of serious casualty crashes, using the fourth power law proposed by Nilsson (1993), would be an order of magnitude lower than that reported by Newstead et al (1995). Whilst the conditions are not strictly comparable, this represents a substantially different finding. A comparison on a rigorous basis is planned as future work.

Finally, further work is planned to extrapolate the short term speed reductions into a planned advertising program against speeding. This will lead to a Benefit-Cost Ratio for television advertising against speeding.

RECOMMENDATIONS

R1	The previous finding that advertising has an immediate effect statistically independent of enforcement be accepted. Note, however, that the effect on speeds leads to a much smaller proportional effect on projected crash numbers than that reported in the earlier MUARC research.
R2	On the basis of the findings from this study, high intensities of anti-speeding road safety advertising cannot be justified.
R3	Anti-speed television advertising *should continue*, acknowledging that a maximum short term effect is achieved, *probably* in the vicinity of current industry standards of, say, between 150 and 250 TARPS per week.
R4	Suitable behaviour modification frameworks be used in formulating a media campaign strategy.
R5	The use of 'shock tactics' and *strong* emotion, if used at all, should be used with extreme caution.
R6	Further research be conducted to see how sustainable the speed reductions are and how such reductions may be consolidated in long term planning. The study has resulted in a very large collection of valuable data - these data should be exploited further for road safety research to widen the scope of the study.

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