Highway Safety Research Center

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COMPULSORY WEARING OF SEAT BELTS -- THE AUSTRALIAN EXPERIENCE

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SUMMARY

This document consists of a number of reports relating to the effects of legislation requiring the wearing of seat belts by Australian motorists. These reports are arranged in chronological order, and the most recent, by Dr. A. P. Vulcan, provides the best review of this subject. A sheet of notes precedes his paper, and may clarify or highlight some of the issues that he discusses.

One study is not represented by a report in this collection of papers because it is believed that it has not yet been published. It was conducted by Dr. G. A. Ryan, of Monash University, and its aim was to determine whether a seat belt had actually been worn in cases where there was a report to that effect and the individual supposed to have been wearing the belt was injured or killed. The main findings are outlined on a separate sheet later in this folder.

In general, based on analyses of the data from the states of Victoria and New South Wales, it appears that this legislation has resulted in a reduction in fatalities to the occupants of motor vehicles of about 20%. The Victorian data show a much larger reduction in metropolitan areas (25%) than in rural areas (6%). This is associated with a lower wearing rate, and with a greater severity of accidents, in rural areas.

These reductions should not necessarily be taken as a valid indication of the likely effects of seat belt wearing legislation should it be introduced in this State, unless the legislation were to require the use of lap and shoulder belts by the driver and right front passenger, as is the case in Australia. A lap belt alone has not been shown to reduce the severity of the injuries sustained by a non-ejected occupant.

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CORRESPONDENCE

SEAT BELTS FOR VICTORIA

SIR: Dr Buntine (Journal, June 19, 1971) draws attention to the reported lower death frequencies in Victoria in the early months of this year, and refers to the new Victorian law making compulsory the wearing of belts where fitted. "Doctors may be forgiven", he continues, "for relating the significantly lower number of road deaths and injuries since introduction of the legislation to the new laws . . .".

The only hard data publicly available at present are the death frequencies from road accidents, by States, for the first five months of 1971 (Commonwealth Bureau of Census and Statistics, June 17). These are as follows (Table 1).

TABLE 1
January through May

State or Territory	1970	1971	Change, Percentage of 1970	Contribution to χ^2 [1]
New South Wales and Australian Capital Territory	576	506	−12	0·55
Victoria	442	380	−14	1·12
Queensland	203	237	+17	15·09
South Australia ..	160	112	−30	7·60
Western Australia ..	150	140	−7	0·11
Tasmania	61	63	+3	1·04
Northern Territory ..	13	19	+46	4·39
Australia	1,605	1,457	−10	29·9

[1] On hypothesis that the 1971 death total is shared between States in the same proportions as 1970.

It is necessary to consider other States, as well as Victoria, to avoid being misled by secular trends. In fact, Australian road deaths, as a whole, are down by 10%, and this decrease is statistically significant ($\chi^2 = 7{\cdot}15$). The difference in proportions of these deaths, shared between the States, is also significant ($\chi^2 = 29{\cdot}9$, $P < 0{\cdot}001$). However, the significant contributions to the value of χ^2 are those of Queensland, South Australia and Northern Territory. Thus, Victorian deaths cannot be said to have dropped more than those of the other States.

Of course, the total of death frequencies is a very insensitive measure of any effect of the Victorian safety-belt law. It will be some months yet before the death frequencies for the first half of the year are available broken down by type of road-user. Even then, the classification provided will not, it seems, yield the breakdown required—namely, car occupants versus all others.

Surveys at a few Melbourne inner city locations, in day time on weekdays, have indicated a large increase in belt-wearing rate since the law was introduced. Whether this increase is reflected in the wear rate at night, at weekends and at other locations will not be known until reliable data are available on the wearing rate in cars actually involved in accidents.

In short, the Victorian seat-belt law may well be having the effect it is intended to have (and one certainly hopes so), but evidence of this is not at present available from published statistics.

Doctors are expected to take a critical attitude to claims for the effectiveness of preventive or therapeutic agents. Consequently, they ought *not* to be forgiven if they draw the inference that Dr Buntine invites them to draw.

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Notes on an unpublished study by G. A. Ryan of Monash University, Melbourne, Australia of seat belt wearing by occupants injured or killed in accidents.

Dr. Ryan investigated 60 cases from an outer Melbourne hospital in which there were reports that a seat belt had been worn. This investigation was conducted after the introduction of the legislation making the wearing of seat belts compulsory. One reason for this study was a concern that compulsion might result in many persons wearing incorrectly adjusted belts. Another reason was to make some evaluation of the reliability of "word of mouth" reports that a seat belt was worn -- the concern here being that individuals would automatically claim that they were wearing their belts, and thereby obeying the law.

The 60 cases consisted of 6 cases of minor injury, 38 severe and 16 fatal. These persons were all over 10 years of age. In the fatal cases the police report stated that a seat belt was worn.

Investigation of the vehicles, interviews with the occupants and witnesses, and inspections of the indivual injuries produced the following results: In only 36 cases was there reasonable evidence to support the claim that a belt was in fact worn. In five cases no belts were fitted in the vehicle. Of these 36 cases there were eleven cases in which there was evidence that some injury could be attributed to the seat belt per se. (This does not necessarily mean that the person would have been better off not wearing a belt, most of these injuries were minor abrasions. In 3 cases there were internal injuries that were consistant with loadings from the belts.)

In 16 cases it was possible to comment on the adjustment of the belt. All but one person had the belt too loose to afford full protection, and, again, 15 of these 16 cases had the buckle of the three-point belt too far forward--located on the abdomen rather than at the side of the hip.

Subsequent roadside observation of 500 drivers demonstrated that over half wore their belts with excessive slack or with the buckle too far forward -- such that under load the shoulder strap pulls the lap belt up off the pelvis.

The author makes no claims that this work is representative of the Melbourne experience in general, and it should not be treated as such. It does highlight some of the problems associated with the compulsory wearing of seat belts, particularly emphasising deficiencies in the design of these belts insofar as they require individual and careful adjustment by each occupant.

National Road Safety Symposium 14-16 March 1972 Canberra

CONCURRENT SESSION 1A

Traffic Law Enforcement

THE EFFECTS OF COMPULSORY SEAT BELT WEARING LEGISLATION IN VICTORIA

This report describes the methods used and analysis proposed in a study of the effects of compulsory seat belt wearing in Victoria and presents some interim results on wearing rates, attitudes, and effect of seat belts in accidents. Interim results appear to indicate that compulsory wearing has been effective.

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'He who does not treasure life does not merit it.'
—da Vinci

COMPARED with previous years and other States in Australia there was a reduction in the number of casualties in Victoria in 1971. This reduction, which can be shown to be significant for car occupants could, superficially, be attributed to the introduction of compulsory seat belt wearing. However, until such time as the detailed examination is completed, only a tentative conclusion can be drawn.

This paper therefore, is an interim report on the effects of introducing compulsory seat belt wearing in the State of Victoria during 1971.

The effects of the legislation are examined in two ways:—

Mr Andreassend is Chief Engineer of the Road Safety and Traffic Authority, Victoria.

He commenced working in traffic engineering in 1958 with the Transport Department (now Ministry of Transport) of New Zealand and in 1964 and 1965 he engaged in post-graduate study at the School of Traffic Engineering, University of New South Wales.

Mr Andreassend joined the Victorian Traffic Commission in 1967 and became its Chief Engineer in 1968. The Commission changed its name to Road Safety and Traffic Authority and expanded its activities in 1971.

Mr Andreassend has written examination papers for driver licence tests, carried out studies of the efficacy of traffic control devices, has worked on the accident location system and the road user movement (R.U.M.) classification system, upgrading accident records and traffic signal systems.

(1) The effect on motorists (i.e. compliance with the law).

(2) The effect on accidents.

The effect on the motorist has been surveyed in several ways.

(1) A continuing observance study on a Latin square plan to determine wearing rates of drivers and left hand front passengers at times of peak accident occurrence.

(2) Interview studies of motorists to ascertain their frequency of use of seat belts, attitudes to compulsory wearing, age, trip length, purpose and so on, and the correctness of wearing.

(3) Relative wearing rates of driver and passenger according to their respective sex at various times of the day.

The effect on accidents is examined in terms of overall changes and detail involvement by accident type. Full examination is not possible until all the 1971 detail data are available.

The total study is still continuing at the time of writing this paper and thus this paper limits itself to the scope of the study, the procedures and methods adopted and the interim results to hand.

History

The Parliamentary Road Safety Committee in their third progress report dated 9 September 1969 recommended:—

'The Committee is convinced that no matter how much the public is exposed to education in the use of seat belts, apathy, lack of interest and lack of concern will mean that many people will not wear them. The Committee, therefore, recommends that all occupants of motor vehicles should be required to wear seat belts with[in] a maximum period of two years.'

On 22 December 1970 through the then Chief Secretary, Sir Arthur Rylah, the bill was proclaimed but a one month period of education was allowed before enforcement commenced. The legislation basically provided that 'a person shall not be seated in a motor car that is in motion, in a seat for which a safety belt is provided, unless he is wearing the safety belt and it is properly adjusted and securely fastened'.

Seat belts have been fitted voluntarily in Victorian cars for many years (details are given later) and became compulsory equipment for driver and left hand front passenger positions after 1 January 1969 and for all seating positions after 1 January 1971. The outer seating positions must be fitted with three-point belts, the middle seats are permitted to be fitted with lap belts.

Although Victoria cannot claim to be the first place in the world to make seat belt wearing compulsory (it is understood Malawi was) it was the first State in Australia and indeed in the motorised world to do so.

Scope of the study

The study, as planned, was broken into six sections as follows:—

Macroscopic accident analysis

A comparison of fatal, injury and property damage accidents for 1971 in Victoria with trends in other States with a separation into car occupants and others.

Coarse Victorian accident analysis

An analysis of the degree of injury sustained by the driver (and left hand front passenger) for belt wearers and non-wearers. The 'degree of injury' used is fatal; injured, admitted to hospital; injured, requiring medical treatment; injured, not requiring medical treatment; and not injured.

Microscopic Victorian accident analysis

The accidents will first be sorted into general areas of location (i.e. metropolitan Melbourne, country towns, rural) so as not to mask the differences related to these locations.

The following factors will probably be looked at in combination with the above and with each other—

(a) Road user movement (R.U.M.) see Appendix, Fig. 1.
(b) Time of day and day of week.
(c) Weather conditions.
(d) Light conditions.
(e) Alcohol.
(f) Age and experience of drivers.
(g) Speed.
(h) Seat belts worn/not worn.

Observance of seat belt fitting and wearing

The following statistics are being measured:—

(a) Fitting rate (percentage of cars and equivalents fitted with seat belts).
(b) Wearing rate (percentage of drivers using fitted belts).
(c) Penetration rate (percentage of all drivers using belts).

Sites and times chosen for the observance study were based on accident records.

Characteristics of wearers and non-wearers

As a sub-study, interviews were carried out 'on the road' to establish characteristics of wearers and non-wearers.

The factors included were:—

(a) Age and sex of driver.
(b) Socio-economic group.
(c) Purpose of journey.
(d) Length of journey.
(e) Car age, make and model.
(f) Locality, time of day, day of week.
(g) Wearing/non-wearing of seat belts for drivers and left hand front passengers.
(h) Adjustment of belt worn (twisted etc.).
(i) Attitudes to belt wearing.
(j) Reasons for not wearing/wearing.

Investigation, on site, of casualty accidents

A two man team is investigating whether a belt was actually worn and if so, whether or not it was correctly adjusted.

If a belt was worn the following is examined:—

(a) Causes of injury.
(b) (i) Parts of vehicle hit (interior).
(ii) Design of belt and its installation.
(iii) Intrusion of the occupied area.
(c) Accident circumstances.
(i) Speed.
(ii) Object hit.
(iii) Deceleration distance.

Of the six sections the Authority is undertaking the first five and the sixth is being carried out by a team from the Monash University (Social and Preventive Medicine Department).

In addition, a sub-study has been made of seat belt wearing of drivers and left hand front passengers according to their sex. Furthermore, a continuing study is being carried out once a week at the same site to reflect any immediate changes that may be occurring.

Procedure

Observance study

As a body involved in road safety, the Authority was not merely interested in the overall compliance of motorists to this law, but set itself out to determine, against the background of the 'before' situation, whether motorists wore their belts when it mattered, that is, at the times when most accidents occurred. Thence a programme was established on a Latin square design to

sample the wearing rates of drivers (and passengers) at various locations throughout the Melbourne Metropolitan Area and the country towns (to allow for geographic variations) and at the various times determined from an examination of the accident pattern.

Three statistics are defined as follows:—

(i) Fitting rate (i.e. cars and equivalents fitted with seat belts).

(ii) Wearing rate (i.e. drivers wearing fitted belts).

(iii) Penetration rate (i.e. percentage of all drivers wearing belts — this is the product of the two above).

Sites were chosen on the basis of conglomerates of accidents. The proportion of reported accidents is two thirds metropolitan area and one third the rest of the State, so two thirds of the sites chosen were in the metropolitan area i.e. (12) and one third in the country (6).

Other factors were involved in the choice of sites such as good street lighting, central traffic island and signalisation.

In addition to the three 'statistics' above, the following additional information was collected at each site:—

(1) Total cars and equivalents.

(2) Total vehicles.

The survey was restricted to the observed wearing of three-point belts because of the problems of viewing lap belts. (Also, 90 per cent of belts in present cars are three-point belts.)

For each vehicle (that is, cars and car derivatives), the observer checked the driver and left hand front passenger (if any). He then recorded whether or not a seat belt was fitted, and if fitted, whether or not it was worn by the respective occupant. The fitting of a seat belt for a left hand front passenger was checked only if such a passenger was actually being carried in the vehicle (that is, fitting and wearing pertains to occupied seats only).

The times chosen for the observance times are shown in Tables 1(a) and 1(b) in the Appendix. (Metropolitan and Rural.)

Interview study

This study was made as an adjunct to the main study to determinue characteristics of wearers and non wearers.

Similar (but not the same) sites for the observation study were chosen and the same times were used to relate attitudes to observed wearing. Eight sites were used. Interviews were restricted to the metropolitan area.

At each interview session a 'road block' was set up with the assistance of the police and a car was selected randomly from the traffic stream as each interview was completed.

Interim results

Belt fitting surveys

As mentioned earlier, periodical surveys of belt fitting have been carried out in the Melbourne metropolitan area and a summary of the years 1965-1971 is on Table II in the Appendix. This table shows an increase in fitting in driver and left hand front passenger positions from 19.6 per cent in 1965 to 75.9 per cent in 1971 with three-point belts now forming 91.2 per cent of all belts fitted.

The figure of 75.9 per cent (69.2 per cent three-point belts) for this parking area survey can be compared with the fitting rate for three-point belts observed in the main study of 73.1 per cent (metropolitan area).

At the time of writing, approximately 64,000 cars had been observed in the main study compared with 24,000 in the parking areas.

Macroscopic study of accidents

(i) The number of persons killed and injured in Victoria according to police figures for January-December, 1971 inclusive, was reduced by 11.6 per cent compared with the corresponding period of 1970 (this was a reduction of 14.9 per cent in persons killed and 11.5 per cent in persons injured).

(ii) However, these figures alone are insufficient to justify comment on the effect of belts since they do not discriminate between potential belt users and non-potential users (that is, car occupants and other road users). To make this comparison, the figures for the first six months were used and a reduction of 18.2 per cent in casualties was found for drivers and passengers in car equivalents and only a 5.7 per cent reduction for other road users. (See Table III in the Appendix.)

The reductions were significantly different, that is, the reduction for car occupants was significantly greater than the reduction for other road users.

(Note: This groups all car occupants together irrespective of whether or not a belt was fitted in the car.)

(iii) To compare Victoria with other States in Australia, it was not possible to get the same detail as in (ii) above, so 'drivers of motor vehicles' and 'passengers (all types)' were used.

(Note: Little difference will exist due to preponderance of the numbers of car equivalents in accidents.)

An examination of Table IV in the Appendix pertaining to driver casualties shows N.S.W., Queensland and the Northern Territory to have significant increases and Victoria a significant decrease, using a $p = .01$ level of significance. If a lower level of $p = .05$ is used, then South Australia has a significant reduction also. I will return to this shortly.

The passenger casualty figures, Table V in the Appendix shows only significant increases in Queensland and the Northern Territory.

The other road users, Table VI, show only significant increases in Queensland and the Northern Territory.

(iv) In order to make this interim macroscopic analysis a little more complete, trend lines were determined for the first half year period from 1955 to 1971 inclusive. These trend lines shown in Figures 2 and 3 in the Appendix for driver and passenger deaths respectively demonstrate that the use of 1970 as a 'before'

period in Victoria, for this exercise anyway, is not biased by any sort of unusually high year with reference to the trend line.

To return to the decrease in South Australia, where belt wearing was not compulsory, Figure 4 in the Appendix illustrates that 1970 was an unusually high year with respect to the trend and thus not suitable as a before period.

Observation study

At the time of writing, three more replications were to be done in the metropolitan area and two more in the rural area.

(i) Wearing rate

(a) Dealing first with the Melbourne metropolitan area, a total of 63,587 cars were observed and the overall average wearing rate for drivers was 75 per cent. The wearing rate ranges over the 12 sites from 69.3 per cent to 81.1 per cent and over the 12 periods from 68.4 per cent to 79.2 per cent.

The lowest observed wearing rate in any one session was 54.2 per cent and the highest 85 per cent.

(b) In the rural area, a total of 30,065 cars were observed and the overall average wearing rate for drivers was 64.1 per cent. The wearing rate ranged over the six sites from 51.3 per cent to 68.9 per cent and over the 12 periods from 58.2 per cent to 70.8 per cent. The lowest observed wearing rate in any one session was 40.1 per cent and the highest 77.4 per cent.

The wearing rate in the metropolitan area is approximately 11 per cent higher than in the rural area. The wearing rate for left hand front passengers was approximately eight per cent less than the wearing rate for drivers in both areas.

(ii) Fitting rate

(a) In the metropolitan area the average fitting rate was 73.1 per cent.

(b) In the rural area the average fitting rate was 65.1 per cent.

(iii) Penetration rate

(a) In the metropolitan area the average penetration rate was 54.8 per cent.

(b) In the rural area the average penetration rate was 41.7 per cent.

(iv) A sub-study was made of the relative wearing rates for drivers and passengers by respective sex.

A total of 2643 cars was observed carrying 1321 left hand front passengers (the average number of passengers per car was .5).

This was subdivided as follows:—

(a) Driver only, no passenger	1322
(b) Driver, passenger, belts fitted	984
(c) Driver, passenger, no belts	318
	2624
Balance in which only one belt fitted	19
	2643

Of these groups, males formed 88.6 per cent of the drivers and 30.4 per cent of the passengers. Male drivers in the above group were:—

(a) 85.8 per cent.
(b) 92.1 per cent.
(c) 90.9 per cent.

For group (a), drivers only, the following figures were obtained:—

Wearing rate	76.0 per cent.
Fitting rate	74.3 per cent.
Penetration rate	56.4 per cent.

Women tended to have a higher wearing rate but drove cars with a lower fitting rate.

For groups (b) and (c) the following driver/passenger sex combinations were possible:—

	Male, per cent	Male, per cent	Female, per cent	Female, per cent
(b)	26.0	66.1	2.4	5.5
(c)	30.8	60.1	3.8	5.3

It is evident that even with seat belts, the male still prefers to drive in preference to letting his female companion drive.

For group (b), the further combination of wearing and not wearing were possible and the results were as follows in driver, passenger order:—

Driver	Pass.	W,W	W,NW	NW,W	NW,NW
M	M	16.2%	3.4%	1.3%	5.2%
M	F	45.6%	5.9%	3.2%	11.4%
F	M	1.7%	0.1%	0.0%	0.6%
F	F	4.4%	0.2%	0.1%	0.8%
TOTAL		67.9%	9.6%	4.6%	18.0%

Thus, the predominant behaviour for a driver and passenger in a car fitted with belts is for both to wear the belts, followed by both not wearing them.

Again, women drivers tended to have a three per cent higher wearing rate but the sample size was small. Women passengers also had a higher wearing rate than male passengers (75 per cent vs 67 per cent).

(v) The weekly study of morning peak traffic at Kew Junction is used to illustrate the effect of the one month 'education' period on the wearing rate.

Figure 5 shows the gradual drop in wearing rate until the announcement of enforcement starting and the climb to what has been a consistent value for this site for the rest of the year.

Interview survey

Conducted over a period of a month (November-December, 1971) at eight different metropolitan sites, this survey had a total sample of 884 drivers. Data were collected by two means:—

(1) Through the use of a questionnaire which was administered by an interviewer.

(2) Through the use of an observation sheet filled in by on-site observer.

Interviews were conducted on the roadside for a maximum of two hours and drivers were sampled as they passed a predetermined sampling line.

A discussion of the results at this stage will be general in nature and only a few of the major findings will be reported. In accord with the objectives, two main areas – seat belt usage and attitudes towards belts and the compulsory legislation – will be covered in this summary.

Seat belt usage

(i) The actual wearing rate as recorded by the on-site observer was 76.2 per cent for drivers (n = 697) and 76.8 per cent for left hand front passengers (n = 349). An assessment of the wearing frequency for these two groups by sex indicated that there was a tendency for both women drivers and passengers to have a higher wearing rate than their male counterparts. For example, out of a total number of 160 female passengers, 81.2 per cent were wearing belts compared with 68.8 per cent of the male passengers (n = 80).

(ii) Although the lowest wearers were in the under 20 age group, there was no significant relationship between age and wearing frequency. The pattern was inconsistent because of the small samples of drivers in the lower and upper extremes of the age range.

(iii) Wearers and non-wearers of seat belts were compared according to the length of their trip. The highest proportion of wearers appears in the 11-15 miles group – 82.2 per cent and the lowest in the 0-5 miles group – 57.1 per cent. Because of few respondents in some of the categories, the overall association between these two variables – length of journey and wearing rate – could not be tested.

(iv) Two indices of socio-economic status were used for this study – (i) Congalton's occupational status scale. (ii) Lancaster Jones' social ranking of Melbourne suburbs.

On both variables there was an association between the driver's belt usage and socio-economic status (see Tables VII and VIII in the Appendix).

(v) For those drivers recorded as wearing a three-point belt at the time of the interview, an analysis was made of their adjustment. The following results were recorded:–

Twisted	148 drivers	25.9 per cent
Loose	149 drivers	26.0 per cent
Very loose	70 drivers	12.2 per cent
Buckle not on hip	116 drivers	20.3 per cent
*Belt stored	12 drivers	2.1 per cent
Correctly adjusted	77 drivers	13.5 per cent

*Belt stored refers to retractor type belts, that is, non-inertia reel types where part of the belt remains around the retractor.

The 77 drivers observed as having their belts correctly adjusted were those whose belts were not twisted, loose or had the buckle towards the centre of their body. Drivers between the ages of 25 and 29 years were noted as having the highest proportion of correctly adjusted belts, 21.6 per cent.

(vi) During the interview, drivers were asked to report on their seat belt wearing frequency. They had four options – always, mostly, seldom, never. The proportions in each group were as follows:–

(i) Always – 490 drivers (55.4 per cent).
(ii) Mostly – 148 drivers (16.7 per cent).
(iii) Seldom – 36 drivers (4.1 per cent).
(iv) Never – 23 drivers (2.6 per cent).

Attitudes towards seat belts

(i) For drivers who reported their usage as 'always', 46.1 per cent (225 drivers) said their main reason for wearing a belt was for 'safety'. Seventy-eight drivers, that is, 16 per cent gave 'physical restraint' as a reason, nine per cent (44 drivers) for 'emotional comfort' and 20.9 per cent (102 drivers) wore belts because it was compulsory.

Of the remainder, 7.8 per cent (38 drivers) used belts out of 'habit' and three drivers gave no reason at all.

(ii) The reasons given for 'mostly' wearing a belt are outlined below:–

(a) Safety, especially for longer trips
51 drivers 34.0 per cent
(b) Not habit, sometimes forgets or in a hurry
27 drivers 18.0 per cent
(c) Because of the law
33 drivers 22.0 per cent
(d) Physical restraint
28 drivers 18.7 per cent
(e) Emotional comfort, security
6 drivers 4.0 per cent

(iii) At this stage, no details are given about the 'seldom' and 'never' groups because of the smallness of each sample.

(iv) For the largest group, 'always wears', there are two general comments that can be made. There was a tendency for more female drivers to give 'law' as their reason for always wearing a seat belt than male drivers. The majority of male drivers, 22.9 per cent, gave 'safety' as their reason. Furthermore, the largest number of drivers giving this reason fell in the age groups 40-49, 50-59 and over 60. This tendency is noted again in the relationship between age and driver attitudes towards the compulsory seat belt legislation.

(v) Drivers were asked whether they agreed or disagreed with the legislation and also to give reasons for their responses. The categories of answers and the proportions falling into each are shown below.

1. Agree with law for safety reasons
134 drivers 15.2 per cent
2. Agree with law – reduces injury/deaths
382 drivers 43.2 per cent
3. Agree with law – refers to own physical and emotional safety
78 drivers 8.8 per cent
4. Agree with law, forces people to wear belts
80 drivers 9.0 per cent
5. Disagree – should be individual choice
76 drivers 8.6 per cent
6. Disagree – not fully proved
61 drivers 7.0 per cent
7. Other/no reason
73 drivers 8.1 per cent

An assessment of these attitudes by age indicates a trend for the older age groups — from 40 years onwards to disagree with the legislation. However, at this stage no tests have been carried out to determine the significance of this relationship.

The results of the interview survey presented in this brief summary are only of a preliminary nature. It is intended that they will be analysed in greater detail and be published in the final report.

Microscopic study of accidents

For this paper the accident report forms received in the office by the end of October, 1971 were processed into the following groups of road user units:—

	No.
1. Drivers of cars, station wagons, taxis and hire cars wearing three-point belts excl. 01-19 accident types (road user movement)	4747
2. Drivers of above in 01-19 accident types	742
3. Drivers of other vehicle types wearing three-point belts	446
4. Drivers of all vehicle types wearing other belts	963
5. Drivers of all vehicle types not wearing fitted belts	489
6. Drivers of all vehicle types, belts not fitted	7916
7. Drivers of all vehicle types, not known if fitted	3217
8. Drivers of all vehicle types, not known if belts worn	975
9. Accidents involving motor cycles, bicycles and pedestrians but excluding drivers of car equivalents in 01-19 accident types	1904

(i) From the accident forms the 'reported' fitting rate was 48.3 per cent, the reported wearing rate was 93.4 per cent and thus the penetration rate was 45.1 per cent.

(ii) The first observation that must be made relates to the discrepancy between observed wearing and reported wearing — obviously now that it is an offence not to wear a belt, a number of drivers are reporting untruthfully that they were wearing their belts (about 24 per cent of the drivers).

Thus the detail examination of the 1971 records must be handled with this 'lie factor' in mind.

(iii) For this interim report, the group 1, above, was investigated in depth.

Of the 4747 group 1 involvements, 3074 were at intersections and 1673 at midblock locations.

The degree of injury sustained by three-point belt wearers overall was:

Location	Fatal	Hosp. admit.	Med. treat.	No. treat.	Not inj'd.	TOTAL
Intersection	0.3	5.4	12.4	4.2	77.7	100.0%
Midblock	1.0	13.1	16.6	4.1	65.2	100.0%

From this it can be seen that midblock involvements resulted in a greater degree of injury. This was because of the area and the type of road user movement involved so for the two most serious degrees of injury (fatal and hospital) the above was divided into areas.

	Intersection	Midblock
State	5.7 per cent	14.1 per cent
Metro 1	4.5 per cent	7.1 per cent
Towns	5.8 per cent	10.1 per cent
Metro (2-1)	10.9 per cent	16.5 per cent
Rural	15.5 per cent	26.3 per cent

(Note: Metro 1 refers to a subset of Metro 2 which is the Commonwealth Statistician's Metro. Statistical Division.)

This table shows a progression to more serious degrees of injury as the speed character of the area increases which is as expected.

(iv) The intersection and midblock involvements were sorted into R.U.M.* and the following major groups emerged:—

(1) Intersection — 21, 24, 31, 37,.

(2) Midblock — 51, 58, 63, 82, 85.

* R.U.M. shown in Figure 1 is the classification system for accident types in current use by the Authority.

(v) To facilitate comparison with 1971 and act as a 'before' situation the 1968 accidents were analysed in a similar fashion but in greater depth. Since the drivers in 1971 were not truthful about their wearing, it was decided to compare the degree of injury for three-point belt wearers with those in 1968.

Table IX in the Appendix shows the relative results at intersection and midblock. For casualties (that is, fatal, hospital and medical treatment) the split is:—

Intersection	1971	18.1 per cent
	1968	15.8 per cent
Midblock	1971	30.7 per cent
	1968	21.4 per cent

So it can be seen that the 'lie factor' is greater for midblock accidents by a factor of two assuming the 1968 degree of injury to be accurate.

Is there any way of checking this? If we can predict the expected reduction in casualties from the earlier results, say 1968 and 1969, and the observed fitting and wearing rates for 1971, then we could be reasonably confident of our early results. Table X in the Appendix shows the apparent reduction in driver casualties by wearing three-point belts in cars so fitted for the years 1968 and 1969. If we average the reduction effect (i.e. 27.5 per cent) and take the observed fitting and wearing rates weighted two thirds and one third for the metropolitan and rural figures respectively, the following is obtained:—

$.275 \times .704 \times .713 = .138$ (i.e. 13.8 per cent).

For the six months of 1971 in Victoria, 19.7 per cent fewer driver casualties were recorded (see Table IV) but as there was a general down trend in casualties to other road users of 5.7 per cent not due to seat belts, it could be assessed that approximately 14.0 per cent fewer driver casualties occurred due to the wearing of belts which (fortunately) is about what was predicted. This, of course, does not prove the case but the figures correspond closely enough to believe it is so. It should be noted that a general small order down trend was

observed in the rest of Australia for the first six months of 1971 which may have been because of economic factors. This is added to show that not all of the 19.7 per cent reduction in Victoria can be attributed to the wearing of seat belts.

(vi) It can be argued that wearing of belts voluntarily is related to the 'timid', 'more cautious', 'better' or what have you driver, and because of this he is not involved in the same type of accident as the non-wearer. It is also sometimes argued that wearing a belt makes some drivers over confident and hence take greater risks (a new type of St. Christopher medal). While the detailed breakup that will be carried out later may agree with one or neither of these opinions, it was examined for the State data (without the breakup into areas) to see if any obvious differences existed. The wearers of belts in 1968 and 1971 and the non-wearers in 1968 were tested (see Table XI) but no significant difference was found in their relative involvement by accident R.U.M.

This means that on the broad scale the effectiveness of seat belts in particular accident types (R.U.M.) can be assessed and further means of occupant protection exploited.

From Table XII in the Appendix it can be seen that the reduction in casualties by wearing a belt goes as high as 50 per cent. The highest reductions are (1) in 'head on' type accidents, that is, generally frontal impact — which is to be expected — and (2) in accidents in which one of the vehicles was turning.

Without a detailed examination, one can but guess that the large saving in the latter might be due to a reduction in ejections from the vehicle and this will be looked at for the final report. If the effectiveness of the belt could be enhanced in R.U.M. 21 type accidents to give occupants some lateral protection equivalent to that given for frontal impacts, the apparent reduction could be increased to say 47 per cent (i.e. reducing casualties to 13.7 per cent for wearers). The overall effectiveness of seat belts (all R.U.M.) would be increased to approximately 35 per cent.

(vii) Other means of increasing the reduction in casualties for the State would be to increase the wearing rate through more enforcement and/or to increase the number of cars fitted with seat belts. If both of these means were employed the maximum reduction that could have been expected in the State's vehicle occupant casualty figures would have been about 27.5 per cent (plus the general down trend of 5.7 per cent i.e. a total of 33.2 per cent).

It is intended to introduce 'on the spot fines' for not wearing belts into Victoria (other States have made use of our experience and have already done this) and this will expedite the process of effective enforcement and may increase the wearing rate. Increasing the fine above $20 could also be considered. Enforcement should be particularly directed to country areas where one third of all accidents occur and half the State fatalities. The question of retrospective fitting of belts to all pre-1969 cars is one that should be considered.

Preliminary investigation suggests that as the 85 percentile age of the vehicle fleet is 10 years and the 85 percentile age of vehicles involved in all accidents is also 10 years, little real benefit would be gained in fitting belts into vehicles that will soon be off the road and the reduction in casualties likely would not justify the expense of fitting the belts.

(viii) Comparative casualty reduction level for wearers of different belt types tends to show superiority for the three-point belt, then comes the lap belt, and lastly, the diagonal belt (for 1969 data; 27.2 per cent, 24.4 per cent and 16.8 per cent apparent reduction).

(ix) Re-education in the proper wearing and adjustment of belts seems to be more than justified to improve correctness of wearing. At this stage the effect of loose belts, twists etc. has not been evaluated so the benefits from improved wearing are difficult to assess.

Conclusions

The compulsory wearing of belts in Victoria is being observed by 64-75 per cent of the drivers in country and metropolitan areas respectively. Relative fitting rates are 65 per cent country, 73 per cent metropolitan which gives overall penetration rates of 42-55 per cent.

The overall vehicle driver casualties have fallen by about 14 per cent due to belt wearing and six per cent due to a general down trend in the first six months of 1971.

The wearing rate does not vary with the age of the driver but appears to vary with the length of the trip and the socio-economic status of the driver.

The quality of wearing was not very good, as most drivers observed during the interview survey did not have their belts correctly adjusted. It would seem education is needed in this sphere.

The main reason for wearing belts was given as 'safety'. 'Law' as a reason was given more frequently by women drivers and drivers in the older age groups (above 40 years).

Detailed examination of accident data shows seat belt wearing to have a casualty reduction potential in a variety of accident types. However, the effectiveness could be improved by vehicle design to give better lateral protection to occupants.

Vehicle design aside, further reduction in casualties could be possible by improving the wearing rate and/or the fitting rate. The wearing rate could be improved by increased enforcement and improved convenience of use.

Some limited amount of retrospective fitting of belts, say to 1965, would appear to be justified and this is presently being examined.

ACKNOWLEDGEMENT

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TABLE 1A

Observation programme, Metro area.

Replication		1			2			3			4			5			6			7			8			9			10			11			12		
Observance time	Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sunday 4-6 p.m.	Site 1		2			3			4			5			6			7			8			9			10			11			12		
Tuesday 7-9 a.m.	2			3			4			5			6			7			8			9			10			11			12			1	
Friday 4-6 p.m.	3			4			5			6			7			8			9			10			11			12			1			2	
Friday 8-9 p.m.	4			5			6			7			8			9			10			11			12			1			2			3	
Saturday 5-7 p.m.	5			6			7			8			9			10			11			12			1			2			3			4	
Saturday 9-11 p.m.	6			7			8			9			10			11			12			1			2			3			4			5	
Tuesday 1.30-2.30 p.m.	7			8			9			10			11			12			1			2			3			4			5			6	
Tuesday 4-6 p.m.	8			9			10			11			12			1			2			3			4			5			6			7	
Friday 6-8 p.m.	9			10			11			12			1			2			3			4			5			6			7			8	
Friday 10-11 p.m.	10			11			12			1			2			3			4			5			6			7			8			9	
Saturday 7-9 p.m.	11			12			1			2			3			4			5			6			7			8			9			10	
Saturday 11-1 a.m.	12			1			2			3			4			5			6			7			8			9			10			11	

TABLE 1B

Rural.

Replication		1			2			3			4			5			6			7			8			9			10			11			12		
Observance times	Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sunday 4-6 p.m. Tues. 7-9 a.m.	Site 1			2			3			4			5			6			7			8			9			10			11			12		
Friday 4-6 p.m. 8-9 p.m.	2			3			4			5			6			1			2			3			4			5			6			7	
Saturday 5-7 p.m. 9-11 p.m.	3			4			5			6			7			2			3			4			5			6			1			8	
Tuesday 1.30-2.30 p.m. 4-6 p.m.		4			5			6			1			2			3			4			5			6			7			8			9
Friday 6-8 p.m. 10-11 p.m.		5			6			1			2			3			4			5			6			7			8			9			10
Saturday 7-9 p.m. 11 p.m.-1 a.m.		6			1			2			3			4			5			6			7			8			9			10			11

TABLE II

Observed trends in belt fitting.[1]

(For driver and L.H.F. passenger seats.)

	1965	1967	1969[2]	1971
% Fitted — all belt types	19.6	29.3	49.7	75.9[3]
% Fitted 3pt belts	13.0	22.0	41.4	69.2[4]
% 3pt of all belts	66.3	75.1	83.3	91.2
Sample Size n =	14,031	14,450	20,238	23,787

Notes: (1) Survey of parking areas in Melbourne Metropolitan Area.
(2) Compulsory fitting introduced January 1969.
(3) Survey covers Melbourne Metropolitan Areas — fitting ranges from 70.5 per cent in factory parking areas to 86.3 per cent in C.B.D. parking areas.
(4) Other belt types fitted are:—Lap 5.9 per cent, diagonal .3 per cent, full harness .4 per cent.

TABLE III

Persons killed or injured by road user, first six months.

Road user	1st 6 mths 1970	1st 6 mths 1971	Reduction	%
(1) Driver and pass. in cars, station wagons, utilities, etc.	8089	6618	1471	18.2
(2) Other road users	4594	4330	264	5.7
Total	12683	10948	—	—

$x^2 = 27.7$, $p < .001$

Note: (1) is significantly different to (2).

TABLE IV

Drivers of motor vehicles killed or injured.

State or Territory	No. of Casualties 1st 6 mths 1970	1st 6 mths 1971	Contribution to x^2
N.S.W.	6769	6924	(+) 25.0
Vic. (1)	5171	4154	(—) 56.3
Qld.	2162	2256	(+) 12.3
S.A.	2159	1872	6.4
W.A.	1686	1602	0.1
Tas.	478	440	0.1
N.T.	133	187	(+) 12.8
A.C.T.	257	234	0.1
Total	18815	17669	113.1

(1) A reduction in driver casualties of 19.7 per cent.

TABLE V

Passengers (all types) killed or injured.

State or Territory	No. of casualties 1st 6 mths 1970	1st 6 mths 1971	Contribution to x^2
N.S.W.	7154	6477	1.0
Vic.	5015	4394	( ) 5.9
Qld.	2008	2281	47.0
S.A.	2084	1860	1.0
W.A.	1474	1349	0.0
Tas.	543	443	3.8
N.T.	143	176	(+) 6.7
A.C.T.	229	205	0.1
Total	18652	17185	64.5

TABLE VI

Other road users killed or injured.

State or Territory	No. of casualties 1st 6 mths 1970	1st 6 mths 1971	Contribution to x^2
N.S.W.	4291	4287	0.6
Vic.	2497	2400	3.8
Qld.	1062	1238	(+) 10.8
S.A.	1094	1127	0.1
W.A.	725	708	0.6
Tas.	205	211	0.0
N.T.	50	90	(+) 10.8
A.C.T.	133	161	2.2
Total	10057	10222	28.9

TABLE VII

Driver's occupational status versus seat belt usage.

(Observed and expected frequencies.)

Status	WORN Observed	WORN Expected	NOT WORN Observed	NOT WORN Expected	Total observed
High	129	117.6	26	37.4	155
Average	114	117.6	41	37.4	155
Below av.	136	127.4	32	40.6	168
Low	130	146.4	63	46.6	193
Total	509	509	162	162	671

Note: $X^2 = 15.1$ ($P. < .01$)

TABLE VIII

Driver's residential status versus seat belt usage.

(Observed and expected frequencies.)

Residential status	WORN Obs	WORN Exp	NOT WORN Obs	NOT WORN Exp	Total observed
Upper Middle	108	105.9	31	33.1	139
Middle	157	145.5	34	45.5	191
Lower Middle	112	121.8	48	38.2	160
Working	83	86.8	31	27.2	114
Total	460	460	144	144	604

Note: $X^2 = 7.991$ ($P. < .05$)

TABLE IX

1968 versus 1971.

Three point belt wearers versus degree of injury.

	Fatal	Hosp.	Med. treat.	No treat.	No injury	Total
Intersection						
1971	0.3	5.4	12.4	4.2	77.7	100% (n = 3074)
1968	0.4	—	15.4	4.6	79.6	100% (n = 799)
Midblock						
1971	1.0	13.1	16.6	4.1	65.2	100% (n = 1673)
1968	0.4	—	21.0	6.1	72.5	100% (n = 505)

Note: in 1968 'Hospital' and 'Medical Treatment' were not separated.

TABLE X

(a) 1968 — Three point belts versus degree of injury.
(Intersection and midblock accidents.)

Degree of injury	Worn f	Worn %	Not worn f	Not worn %	Apparent changes Wrt N/W	
Fatal	5	0.4	18	1.4	−72.0%	27.9%
Inj-med treatment	229	17.6	315	24.2	−27.3%	
Inj-no treatment	68	5.2	75	5.8	− 9.0%	
No injury	1002	76.8	892	68.6	+12.0%	
Sample size n =	1304	100.0	1300	100.0		

(b) 1969 — Three point belts versus degree of injury.

Degree of injury	Worn %	Not worn %	Apparent changes	
Fatal and admissions to hospital	6.1	11.1	−45.5%	27.2%
Inj med treatment	11.8	13.4	−11.9%	
Inj no treatment	4.1	3.9		
No injury	78.0	71.6		
Sample size n =	100.0 2252	100.0 3139		

Note:—in 1968 'Inj-Med Treatment' included 'Admissions to Hospital'

TABLE XI

Three point belts versus accident type.

	R.U.M.	1968 Worn %	1968 N/worn %	1971 Worn %
Intersections	21	22.8	25.8	27.5
	24	2.9	3.8	3.4
	31	6.6	7.0	9.2
	37	11.2	7.9	8.2
Remainder		17.8	18.0	16.5
	51	8.1	6.2	7.1
	58	2.1	0.8	0.9
Midblocks	63	2.1	1.7	2.5
	82	2.3	2.4	1.8
	85	4.9	5.5	3.8
Remainder		19.2	20.9	19.1
Sample Size n =		1304	1300	4747

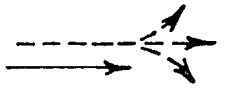
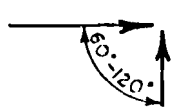
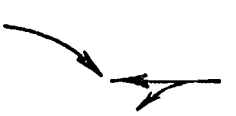
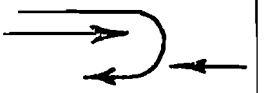
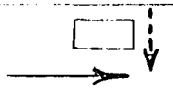
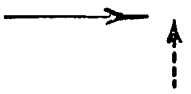
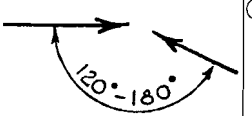
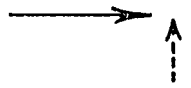
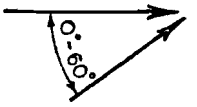
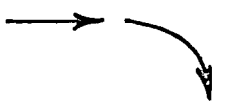
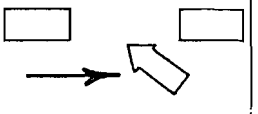
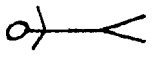
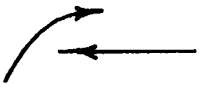
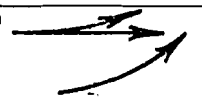
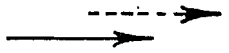
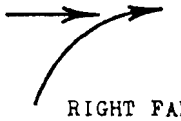
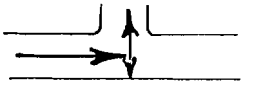
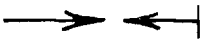
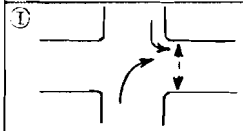
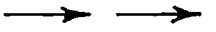
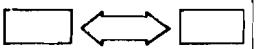
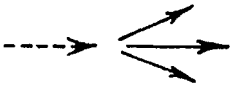
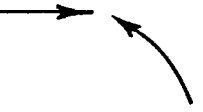
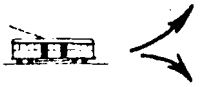
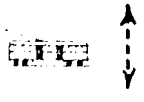
Non-significant difference between columns by Kruskal-Wallis test. This means that the three groups are involved in similar accident types (R.U.M.).

TABLE XII

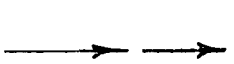
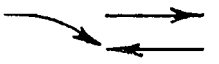
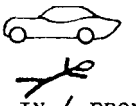
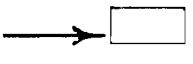
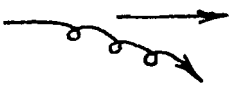
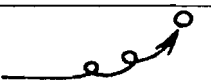
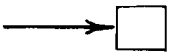
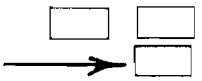
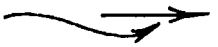
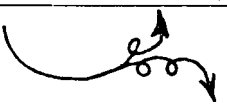
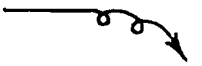
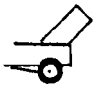
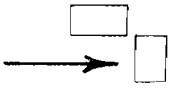
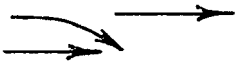
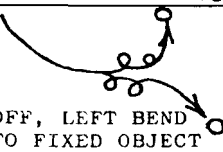
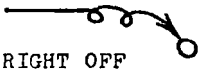
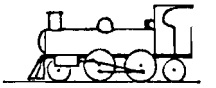
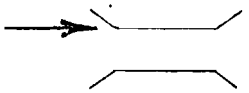
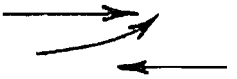
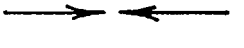
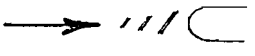
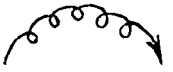
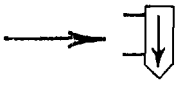
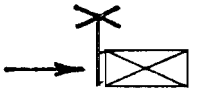
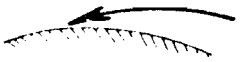
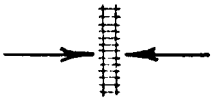
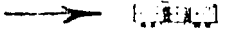
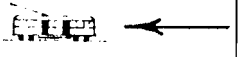
Reduction in casualties by R.U.M.

R.U.M.		WORN % cas.	WORN total n	NOT WORN % cas.	NOT WORN total n	Apparent Reduction
Intersection	21	19.5	297	25.7	336	24.1%
	24	10.5	38	22.0	50	52.3%
	31	11.6	86	23.1	91	48.8%
	37	11.7	146	12.6	103	7.1%
Midblock	51	11.4	105	16.2	80	29.6%
	82	50.0	30	71.0	31	29.6%
	84	42.9	21	75.0	28	42.8%
	85	18.8	64	36.7	72	48.8%
Total Intersection		15.8	799	22.4	814	29.5%
Total midblock		21.4	505	31.0	486	31.0%
Grand total		18.0	1304	25.6	1300	27.9%

FIGURE 1. ROAD SAFETY AND TRAFFIC AUTHORITY
Date of issue:

PEDESTRIAN (ON FOOT IN TOY/PRAM)	PEDAL CYCLIST	INTERSECTION (VEHICLES FROM TWO STREETS)	INTERSECTION (VEHICLES FROM ONE STREET)	MANOEUVRING
 NEAR SIDE 01	 STRUCK FROM BEHIND 11	 CROSS TRAFFIC 21	 RIGHT AGAINST 31	 U TURN 41
 EMERGING 02	 ENTERING 12	 OBLIQUE APPROACH 22	 RIGHT TURN SIDE SWIPE 32	 LEAVING PARKING 42
 FAR SIDE 03	 CAR TURNING RIGHT AGAINST 13	 MERGING 23	 RIGHT REAR 33	 PARKING 43
 PLAYING, WORKING, LYING, STANDING ON CARRIAGEWAY 04	 CAR DOOR 14	 RIGHT NEAR 24	 LEFT TURN SIDE SWIPE 34	 DRIVEWAY 44
 WALKING WITH TRAFFIC 05	 CORNERING OR OUT OF CONTROL 15	 RIGHT FAR 25	 LEFT REAR 35	 LOADING BAY OR LANE 45
 FACING TRAFFIC 06	 CYCLE TURNING RIGHT AGAINST 16	 TWO TURNING 26	 HEAD ON AT INTERSECTION 36	 REVERSING 46
 L OR R TURNING VEHICLE 07	 PARKED CAR OR OBSTACLE 17	 LEFT NEAR 27	 REAR END AT INTERSECTION 37	 PARKING VEHICLES ONLY 47
 ON FOOTPATH 08	 REAR END OR OVERTAKING A CAR 18	 LEFT FAR 28	 ALL TRAM TURNING OR DEVIATING 38	 REVERSING INTO FIXED OBJECT 48
 TRAM STRUCK PEDESTRIAN 09	CYCLIST OTHER INCLUDING TRAM 19	 ENTERING TRAFFIC TRAM INVOLVED 29	 VEHICLE TURNING TRAM INVOLVED 39	49

1. Road user movement should be classified first by the written divisions along the top of the page and then by the diagrammatic subdivisions.
2. The subdivision chosen should describe as accurately as possible the general movement executed by the vehicles having the initial collision, it should not describe the cause of the accident; a car might cut into a traffic stream and while not actually colliding with any vehicle, cause another vehicle

ON PATH	OVERTAKING	CORNERING	OFF PATH	PASSENGER AND MISCELLANEOUS
Ⓜ  REAR END (MID BLOCK) 51	 HEAD ON 61	 OFF CARRIAGEWAY, RIGHT BEND 71	 OFF CARRIAGEWAY TO LEFT 81	 FELL IN / FROM VEHICLE 91
 PARKED 52	 OUT OF CONTROL 62	 OFF, RIGHT BEND INTO FIXED OBJECT 72	 LEFT OFF CARRIAGEWAY INTO FIXED OBJECT 82	 STRUCK OBJECT ON CARRIAGEWAY 92
 DOUBLE PARKED 53	 SIDE SWIPE OR CUTTING IN 63	 OFF CARRIAGEWAY, LEFT BEND 73	 OFF CARRIAGEWAY TO RIGHT 83	 LOAD OR MISSILE STRUCK VEHICLE 93
 ACCIDENT OR BROKEN DOWN 54	 PULLING OUT 64	 OFF, LEFT BEND INTO FIXED OBJECT 74	 RIGHT OFF CARRIAGEWAY INTO FIXED OBJECT 84	 STRUCK TRAIN 94
 PERMANENT OBSTRUCTION 55	 CUTTING IN (WITH OPPOSING TRAFFIC) 65	75	Ⓜ  HEAD ON (MID BLOCK) 85	PARKED CAR RAN AWAY 95
 TRAFFIC ISLAND 56	 SIDE SWIPE PASSING ON LEFT 66	 OUT OF CONTROL ON CARRIAGEWAY 76	 OUT OF CONTROL ON CARRIAGEWAY 86	OTHER 96
First Preference *  TEMPORARY ROADWORKS 57	67	 CORNERING, HEAD ON 77	87	 STRUCK RAILWAY GATES OR BOOMS 97
 ANIMAL 58	68	 STRUCK EMBANKMENT 78	 HEAD ON AT RAIL CROSSING 88	98
 REAR END – TRAM INVOLVED 59	 TRAM OVERTAKING/ OVERTAKEN 69	(I)  OFF CARRIAGEWAY AT INTERSECTION 79	 HEAD ON WITH TRAM 89	STRUCK WHILE BOARDING OR ALIGHTING 99

to run off the road. This should be coded as '81, off roadway to left'. 3. Priority should be given to 57, then to subdivisions in numerical order. 4. Road user movements marked I within a circle or M within a circle must be used only at intersections or midblocks respectively.

FIGURE 2

TREND LINE DRIVER DEATHS

VICTORIA vs REST OF AUSTRALIA.

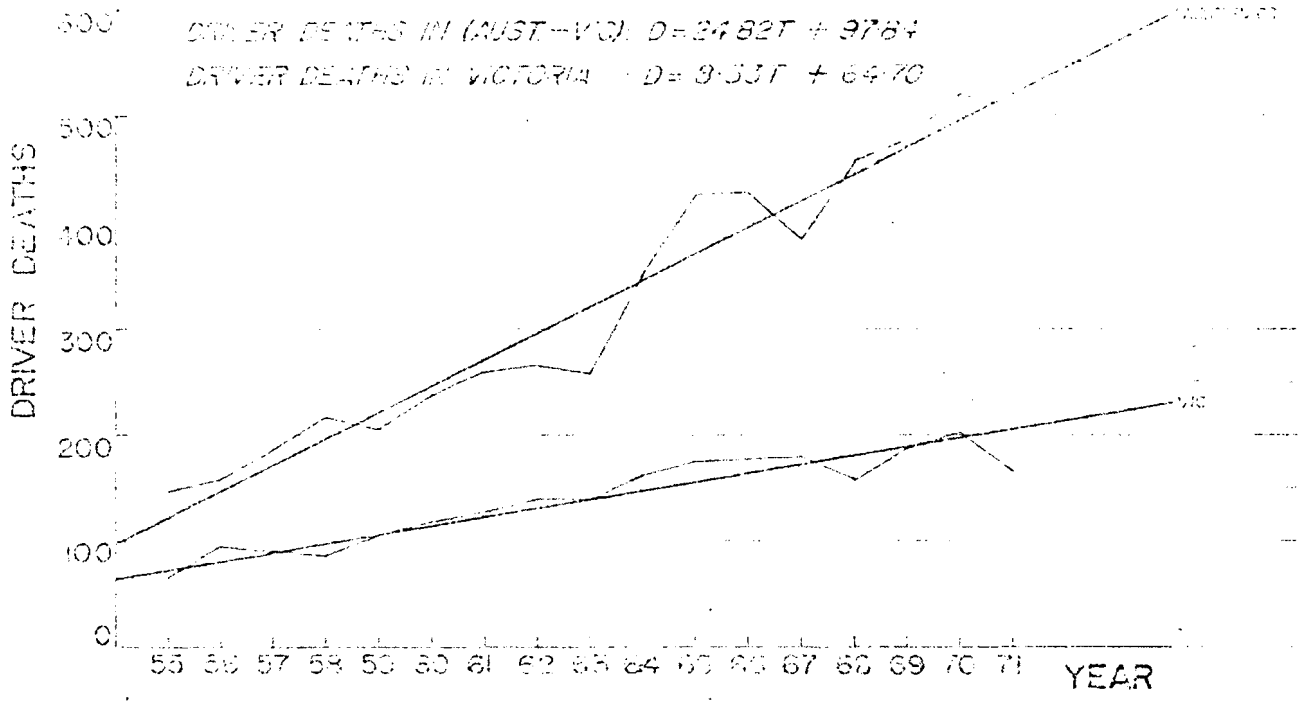


FIGURE 3

TREND LINE PASSENGER DEATHS.

VICTORIA vs REST OF AUSTRALIA.

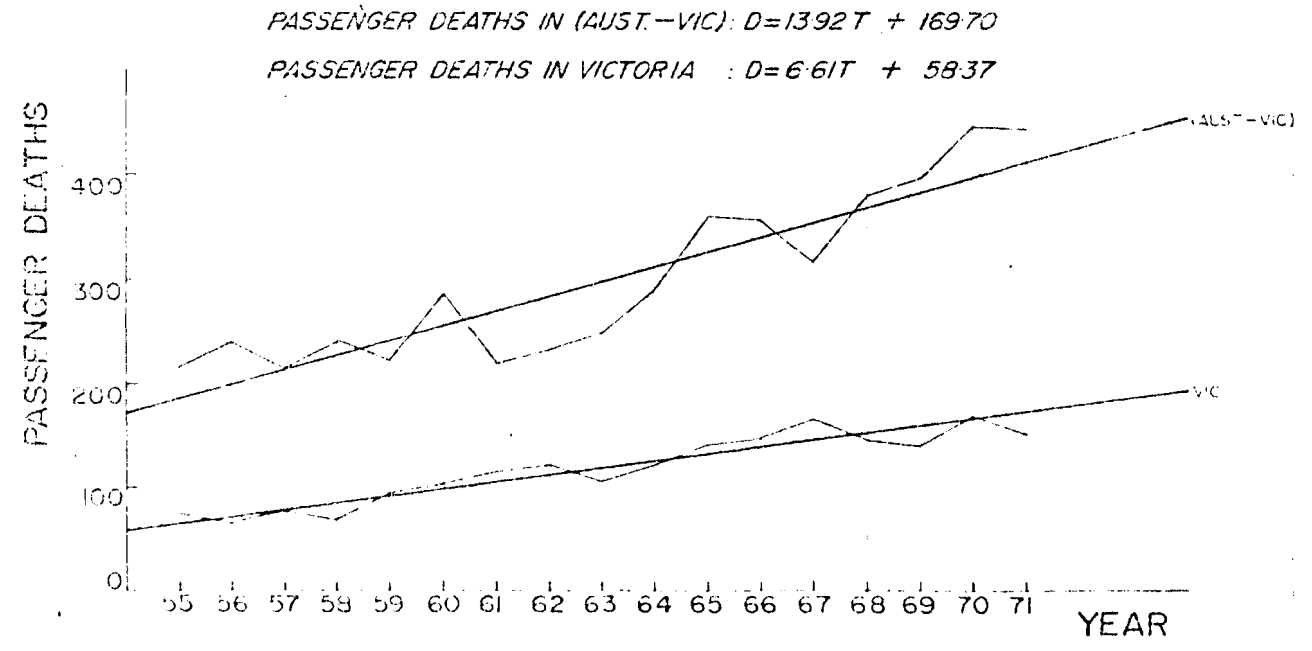


FIGURE 4

TREND LINE DRIVER AND PASSENGER DEATHS

SOUTH AUSTRALIA.

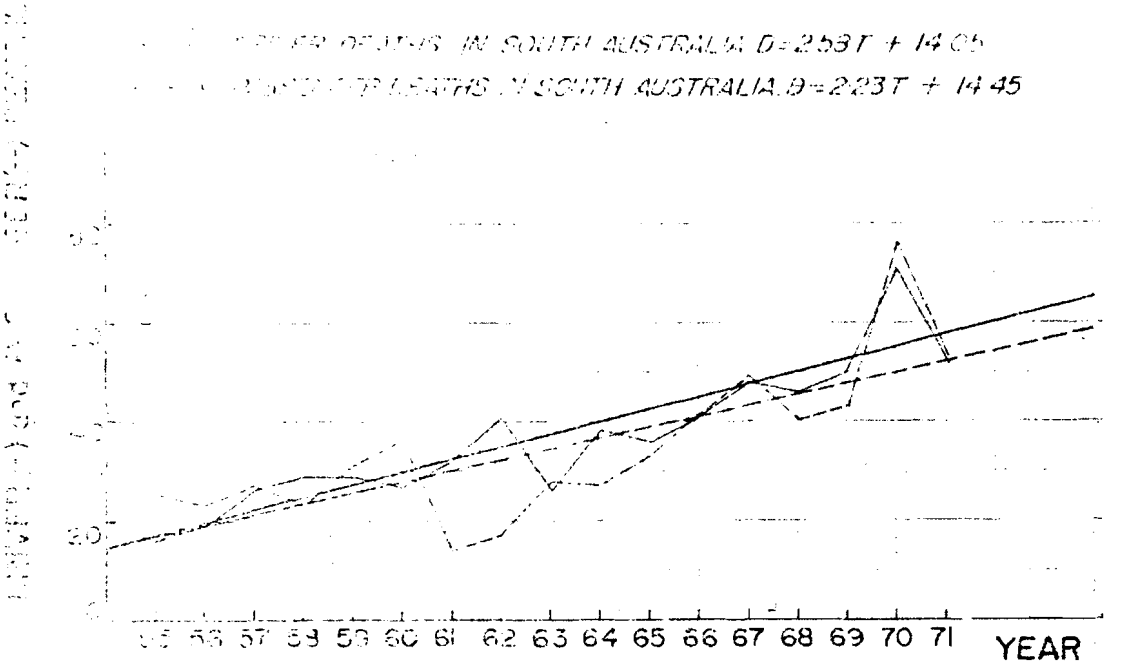
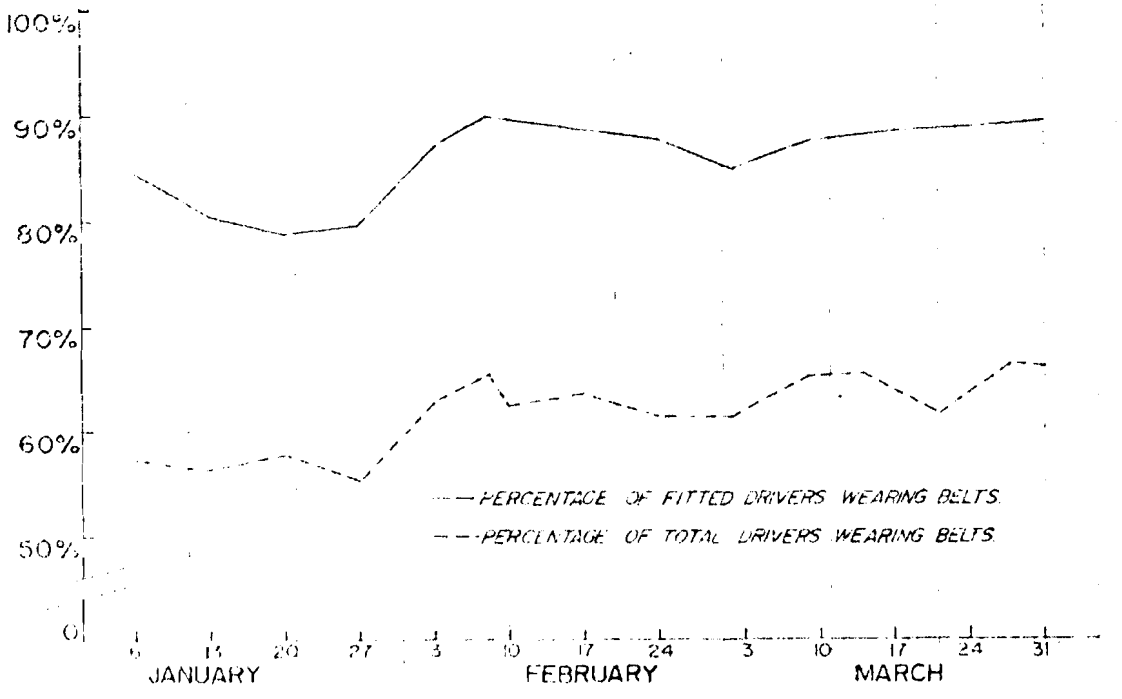


FIGURE 5

3 POINT BELT USAGE--KEW JUNCTION

8·00—9·00A.M. CITY BOUND TRAFFIC



CORRESPONDENCE

SEAT BELTS FOR VICTORIA

SIR: In a letter published in the Journal (Journal, July 24, 1971), one of us (J.L.) cautioned against premature claims as to the effectiveness of the Victorian compulsory belt-wearing law, claims which at that time could not be substantiated. This letter pointed out that an examination of death frequencies required a comparison of the Victorian data with those of other States, and also subdivision into those likely to be affected by the law—namely, car occupants, and the remainder of road users.

Several measures of the effectiveness of the belt-wearing law are possible. It has been shown by Andreassend (1972)[1] that the wearing rate in roadside surveys has increased very substantially since the law became effective. The reported wearing rate in casualty accidents has also increased substantially, though the reliability of these data is dubious. However, objections can be made to the use of this intermediate criterion (wearing rate), and the better measure of success would be the reduction, if demonstrated, in the number of car occupants killed or injured, since the intention of the law is to achieve such reductions.

It will be recalled that the Victorian law became effective on December 26, 1970, and was the only law of this kind in force in Australia until October, 1971. Thus, the first three-quarters of 1971 provide an interval of time in which Victoria may be contrasted with the other States.

Death frequencies subdivided by States and by type of road user for corresponding half-years have now become available, and one of us (L.F.) has been able to analyse this information.

The method uses a four-dimensional χ^2 partitioning which takes account of these factors: State (Victoria versus rest of Australia); capital city metropolitan area versus rest of State; car occupant versus other road user, and the first half of 1970 versus the first half of 1971.

Table 1 shows the percentage changes between 1970 and 1971 for the various categories. Note that all of the 27 percentage figures are negative—they are all reductions! The overall reduction for Australia is 6% and the extreme values are 25%, for the reduction in fatalities in car occupants in metropolitan Melbourne, and 1·5% for car occupants in the metropolitan areas of the other States combined. This general reduction might cautiously be attributed to economic circumstances.

TABLE 1

Road Accident Deaths: Percentage Changes, First Half of 1971 Minus First Half of 1970

Area	Motor-Vehicle Occupants			Other Road Users			All Road Users		
	Metropolitan	Non-Metropolitan	Total	Metropolitan	Non-Metropolitan	Total	Metropolitan	Non-Metropolitan	Total
Victoria ..	−24·8	−6·3	−14·5	−6·6	−9·5	−7·3	−17·0	−3·5	−12·3
Rest of Australia	−1·5	−2·2	−2·0	−10·1	−1·9	−6·9	−5·7	−2·2	−3·5
Australia ..	−10·3	−3·2	−5·5	−9·0	−3·4	−7·0	−9·7	−3·2	−6·0

TABLE 2

Four-Dimensional χ^2 Partition Test

Order of Interactions	χ^2	Degrees of Freedom	Significance at 10% Level
A: First order:			
1 States (Victoria *v.* rest) by years	1·63	1	ns
2 States by metropolitan *v.* non-metropolitan area ..	58·19	1	VHS
3 States by type of road user ..	0·82	1	ns
4 Area[1] by years (1970 *v.* 1971)	1·05	1	ns
5 Area by road user	336·78	1	VHS
6 Road user by years ..	0·05	1	ns
B: Second order:			
7 State by area by road user	19·03	1	VHS
8 State by area by years ..	0·22	1	ns
9 State by road user by years	2·63	1	ns
10 Area by road user by years	5·00	1	S
C: Third order:			
11 States by area by road user by years	1·37	1	ns
Total	426·78	11	VHS

[1] "Area" refers to the metropolitan versus non-metropolitan classification.
[2] ns: no significance.
[3] VHS: very high significance.

TABLE 3

χ^2 Partition-Tests of the Two Three-Dimensional Tables

Area	χ^2	Degrees of Freedom	Significance at 10% Level
Metropolitan:			
1. Zero-order interactions:			
A. Road user by years:			
Victoria	1·51	1	ns
Rest of Australia ..	0·53	1	ns
B. States by years:			
Motor-vehicle occupants	3·34	1	S
Other road users ..	0·06	1	ns
C. States by road users:			
1970	2·52	1	ns
1971	0·22	1	ns
2. First-order interactions:			
D. Road user by years ..	0·02	1	ns
E. States by years ..	1·38	1	ns
F. States by road user ..	0·72	1	ns
3. Second-order interaction:			
G. States by road users by years	2·75	1	S
Non-metropolitan	–		All non-significant

In Table 2, the results of the factorial analysis, all three very highly significant χ^2 values (A2, A5 and B7) are related to the metropolitan versus non-metropolitan classification. The implication is that the metropolitan versus non-metropolitan classification separates two populations of road-accident fatalities, which are different from each other to the extent that they cannot meaningfully be pooled in a study of this variation of road-accident fatalities.

The item for which the analysis was carried out is B 10. Its significant value implies that there were real differences in the reductions of deaths from 1970 to 1971 when area (metropolitan or non-metropolitan) and kind of road user are taken into account. This raises the expectation that separate analyses of the metropolitan and non-metropolitan data might be able to indicate the effect of the legislation.

The results of this analysis, shown in Table 3, are in brief: (i) for non-metropolitan areas, the effect of the legislation is not significant; (ii) for capital city metropolitan areas the effect of the legislation is significant and appears to be a reduction of about 18% for Melbourne.

What has been demonstrated above is a significant reduction in deaths of motor-vehicle occupants, and this has been attributed to the only factor apparently affecting car occupants (the main component of all vehicle occupants)—namely, the increased wearing of belts brought about by the law. The lack of a significant reduction in the non-metropolitan area of Victoria might be attributed to a lower belt-wearing rate (Andreassend's "penetration rate" was 51·8% for metropolitan and 41·7% for rural areas), and the generally greater severity of rural accidents.

A fuller account will be published elsewhere when analyses have been extended to the full three-quarters of 1970 and 1971 and to non-fatally as well as fatally injured persons. Thanks are due to the Traffic Accident Research Unit of the Department of Motor Transport in New South Wales, to the statistical offices in the other States and to the Commonwealth Bureau of Census and Statistics for the necessary tabulations. The work was made possible by a grant from the Insurance Institute for Highway Safety of Washington, D.C., U.S.A.

24 Smith Road,
Camberwell, Vic. 3124.

L. FOLDVARY.
J. LANE.

[1] Andreassend, D. C., "The Effects of Compulsory Seat Belt Wearing Legislation in Victoria", National Road Safety Symposium, Canberra, March, 1972.

MATERNAL DEATHS IN AUSTRALIA AND IN ENGLAND AND WALES

SIR: In the article "Maternal Deaths in Australia and in England and Wales" by J. R. Neil and L. Townsend (Journal, April 1, 1972), the authors correctly draw attention to the difficulties of comparing maternal mortality rates in the two countries, but then overlook the fact that valid comparisons can be made only between issues developed from comparable criteria and data. Deaths notified to the respective Committees are classified as maternal deaths and associated deaths. For statistical purposes the following definitions apply.

1. Maternal death. This is a death arising directly from a complication of pregnancy or child birth, and is coded to a cause included in Chapter XI, International Classification of Diseases.

2. Associated death. This is a death which occurs during pregnancy or within six weeks thereafter, but is not directly due to a complication of the pregnancy or child birth. It is coded to a cause elsewhere than in Chapter XI, International Classification of Diseases.

3. Maternal mortality rate. This is the expression of the number of maternal deaths per thousand live births.

In the above article, the comparison of the two mortality rates—0·41 per 1,000 in Australia and 0·26 per 1,000 in England and Wales—is inapplicable, as it relates to two different groupings. The Australian figures include maternal deaths and associated deaths (Report on Maternal Deaths in the Commonwealth of Australia 1964 to 1966, pages 4 and 50), whereas the England and Wales figures include only maternal deaths (671 deaths in 2,600,367 maternities—Report on Confidential Enquiries into Maternal Deaths in England and Wales 1964 to 1966, pages 112 and 116). Table 1 shows the maternal mortality rates for the years 1964 to 1969 inclusive on a comparable basis for New South Wales and England and Wales.

In New South Wales, the method of collection of deaths for consideration by the Maternal and Perinatal Mortality Committee is searching, and many avenues are explored for women who might have been pregnant, or who were recently delivered when death occurred. In England and Wales, the numbers are taken from the Registrar-General's figures, which include only those deaths where the death certificate indicated that the woman was or had been recently pregnant (Report on Confidential Enquiries into Maternal Deaths in England and Wales 1964 to 1966, page 8). This difference in methodology would also affect the rates of the two countries. In the body of the article incorrect comparisons are made, because the Australian Report considers ". . . the number of associated deaths with each condition and not the number listed in Appendix I. As one patient may die from a hemorrhage associated with toxæmia both are listed for the one patient" (Report on Maternal Deaths in the Commonwealth of Australia 1964 to 1966, page 5). In England and Wales, each death is attributed to one and only one cause (Report on Confidential Enquiries into Maternal Deaths in England and Wales 1964 to 1966, Volume 119; page 9). Unless the definitions, the method of collection of deaths and the criteria used are uniform, comparisons cannot be made.

TABLE 1

Maternal Mortality Rates 1964 to 1969, New South Wales and England and Wales

Year	New South Wales	England and Wales
1964	0·35	0·26
1965	0·32	0·26
1966	0·28	0·26
1967	0·24	0·21
1968	0·34	0·24
1969	0·17	0·19

As will be seen, one of the difficulties associated with comparisons of maternal mortality rates is the lack of uniformity in classifying maternal deaths. In a desire to obtain uniformity, the Maternal and Perinatal Mortality Committee of New South Wales has adopted the following classification of maternal deaths (Figure 1), and has sought the cooperation of other States so that a common procedure may be adopted.

Classification of Maternal Deaths

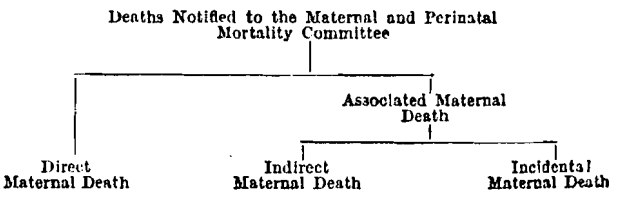


Figure 1

A death notified to the Maternal and Perinatal Mortality Committee would be classified either as: (i) a direct maternal death; or (ii) an associated maternal death.

Direct Maternal Death

1. A direct maternal death is one which results from events arising directly due to complications of pregnancy, delivery, or during the first six weeks thereafter (the puerperium). This includes all deaths from abortion. Such a death would be classified to Section XI of the International Classification of Diseases—Complications of Pregnancy, Childbirth and the Puerperium. The maternal mortality rate would be compiled from the number of direct maternal deaths only.

Primary Avoidable Factors

When a classification of direct maternal death is made, the presence of primary avoidable factors together with the location of responsibility would be made.

Associated Maternal Death

2. An associated maternal death is one which does not arise directly from a complication of pregnancy, delivery or the puerperium. Such deaths would be classified, for statistical purposes, elsewhere than to Section XI of the International Classification of Diseases. For the purposes of deliberation, the Maternal and Perinatal Mortality Committee would subdivide such deaths into: (*a*) indirect maternal death; or (*b*) incidental maternal death.

Indirect Maternal Death

An indirect maternal death is one which occurred in: (i) a woman in whom pregnancy was superadded to

the highway loss reduction

STATUS REPORT

INSURANCE INSTITUTE for Highway Safety

Vol. 7, No. 11 June 12, 1972

'Australian Experiment' Found Successful

Vehicle occupant fatalities in the Australian state of Victoria dropped significantly during the nine months in which it was the only state in that country to have a law requiring the use of safety belts.

Preliminary results of a study sponsored by the Insurance Institute for Highway Safety show that during the nine month period, occupant fatalities in metropolitan areas of the state dropped by 24 per cent when compared with the corresponding nine months of the previous year. Occupant fatalities in rural areas of the state were cut by 13 per cent.

Vehicle occupant deaths in the rest of the country—where safety belt use was not required by law—declined by three per cent in metropolitan areas and increased by one per cent in non-urban areas.

In December 1970, Victoria enacted a law that requires vehicle occupants to wear safety belts. Violations of the law are punishable by fines of $20.

D.C. Andreassend, an official of the Victoria Road Safety and Traffic Authority, reported to an Australian safety convention that the observed average wearing rate in the state for drivers was 75 per cent in metropolitan areas and 64.1 per cent in rural areas.

In a recent speech before the Canada Safety Council, another Australian official, P. King, said the Victoria law is "very clearly an experiment." He said, "There are, of course, the usual civil rights and liberty infringement objections, however these have not been outspoken and (have) made little if any impact." He concluded that, "If the Victorian experiment is a success it is safe to assume that similar regulations will be enacted around the world."

By January 1972, all Australian jurisdictions had passed similar legislation.

Some of the Australian belt-use laws exempt:

- Deliverymen, as long as the delivery vehicle does not exceed fifteen miles per hour;
- Children under age eight and persons over age seventy;
- Persons having medical certificates "certifying that that person is unable for medical reasons to wear a seat belt."

The Victoria belt law exempts those "to which it is impracticable, undesirable or inexpedient" to wear belts. The law in New South Wales exempts drivers and passengers of taxi cabs.

TRAFFIC ACCIDENT RESEARCH UNIT

DEPARTMENT OF MOTOR TRANSPORT N.S.W.

COMPULSORY WEARING OF SEAT BELTS

A preliminary evaluation of effects

DEPARTMENT OF MOTOR TRANSPORT NEW SOUTH WALES

COMPULSORY WEARING OF SEAT BELTS

A preliminary evaluation of effects

Introduction

In November, 1970, the New South Wales Cabinet Standing Committee on Road Safety accepted in principle the case for making seat-belt wearing compulsory. The Commissioner for Motor Transport then submitted a detailed proposition in the form of a Traffic Accident Research Unit report, "Compulsory Wearing of Seat Belts : a Feasibility Study" (TARU 6/70), which was published in December and widely circulated.

In December, 1970, as a result of a recommendation by the Victorian Parliamentary Select Committee on Road Safety, seat-belt wearing became compulsory in that State.

February, 1971, saw the publication of a second TARU report (2/71) on the subject : "Seat Belts : a Survey of Usage and Attitudes". This study found widespread public belief in the safety value of seat belts, even among those who never wore them, but a reportedly low wearing rate. One conclusion was : "If seat belts are to continue as occupant restraints, legislation for compulsory usage may be the only way to markedly increase the wearing rate".

The wearing of seat belts when fitted to cars became compulsory in New South Wales on October 1, 1971, but the law was not enforced until November 1, 1971. By early 1972, all States in Australia has enacted similar legislation, making this country the first developed nation in the world to take the step. In New Zealand the decision was taken to follow suit as from June, 1972, bills have been (so far unsuccessfully) presented in a number of American States, the British Minister of Transport Industries has publicly discussed the issue, and in Sweden a Government committee has been established to examine the question in depth.

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In this paper the early effects of the legislation in New South Wales are examined.

The target group

The prime objective of this legislation is to save lives, and indeed at this early stage it is only possible to measure the effect on fatalities. (More detailed analysis of injuries will be undertaken at a later date.) First, therefore, it is necessary to assess the size of the population which will be affected by the legislation.

Naturally, only the occupants of passenger cars and passenger car derivatives fitted with seat belts will be affected, and even then not all of the occupants will have seat belts available. Most vehicles with belts fitted have them for the front outer seats only.

There were 1249 people killed in traffic crashes in New South Wales during 1971, of whom 860 were vehicle occupants. The remainder was comprised of pedestrians, 250; motorcyclists and pillion passengers, 122; and pedal cyclists and others, 17. Of the 860 vehicle occupant fatalities, 775 (90.1%) were occupants of passenger cars and their derivatives, and it is only on this group of fatalities that the legislation can at present operate (seat belts are not at present required to be fitted to heavy vehicles).

Even when seat belts are fitted and correctly worn there are many crashes which a properly restrained occupant cannot survive because of any one or a combination of the following factors: first, very high deceleration forces above the survivable threshold; second, major structural failure which in turn results in restraint system failure; third distortion of the passenger compartment which brings the occupant into direct contact with unyielding surfaces and projections.

A detailed examination of police reports forms for all fatal accidents which occurred during 1971 indicated that 478 (61.7%) persons were killed in crashes which, in respect to the person killed in each

case, were assessed as being unsurvivable whether a seat belt was worn or not.[1] Therefore only 297 (38.3%) of the persons killed in passenger cars and derivatives could have been saved if belts had been worn universally. Moreover, in 160 of these cases there was no belt fitted for the particular seat, and therefore only 137 of the persons killed in traffic accidents in 1971 would have been affected by compulsory-wearing legislation if it had been in operation throughout the year.

On the basis of the above survey of fatal crashes it could be estimated that there would have been a reduction in total vehicle-occupant deaths of something like 16% if all seat belts available had been worn, and if a similar pattern of accident survivability continues, then a similar conclusion would hold for subsequent years. If, however, some allowance is made for inaccuracy in predicting survivability and if the actual wearing rate of seat belts (in fatal accidents) is 75% of those fitted (the reported rate for the first quarter of 1972), then the likely reduction is reduced to just over 10%.

However, a factor which would affect this estimated reduction in deaths is the increasing number of cars in which seat belts are fitted; naturally, as more seat belts become available for use, greater reductions should be expected. An analysis of the proportion of cars in fatal accidents fitted with seat belts indicates that there was an increase from just on 50% in 1971 to 62% in the first quarter of 1972. Not all of this increase is attributable to the Australian Design Rule requirements for new cars, as there is evidence that there has been a considerable degree of voluntary retrospective fitting of seat belts to older cars: a survey in May, 1972, of 978 passenger cars and derivatives parked in the Rosebery area showed a fitting rate of 76% to front outer seats, with 16% of vehicles having belts fitted to all seats.

[1] In order to assess "survivability", a set of objective criteria were developed around the factors stated to have been operating in each crash. When assessments based solely on these criteria were compared with the actual results of fatal crashes in which seat belts were known to have been worn by the deceased, it was found that in 85% of cases the assessor rightly judged that the occupants in question would have been killed.

.../4

Design Rule 4 (seat belts for front seats) was enforced in New South Wales from January 1, 1969, and applied to rear seats from January 1, 1971, Approximately one-third of the passenger cars now on the register will on this basis have had seat belts fitted in the front as original equipment, and this proportion will rise at the rate of 7-8% per annum over the next three years. For rear seats, only 15% of currently registered passenger cars will have had belts fitted as original equipment.

No accurate figures are available on a State-wide basis as to the number of belts fitted as original equipment before these dates, or for the number of belts fitted voluntarily but clearly a very large number have been. Around one million lap/sash seat belts are produced for "retrofitment" each year in Australia, of which about 400,000 would be destined for New South Wales. Assuming that these would normally be sold in pairs, this is equivalent to fitting out the front seats of about 200,000 used cars each year, or 10% of the car population.

Assuming that the seat-belt fitting rate for vehicles involved in fatal accidents remains at 62%, and if the 85% accuracy of prediction used previously and the observed 75% wearing rate in fatal accidents are used as a basis for calculation, the overall real reduction in vehicle-occupant deaths to be expected would be 13.6%. If, on the other hand, instead of remaining at the observed value for the first quarter the fitting rate in fatal accidents increased to 68% and the wearing rate increased to, say, 85%, then the overall reduction in occupant deaths to be expected would be about 20%.

Effect on wearing rate

The ultimate objective of this legislation can be taken as the saving of lives, but to fulfil this aim a necessary prerequisite is the raising of the proportion of car occupants using those seat belts which are available to them.

Surveys of seat-belt wearing in daylight commuter traffic, during off-peak times and in shopping traffic, showed that the overall wearing

rate of seat belts in front seat positions rose from levels of around 25% before the legislation to around 75% very soon afterwards, equivalent to an almost 100% wearing rate from those vehicles with seat belts fitted.

Previous attempts in this country and overseas to increase voluntary wearing rates by propaganda have been unsuccessful. It is reliably reported that the $51 million multi-media advertising campaign conducted during 1968 in the United States to persuade occupants to wear seat belts did not raise the wearing rate from the disappointingly low level before the campaign, and, more recently, tightly controlled research in American on the effect of television propaganda messages has led to similarly pessimistic conclusions. It does appear, as predicted in TARU report 2/71, that the only way to markedly increase the wearing rate of seat belts is to make wearing compulsory.

Public opinion

Public and mass media opinions have been in almost universal support of this legislation, an effect which might have been forecast by the Traffic Accident Research Unit's earlier finding that there was widespread acceptance of the benefits of seat belts. By mid-1971, the general attitude could have been summarised as : "I know seat belts are good, even though I don't usually wear them; but I will when they're made compulsory".

There have been some comments that the feeling of security engendered by seat belts would promote reckless driving, but this view has been countered by others who opine that the general use of seat belts stimulates an awareness of the importance of traffic safety. Neither view has been tested empirically.

Requests for exemption from wearing belts have been very small in number, totalling only 262 in all. In only three cases was exemption granted, and in 104 cases exemption was already covered by the wording of the regulation.

Effect of legislation on fatalities in New South Wales

The seat-belt wearing rate has been trebled, and there has in addition been a "spin-off" effect manifest by a considerable amount of voluntary fitting of seat belts to older cars by their owners.

To a very large extent the objective of this legislation appears to have been fulfilled - that is, that car occupants involved in survivable crashes who have donned seat belts because of the regulation are now having their lives saved.

A comparison between the fatal accidents which occurred in 1971 and those which occurred in the first quarter of 1972 shows that, in 1971, 297 (38.3%) of the 775 deaths in passenger cars and derivatives were judged as occurring in crashes which could have been survived if a seat belt had been worn. However, in the first quarter of 1972 this percentage dropped to 25%, an indication that because of an increase in seat-belt wearing fewer people were being killed in survivable crashes.

A direct comparison between the number of occupants of passenger cars and derivatives killed in the first quarter of 1971 with those killed in the first quarter of 1972 shows a reduction from 172 to 133, or 23%.

Cumulative weekly totals of deaths to occupants of all types of vehicle are depicted in Figures 1 and 2, in association with lines fitted to the data in order to demonstrate general trends over particular time periods. The "trend line" for the period from the week ending July 5, 1970 to the week ending October 31, 1971 (immediately preceding compulsion) shows an excellent fit. By extension to this line, predictions as to future numbers of deaths can be made. In this way, by extending the line to the week ending July 2, 1972, a cumulative total of occupant fatalities of 418 might have been predicted if circumstances had remained unchanged.

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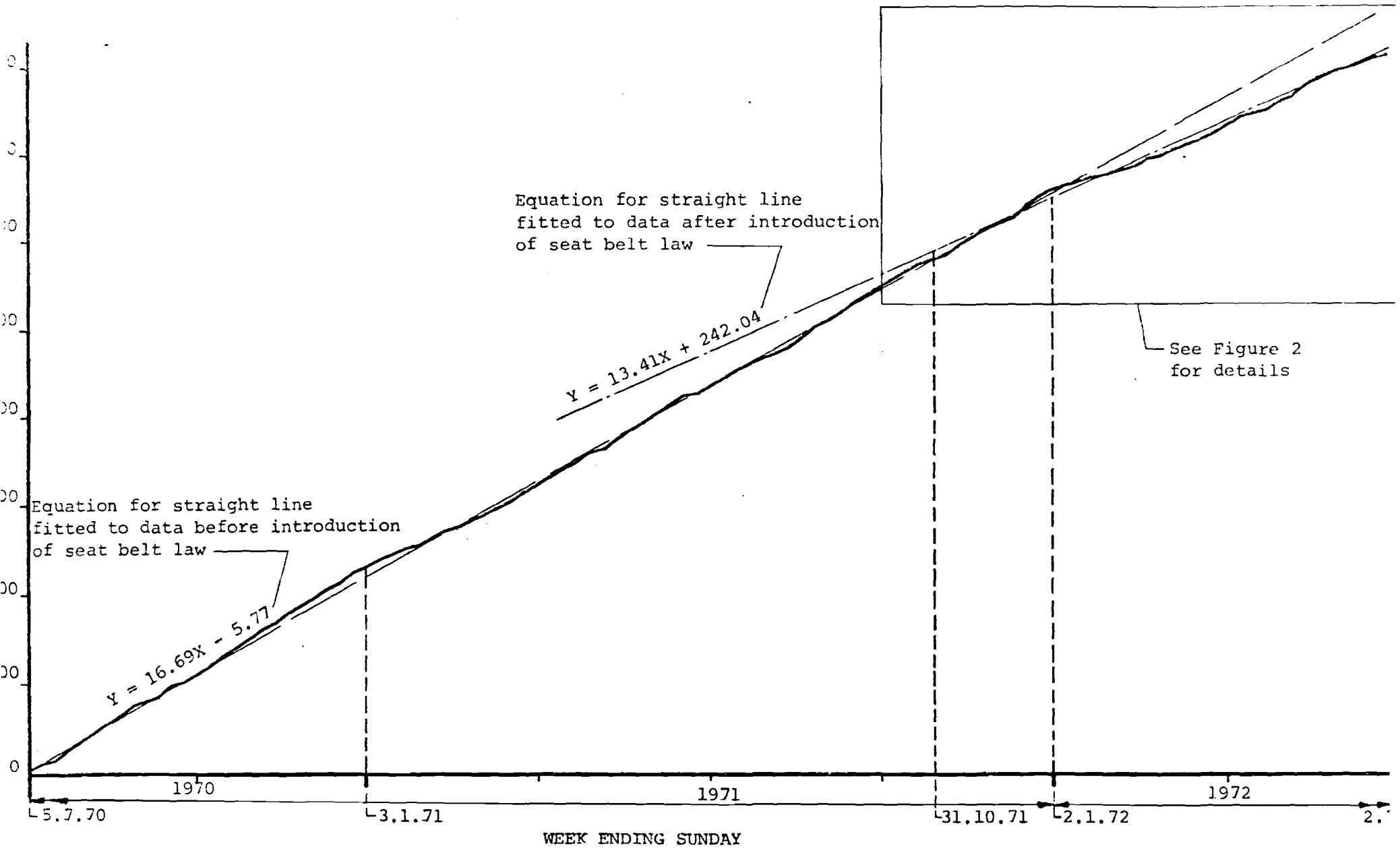

FIGURE 1 : TRENDS FOR CUMULATIVE WEEKLY TOTALS OF ALL VEHICLE OCCUPANT FATALITIES, BEFORE AND AFTER INTRODUCTION OF SEAT BELT LAW

Notes (1) Predicted from trend established before seat belt law

(2) Predicted from trends established after seat belt law

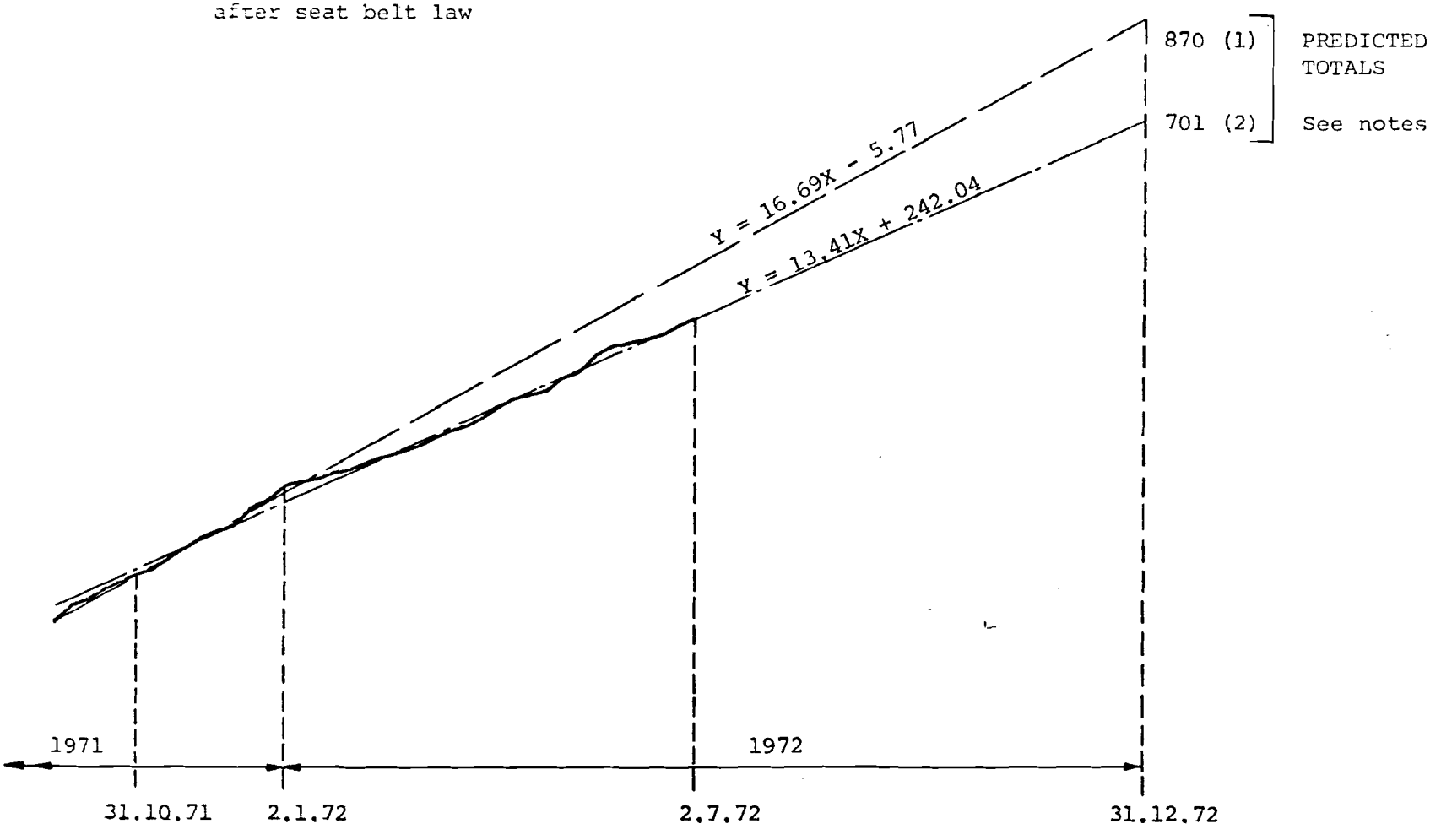

FIGURE 2 : Prediction of 1972 Total Vehicle Occupant Fatalities

In fact, however, the actual cumulative total for the period to the week ending July 2 was 332, or 86 fewer than might have been predicted. If the period January 1 to July 2, 1972, is compared to the same period in 1971 the actual drop in fatalities is found to be 88, a figure virtually identical with that which could have been predicted by projection of the "old" trend line. This is because at around the turn of the year 1971/72 there was a deviation in the steadily climbing trend of occupant deaths, and a new linear trend has been established which is equivalent to a constantly-maintained decrease in vehicle occupant deaths of about 20%.

The law requiring seat-belt wearing came into enforced operation on November 1, 1971, but the deviation downwards is not apparent until the turn of the year. The intervening period might be regarded as one of transition, during which time vehicle occupants became accustomed to belt wearing and the wearing rate built up to its present high level. However, even if a trend line is fitted to the date from November 1 onwards, the new trend still indicates a similar reduction of 20% in occupant deaths and, if maintained, predicts that the total number of occupant fatalities in 1972 will be about 700 instead of the value of 894 which could have otherwise been reliably predicted by the previous annual trend established over the past 20 years. This is an unprecedented drop, but one which is very closely in accord with that already reported for Victoria.

Discussion and conclusions

The compulsory wearing of seat belts legislation has trebled the wearing rate of seat belts, which in turn has resulted in a reduction in deaths among vehicle occupants of about 20%. That a similar reduction either in the number and/or severity of injuries in non-fatal crashes has taken place is almost certainly so. However, at this stage it is not possible to properly assess injury reduction in detail.

There still remain something like 400 deaths per year which occur in crashes judged as being unsurvivable even when a seat belt is properly worn. Crashes assessed as being unsurvivable but in which seat belts were available can be categorized as follows:

Collision with tree or pole at roadside	30%
High speed frontal impact or side-swipe with car	23%
Side impact in angle collision with other vehicle	21%
High speed collision with other fixed object or rollover	10%
Frontal impact with heavy commercial vehicle	7%
Other types	5%
Penetration of occupant space by fixed object	4%

Crashes in which vehicle occupants are killed are characteristically regarded as high-speed collisions involving tremendous exchanges of energy. However, even preliminary examination of the results of the fatal crashes which are now occurring, after the introduction of the new regulation, reveals that a high proportion (probably more than half) of the deaths are associated with massive deformation, intrusion and sometimes destruction of the occupant space at relatively low impact speeds.

If continuing inroads are to be made on the number of people killed in cars, then the group of most immediate concern is composed of vehicle occupants who die when wearing seat belts. The poor resistance to side intrusion in most current models (even in collisions with identical vehicles) and the ease with which solid objects such as trees and poles cause such devastating structural deformation indicate that strengthening of the passenger space and lessening the hostility of the environment have become areas of prime concern since the introduction of this legislation.

The influence of the Australian off-side priority system on the incidence of right-angle crashes has never been properly examined, but

the results of the current priority road experiment in Sydney may prove enlightening. Certainly, a rational priority system, designed in accordance with driver expectations and capabilities, should minimize the number of collisions which result in intrusion of the passenger space from the side.

Clearly, however, in those side impacts which do occur, those occupants who are wearing seat belts are being afforded little protection thereby, and therefore the effects of American legislation which proposes minimum standards for side intrusion should be examined as a matter of urgency.

Further, a rigid roadside pole can destroy a car whereas a "breakaway" pole cannot. Guarding, moving, reconstructing or modifying roadside obstacles could save hundreds of lives over the years. As a measure of the potential savings, the cost to the community of the 120 or so deaths which occur in collisions with trees and poles in New South Wales is approximately $6 million, and this does not include the costs in injury and property damage. On the fact of it, therefore, similar expenditure in countermeasure programmes could be justified.

Summary

The New South Wales legislation requiring the wearing of seat belts when fitted to cars has been associated with a sudden, but sustained, drop in vehicle occupant deaths of 20% in this State.

Further improvements in occupant protection must be sought in increasing resistance to deformation of the vehicle passenger space, together with improved restraints to obtain maximum advantage of this, and reduction of the hostility presented by rigid obstacles at the roadside. It is fair to assume that the seat-belt legislation will in fact be as successful as is now hoped, and therefore these other improvements to the system - which can only be implemented over a comparatively long term - should be considered without delay.

M. Henderson,
Traffic Accident Research Unit,
Department of Motor Transport,
July 1972.

Notes on "Compulsory Seat Belt Wearing in Australia" -- A. P. Vulcan

Page 1 "Three-point" belts, or "lap-sash" belts, as indicated here, are not designed to be used as either lap, or lap and shoulder belts. Hence if the belt is worn at all, it is as a lap and shoulder belt.

Page 2 Note that the initial legislation, in Victoria, "took the community by surprise." There was no advance publicity aimed at ensuring passage of the legislation -- simply because the Party in power in the State knew that they had the votes, and control over their own members.

Page 4 Adjustment of belts: Obviously a "very loose" belt will afford little protection, and may even increase the risk of injury. It is probable that compulsion will increase the frequency of incorrectly adjusted belts among those in use, but mal-adjustment is also a problem when belts are worn voluntarily.

Compulsory Seat Belt Wearing in Australia *

1. Introduction

Seat belts save lives and reduce injury. This has been proven in studies in many countries (Grime, Moreland - U.K.; Tourin and Garrett - U.S.A.; Bohlin - Sweden).

For example, in Australia substantial reductions in death and injury were achieved during the latter part of the 20-year construction period of the Snowy Mountains Hydro-Electric scheme after all vehicles were fitted with belts and their wearing was made compulsory. The constructing authority operated a fleet of between 600 and 700 road vehicles which travelled about 5.5 million vehicle miles per annum mostly over mountain roads subject to snow and ice during four to five months in winter. Where belts were worn not one death and only one serious injury occurred between 1960 and 1967, despite accidents which included vehicles leaving the road at high speeds, rolling down mountain sides, striking trees and being involved in head-on collisions.(1)

In spite of the evidence in support of the wearing of seat-belts, voluntary fitment and usage rates remained low. In 1967 in Victoria, only about 10% of all drivers involved in accidents were wearing seat belts.(2) At that time most new vehicles were being fitted with seat belt anchorage points for front seats and some manufacturers were fitting seat belts for the driver and front seat passenger.

2. Introduction of Belt Wearing Legislation in Victoria

In 1967, the Victorian Parliament set up a Joint Select Committee on Road Safety composed of both Government and Opposition members. Their third report published in 1969 recommended the compulsory wearing of seat belts by all occupants after a period of two years, during which a campaign was to be conducted to encourage public acceptance.(2) The report aroused interest, but was not immediately adopted.

In the meantime, a number of Australian Design Rules specifying vehicle safety standards, had been endorsed by the Australian Transport Advisory Council. One Rule made seat belts compulsory equipment for front seating positions of passenger cars and derivatives, after 1 January 1970 and for all seating positions after 1 January 1971. The outer seating positions must be fitted with three-point belts, the middle seats may be fitted with lap belts.

* Presented by Dr. A. P. Vulcan, Controller, Road Safety Research, Department of Shipping and Transport, Australia, for the 16th Stapp Car Crash Conference, November, 1972.

The provision of seat belt anchorages for the driver and one front seat passenger had been compulsory in most States since 1965 and in some the fitting of seat belts was also required before 1970. Hence, by 1971 76% of all driver and left hand front seat passenger positions of vehicles in the Melbourne metropolitan area were fitted with belts compared with only 20% in 1965. Over 90% of the belts were of the lap-sash type.

The problem of getting people to wear them remained.

At about this time, a number of groups in the community had focussed attention on the road accident problem. The Royal Automobile Club of Victoria (which is a motorists' association), and the Royal Australasian College of Surgeons both actively supported a policy of compulsory wearing. Late in 1970 a widely circulated morning newspaper commenced an intensive long-term campaign to focus attention on the road accident problem.

Nevertheless the announcement that legislation would be introduced on 22 December 1970 requiring seat belts to be worn, took the community by surprise. This was three days before the start of the Christmas-New Year holiday period, which has a traditionally high road toll.

The legislation basically provided that 'a person shall not be seated in a motor car which is in motion, in a seat for which a safety belt is provided, unless he is wearing the safety belt and it is properly adjusted and securely fastened.' There are only a small number of exemptions such as some delivery men, persons reversing vehicles and persons exempted by a doctor's certificate. At present the legislation is not applied to children under the age of 8 years.

Other legislation was passed which required any motor-car being re-sold to be fitted with seat belts in the front seat. This legislation is primarily aimed at those vehicles built prior to 1970 which would not have seat belts compulsorily fitted as a result of the Design Rule. Exemptions are granted to vehicles manufactured before 1951 and a number of other types of unsuitable vehicles.

In New South Wales, two comprehensive studies were undertaken on belt usage and public attitudes(4) and on the feasibility of making belt wearing compulsory. (5) The first concluded that 'legislation for compulsory usage may be the only way to markedly increase wearing rate.' The second study concluded that compulsory wearing was feasible and desirable and proposed a list of exemptions under such a law. Legislation similar to Victoria's came into effect in New South Wales on 1 October 1971 although it was not enforced until 1 November 1971. Other States and Territories soon followed

Tasmania	13 October 1971
South Australia	29 November 1971
Western Australia	24 December 1971
Queensland	1 January1972
Australian Capital Territory	1 January 1972
Northern Territory	1 January 1972

3. Enforcement

The penalty for not wearing a belt when fitted has been set at $20 in Victoria. The requirement to fit lap-sash belts greatly assists the enforcement of the legislation (and also the determination of fitting and wearing rates by roadside counting)

Enforcement in Victoria was commenced after a one month period, allowed for warnings by police and for education. To date, 5,300 persons have been convicted for non-compliance in the metropolitan area and 900 in rural areas.(5) This detection rate is less than one per cent of the total number of detected traffic offences in Victoria each year.

Other States and Territories have similar penalties for non-compliance. In Queensland, however, provisional drivers, (and passengers with a provisional driver's licence), convicted of not wearing a seat-belt are automatically fined and penalised three points in a points demerit scheme. The maximum allowable number of points before automatic suspension of probationary licences is four in Queensland.

4. Public Attitude

An interview survey was conducted during November-December 1971 at eight urban locations.(3) Drivers were asked whether they agreed or disagreed with the legislation and also to give reasons for their responses. The categories of answers and the proportions falling into each are shown below.

1. Agree with law for safety reasons	- 134 drivers	(15%)
2. Agree with law - reduces injury/deaths	- 382 drivers	(43%)
3. Agree with law - refers to own physical and emotional safety	- 78 drivers	(9%)
4. Agree with law, forces people to wear belts	- 80 drivers	(9%)
5. Disagree - should be individual choice	- 76 drivers	(9%)
6. Disagree - not fully proved	- 61 drivers	(7%)
7. Other/no reason	- 73 drivers	(8%)
TOTAL	884 drivers	

It can be seen from these figures that over 75% agreed with the law. There was a tendency for more opposition to the law to come from those of 40 years and over.

5. Effect of the Legislation on Belt Usage

A survey of seat belt wearing was undertaken at 12 metropolitan and 6 country sites during the second half of 1971. Observations were made by day and at night.

The average seat-belt fitting and wearing rates for drivers were found to be(3)

	Seat Belt Fitting Rate	Wearing Rate (Where Fitted)	Overall Rate
Metropolitan (Sample = 63,587)	73%	75%	55%
Country (Sample = 30,065)	65%	64%	42%

Wearing rates have therefore increased from about 25% pre-legislation to 64-75% post-legislation. Figure 1 illustrates the higher overall wearing rates in urban areas and the variation in rates by time of day and day of week. Wearing rates also vary with length of trip, sex, age and socio-economic status of the driver.

A survey was made of the adjustment of lap-sash belts worn by nearly 600 drivers and the following results were obtained.(3)

Twisted	148 drivers	(25.9%)
Loose	149 drivers	(26.0%)
Very Loose	70 drivers	(12.2%)
Buckle not on hip	116 drivers	(20.3%)
Stored on retractor	12 drivers	(2.1%)
Correctly adjusted	77 drivers	(13.5%)

On the basis of these data there is still scope for more education on correct adjustment of the seat belt and the development of improved belt designs.

6. Effect on the Total Number of Injuries and Fatalities

Available evidence points to the effectiveness of the Victorian legislation. The data cover the first 9 months of 1971 when Victoria was the only State with such legislation. The following tables show that there was a 17.7 % drop in fatalities and 14.8% in injuries of vehicle occupants. Furthermore the reduction in other road-user fatalities in Victoria is not statistically significant. (It should be noted, however, that the small reduction in other road-user injuries in Victoria is statistically significant when compared with the large unexplained increase in the remainder of Australia). Hence, some factor was operating on vehicle occupants in Victoria, which did not apply to vehicle occupants in the rest of Australia, nor to other road-users. It

These results were achieved even though at least half of all vehicle occupants were not wearing seat belts.

Occupant Fatalities** (first nine months)

	1970	1971	Percentage Change
Victoria	564	464	-17.7
Rest of Australia	1426	1429	+ 0.2

P* < 0.01 - Significant

Occupant Injuries** (first nine months)

	1970	1971	Percentage Change
Victoria	14,620	12,454	-14.8
Rest of Australia	39,980	40,396	+1.0

P < 0.01 - Significant

Other Road User Fatalities (first nine months)

	1970	1971	Percentage Change
Victoria	260	236	-9.2
Rest of Australia	594	573	-3.5

P < 0.70 - Not significant

Other Road-User Injuries (first nine months)

	1970	1971	Percentage Change
Victoria	3,458	3,355	-3.0
Rest of Australia	10,714	11,851	+10.6

P < 0.01 - Significant

*P is the probability that the observed change occurred by chance, using the chi-square test, applied to the 2 x 2 tables and ignoring higher order inter-actions.

In a more comprehensive analysis for the first half of 1971, it has been shown that fatalities were significantly reduced by 24.8% in metropolitan areas compared with a 6.3% reduction in rural areas which was not found to be statistically significant.(7) Possible reasons for this were considered to be the lower belt wearing rates in rural areas and the generally higher severity of rural accidents. It is understood that a similar analysis by the same authors extended to 30 September 1971 shows the same trends.

In November 1970 a daily newspaper in Victoria commenced a road safety campaign which was sustained throughout 1971. It has been claimed that this could have contributed to the observed reduction in casualties. If so, then the effects on other road users would be expected to be similar to those for vehicle occupants. This is not the case for injuries where the large reduction in occupant injuries was significantly greater than the small reduction in other road-user injuries. The same trend was apparent for fatalities although not statistically significant. Hence, the information available to determine the effect of the newspaper campaign is inconclusive.

In N.S.W. it has been shown that vehicle occupant fatalities from the date of implementation of the law up to 30 June 1972 are some 20% lower than expected (as shown in Figures 2 and 3)(8). It is understood that this trend has continued in the September quarter.

Victorian occupant fatalities have remained lower and the N.S.W. decreases have been 'sustained'.(8) Insufficient data are yet available to individually measure the effectiveness of seat belt wearing in the other States and Territories. Although there has already been an 18% decrease in occupant fatalities for Australia as a whole in the first quarter of 1972 (when all States and Territories had compulsory wearing) compared with the same quarter in 1971. Long term trend data for Victoria and Australia are presented in Figures 4, 5, 6, & 7. Although fluctuations from quarter to quarter tend to mask longer term trends this method has been used so that the latest available results for 1972 may be shown.

7. Effect on the Pattern of Injury in Victoria

The Royal Australasian College of Surgeons is conducting a detailed study of changes in injury patterns in Victoria. A recently presented paper has reported some of the main results.(9)

'The injury pattern has changed with fewer multiple and severe injuries occurring.'

'Spinal injuries in Victoria are treated at the Austin Hospital in Melbourne and their 1971 admissions due to traffic accidents were 27 compared with 37 for 1970. The admissions for the first 6 months of 1970 to 1972 are:

1970	1971	1972
28	18	8

... that a steady decline in spinal injuries is evident. An even greater decline in serious eye injuries has been reported by the Royal Melbourne Hospital. Of 56 cases treated over the last 4 years, all except one occurred before the seat-belt law came into force.'

8. Other Effects

During 1971 seat belt wearing rates began to show some increase in Australian States other than Victoria. For example in the city of Adelaide, South Australia, the voluntary wearing rate increased by over 70% between October 1970 and October 1971.(10)

It has been reported (11) that the amount of compensation being paid to road accident victims in Victoria is being reduced based on arguments of the contributory negligence of persons not wearing a belt where it was available.

9. Summary

The Victorian legislation has had the following beneficial effects:

(i) substantially increased belt usage rates,

(ii) significantly decreased driver and passenger fatalities and injuries.

There is still scope for more enforcement, education and improved seat belt design to maximise the effectiveness of the legislation.

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1. Herbert, D.C., Seven Years Experience with Seat Belts, Snowy Mountains Hydro Electric Authority Report No. 1479. May 1968.

2. Joint Select Committee on Road Safety, Victoria, Report Upon an Investigation into the Desirability of the Compulsory Fitting and the Compulsory Wearing of Seat Belts. 1969

3. Andreassend D.C., The Effects of Compulsory Seat Belt Wearing Legislation in Victoria, Paper presented to the National Road Safety Symposium, Canberra, 1972

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5. Skinner N., Henderson M. and Herbert D., Compulsory Wearing of Seat Belts - A Feasibility Study, Traffic Accident Research Unit Report 6/70, 1970.

6. Information provided by Victoria Police Public Relations Section, 6 October 1972.

7. Foldvary L.A. and Lane J.C., Seat Belts for Victoria, Med. J. Aust 1: (20) 1054-5 1972

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10. Road Traffic Board of South Australia, A Review of Seat Belt Usage in South Australia 1964-1971, August 1972

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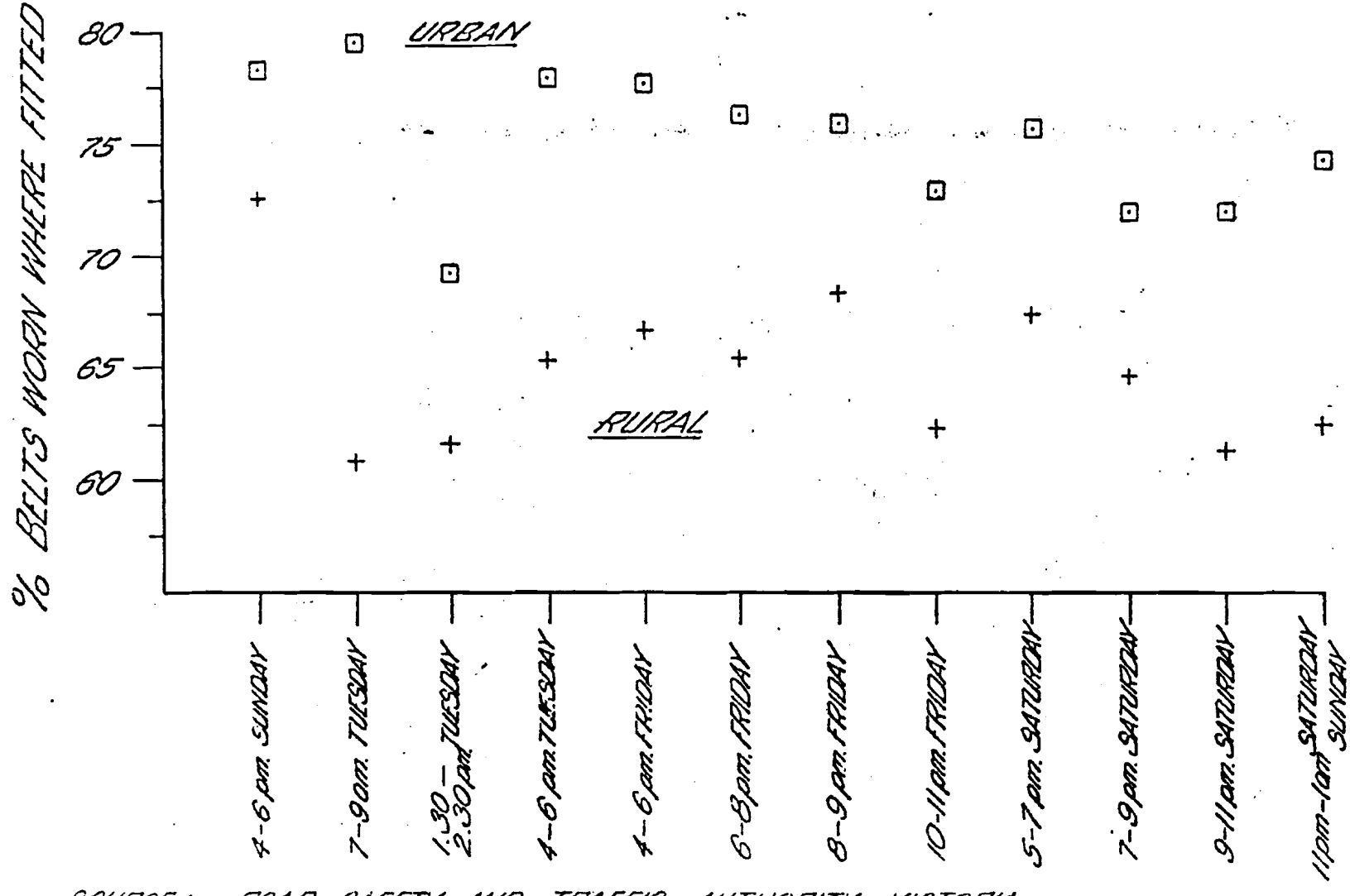
FIG. 1

SEAT BELT USAGE
(DRIVERS ONLY)



SOURCE: ROAD SAFETY AND TRAFFIC AUTHORITY, VICTORIA.

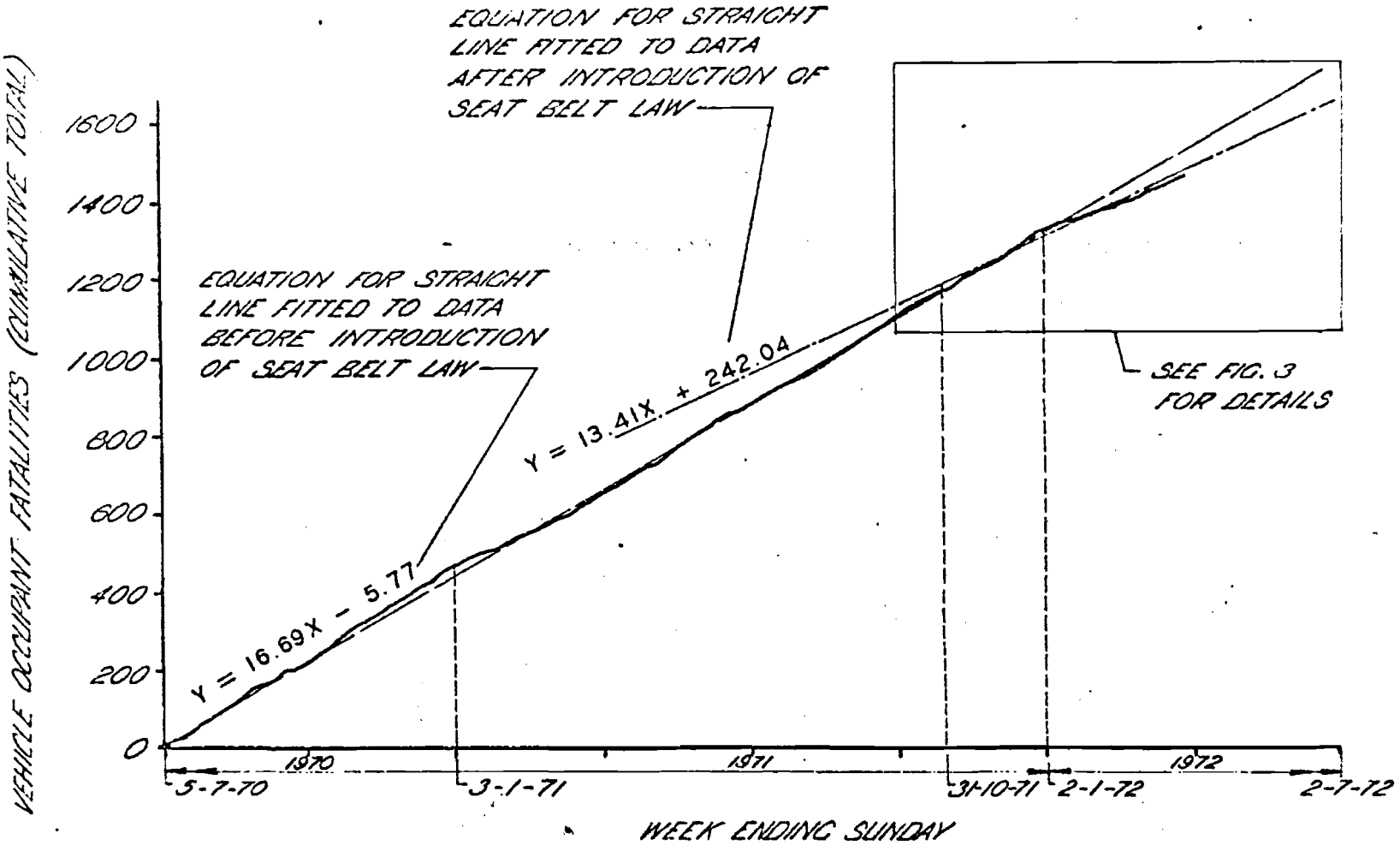


FIG. 2 TRENDS FOR CUMULATIVE WEEKLY TOTALS OF ALL VEHICLE OCCUPANT FATALITIES, BEFORE AND AFTER INTRODUCTION OF SEAT BELT LAW.

[illegible] PETERSON M., COMPULSORY WEARING OF SEAT BELTS — A PRELIMINARY [illegible] TRAFFIC ACCIDENT RESEARCH UNIT REPORT, 1972

NOTES (1) PREDICTED FROM TREND ESTABLISHED BEFORE SEAT BELT LAW.

(2) PREDICTED FROM TRENDS ESTABLISHED AFTER SEAT BELT LAW.

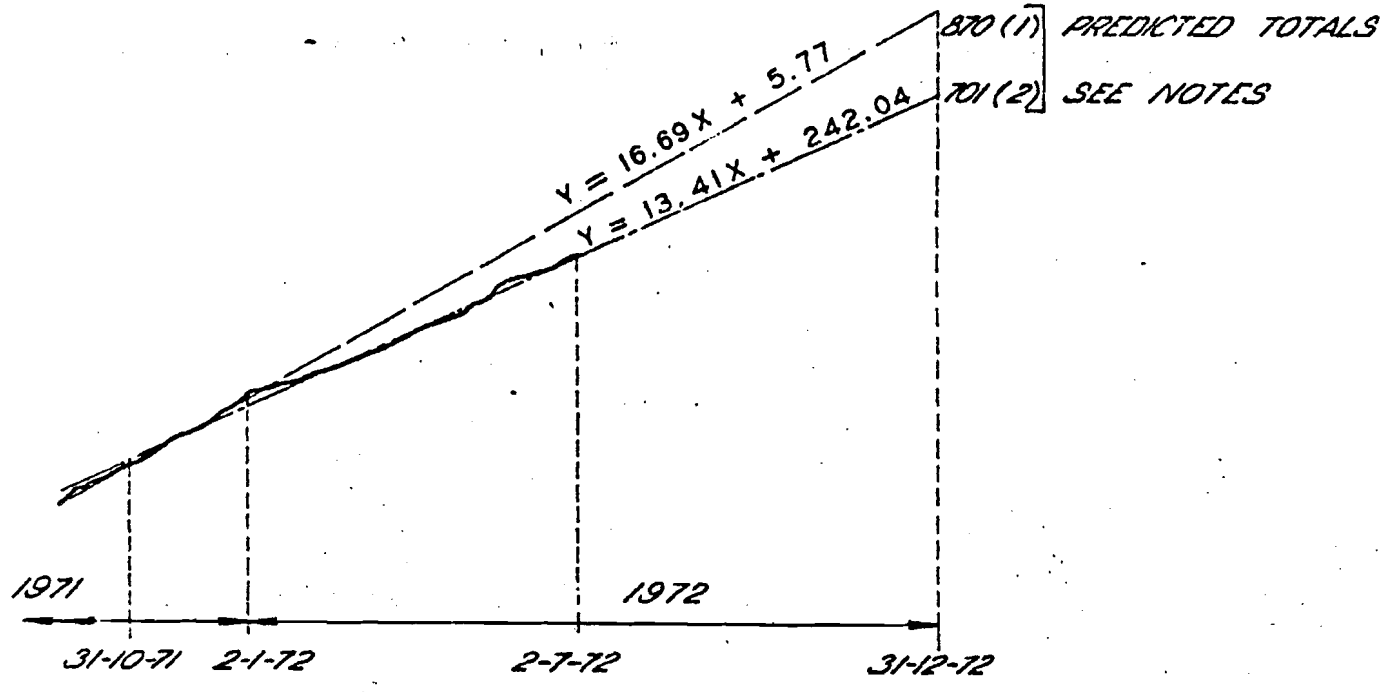


FIG. 3 PREDICTION OF 1972 TOTAL VEHICLE OCCUPANT FATALITIES

SOURCE: [illegible]

FIG. 4

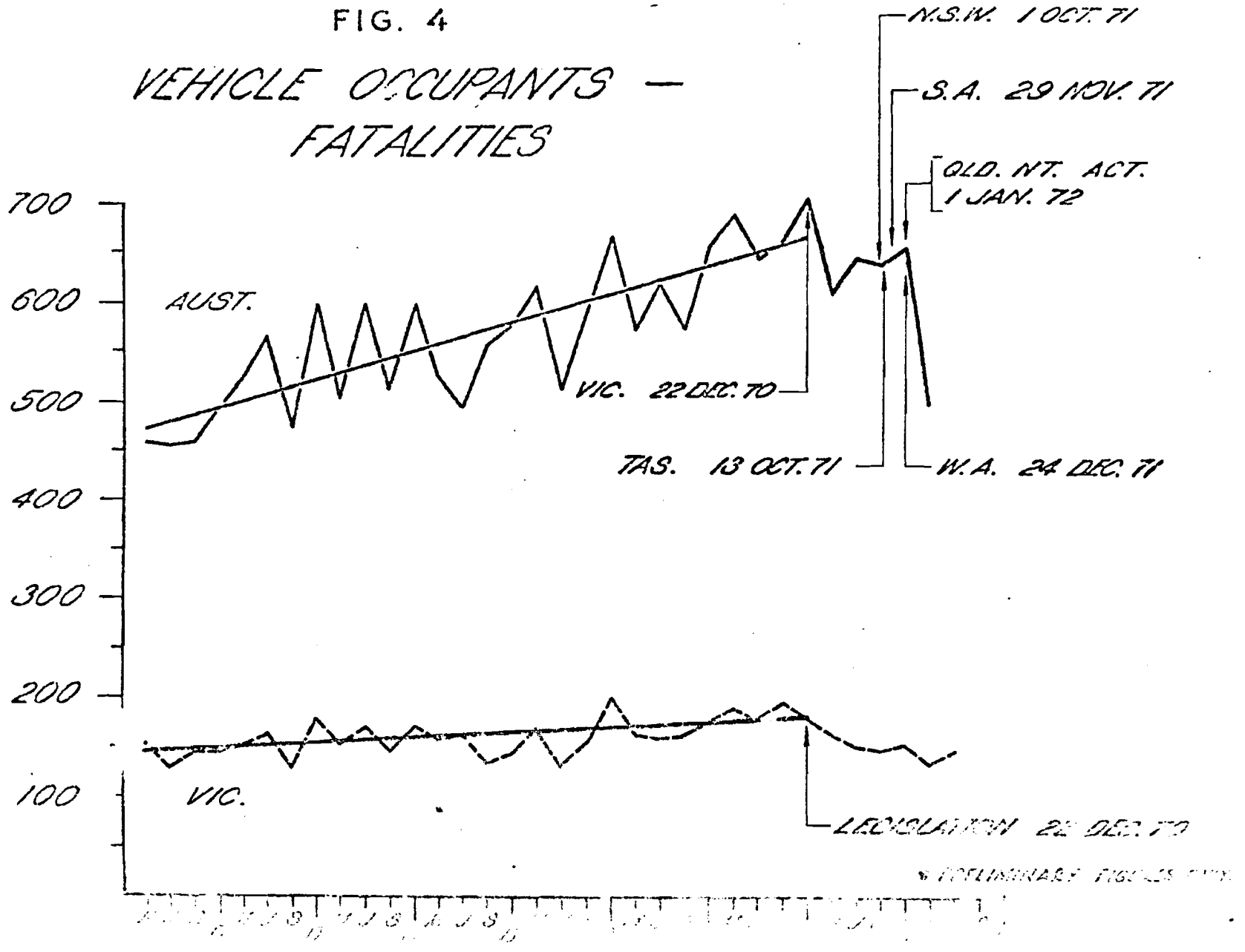
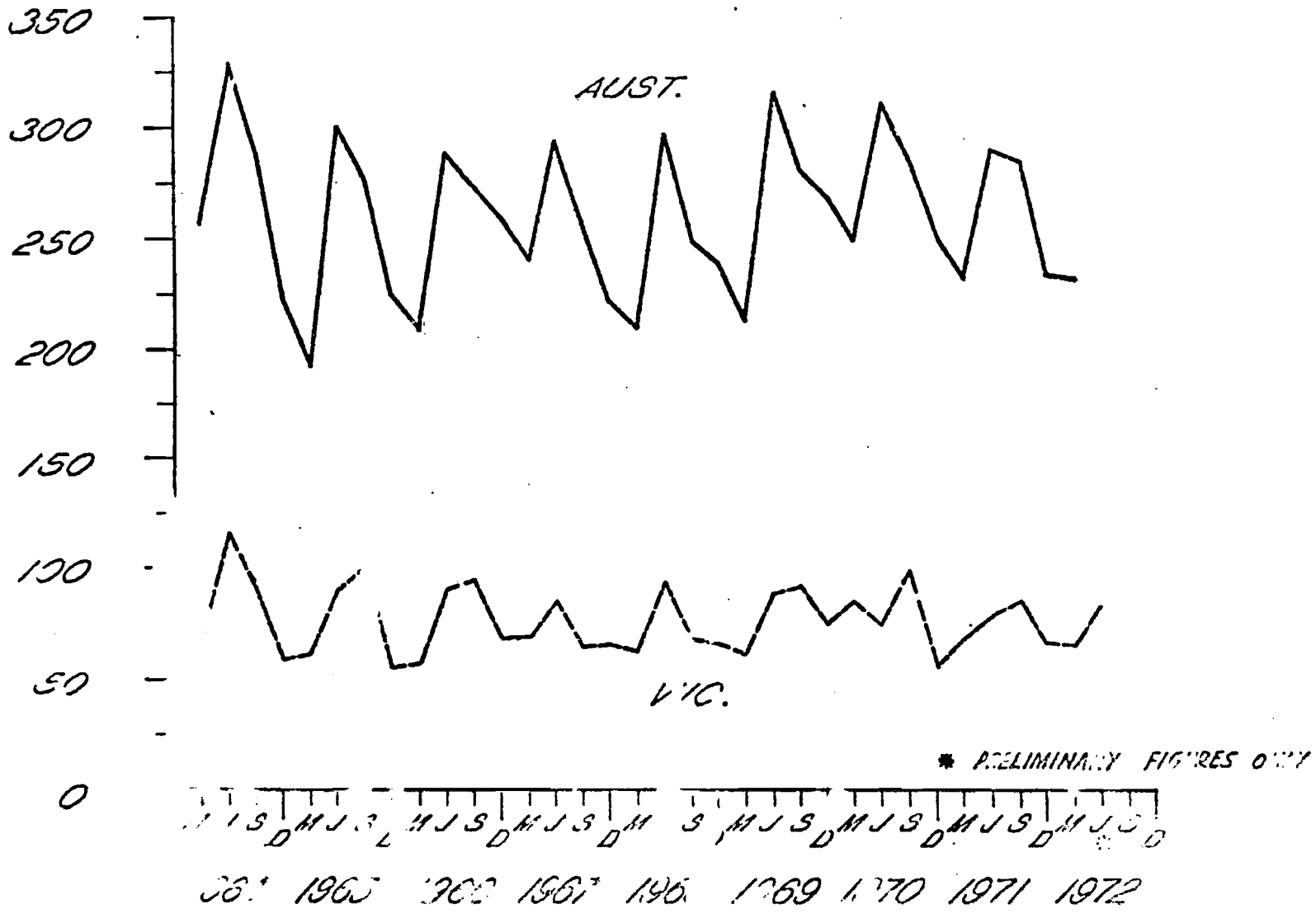

VEHICLE OCCUPANTS — FATALITIES
N.S.W. 1 OCT. 71
S.A. 29 NOV. 71
QLD. NT. ACT. 1 JAN. 72
700
600
500
400
300
200
100
AUST.
VIC. 22 DEC. 70
TAS. 13 OCT. 71
W.A. 24 DEC. 71
VIC.
LEGISLATION 22 DEC. 70

FIG. 5



ROAD ACCIDENTS OTHER THAN MOTOR VEHICLE ACCIDENTS — FATALITIES

FIG. 6

VEHICLE OCCUPANTS — INJURIES

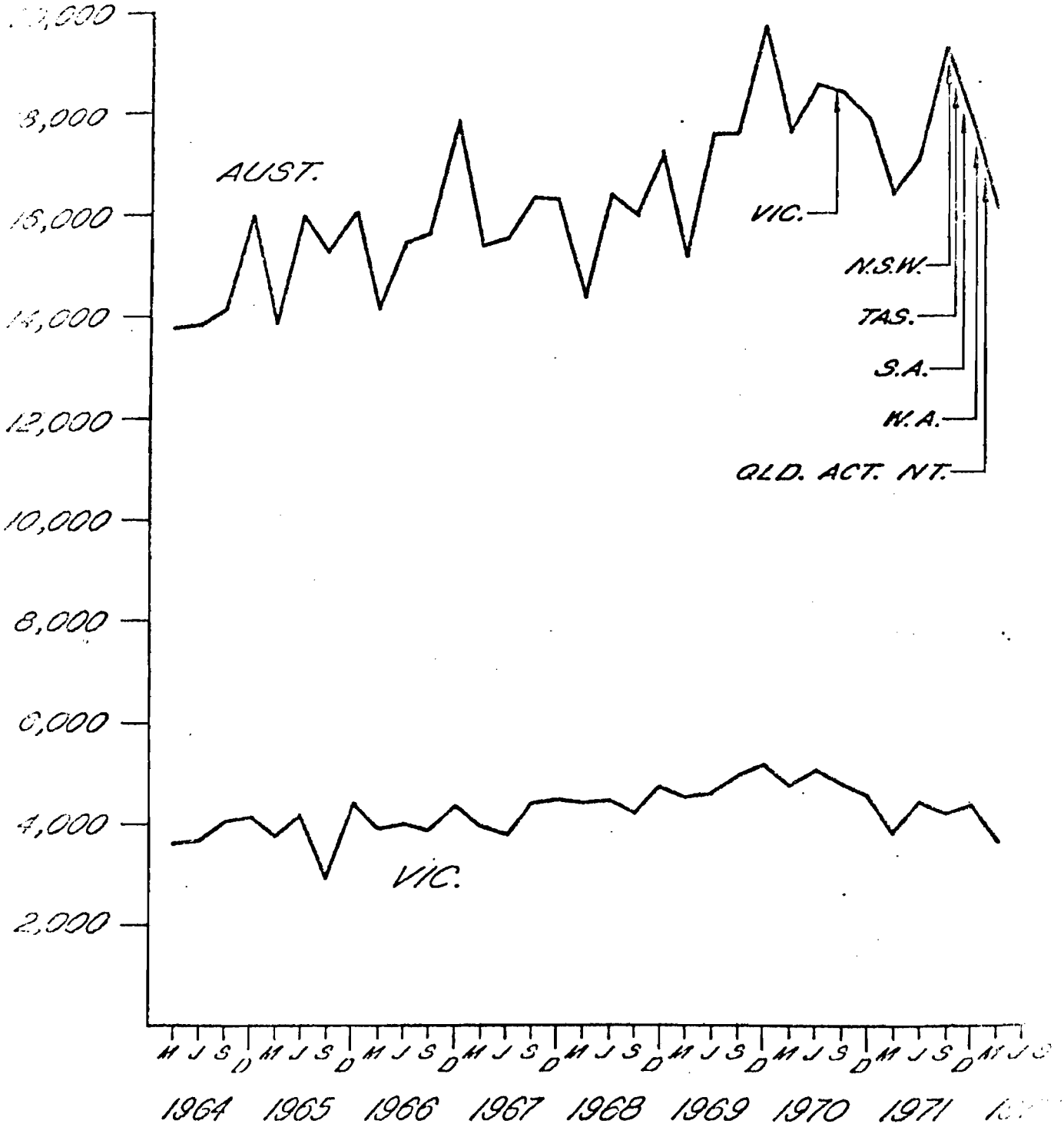
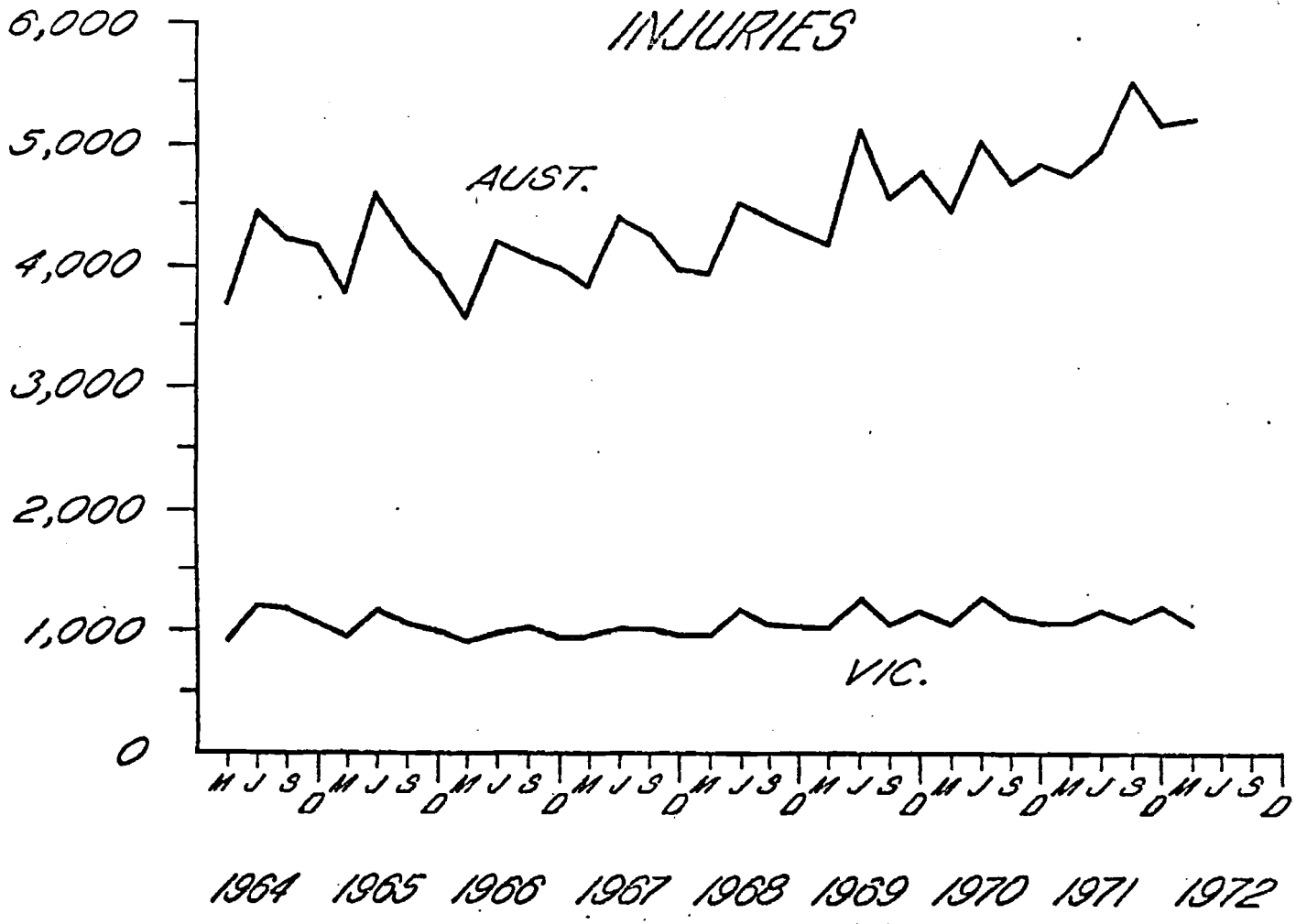


FIG. 7

ROAD USERS OTHER THAN VEHICLE OCCUPANTS — INJURIES



"The Advertiser" -- Editorial

Adelaide, South Australia

February 1, 1973

The seat belt law

There are two conclusions which can be drawn about a law which is ignored by almost half the people who are supposed to be obeying it. Either the law is not being properly enforced, or it is so impractical and so generally unpopular that it can't be enforced. In the first case it should be enforced properly, in the second it should be repealed.

Either of these conclusions could be drawn from the way South Australia's compulsory seat belt legislation is working. This law applies to most of the State's 600,000 licensed drivers but, according to the annual report of the SA Road Safety Council, only 42 p.c. of them are obeying it. Why?

There seems little cause to conclude that the law is so impractical and so unpopular that it can't be enforced. Although the law is difficult to administer, the police have never publicly protested that enforcement is impossible. Nor has there been any sign of widespread opposition to the law, although there has been plenty of apathy to it and the reasons for its introduction.

The reasonable conclusion to be drawn from the Road Safety Council's report is that the law is not being properly enforced. There have been very few convictions for not wearing seat belts, and the traffic police don't appear to have over-exerted themselves in the detection of offenders. Yet if the law is to be effective, it must be enforced like any other road traffic law.

There have been many reasons put forward in support of the compulsory seat belt legislation, and also some strong objections, particularly to the element of compulsion contained in the law. However, its overall benefit to the community promises to outweigh these objections.

What should happen now is that the law should be enforced more stringently. If it proves impossible to do this, and a large number of drivers still refuses to comply with the law then, but only then, it should be repealed.

"The Advertiser"

Adelaide, South Australia

February 1, 1973

Cynics over seat belts

by STEWART COCKBURN

For the past year, seven out of every 10 of SA's 600,000 licensed motor vehicle drivers have been required by law to fit and wear seat belts.

If they don't have seat belts fitted, they are liable to a fine of up to $50. If they have them fitted but don't wear them, the maximum fine is $20.

Such penalties apparently don't worry people very much. The SA Road Traffic Board has discovered that only 5,516, or 42 p.c., of all drivers involved in accidents last year were using belts when the accidents occurred.

In other words, several thousand accident victims hadn't bothered to fasten the belts designed to protect them in such situations.

More simple arithmetic suggests that only a little over half of all drivers legally required to wear seat belts are in fact taking any notice of the law

Officially, Road Traffic Board and police spokesmen say they consider the law is working well.

Many people may think it an odd claim.

The board points out that bad, or accident-prone drivers tend to cause most accidents. Such people probably are more careless, or wilful, about observing the law than the safe drivers.

A special board survey in October showed, in fact, that 80 p.c. of drivers interviewed were strapped up as required by law.

That, of course, seems to beg the issue to some extent, because it is precisely the dangerous or careless driver who needs protection most, on both his own behalf and the community's.

The police also say the public is generally playing the game and being sensible.

Police policy on seat belts is "co-operation rather than coercion," according to the head of the Traffic Division (Senior Inspector A. K. Laslett).

He adds that hundreds of drivers have been warned and he believes that a warning system, rather than the big stick, is the best way to get the public on side.

Inspector Laslett also acknowledges that no special instructions have been issued to police regarding enforcement of the law.

Action is left to their individual judgment on the job.

This attitude of sweetness and light is all very well, but if it is really the best way of developing a law-abiding community why isn't the same policy followed with people who break the speed limit: with burglars; with bank robbers; and with other law breakers?

The truth seems to be that you don't take much of a risk of police action if you don't wear your seat belt. Only 30 people were prosecuted for breaking this law last year.

By contrast, 26,547 drivers were prosecuted for exceeding the 35 m.p.h. speed limit, and another 9,230 for offences in restricted speed zones.

Perhaps the crucial difference between speeding, burglary, assault and wearing seat belts is that the first three types of offence are likely to hurt innocent people.

Those of us who cockily or carelessly refuse to wear seat belts are not likely to hurt directly anyone but ourselves.

Indirectly, of course, there is a penalty on the taxpayer who has to bear some of the police, medical and other expenses incurred by stupid or selfish people who won't obey the seat belt law voluntarily.

The philosophical questions which the Government may have to face in these circumstances are:

- If laws are not, or cannot be, enforced fairly effectively, should they remain on the statute books?
- When some laws can be broken with impunity, doesn't it encourage contempt for law generally?

The Road Traffic Board has another survey under way at this moment. Results will be published in March.