VICTORIA'S SPEED CAMERA PROGRAM

by

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Abstract *In response to a rising road toll, the government of the state of Victoria, AUS announced in September 1989 a new Road Safety Strategy that included a large increase in the level of red light and speed camera enforcement. This required the development of new processing technologies and a new Traffic Camera Office to view the photographic evidence, issue penalty notices, and handle related enquiries and administrative support activities. Along with bold advertisements and additional enforcement of drink-driving laws, the speed camera program has helped reduce road traffic collisions by more than 25% since 1989. Injuries from road crashes are down 40%, and fatalities have been reduced by over 45%. This means savings of more than AS800 million to the Victorian community, and dramatically reduced risk of collision and injury on Victorian roads.*

INTRODUCTION

During the 1980s, the state of Victoria experienced steadily rising road deaths. For the 12 months to September 1989 there were 796 fatalities, growing at the rate of more than five deaths per month. This represented 18 deaths per 100,000 people (population of 4.4 million) or three per 10,000 registered vehicles (2.58 million vehicles)—on both measures greater than the Australia-wide fatality rates of 17 per 100,000 people and 2.9 per 10,000 vehicles. If these trends had continued, Victoria's road toll would have been 870 in 1990, and, if unchecked,

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more than 1,000 within two years—taking Victoria back to the record levels of the 1970s (Figure 1).

Fatalities are not the only measure of the road toll. Of greater cost in human misery and in government expenditures are the thousands of persons incapacitated by road accidents. In 1975, 18,000 people were seriously injured on Victorian roads. By 1985 this figure had risen to 23,000, and by 1989 more than 37,000 people were injured as a result of road crashes, 10,000 of whom were hospitalized.

The cost of road trauma to the community is enormous. Governments have to maintain emergency services, hospital and medical facilities, accident compensation, and welfare/support for those affected. Together with productivity losses—in the order of 200,000 person-days per year—the cost in Victoria alone is estimated at A$1.5 billion a year. The Australian Bureau of Transport and Communications Economics (1992) has estimated that, in 1988, the cost to the Australian economy of road traffic trauma was A$6.5 billion, with the costs per collision being A$631,000 for each fatality, A$95,000 for each person with major injuries, and A$4,000 for each vehicle involved in "property damage only** collisions.

IDENTIFYING THE PROBLEM

Three factors are inherent in any car crash: road conditions, vehicle performance and road user (particularly driver/rider) behavior. Collisions occur when people use vehicles inappropriately for the environment in which they are driving. More than 90% are the result of human error, 35% involve environmental factors, and about *1%* arise from vehicle malfunction (VicRoads, 1991). Road toll countermeasures fall into three broad groups:

(1) enforcement that promotes short-term behavior change, but must be continued to sustain the changes;

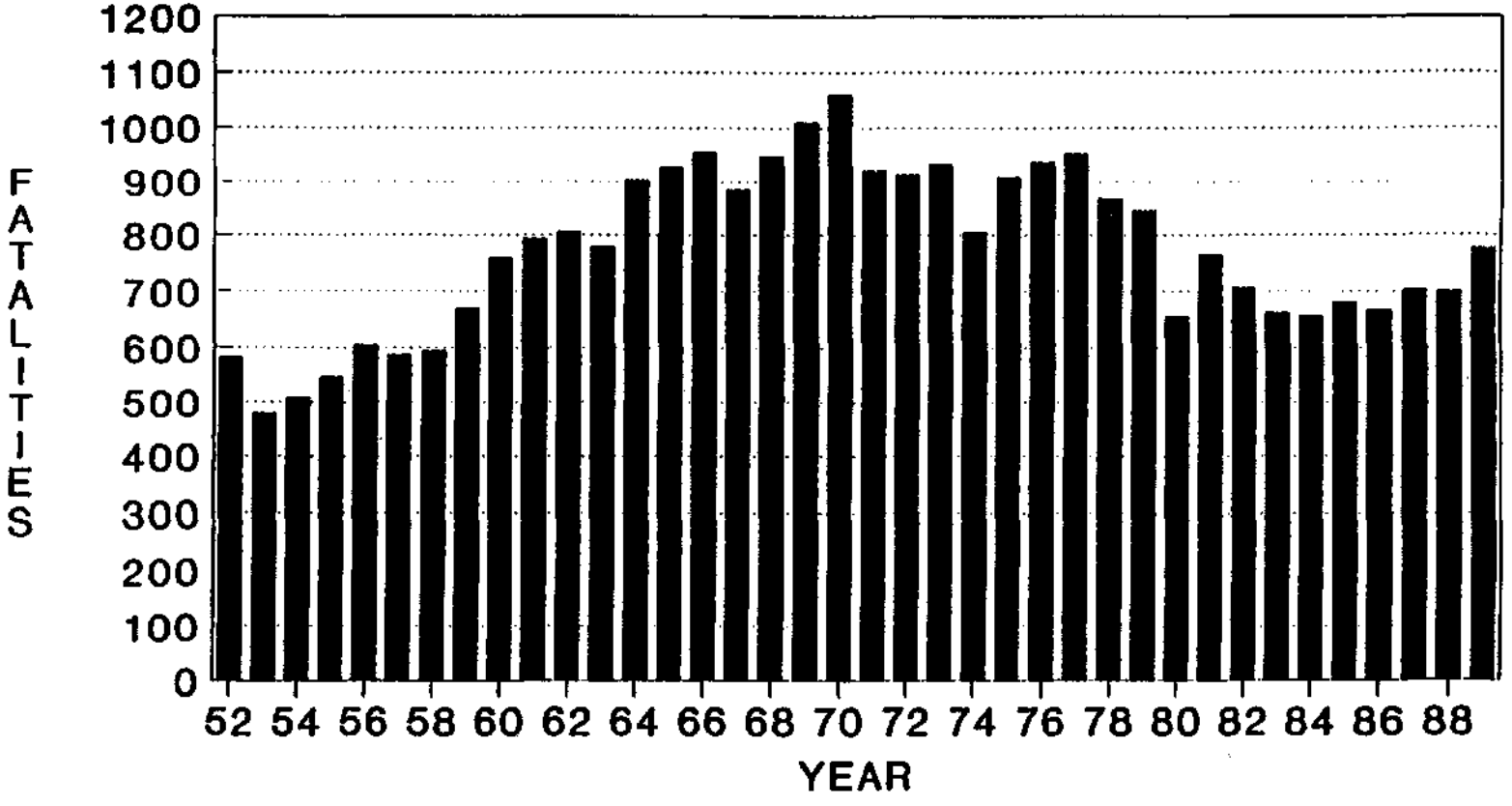
(2) education to raise awareness and improve attitudes and skills over the medium to long term; and

(3) engineering to address road conditions, vehicle design and traffic management improvements, all of which take a long time to implement and which affect road users only obliquely.

While engineering and education measures operate over the long term, enforcement actions can be implemented quickly within defined budgets, and focus directly on those most at risk. Moreover, the effect can be immediate, releasing scarce resources for other priorities.

Enforcement, engineering and educational measures were included among the ten key elements of the new Coordinated State Road Safety

Figure 1: Fatalities on the Road, Victoria, 1952-1989



Strategy initiated by the Victorian government in September 1989. These ten elements were as follows:

(1) a graduated licensing system requiring additional skills at progressively higher levels for novice and re-licensed drivers;
(2) upgraded road safety education programs in schools and at the pre- and post-licensing stages for drivers;
(3) 13 new "booze buses" (preliminary random breath-testing stations);
(4) increased random breath testing, bringing the total to more than one million tests a year;
(5) a comprehensive review of speed zones;
(6) repeater speed zone signs designed to more frequently advise drivers of the zone limit;
(7) 60 new automatic speed cameras, with loss of license for drivers traveling more than 30 kilometers per hour over any limit;
(8) 20 additional red-light cameras;
(9) compulsory bicycle helmets for all age groups;
(10) a new demerits system, with loss of license after accumulating 12 points in 3 years. (Table 1).

Speeding and the Road Toll

Alcohol, carelessness, inexperience and disregard for traffic signals all cause crashes, but speed has been a major contributor to both the occurrence and the severity of collisions. Solomon (1964), Munden (1967), the Research Triangle Institute (1970) and Fildes et al. (1991) have noted an increased rate of collisions for cars exceeding the mean

Table 1: Speed and Red-light Offense Penalty Table

	Fine ($)	Demerit* Points	License Suspension
Speed (km/h) in excess of that permitted:			
1 - 15	105	1	
16 - 29	165	3	
30 - 39	220	4	1 month
40 - 44	300	4	4 months
45 - 49	300	6	4 months
50 or more	360	6	6 months
Failure to stop at a red light	165	3	

*Demerit Points - 3 months license suspension if 12 points accumulated in 3 years.

travel speed. This, as would be expected, implies that the faster one goes the more likely one is to be involved in a collision. The amount of time available for the driver to react to an emergency situation is decreased at higher speeds, the vehicle will be more difficult to control, and the distance required to stop increases dramatically.

Convincing people of the dangers of speeding is not an easy task. Unlike drunk driving, there has been no social stigma attached to being a speedster. The flashy executive or sporty youth with a racy car can be a fashionable role model. Moreover, no one believes that he or she is a bad driver. In support of the required cultural change, the word "accident" was replaced by "collision" or "crash," as "accident" allows some inherent rationalization that "it just happened" without some cause. Individuals often cannot see that their driving behavior is a major contributing factor to road trauma. There is potential for a backlash from the community when individuals are confronted with the consequences of their behavior, at a time when their belief structure tells them that they were not really doing anything dangerous. This is the major risk factor, and it requires sensitive management for a prevention program to succeed.

In Victoria, a massive increase in the likelihood of detection was required, to be accompanied by a high-level advertising/public education campaign to inform drivers of the risks of speeding and of the risks of getting caught. The challenge was to make speeding socially unacceptable. This required the use of a new generation of speed cameras and new advertisements throughout the state.

THE TRAFFIC CAMERA INITIATIVE

Speed cameras had been operating in Victoria since 1986, but only at a small number of designated (known) sites in the metropolitan area. Under the A$23 million Traffic Camera Program starting in 1989, the strategy included significantly increasing red light and speeding offense detection by the addition of 60 new speed cameras and 35 red-light cameras. The objective was to change driver behavior in order to reduce travel speeds across all zones by 10-15 km/h in six to twelve months, and thus reduce the number and severity of traffic collisions by an estimated 10%.

The community benefits were expected to flow from: a reduction in the number and severity of collisions; fewer deaths and less severe injuries; fewer "lost production" days and fewer compensation claims for smaller amounts; and reduced hospital costs from fewer bed days and less complex treatment.

It was postulated that good driver behavior would be directly proportional to the rate of detection, which is a function of the number of cameras available, the amount they are used, and the ability of the system to issue Traffic Infringement Notices. Moreover, the higher the level of detection, the longer the relapse time for bad habits to reassert themselves, which is critical for long-term attitudinal change. This suggests that resources need to be "ramped up" initially to maintain the detection rate, but, after a period of time, the effect will, to a large extent, sustain itself and require decreased resource input.

To be effective the program required the installation of new technology to process the images and issue the resultant penalty notices. Speed cameras can assess a vehicle's speed and take a photo each second. With 60 cameras checking vehicle speeds two million times per month, a system with the capacity to examine up to 200,000 frames a month was required to be operational within six months. The capacity of this system was the critical success factor to achieve the desired effect on driver behavior.

Before 1989, each speed camera required four officers, two at the site and two more down the road to intercept drivers traveling more than 30 km/h over the posted limit. The film was assessed using slides in a darkroom environment. This was also a resource-intensive process requiring three operators for up to ten minutes per frame.

The productivity objectives for the new system were:

(1) to establish processes to enable single member camera operations; and

(2) to build a system to enable the assessment of evidence at the rate of one frame per minute by a single verification operator in a standard office environment.

INTRODUCTION OF THE SYSTEM

The 60 speed cameras were progressively introduced from December 1989 (4 units) to August 1990, with single-officer operations from August 1990. The new cameras are fitted in vehicles or on tripods and can be moved to any site quickly. Since 1990, speeding has been randomly checked in more than 1,000 sites throughout the state.

The new Traffic Camera Office was established from a zero base to a staff of 100 by December 1990. Automated processing on the Traffic Infringement Management System (TIMS^0), commenced on June 10, 1990^'ust five and a half months after the development contract was signed—with the assessment of images at the rate of two per minute (twice the target productivity rate). A Government Technology Produc-

tivity Award was presented to the program for its development of TIMS[C] at the Australian Government Technology Event in Canberra in February 1991.

The deterrent effect on speeding was quickly raised to an extremely high level. Camera operations resulted in 8.2 million vehicle speed checks during 1990-91 (over 20,000 speed checks per day), growing to more than 2 million speed checks per month in 1992. A total of 374,050 speeding penalty notices (citations) were issued during 1990-91, with A$23.6 million paid in fines that year. A further 607,165 notices were issued in 1991-92, with an additional A$55.8 million collected from fines.

THE RESULTS

The increased enforcement, combined with the shock advertising, has led to a sharp reduction in the percentage of vehicles being photographed (i.e., exceeding the camera threshold of 10% + 3 kph above the posted speed limit, or more than 70 kph in a 60 kph zone). This represents a decrease from 23% in December 1989 to 11% in June 1990, which was further reduced to less than 5% by August 1992 (Figure 2)-

The proportion of excessive speed offenses (30 km/h or more over the limit) has also fallen sharply—from 1.6% in December 1989 to 0.6% in June 1990—and has remained steady at 0.5% since. Clearly, many more drivers than ever before were confronted with the prospect of losing their licenses through accumulated demerit points if their driving behavior did not quickly change. As suggested by these results, the community reaction was rapid and dramatic—to the extent that very few drivers now risk high speed behavior.

Following introduction of the coordinated Road Safety Strategy in 1989, the number of collisions has fallen by 16% in 1990, and by more than 25% to August 1992 (Figure 3).

Rolling 12-month totals are used in Figure 3 to clearly show the point at which a trend shift occurs. The rolling 12-month total is the sum of the previous 11 and the current months. If the new month outcome is greater (or lesser) than the equivalent month a year ago, the curve will move up (or down) by the difference.

Injuries resulting from traffic collisions were reduced by 21% in 1990, with a 22% drop in injuries requiring hospital admission—a savings of over 8,000 bed-days made available for other urgent treatment. Injuries from road crashes have fallen 40% since 1989 (Figure 4)-

Figure 2: Percent of Vehicles Exceeding Camera Threshold

Victoria, December 1989-September 1992

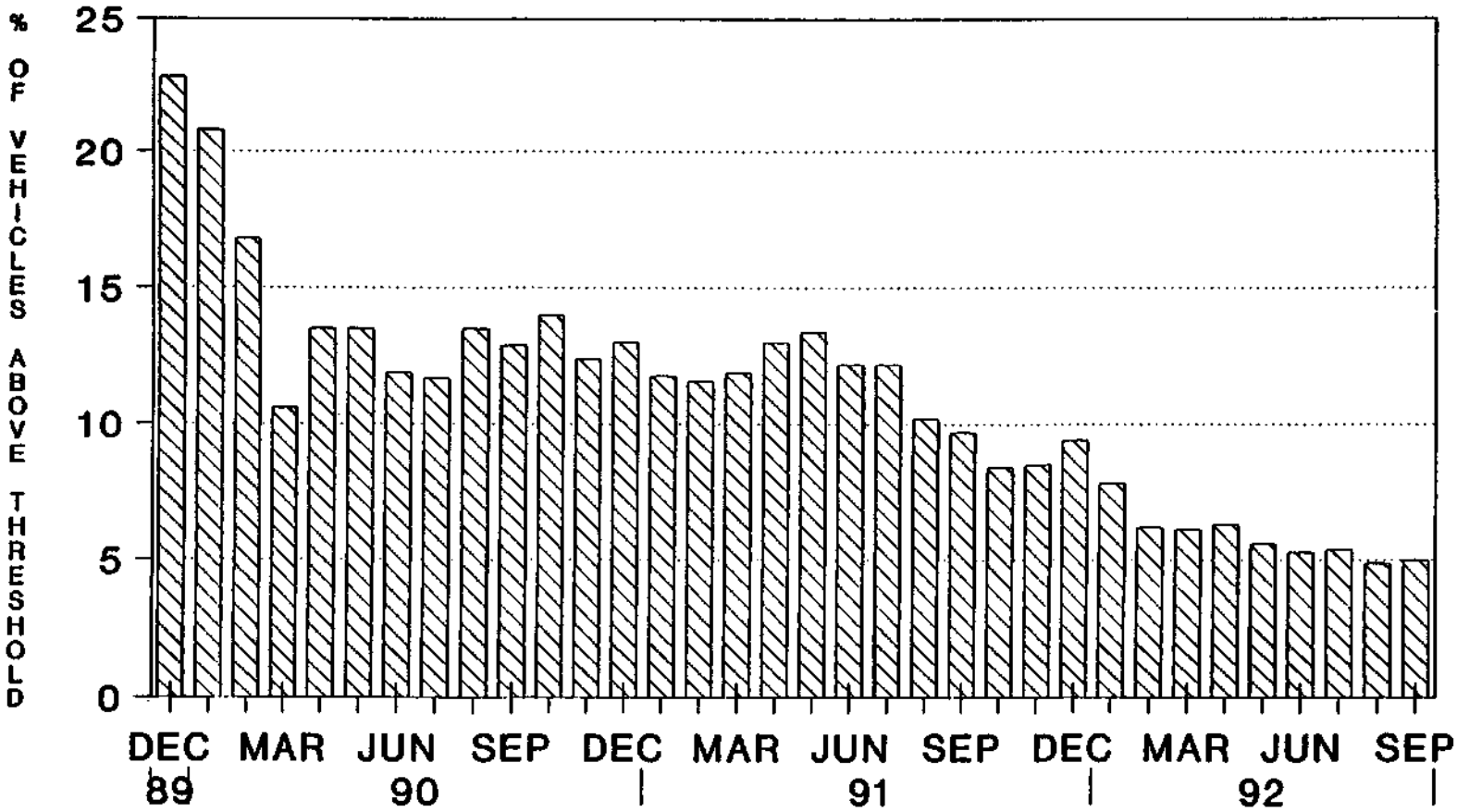


Figure 3: Collisions, Twelve Month Rolling Totals

Victoria 1987-1992

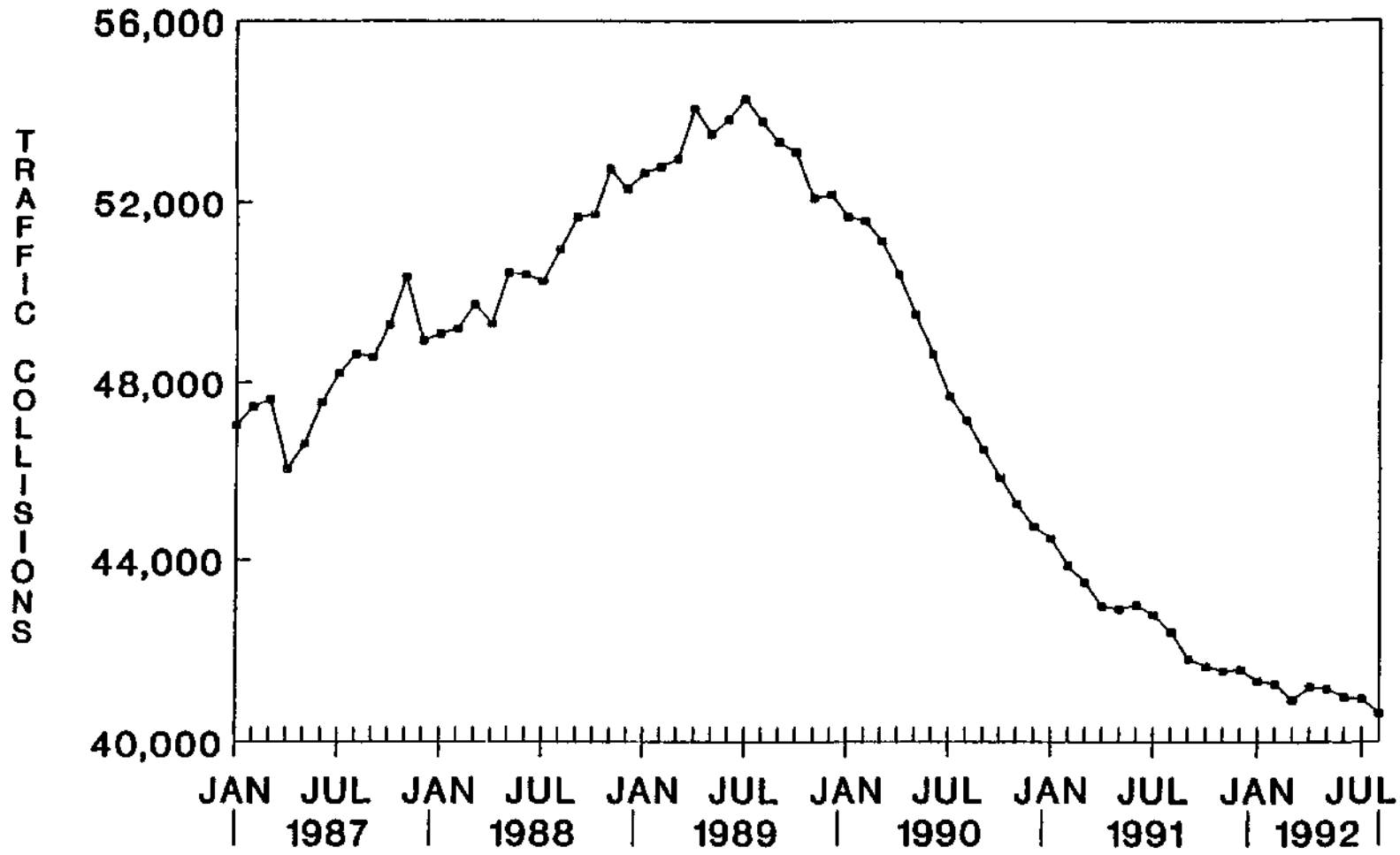


Figure 4: Injuries, Twelve Month Rolling Totals

Victoria 1987-1992

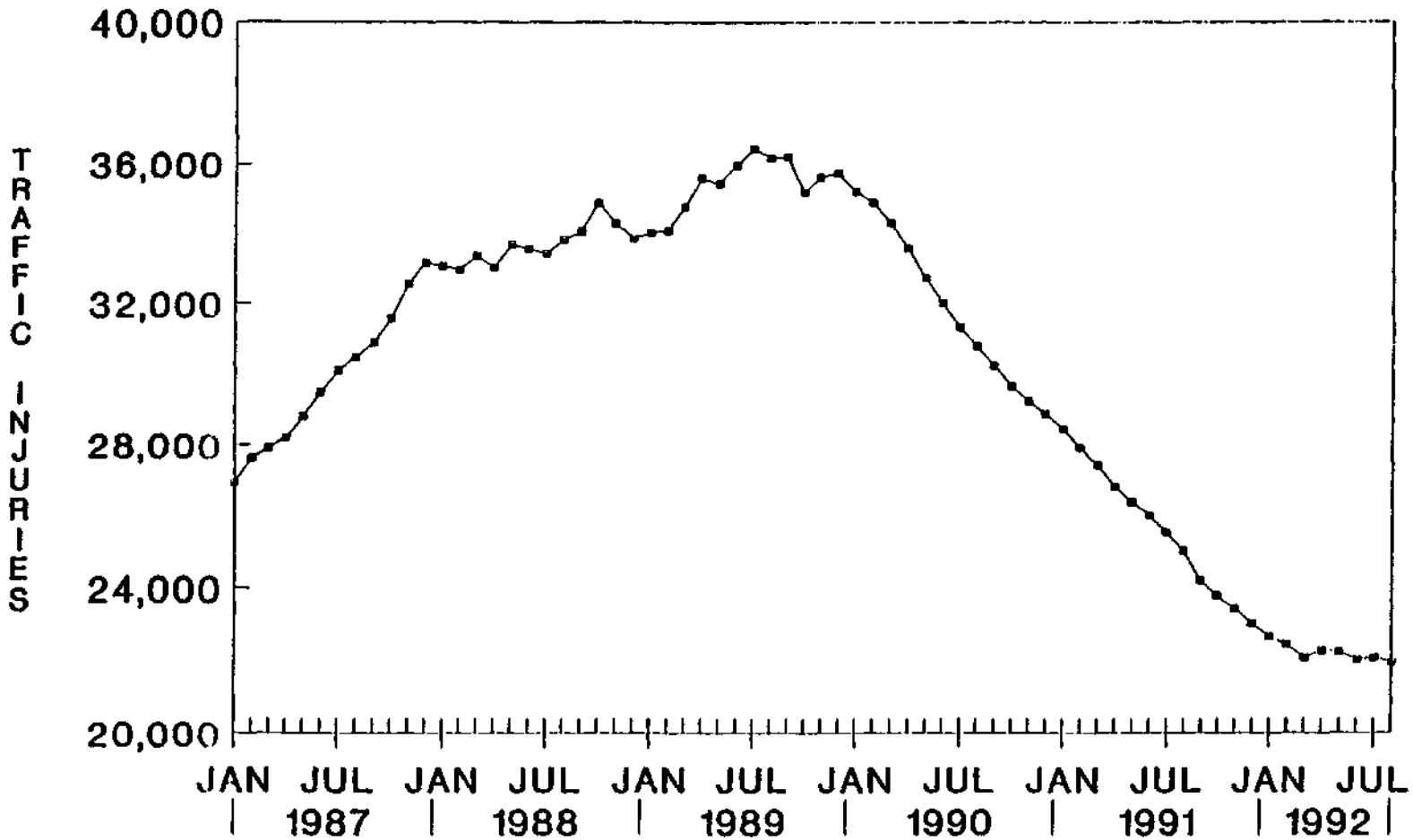
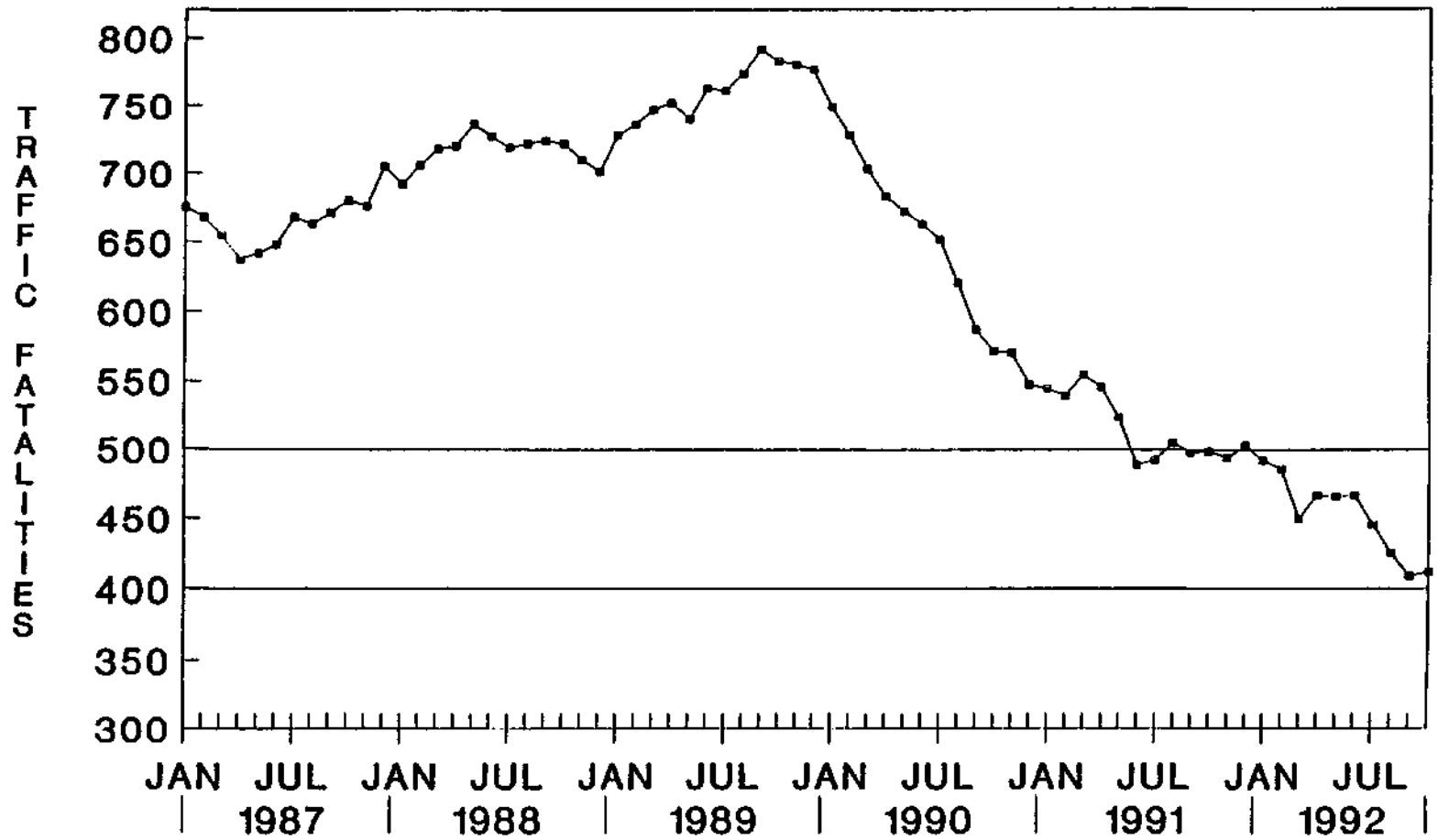


Figure 5: Fatalities, Twelve Month Rolling Totals

Victoria 1987-1992



Road traffic fatalities were reduced by 30% in the first year of the program, a saving of 229 lives compared with 1989. A further 21% reduction was recorded during the first half of 1991. In sum, the death toll on Victoria's roads has been cut by over 45% since 1989 (Figure 5).

This reduction in road traffic collisions, fatalities and injuries during 1990 saved Victorians over A$300 million in hospital, compensation, lost productivity and property damage costs. The savings since 1989 amount to more than A$800 million, including over $A200 million less in compensation claims payments.

The road toll reductions in Victoria have far exceeded those experienced in other Australian states. In 1989, the Victorian road toll was 777, and the toll for the rest of Australia was 2,028. From the end of 1989 to September 1992, the toll for the rest of Australia fell 22.9% to 1,563 a year, while the Victorian toll was reduced at more than twice that rate over the same period to 409 a year—down by 47.4%.

DISCUSSION

The initial estimate for the 10% reduction in the number of collisions has been shown to be conservative. Recent European research suggests that the change in the rate of collisions is in the order of a fourth-power relationship to the general reduction in travel speeds (Gerondeau, 1991) rather than the squared relationship (impact energy proportional to the square of the velocity change in a collision) that had been assumed in Victoria. On this basis, jurisdictions could confidently anticipate significant road toll gains given a sufficiently high level of speed enforcement.

Some have argued that the reduction in the road toll is largely due to reductions in road usage resulting from the economic recession. The Monash University Accident Research Centre (1992) has published an analysis of the links among the reduced road toll (a drop of 29% in 1990) and economic activity, road safety measures, social and other factors. The Centre's findings indicate that speed (6.4%) and blood alcohol enforcement and publicity (12.9%), accounted for over half of the decrease. The other factors were: reduced alcohol sales (5.0%), increasing rates of seat belt wearing (5.8%), population growth (4.1%), new licenses issued (0.8%), and total unemployment as an economic activity indicator (6.8%).

The motoring community in the state of Victoria has clearly reacted to the perceived increased risks of being caught speeding. This perception has been raised many-fold by a combination of high-impact advertisements, the knowledge that speed cameras are deployed throughout

Victoria, discussion with people who have had a speeding "ticket," and actually receiving a ticket—or more than one.

By far the biggest factor in this change is the potential to accumulate demerit points, ensuring that continuing bad driver behavior is punished and can result in loss of license. Other jurisdictions have similar speed camera enforcement levels (e.g., South Australia), but without the deterrent of license loss. This means that the offenses are treated by those who drive for a living (e.g., taxi and parcel delivery drivers), as just another parking ticket.

There are, however, three major community concerns frequently raised about the program. The first is that speed limits are not well posted or are too low. But more than 20,000 repeater speed signs were installed before the introduction of the cameras in 1989, and all speed zones, especially the intermediate zones (between 70-90 km/h), have been reviewed before enforcement. In addition, the location of camera sites is related to the collision and road toll history of each area, and is sensitive to the reasons for the local speed zone, for example, the time of day or year for shopping or school activities and special events. The Social Development Committee of the Victorian Parliament has inquired into Victoria's speed limits, as a result of which a new set of limits ranging in 10 km/h increments from 40 km/h to 110 km/h are to be introduced progressively starting in December 1992 (Social Development Committee, 1991).

The second concern poses the question "Why are police chasing drivers instead of criminals and burglars?" The answer of course, is that exceeding speed limits is against the law, and injuries are more severe in higher speed collisions. The police resource requirement for the traffic camera program is very low compared with the massive road toll savings, and substantial police time has been saved in not having to attend so many collisions.

Third, it is frequently charged that traffic camera enforcement has been increased simply to raise additional revenue. The answer here is that in all law enforcement jurisdictions monetary penalties are applied to a very wide range of offenses, including traffic offenses, as a first option to avoid the more punitive license loss or expensive custodial options. Moreover, the road safety benefits of reduced road trauma and decreased demand for health care services far exceed the value of revenue collected. Drivers need not pay at all if they travel at the posted speeds. In addition, all motorists enjoy the benefits of safer road use, which is reflected in reduced vehicle insurance premiums as well as lower petrol consumption and reduced emission gases resulting from even traffic flow at reduced speeds.

Even given these community concerns, 80% of respondents in a driver survey conducted in May 1991 supported the use of speed cameras because they "slow drivers down," "reduce collisions," and "catch speeders" (VicRoads, 1991, August). The same level of support was shown in a repeat survey conducted in December 1991 (VicRoads, 1992, January).

FUTURE DIRECTIONS

Road Safety Strategy

The Victorian Coordinated Road Safety Strategy (VicRoads, March, 1991, and April 1992), which links and coordinates the efforts of the key road safety agencies, is continuing its major focus on speed, drunk driving and seat belts, while commencing programs to tackle fatigue, drugs other than alcohol, enhanced safety for motorcyclists and pedestrians as road users, road system ("black spot") treatments, and vehicle occupant protection improvements (crash worthiness indicators and air bags).

Infringement Processing

Future developments in relation to infringement detection and processing will, in our view, include the availability within a few years of equipment to perform a variety of new functions. Portable equipment to capture images will process these at remote roadside sites in "real time," with the image and offense file being transmitted to the central processing bureau. Known as remote-image processing, the technical challenge is to balance resolution and data file size with a broad enough transmission band width to enable real-time communications. This would enable "on-line infringement processing" without the delay inherent in film processing.

Equipment is already available to allow "on the spot" penalty notices to be issued using a hand-held terminal with built-in data memory, which is downloaded to a central processor at the end of a shift. This provides automatic remote data capture that overcomes the mistakes inherent in duplicating data entry, particularly when using a field-produced handwritten copy as the data entry form.

Equipment now being used in South Australia and many other jurisdictions gives officers on the street on-line enquiry access to vehicle, driver and offense databases. This allows police the benefit of reviewing relevant information prior to or while interviewing a driver in the street. Given suitable image compression techniques, this could be extended to

high-quality digital images in vehicles, police stations, and, in time, even on the beat. Combining these technologies would allow a police officer on the beat to quickly and accurately process a citation while ensuring central database updates.

Traffic Management

The TIMS[0] image handling software is designed in part to find and recognize a defined shape in two-dimensional space. This has wide applications in other areas of traffic enforcement and traffic management. The ability to identify vehicles without the use of an expensive radio frequency transponder grid infrastructure allows a number of new roadside applications. These include road pricing (toll roads) either by prepayment with recognition of the on-vehicle receipt or sticker, or by periodically billing against the vehicle registration plate. The same applies to pricing for car parking spaces, whether at the side of the road or in a parking lot.

Pollution Control

Researchers at the University of Denver have recently developed a roadside exhaust gas analysis system to screen the emissions of passing vehicles and identify gross polluters. Combined with a remote image capture system and vehicle registration identification process, this would allow these vehicles to be referred for further testing and maintenance to reduce overall pollutant emissions.

CONCLUSION

Under the Coordinated Road Safety Strategy, Victoria introduced a major speed camera publicity and enforcement program in 1989 that has reduced the incidence of excess travel speeds (more than 30 kph over the posted limit) by two-thirds and the proportion of speeding vehicles in overall traffic flows by three-quarters. This has been a key factor in the 45% reduction in Victoria's road toll since 1989.

The technology applied has enabled speed camera enforcement to be increased over 30-fold, from around 20,000 infringement notices per year before the program commenced to over 600,000 notices a year in 1991-92. This has led to a major change in driver speeding, and has established a base whereby speeding can become socially unacceptable given continued publicity and sustained enforcement.

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