YOUNG DRIVER RESEARCH PROGRAM:

A TECHNICAL AND STRATEGIC OVERVIEW OF EXPOSURE REDUCTION MEASURES AS A MEANS OF REDUCING YOUNG DRIVER CRASHES

ALAN E DRUMMOND
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Young Driver Research Program:
A Technical and Strategic Overview of Exposure Reduction Measures as a Means of Reducing Young Driver Crashes

Author(s)
Drummond, Alan E

Performing Organization (Name and Address)
Accident Research Centre
Monash University, CLAYTON VIC 3168

Sponsor
Federal Office of Road Safety
GPO Box 594, CANBERRA ACT 2601

Project Officer:
K B Smith

Available from
Federal Office of Road Safety
GPO Box 594, CANBERRA ACT 2601

Abstract:
There are potential road safety benefits to be obtained from reducing the opportunity for young drivers to be involved in road crashes, that is, by reducing their driving exposure. This report identifies a range of technical and strategic issues which are relevant to a comprehensive discussion of such measures. This is an area in which there are no "right" answers: ultimately, an effective, efficient and equitable balance must be reached between a range of competing objectives in order to achieve a consensus policy position on the desirability of exposure reduction measures as one method for reducing your driver crashes.

Key Words:
young driver, crash, exposure reduction, nighttime driving restrictions, occupancy restrictions, licensing age, legal drinking age, zero BAC, vehicle power

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EXECUTIVE SUMMARY

It is a truism to say that road crashes could be reduced if people stopped driving: similarly, the frequency of young driver crashes could be reduced if the legal licensing age was raised by several years. Before these extremes are reached, however, there are still potential road safety benefits to be obtained from reducing the opportunity for young drivers to be involved in crashes. The principle underpinning such measures, exposure reduction measures, has wide acceptance from a public health perspective. Such reductions should be directed at those types of exposure of greatest risk of crash involvement. Despite this status, there is a remarkable lack of information in road safety circles, at both a conceptual and practical level, on exposure reduction. To date, the discussion of exposure reduction countermeasures as a means of reducing young driver crashes has been superficial and fragmented.

This report has attempted to place exposure reduction countermeasures in an appropriate context and identified a range of technical and strategic issues which are relevant to a comprehensive and valid discussion of such measures. The road safety system has the immediate capacity to reduce the incidence of crashes involving young drivers by reducing their exposure, primarily through restrictions on nighttime driving.

As noted in the report, however, this is an area in which there are no "right" answers. Even though most road safety practitioners would place greatest emphasis on the potential public health benefits, a reduction in the number of young driver crashes does not necessarily indicate the best outcome from a community perspective. Ultimately, an effective, efficient and equitable balance must be reached between a range of competing objectives in order to reach a consensus policy position on the desirability of exposure reduction countermeasures as one method for reducing young driver crashes.

On the basis of this review, it appears that young driver exposure reduction measures fall into one of four categories, viz:

- measures likely to be effective but which are unlikely to be implemented, despite strong technical support. In this first category fall measures such as raising the driver licensing age, raising the legal drinking age and nighttime driving restrictions;
- measures which are unlikely to be effective and may, in fact, be disbeneficial, but which have some policy support. Occupancy restrictions would be in this category;
- measures which may be effective, especially if developed further, but which are likely to have marginal effects on young driver crash frequencies. Vehicle power limits fall into this category;
- measures which have the potential to reduce young driver crashes but which may require further research and development. Measures in this category include vehicle transmission type restrictions and Zero BAC legislation.

The alternative strategy, specifically reducing the young driver risk of crash involvement, remains an 'in principle' strategy at this point in time; there are no strategies currently available which have technical support, although research is proceeding.

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1.0 INTRODUCTION

It is a truism to say that road crashes could be reduced if people stopped driving: similarly, the frequency of young driver crashes could be reduced if the legal licensing age was raised by several years. Before these extremes are reached, however, there are still potential road safety benefits to be obtained from reducing the opportunity for young drivers to be involved in crashes. The principle underpinning such measures, exposure reduction measures, has wide acceptance from a public health perspective. Such reductions should be directed at those types of exposure of greatest risk of crash involvement. Despite this status, there is a remarkable lack of information in road safety circles, at both a conceptual and practical level, on exposure reduction.

Decisions on the type, extent and value of exposure reduction measures raise a number of significant issues in both the technical and policy domains. The aim of this report is to provide an overview of exposure reduction measures as a means of reducing the frequency of young driver crashes. To achieve this aim, it will be basically covering three main areas:

- a range of contextual issues
- the elements of the decision making process
- a review of known and/or implemented exposure reduction countermeasures. This review will encompass both technical issues, primarily through the presentation of relevant data, and strategic issues for subsequent discussion in policy forums.

In achieving these aims, it should be noted that this report primarily consolidates currently available technical information rather than generating new information or even updating past results. Thus, it will provide the foundation for discussion, and perhaps agreement in principle, on the value of exposure reduction measures in general as a means of reducing the frequency of young driver crashes. It may also serve to prioritise the range of measures: however, information to support a specific decision within a jurisdiction will probably need to be generated locally.

2.0 BACKGROUND

There are many, and varied, ways of assessing road safety progress, all of which show that road safety has improved dramatically over the last two decades. There are two basic ways in which this has been achieved, viz:

- general improvements to the road safety system which have reduced the average risk of crash involvement for all drivers (and other road users). Such general improvements are derived from increased levels of resources and improved technology for the road traffic system associated with an increasing level of motorisation, e.g. better roads, more traffic police etc.

- targetted improvements to the road safety system, focussing on crash "blackspots" in the road system, specific types of vehicles, particular types of road users and/or particular types of road user behaviours.

While young and/or inexperienced drivers have undoubtedly benefitted from the systemic improvements, there is very little evidence (other than, perhaps, the Zero BAC legislation for novice drivers) to indicate that targetted young/novice driver countermeasures have been successfully implemented and evaluated with positive outcomes. This is demonstrated by the graphs below which show both the absolute number of 17-25 year old driver fatalities and their proportion of the total problem.

FIGURE 1

DRIVER FATALITIES BY AGE GROUP
1976 - 1992, VICTORIA

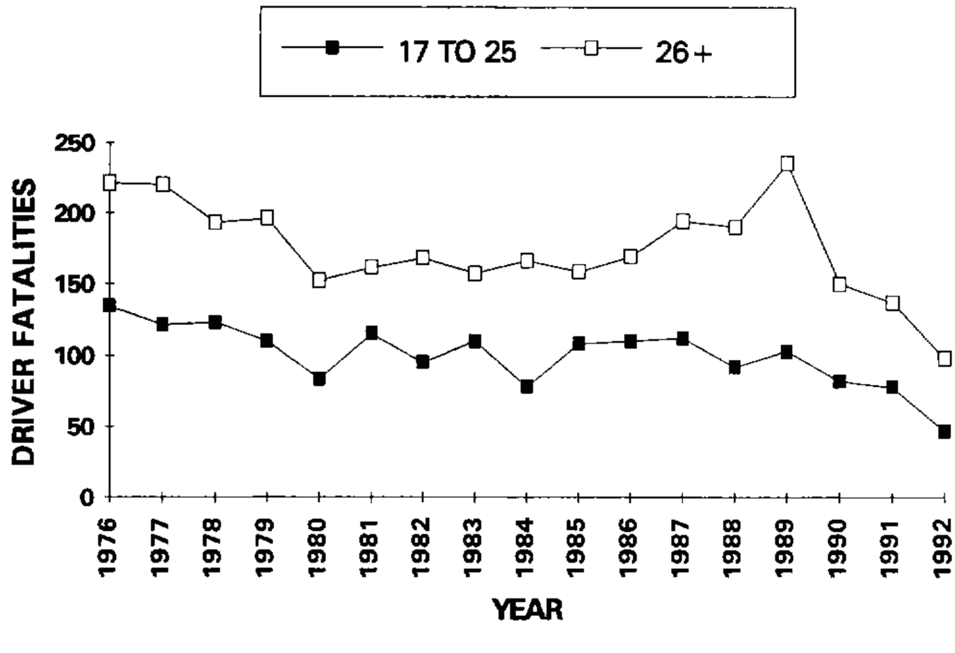
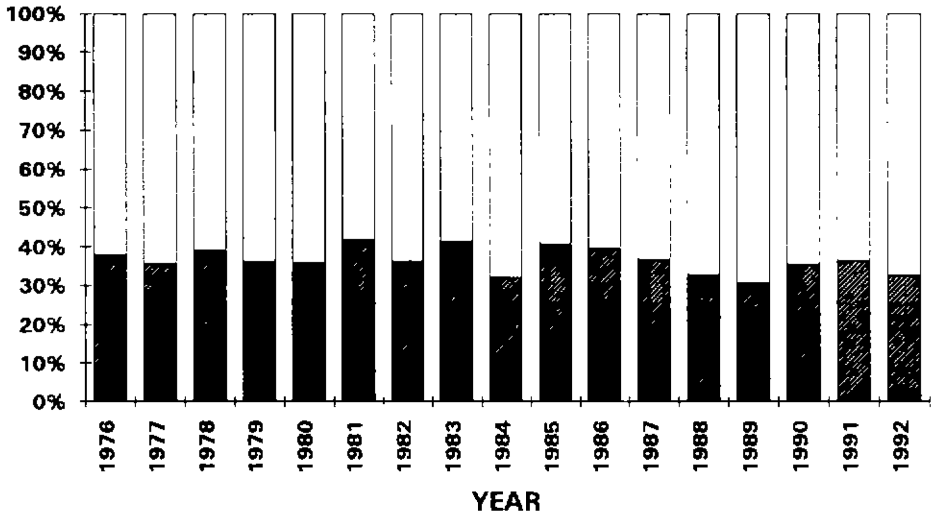


FIGURE 2

17-25 YEAR OLD DRIVER FATALITIES AS A PROPORTION OF ALL DRIVER FATALITIES, 1976 - 1992, VICTORIA



As can be seen from the first graph, both age groups demonstrate a substantial reduction in the absolute number of driver fatalities over the entire period, although they have achieved this result in different ways. While the younger age group has shown a reasonably consistent, but gentle, downward trend, the older driver age group has shown a more dynamic picture, with a sharper increase through the late 1980s and a much sharper decrease since 1989.

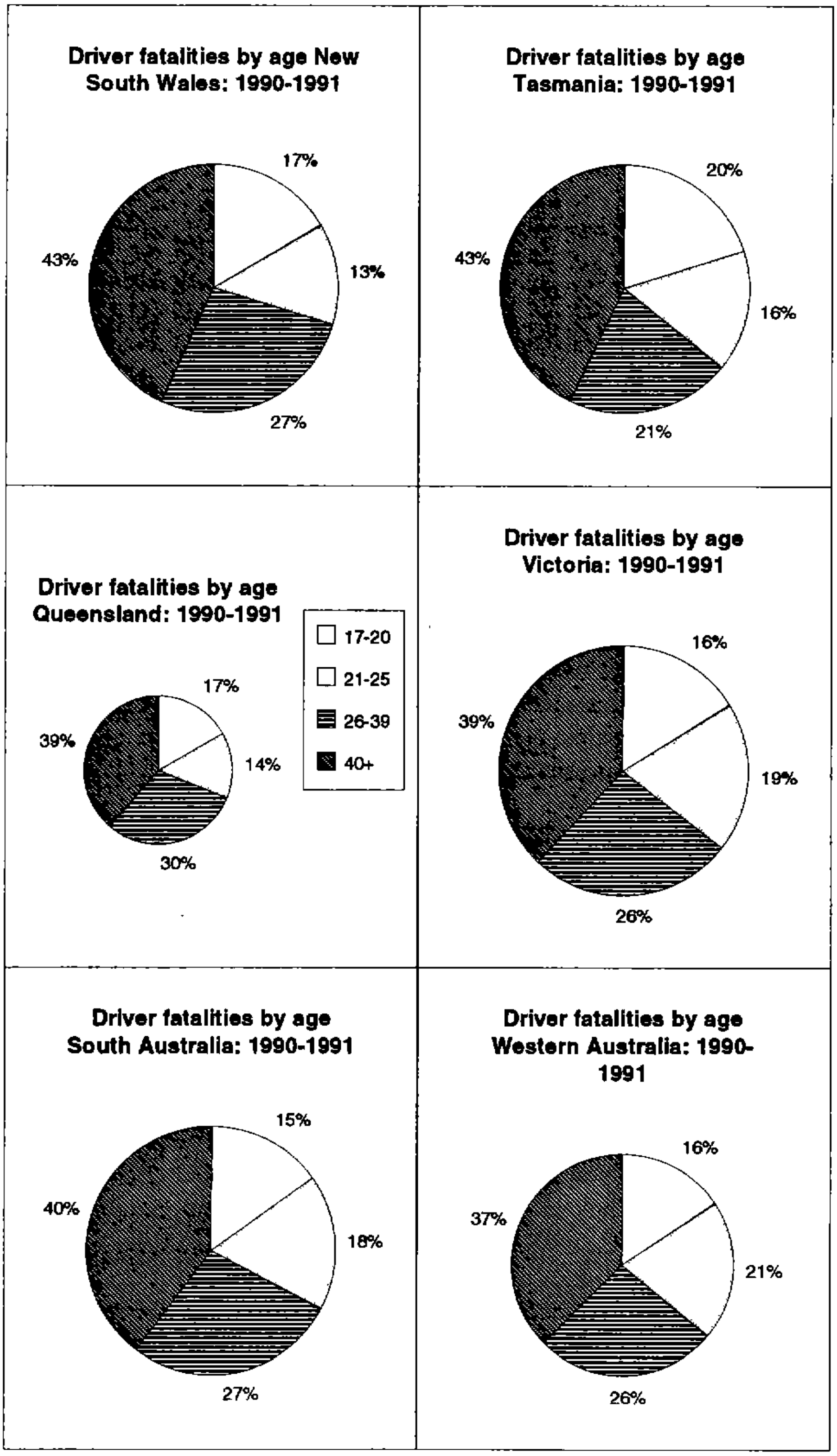
Irrespective of the changes in absolute frequencies, Figure 2 shows that Victorian drivers under the age of 25 have consistently contributed around 35-40% of driver fatalities for the period. Drummond, Sullivan and Vulcan (1991) conducted a descriptive analysis of the 1990 Victorian road toll and showed that, while driver and rider fatalities for all age groups above 22 years declined substantially in 1990 compared to 1989, 20 and 21 year old driver and rider fatalities actually increased in 1990. There was only a very slight decline for 17, 18 and 19 year olds.

The pie charts overleaf present the proportion of driver fatalities for each of four age groups by State for the last two years (1990 and 1991). The proportions for driver fatalities under the age of 26 years range from 29.9% in New South Wales to 36.3% in Western Australia. Thus, in every State, young drivers contribute disproportionately to driver fatalities.

Further, the overinvolvement (per year of age) in road trauma remains if the number of serious casualties or drivers involved (but not necessarily injured) in casualty crashes by age group is examined.

FIGURE 3

PROPORTION OF TOTAL DRIVER FATALITIES BY AGE GROUP AND STATE, 1990 & 1991



For any general road safety measure and perhaps at any point in time, different driver age groups could be reasonably expected to respond in different ways. However, the reasonably consistent proportion of the problem which young drivers contribute (even though the total problem is getting smaller) and the different response by the youngest drivers in recent years when there have been dramatic reductions in the road toll, suggests that there has been relatively little success in **specifically** improving young driver safety. In this way, the "young driver" problem may be considered atypical when compared to other road safety problems.

If the young driver "problem" is atypical, this could also explain why there has been an increasing focus on exposure reduction initiatives (i.e. reducing the amount or type of kilometres driven by young drivers) as the principal variety of effective, targetted young/novice driver crash countermeasures. It should be noted that the operative word in the previous sentence is **effective**, given that the majority of effort and resources has been directed at making young drivers safer per kilometre driven (i.e. reducing their risk of crash involvement) through pre-driver education/driver training strategies and that, on the whole, these have not been effective.

3.0 CONTEXTUAL ISSUES IN EXPOSURE REDUCTION MEASURES

3.1 THE RESPECTIVE ROLES OF RESEARCH AND POLICY IN EXPOSURE REDUCTION MEASURES

This report is different from most other research reports in that it attempts to combine discussion of technical and policy or strategic issues in the one document. In the area of exposure reduction, this is not just desirable but could also be considered necessary. This necessity becomes clear when the respective roles of research and policy in the area of young driver exposure reduction are detailed:

- the role of research is to provide valid and reliable data on a potential exposure reduction target. This encompasses information on which policy decisions can be based, such as levels of absolute and relative risk of crash involvement (through the combination of comparable crash and exposure data) and the unavailability of alternative strategies, usually gleaned from a review of relevant literature. Data related to factors contributing to overinvolvement and crash involvement mechanisms are not generally collected and/or presented (although they may be speculated on), as this information is not as important for a countermeasure aimed at reducing exposure.

  If the information on mechanisms was valid and reliable, it could hopefully be used to develop a risk reduction measure, generating the same level of road safety benefit without affecting the quantity of exposure (although the type of exposure could be affected); however, quantitative mobility of the target group would remain intact. It is the amount of mobility, and the presumed value of this mobility, which provides the single, most direct counter-argument to exposure reduction measures.

- in some respects, the role of policy could be considered to be more important than research for potential exposure reduction countermeasures for two reasons:

  - on first principles, exposure reduction measures should be effective in public health terms, if they lead to an aggregate reduction in exposure or if they replace higher risk exposure with lower risk exposure. While technical data can be used to justify a decision to implement an exposure reduction measure, they need not be central to the process. Some facets of licensing are examples of the greater importance sometimes assigned to policy considerations.

  - as exposure reduction measures are, by definition, restrictive in the broadest sense, it is essential that they be discussed fully and sensibly and that account is taken of all of their possible benefits and costs. This places great emphasis on the policy process, not only to initiate substantive discussion but to ensure that it remains focussed and results in a decision which is recognised as being in the best interests of the community. Unfortunately, one characteristic of exposure reduction measures in Australia has been that they have seldom received the degree of public debate which, given their possible public health outcomes, they deserve. The best example of this is the nighttime driving restriction: this is a complex issue which, to date, has been dismissed on relatively simplistic grounds.

Hence, this report attempts to combine technical and strategic issues to provide the best basis for understanding, and subsequently making decisions about, young driver exposure reduction countermeasures. It is an area in which there are no "right" answers, relying instead on an effective and equitable balance among a range of competing objectives.

3.2 EXPOSURE, CRASHES AND RISK

In discussing exposure reduction measures, it is essential that the relationship between exposure, crashes and risk be clearly understood.

Exposure is often defined as 'the opportunity to have a crash'. A more concrete, operational definition of exposure has been provided by Wolfe (1982) who saw exposure as:

"A measure of the frequency of being in a given traffic situation, which number can be used as the denominator in a fraction with the number of accidents which take place in that situation as the numerator, thus producing an accident rate or risk of being in an accident when in that situation".

The discipline of road safety has traditionally used surrogate measures of this 'opportunity'. This involves exposure measures such as population, licences held or registered vehicles to allow comparisons of crash frequencies over time (during which aggregate exposure has increased) or crash frequencies between groups of different sizes. On only a few occasions in Australian studies have these surrogate exposure measures been replaced by more conceptually direct measures of exposure, viz, distance or duration of travel. Some of this work has supported the crash risk estimation process which is reported in subsequent sections of this report.

It should be noted that, as with factors such as age and experience, exposure as defined above is a generic variable. A number of writers (e.g. Risk and Shaoul, 1982, MacDonald 1992) have pointed out that there may be large variations in the degree of risk inherent in the same unit of exposure for different drivers/road user groups/vehicles etc. This indicates the need to address the qualitative aspects of exposure as well as its quantitative aspects.

Within any given unit of exposure, a certain number of crashes will occur. The actual number of crashes depends on the unit of analysis but is known to vary as a function of, for example, type of road, type of vehicle, time of day, age/experience of driver group etc. The mathematical relationship between risk, crashes and exposure is:

$$\text{RISK} = \frac{\text{CRASHES}}{\text{EXPOSURE}}$$

Relative risk estimates can then be computed: these are calculated by setting the relative risk of the chosen reference group to unity (by dividing that group's risk by itself) and establishing the relativities of other groups by dividing their risk by the risk estimate for the comparison group.

If the aim is to reduce the incidence of crashes, the above formula indicates that there are two basic methods for achieving this:

- Firstly, the amount of exposure can be reduced (preferably that portion of exposure with the greatest risk), thus providing fewer opportunities for crash involvement and hence a reduction in the number of crashes. An outcome of this approach will probably be an apparent reduction in the level of overall risk, derived from reduced exposure in, for example, times of week with higher than average risk of crash involvement. However, the level of risk within the remaining periods remains unchanged. Hence, while reducing exposure can generate an apparent reduction in overall risk, this does not make young drivers "safer" during the times they actually drive. This highlights the difference between reducing young driver crashes (which exposure reduction measures will hopefully achieve) and improving young driver safety on a per unit exposure basis (which exposure reduction measures will not achieve).

  Thus, the exposure reduction strategy reduces the number of young driver crashes by reducing some of the most high risk kilometres they drive.

- The second approach is to make young/novice drivers safer per kilometre of driving: the status of this approach is addressed in the next section.

3.3 THE STATUS OF YOUNG DRIVER RISK REDUCTION STRATEGIES

Without doubt, the greatest amount of effort in the area of young driver safety has been assigned to what could be generically called driver preparation methods, encompassing pre-driver education, driver training and various forms of post-licence training.

Reviews of driver education and training (e.g. Saffron, 1981, Drummond, 1989) have concluded that there is little empirical support for the range of training programs which have been evaluated. The primary reason suggested to explain this negative outcome has been that there is no substantive theoretical foundation to the education/training approach, primarily in the content domain. While training courses often cover a wide range of areas, they are often areas with high face validity and with no theoretical foundation.

Given this lack of real understanding of the driving task, driver education and training usually reverts to global rules and advice, often derived from legal requirements (e.g. indicator on to change lanes, not too close to the car in front, slow down slightly etc.). While this approach is persuasive (Shaoul, 1975), it is not surprising that education and training courses fail to meet their safety objectives when one considers the obvious gap between what is being taught and what the driving task, as a complex psychomotor task performed in a dynamic environment, requires.

While driving is a complex skill involving perceptual, attentional, information processing, decision making and motor skills, and subject to motivational influences, there is an expectation that young/novice drivers will reach satisfactory performance levels after only the most basic of instruction. However, there is a big difference (in crash outcome terms) between being able to drive and being able to drive safely but this should be taken to mean that research and countermeasure development in the area of young driver risk reduction strategies is dealing with very coarse, obvious differences in driving ability (Drummond, 1990).

Thus, although what beginning drivers are taught as constituting safe driving (which, as noted above, is invariably at a general, procedural level) is necessary, it is not sufficient for safe driving. Currently, there is little or no empirical indication as to what actually constitutes safe driving performance, although this is the subject of active research.

In summary, effective, targetted methods for reducing the risk of young driver crash involvement have not been, and are currently still not, available. It is hoped that such strategies can be developed in the short to medium term, flowing from a more sophisticated understanding of the driving task and the differences in driving performance as a function of age and driving experience.

3.4 THE ROLE OF GRADUATED LICENSING

In response to the poor performance of strategies designed to make young drivers safer per kilometre of travel, there has been an increasing focus through the 1980s on the concept of graduated licensing. While there are a variety of forms of graduated licensing, they are all derived from the same conceptual framework (Drummond, 1988):

- the failure (to date) to develop a pre-licence driver training strategy which is more effective in terms of reduced subsequent crash involvement than other strategies.

- the recognition of the fact that different types of driving are associated with different levels of risk of crash involvement.

- the fact that risk of crash involvement decreases with increasing age/experience and the belief that if novice drivers can obtain most experience under lower risk conditions, this will serve to reduce the level of crash risk associated with other, higher risk types of driving when such driving is subsequently undertaken. Thus, road safety benefits of graduated licensing could be expected to accrue from two interdependent mechanisms:

  - participation is restricted to lower risk driving while young and/or inexperienced

  - reduced risk of crash involvement for other types of driving which are undertaken when older/more experienced.

The Federal Office of Road Safety released a suggested five stage model for graduated licensing schemes in Australia in 1983: this model is described in Boughton, Carrick and Noonan (1987) and Hampson (1989). This model comprised two periods of supervised driving with certain conditions, followed by two periods of possible solo driving in which the novice (solo) driver is initially restricted to daytime driving only and is not allowed to carry passengers. In the second period of solo driving, nighttime driving is allowed (but not with passengers). The fifth stage is a 12 months probationary licence. For all of these periods on a learner licence, and the first year of a probationary licence, the novice driver is required to comply with a Zero BAC condition.

To date, this model has not been fully implemented in any Australian jurisdiction, although a revised, diluted version was released as part of the 10 point safety package. The current status and form of graduated licensing can be found in Haworth (1992). It is reasonable to say, however, that the direct safety focus of the original FORS model has been replaced by models in which the form(s) of graduation are further removed from direct limitations on the more risky exposure and therefore do not structure the accumulation of experience as rigorously. The potential remains, however, for the continued development of graduated licensing, which could be more faithful to the original principles on which the concept of graduated licensing was based.

Thus, graduated licensing schemes are of direct relevance to the consideration of exposure reduction measures. More detailed discussion of graduated licensing formats will raise two fundamental issues: licensing age tradeoffs and the passivity of young driver countermeasures. These are briefly discussed in turn below.

Although the licensing age question is dealt with in more detail in Section 5, it is important to note that a common feature of proposed graduated licensing schemes is a reduction in the age at which solo driving can legally commence, even though this solo driving may be subject to restrictions. The supporting reasons for such an age reduction often revolve around three factors:

- a separation of the legal drinking and driving ages

- the belief that at 15/16 years of age, teenagers are more receptive to parental supervision

- the belief that at 15/16 years of age, teenagers are less susceptible to peer group pressures.

Drummond (1987a) demonstrated that a higher licensing age, even if this is coincident with the legal drinking age, bestows a substantial nett road safety benefit for two reasons:

- the effects of additional exposure below the (current) driver licensing age in the form of increased incidence of crashes are not offset by lower accident rates in later years (derived from the benefits of greater accumulated experience). Thus, the nett effect is an overall increase in the frequency of young driver crashes.

- a positive effect (if any) due to the separation of legal drinking and driving ages is, firstly, diluted by under-age exposure to alcohol and, secondly, swamped by the public health disadvantages of increased exposure.

Interestingly, it is much more common for proponents of the need to separate the legal driving and drinking ages to advocate a reduction in the driving age rather than an increase in the legal drinking age, a move which would achieve the same end (and which has been successfully demonstrated in the United States)

The above analysis dealt with the predicted outcomes of an absolute reduction in the legal driving age. Additional work has been undertaken in which the crash outcomes of a range of graduated licensing options were estimated for Victoria (Drummond 1986). This modelling process basically involved six options:

a) the FORS 5-stage proposal, with a minimum age for learning of 16 years and for solo driving of 17 years.

b) as for a), but with the minimum ages re-set at 16.5 and 17.5 years respectively.

c) as for a), but with the minimum ages re-set at 17 and 18 years respectively (i.e. the FORS system superimposed on the (then) existing Victorian licence age structure).

d) a simpler 3-stage proposal based on time of day restrictions with a minimum age for learning of 16 years and for solo driving of 17.

e) as for d). but with the minimum ages re-set at 16.5 and 17.5 years respectively.

f) as for d), but with the minimum ages re-set at 17 and 18 years respectively (i.e. superimposed on the (then) existing Victorian licence age structure).

The general conclusion from this work was that, even with quite severe restrictions on the driving of those below the existing licence age, a nett increase in crash frequencies would be generated. The only options that returned a clear safety benefit (options c and f) were those which retained the existing licence age and imposed further restrictions on novice drivers.

The second issue revolves around whether graduated licensing schemes are a sufficiently active approach to the improvement of young driver safety. Given the current lack of appropriate understanding on the processes necessary and sufficient for safe driving performance, young drivers are, in effect, forced to learn safe driving by trial and error: graduated licensing approaches based on structured experience (designed to maximise trials while minimising errors) are therefore passive approaches.

In the future, a combination of exposure and risk reduction strategies within a graduated licensing format may well provide an optimal probationary licensing structure.

3.5 EFFECTIVENESS, EFFICIENCY AND EQUITY

Traditionally, the three E's in road safety have stood for education, enforcement and engineering. In terms of countermeasure assessment and evaluation, there are a further three E's, viz, effectiveness, efficiency and equity (Drummond, 1990). In the consideration of young driver safety strategies, and exposure reduction measures in particular, it is important that these factors be addressed.

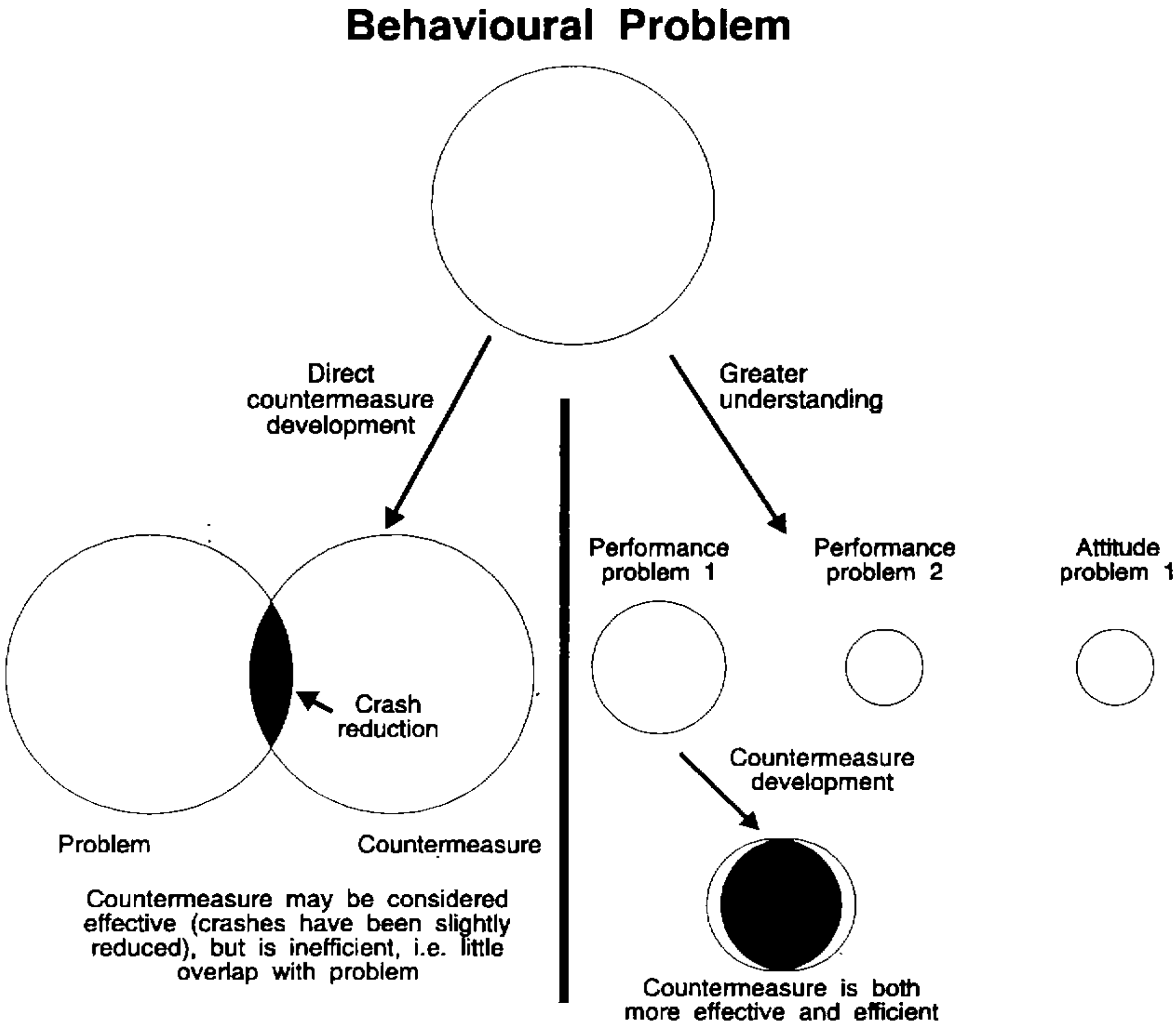
The usual form of countermeasure evaluation has been focussed on effectiveness, that is, following an intervention, has there been a reduction in the incidence and/or severity of crashes and can this reduction be attributed to the intervention rather than other coincident factors? Thus, an outcome from a countermeasure effectiveness evaluation may be, "This intervention reduced Type X crashes by 10%".

It may be, however, that the countermeasure was actually 50% effective, but because it only had a 20% overlap with the targetted problem, a crash reduction of only 10% was produced. Such a countermeasure could perhaps be considered to be effective but not particularly efficient. It should be noted that assessment of the level of efficiency depends on the actual homogeneity of the problem, both in terms of problem content and the extent to which this problem(s) applies to sub-groups of the targetted road user group. The extent to which any particular problem applies to the whole target group could be considered to measure the equity of the intervention.

The hypothesised relationship between problems and countermeasures is shown diagrammatically overleaf. In principle, this diagram could apply equally well to both exposure reduction and risk reduction countermeasure development although, given the mechanisms by which these countermeasure types achieve their crash reduction benefits, it could be considered to be more relevant to risk reduction strategies.

FIGURE 4

THE HYPOTHESISED RELATIONSHIP BETWEEN PROBLEMS AND COUNTERMEASURES



Nevertheless, there are two points arising from this diagram which warrant discussion in the current context:

- firstly, it raises the issue of the level of understanding of the problem which is required before an exposure reduction measure is implemented. In the context of exposure reduction, it is tempting to remain at the general level of problem description because the measure is simply seeking to reduce the incidence of a type of driving. The appropriateness of an exposure reduction measure may vary (in either direction) as a function of the understanding of the problem.

- secondly, it also emphasises the need to address issues of efficiency and equity, rather than simply focus on countermeasure effectiveness. It is important to discuss, and then establish, the balance between these three factors, especially in the context of exposure reduction measures. This issue is discussed in the next section.

3.6 PUBLIC HEALTH VERSUS TRANSPORT MOBILITY

From a pure road safety perspective, a discussion of the value of a particular exposure reduction measure revolves around the potential nett road crash reductions which are considered likely to result from implementation. However, decisions on such measures are rarely restricted to road safety issues alone.

The other side of the decision coin on exposure reduction is transport mobility. By their very nature, exposure reduction measures are restrictive; while there may be road safety benefits to be derived from such restrictions, the mobility and other costs associated with them should not be overlooked. The difficulty of incorporating mobility (and any other) costs into an "equation" is the apparent lack of methods for validly quantifying the value of such costs. It goes beyond the purpose of this report to review this area in detail, suffice to say that it seems reasonable to assume that some individual costs would accrue in circumstances in which there are restrictions placed on young driver mobility. However, it is far from clear whether:

- these individual costs can be aggregated to produce a significant social cost and,

- if they do, how this social cost compares to the estimated social benefits derived from a nett reduction in crashes.

The above argument could be turned around and applied to reducing the legal licensing age, i.e. how do the social benefits (if any) from driving-based mobility at an earlier age compare to the estimated social disbenefits of an increase in the number of crashes? It is considered essential to establish a firm policy position on these issues so that the framework in which young driver crash countemeasures are to be developed is clear.

3.7 DRIVING EXPOSURE IN A SOCIAL CONTEXT

Following the above, it is worth mentioning that the frame of reference could be widened even further to examine both the costs and benefits of current levels of driving, especially in and around capital cities, and the potential costs and benefits of reduced levels of driving. This raises much more fundamental mobility, environmental and social issues than young driver exposure reduction options and hence lie outside the scope of this report.

It should be pointed out, however, that the road safety system has a role to play in such discussions, given the potential for road crash reduction. As road safety research and development approaches the 21st century, one issue it will need to address is the balance between autonomy and interdependence with other technical and strategic areas. It remains to be seen whether the road safety system will assume this role, and, if it does, whether it will do so as a leader or a follower.

4.0 THE DECISION MAKING PROCESS

At one level, a decision to recommend and/or implement an exposure reduction measure appears very straightforward, viz:

1. Type A of young driver driving is (unacceptably) high risk driving

1a. The specific reasons for this high level of risk are not known or cannot be countered directly

THEREFORE

2. The incidence of this form of driving will be reduced through a condition of licensing or other legislation (i.e. this form of driving will be illegal for the defined target group)

IN ORDER FOR

3. A (desirable or cost-beneficial) reduction in crashes, proportional to the amount of exposure reduced, to be generated.

It should also be noted that exposure reduction benefits may also be generated by implementing road safety strategies designed to reduce the risk of crash involvement or reduce the severity of crashes. For example, the introduction of motorcycle skills testing in Victoria generated crash reductions through reducing the motorcycle licensing rate (Wood and Bowen, 1987). Similarly, the introduction of mandatory bicycle helmet use appears to have reduced the amount of cycling (Vulcan, Cameron and Heiman, 1992).

However, the complexities and interdependencies of the real world road safety system usually preclude such a simple problem-countermeasure-outcome relationship. When deliberating on the desirability of a particular exposure reduction measure, a range of factors need to be considered. These factors include:

- ***The potential for, and magnitude of, exposure transfer by the target group***

  Will the measure lead to a nett reduction in aggregate exposure or will the target group transfer this form of exposure to other forms and/or different modes? What are the risk relationships between these other forms and modes and the type of exposure being reduced?

  For example, significantly different outcomes could be expected if the targetted exposure was not replaced or was replaced by increased public transport patronage, as compared with a partial/total transfer to other forms of driving or a shift from cars to motorcycles.

- ***The possibility of behavioural changes by the target group***

  Even if a nett aggregate reduction in exposure is achieved, will this reduced exposure still have the same qualitative characteristics as before? Is there a possibility that target group drivers will change their behaviour in ways which could make their remaining exposure more (or less) risky than it was previously?

- ***The probability of differential effects within the target group***

  To what extent is the countermeasure addressing the one problem? What is the level of problem heterogeneity and how varied or diverse do the strategies need to be to achieve the greatest possible reduction?

  Elliott (1992) distinguishes between three overlapping groups, viz:

  a) the minority of non-compliers with successful countermeasures

  b) the much larger number of occasional but not habitual compliers with successful countermeasures

  c) the large number (maybe even the majority) of occasional and/or regular non-compliers with the less than successful countermeasures.

  It is important that such internal divisions within the target group, and the way in which they may have reacted to other road safety initiatives, be taken into account in planning for an exposure reduction measure. This is designed to ensure that the measure is, in perhaps different ways, relevant to the greatest number of target group members.

- ***Discouragement versus prohibition strategies***

  To generate maximal, achievable crash reductions, what are the relative merits and disadvantages of discouragement or prohibition strategies? This raises a number of systemic questions, encompassing public opinion, desired compliance levels, enforcement options, penalties etc

  While the most direct, unambiguous type of measure is derived from a prohibition model (that is, this form of driving for young drivers is now illegal - do not do it anymore or you will be punished!), it is by no means clear how appropriate this model is. It may be that a less punitive approach, seeking to gain compliance with the spirit of an exposure reduction measure rather than the letter, is more effective.

Information on the benefits and possible costs of the measure and the reasons for its introduction can be cast in a much more positive (as opposed to punitive) light, that is, doing something **for** young drivers rather than doing something **to** them. It may be that innovative approaches may increase both the likelihood of an exposure measure being introduced and the safety benefits it generates (while at the same time, keeping the costs at lower levels). For the foreseeable future, it is likely that this type of issue will be resolved in the policy domain.

- ***Duration and scope of exposure reduction measure***

In principle, the greatest crash reductions will be achieved from the most stringent measures applied for the longest possible time. Given that extreme measures are not available (and nor should they necessarily be), what is the appropriate balance of duration and severity to achieve what could be considered optimal (as opposed to maximal) crash reduction benefits?

- ***The potential for exposure and/or behavioural changes by non-affected drivers***

If targetted drivers maintain their exposure but do so as passengers, what effects will this have on their (new) drivers? Are these completely new trips, what is the relative level of risk associated with these trips and how many trips are required to maintain the (now passenger) exposure of the young person?

For example, some parents may assume the driving role for a teenage son/daughter at night after the implementation of a late night driving restriction. In this event, decisions need to be taken (or data collected to support statistical modelling) on the incidence, relative exposure and relative risk of this additional travel before nett safety outcomes can be estimated.

- ***The type of implementation process***

By its very nature, the implementation of exposure reduction measures may be (or perhaps should be) handled differently to the introduction of other road safety measures. For example, more thought could be given to the pre-implementation phase, a period in which broad community support and consultation is sought. It may be relatively more important to be pro-active rather than reactive, to direct the community debate rather than just respond to it and to ensure that all relevant information is available and accessible.

To avoid misunderstandings and dilution of the measure's potential road safety effect, it is important that clear statements on all aspects of the measure (enforcement, scope, duration, penalties, risk levels etc.) be communicated.

- *Enforcement resources and priorities*

Enforcement resources are finite and are allocated across a range of road safety problems. Discussions would need to be held on the relative enforceability of various exposure reduction measures, the efficacy of such enforcement and thus its relative priority as an enforcement target.

Caution would need to be exercised if enforcement of exposure reduction measures was done in conjunction with current enforcement operations. For example, the most obvious link would be between a nighttime driving restriction and Random Breath Testing (RBT) operations

It is possible that one outcome of such an approach would be a reduction in the deterrent effect of RBT and little, if any, increase in compliance with the nighttime driving restriction. The reduction in the deterrent effect of RBT may be produced as a result of reduced throughput (i.e. the sampling fraction of traffic is decreased and fewer drivers are actually tested) because of the additional enforcement associated with the nighttime driving restriction. The nett outcome of such a scenario may very well be negative.

Again, detailed discussions on enforcement strategies are required prior to implementation. These discussions could assist in reaching a consensus policy position on a range of other issues related to the particular exposure reduction measure being planned.

- *Penalties for non-compliance*

A general rule in road safety is that if a law is introduced, enforcement of that law is required or the community will not perceive the road safety system as being serious about the law. Further, non-compliance with the law must carry a penalty which reinforces its deterrent value (it should be noted that the safety utility of any particular law is determined by a wide range of factors and does not, in practice, reduce solely to a question of amount of enforcement and severity of penalty). Bicycle helmet wearing legislation in Queensland and graduated licensing legislation in New Zealand are two recent examples of road safety interventions in which the type or level of penalty has been acknowledged to be inappropriate and/or ineffective.

Penalties have an important role to play in influencing potential compliance levels, as do a range of other factors. The range and severity of penalties for non-compliance with an exposure reduction measure require comprehensive discussion.

- *Mobility and social costs*

Any costs associated with implementing an exposure reduction measure should be explicitly dealt with and placed in the context of the estimated benefits to be derived. While it may be difficult to measure these costs, they cannot be disregarded; even though such measures may have their origins in road safety circles, the public health benefits need to be assessed relative to social costs.

It would appear incumbent on the road safety system to provide data on both safety and mobility issues (and any other relevant issues), even though their primary focus is safety. Historically, exposure reduction measures have not received sufficient policy or public debate, in part due to a loose philosophical commitment to the value of mobility. A more extensive discussion of the range of issues relevant to the safety versus mobility debate can only benefit the efficient development of future road safety initiatives.

5.0 A REVIEW OF KNOWN EXPOSURE REDUCTION MEASURES

5.1 INTRODUCTION

This section discusses a number of exposure reduction measures. In doing so, it not only uses available technical information but also raises any relevant strategic issues. Wherever possible, the potential exposure reduction target is placed in its crash data context.

In reading this section, it is important to keep in mind contextual information presented in preceding sections. One of the main messages of this report is that it is essential to address all dimensions of an exposure reduction measure. This means all road safety implications need to be investigated, rather than just the potential effects on the target group, together with issues that lie outside the road safety domain.

5.2 NIGHTTIME DRIVING RESTRICTIONS

5.2.1 Relevant Crash Data Analyses

This section attempts to put the nighttime crash involvement of young drivers in an appropriate context, the absolute frequencies contained therein providing information on the (relative) magnitude of the problem, thus complementing the risk estimate data in the next section. Given the illustrative purpose of this section, data have only been analysed from Victoria and New South Wales.

Figures 5a and 5b present driver involvements in reported casualty crashes by hour of day and age group, controlling for time of week (weekdays are defined as Monday to Friday, weekends as Saturday and Sunday). The points to note in these graphs are:

- despite the imbalance in the age group spans (with the youngest age group comprising just over half the number of years of the next two age groups), the 18-25 year old age group represent close to the highest, if not the highest, number of involvements for all hours of day, both during the week and at weekends.

- young drivers comprise the greatest number of crash involved drivers at "night" (say 5pm to 5am) on both weekdays and weekends.

- young drivers represent the greatest number of crash involved drivers for almost all hours of day on weekends.

- young drivers are involved in many more crashes before midnight on weekdays than after midnight: on weekends, young driver crash involvement frequencies are relatively stable from 8pm to 2am.

FIGURE 5A

DRIVER CRASH INVOLVEMENTS IN WEEKDAY REPORTED CASUALTY CRASHES BY HOUR OF DAY AND AGE GROUP, VICTORIA, 1989

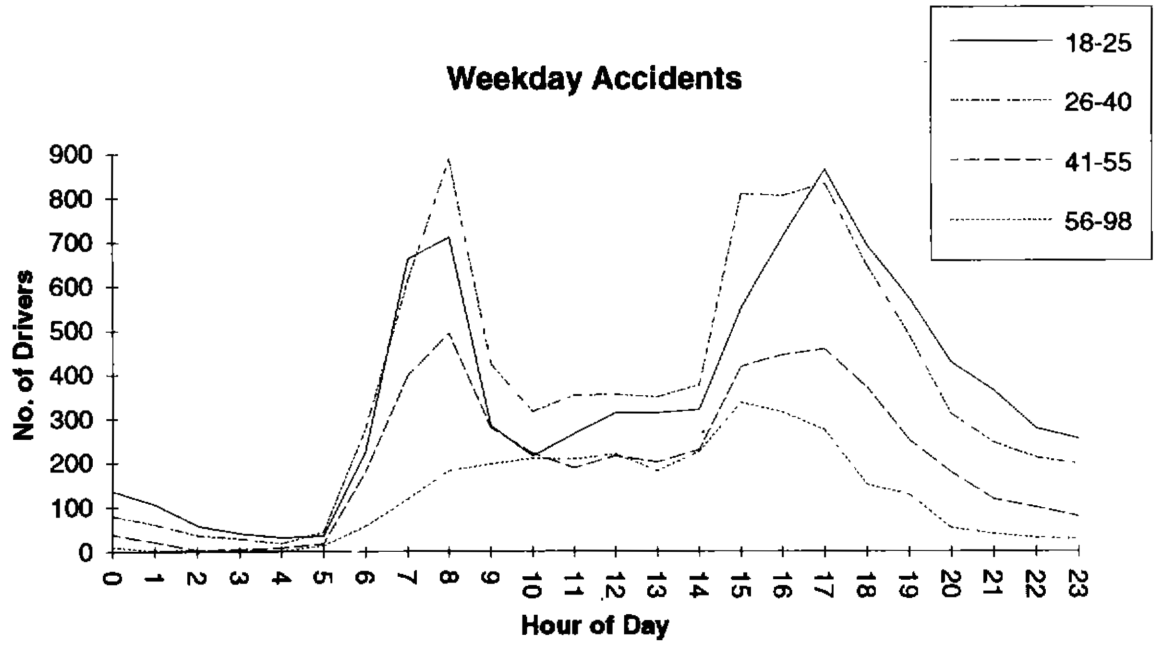


FIGURE 5B

DRIVER CRASH INVOLVEMENTS IN WEEKEND REPORTED CASUALTY CRASHES BY HOUR OF DAY AND AGE GROUP, VICTORIA, 1989

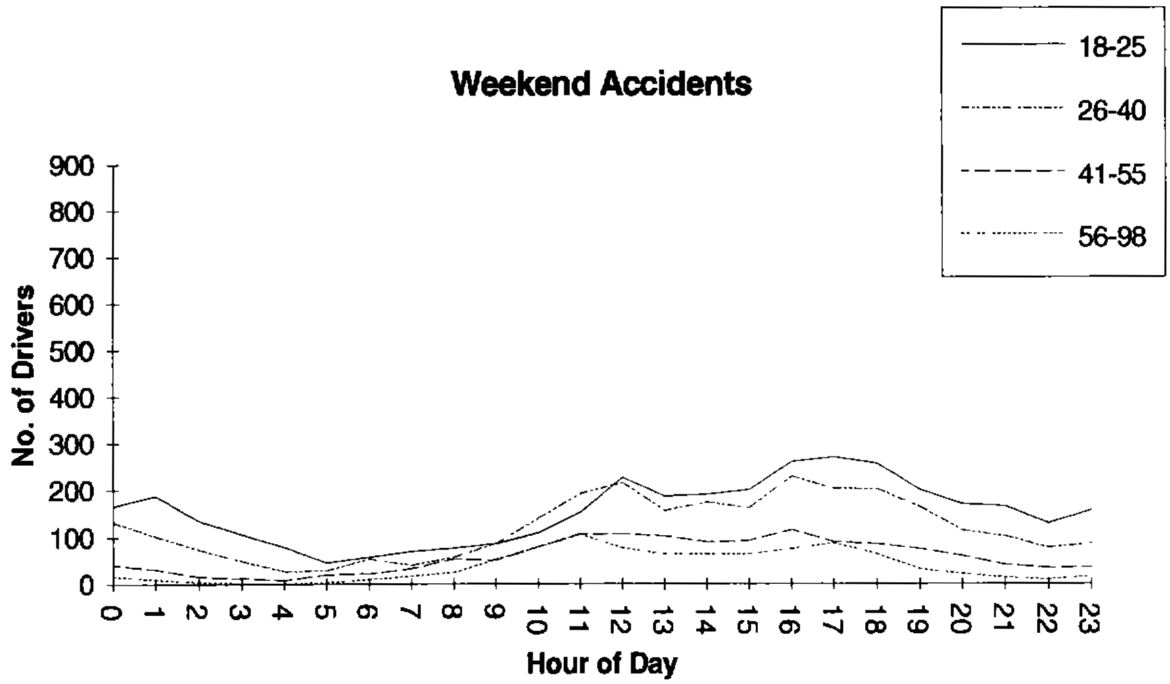
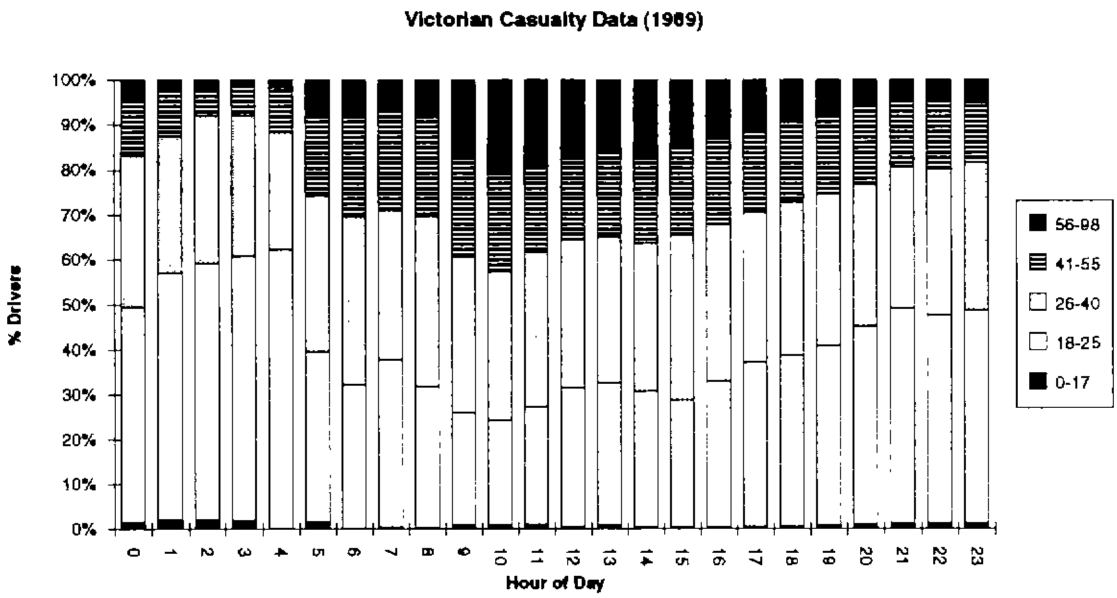


Figure 6 presents the above data for the whole week combined as proportions (within hour) rather than frequencies. The graph shows that the relative contribution of young drivers to total crash involvements is lowest through the day and highest through nighttime hours, reaching 50% or more in the early hours of the morning.

FIGURE 6

PROPORTIONAL DISTRIBUTION OF DRIVER CRASH INVOLVEMENTS IN REPORTED CASUALTY CRASHES WITHIN HOUR OF DAY AND BY AGE GROUP, VICTORIA, 1989



The next two graphs present information to establish whether there have been any trends in young driver (serious) crash involvements in recent years. Figures 7a and 7b show driver involvements in fatal and serious injury crashes since 1983 by age group for two time periods, viz:

- 5am to 10pm, hours of the day which represent a "non-restricted driving" period

- 10pm to 5am, hours of the day which have been previously used to represent a possible nighttime restriction period (and which also define the restriction implemented in New Zealand)

If making comparisons between the two graphs, the differences in vertical scale should be taken into account.

FIGURE 7A

DRIVERS INVOLVED IN FATAL AND SERIOUS INJURY CRASHES BY AGE GROUP, 5AM TO 10PM, VICTORIA, 1983 - 1991

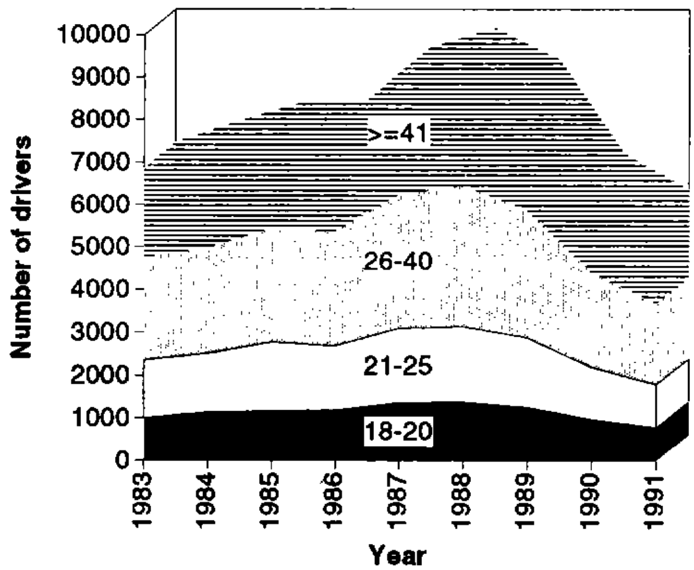
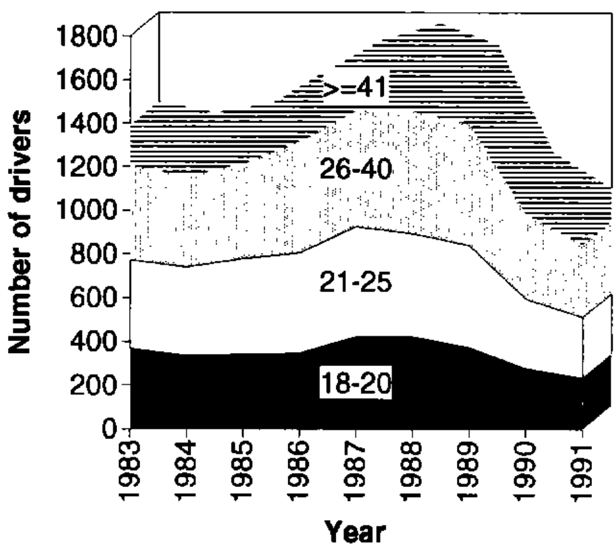


FIGURE 7B

DRIVERS INVOLVED IN FATAL AND SERIOUS INJURY CRASHES BY AGE GROUP, 10PM TO 5AM, VICTORIA, 1983 - 1991



These graphs show that there has been a substantial change in recent years. Compared to 1989, drivers under the age of 26 years have shown a reduction in their absolute number of involvements in 1991 in both time periods, although their relative performance in the late night period has been better. Between 5am and 10pm, the crash involvement frequency of drivers under 26 decreased by 1089, compared to a decrease of 1108 for drivers aged 26-40 years. In the late night period (10pm to 5am), the respective reductions were 327 and 231. While it is hoped that post-1989 results reflect an improved ambient level of safety which will be maintained through the 1990s, it should be emphasised that young drivers are still (over)involved in a substantial number of serious casualty crashes in the late night period. In 1991, drivers under the age of 26 represented.

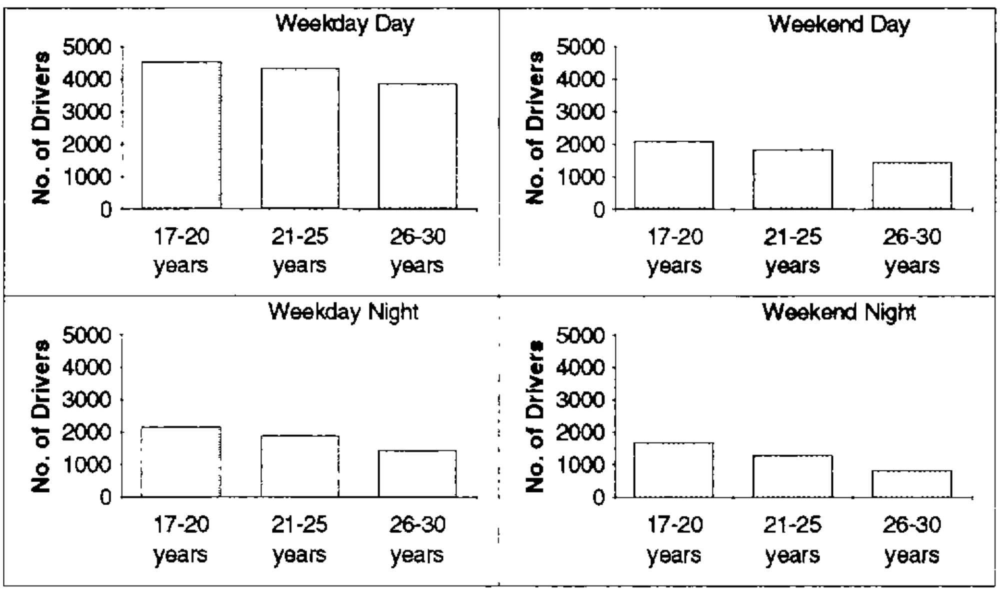
- 52% of all drivers involved in fatal and serious injury crashes between 10pm and 5am. This equates to 512 serious crash involvements.

- 50% of all drivers involved in minor injury crashes between 10pm and 5am. This equates to a further 800 crash involvements.

Figures 8a - 8d present information for New South Wales on the relative magnitude of the nighttime crash problem for young drivers. These graphs show driver involvements in casualty crashes data for 1989 and 1990 combined within four time of week blocks (with nighttime being defined as 7pm to 7am). The age group spans are more directly comparable, being 4, 5 and 5 years.

FIGURES 8A - 8D

DRIVER CRASH INVOLVEMENTS IN CASUALTY CRASHES BY TIME OF WEEK AND AGE GROUP, NEW SOUTH WALES 1989 AND 1990

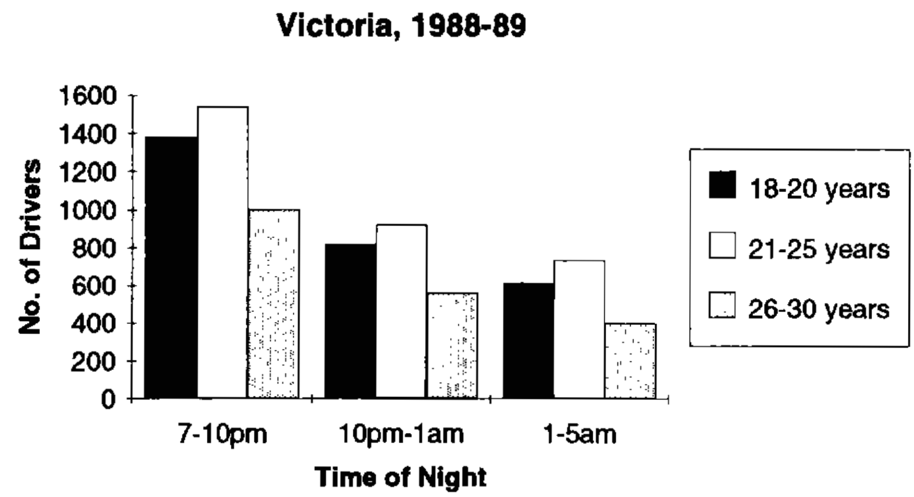


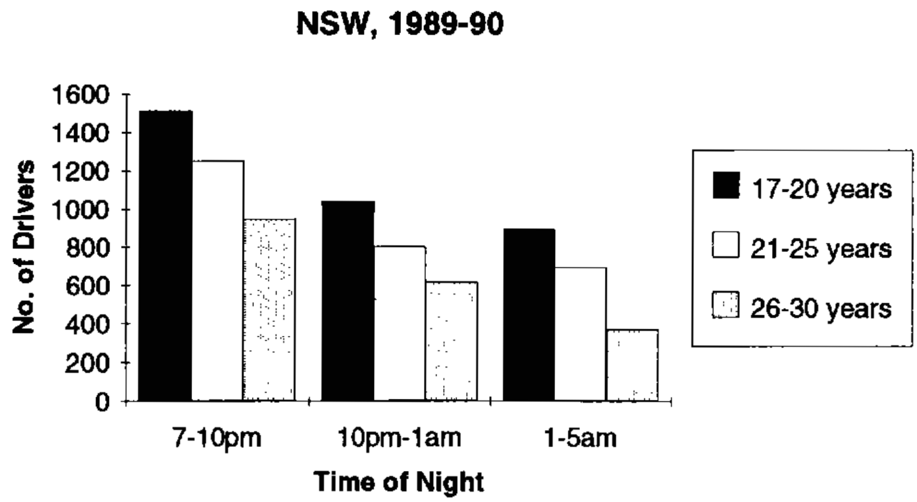
The graphs shows the consistently greater involvement of the youngest driver age group in all time blocks and the proportional overinvolvement of the youngest age group at night, especially on weekends.

The last series of graphs in this section are presented to allow assessments of crash involvement frequency changes through the night, using the finer age group categories (other ages and/or daytime are also shown for further comparison purposes). Figures 9a and 9b present the number of driver involvements in Victoria and New South Wales respectively over a recent two year period for different times of night and age group. The youngest age group in Victoria only comprises three years which probably prevents the consistent pattern in the New South Wales data from appearing (and therefore could be taken as reflecting one effect of the later licensing age in Victoria).

FIGURES 9A AND 9B

DRIVER INVOLVEMENTS IN CASUALTY CRASHES BY AGE GROUP AND TIME OF NIGHT, VICTORIA, 1988 & 1989, NSW, 1989 & 1990





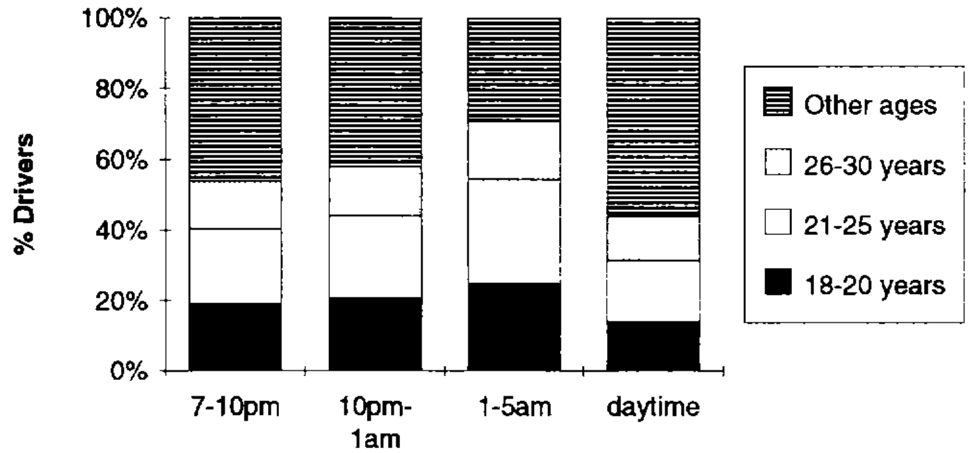
Interestingly, an examination of these graphs indicates that while the youngest age group in New South Wales does relatively worse than the youngest age group in Victoria as the time of night gets later, the result for the 21 to 25 year age group is worse.

Figures 10a and 10b present the age group distribution within each of these nighttime periods (with daytime for comparison purposes) for both Victoria and New South Wales. Both graphs demonstrate that the contribution to total crash involvements increases as the hour of night gets later.

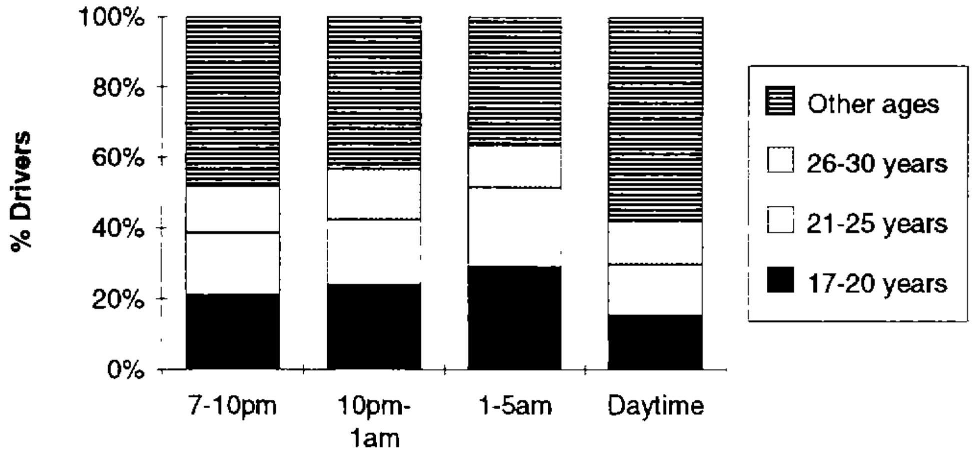
FIGURES 10A AND 10B

AGE GROUP DISTRIBUTION OF CASUALTY CRASH INVOLVEMENTS WITHIN NIGHTTIME PERIODS AND DAYTIME VICTORIA, 1988 & 1989, NSW, 1989 &1990

Victoria, 1988-89



NSW, 1989-90



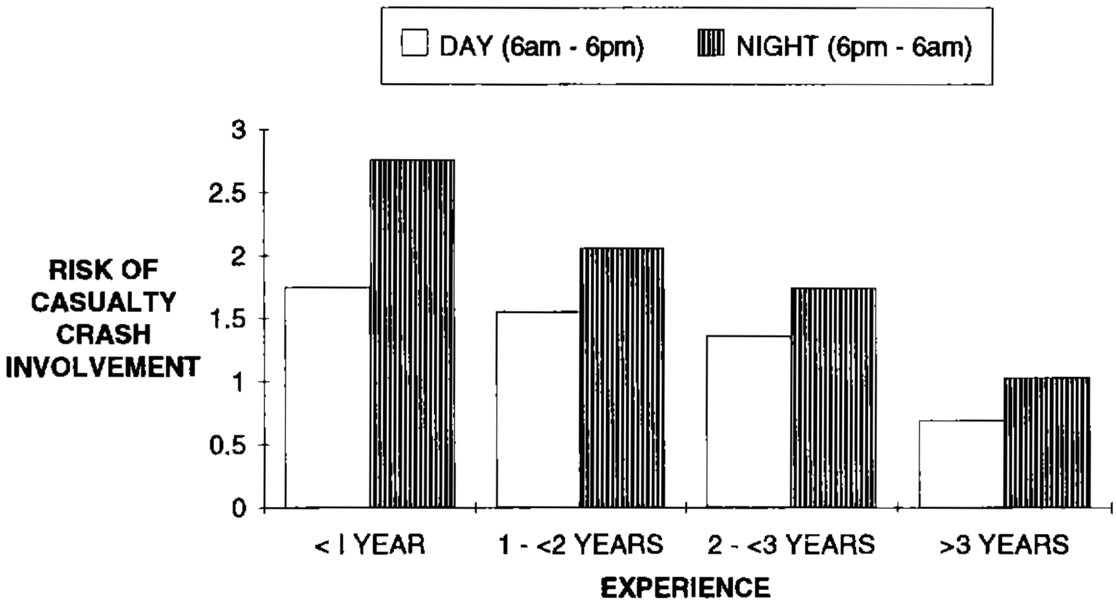
5.2.2 The Riskiness of Nighttime Driving

The previous section has demonstrated that young drivers are involved in a substantial number of casualty crashes at night and that they contribute a large proportion of total nighttime casualty crash involvements. However, the rationale for applying a nighttime driving restriction to young and/or inexperienced drivers is generally on the basis that nighttime driving is a particularly risky type of driving, rather than on the basis of the absolute number of crash involvements. The following results provide evidence of the elevated risk of nighttime crash involvement for beginning drivers.

Analysis of Victorian data (Drummond, Cave and Healy, 1987b) has shown that nighttime driving is associated with higher risk of casualty crash involvement (compared with daytime driving) for all driver groups, as Figure 11 demonstrates.

FIGURE 11

RISK OF CASUALTY CRASH INVOLVEMENT (PER MILLION KILOMETRES) BY DRIVER EXPERIENCE AND TIME BLOCK



While the risk of crash involvement increases for all driver groups at night, the least experienced driver group (those in the first year of a probationary licence) shows:

- the greatest nighttime risk in absolute terms (2.76 crashes per million kilometres travelled)

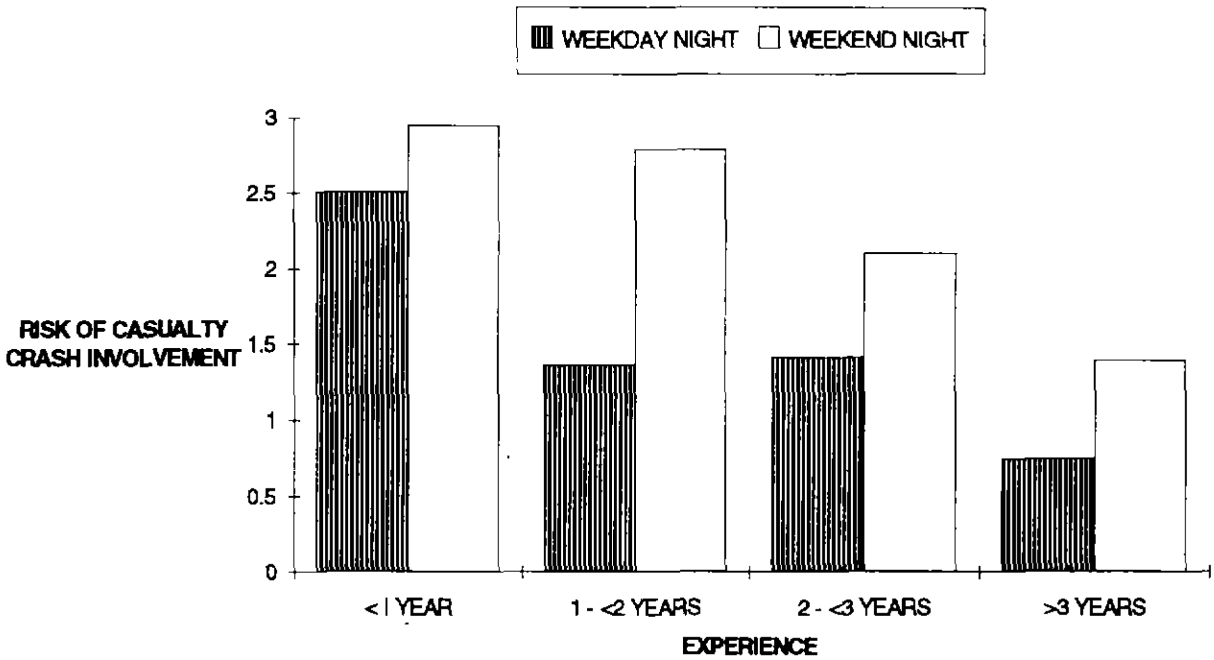
- the largest increase in absolute terms from daytime to nighttime driving (1.01 crashes per million kilometres travelled), compared with an absolute increase in crash involvement risk for drivers with three years or more experience of 0.34 crashes per million kilometres travelled).

- the largest proportional increase in crash involvement risk from daytime to nighttime driving (58%, compared with 33%, 28% and 49% respectively for the other driver groups).

Disaggregating the above result, it could be reasonably anticipated that general nighttime risk would differ across the days of the week. As Figure 12 shows, risk of crash involvement does appear to vary as a function of weekday/weekend night.

FIGURE 12

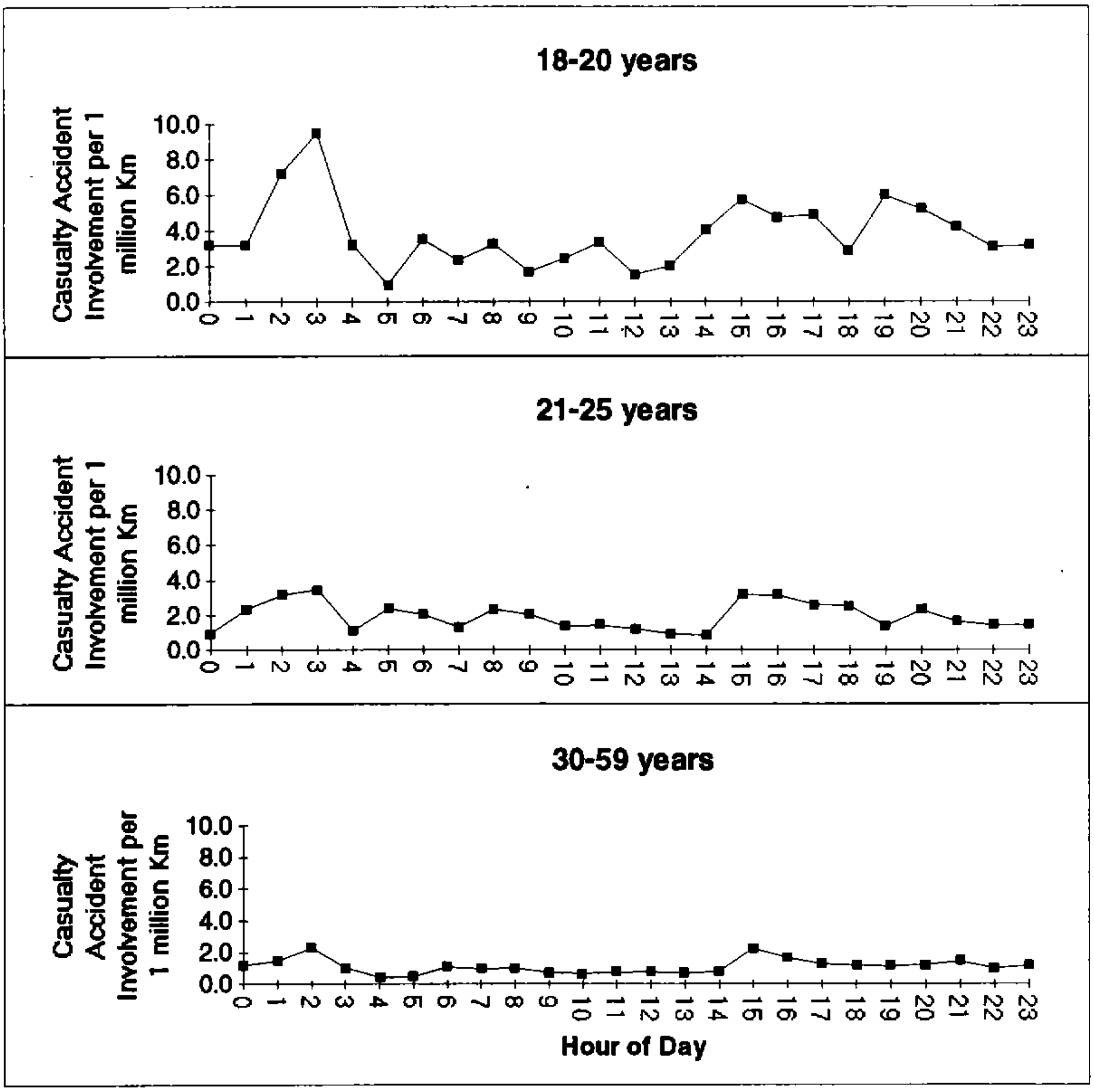
RISK OF CASUALTY CRASH INVOLVEMENT (PER MILLION KILOMETRES)BY TIME HELD LICENCE AND WEEKDAY/WEEKEND NIGHT



While using a different dataset and therefore not directly comparable, Figure 13 presents the risk of driver crash involvement by time of day (in single hours) for three different age groups. These more detailed graphs emphasise the riskiness of nighttime driving for the youngest, most inexperienced driver group.

FIGURE 13

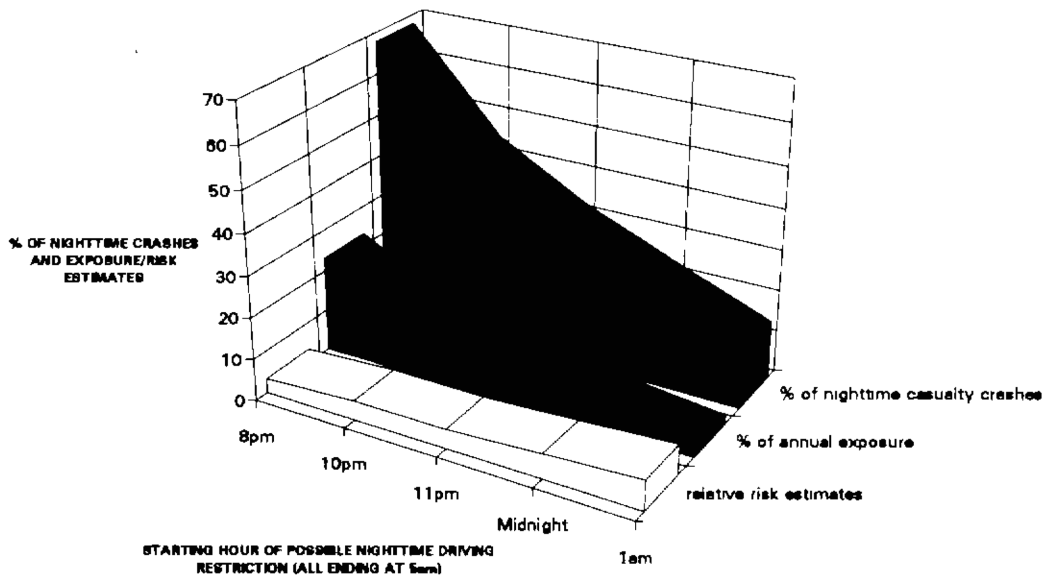
RISK OF DRIVER CRASH INVOLVEMENT BY SINGLE HOUR OF DAY AND DRIVER AGE GROUP, VICTORIA, 1988



A decision to implement a nighttime driving restriction involves striking a balance between the amount of current exposure affected and the magnitude of the safety benefits to be derived, with the risk of crash involvement in the selected period (widely) acknowledged as a road safety problem requiring remedial action. Figure 14 shows how these three factors vary as a function of different possible nighttime restriction starting times (with all restriction options ending at 5am).

FIGURE 14

EXPOSURE, CRASHES AND RISK OF VARIOUS NIGHTTIME DRIVING RESTRICTION PERIODS APPLYING FOR THE FIRST TWELVE MONTHS OF A PROBATIONARY LICENCE



The data represented in Figure 14 are presented in tabular form below so that precise comparisons can be made. A similar table, by driver age rather than driver experience, is presented in Appendix 1.

TABLE 1

EXPOSURE, CRASHES AND RISK OF VARIOUS NIGHTTIME DRIVING RESTRICTION PERIODS APPLYING FOR THE FIRST 12 MONTHS OF A PROBATIONARY LICENCE

RESTRICTED PERIOD FROM - TO	% OF ANNUAL EXPOSURE	RISK ESTIMATES ABSOLUTE	RISK ESTIMATES RELATIVE	% OF NIGHTTIME CRASHES*
2000 - 0500	23.1	2.7	3.5	67.8
2200 - 0500	11.2	3.6	4.7	44.2
2300 - 0500	8.0	3.7	4.8	32.2
2400 - 0500	4.6	4.6	6.0	22.9
0100 - 0500	2.3	5.6	7.3	14.0

* nighttime is defined as 6pm to 6am. The proportion of **total** crash involvements covered by the restricted periods listed above ranges from about 7% (for the smallest period) to just under 30% for the 2000-0500 period.

If, therefore, it is accepted that the risk of crash involvement at night is unacceptably high, a decision to implement a nighttime driving restriction will involve striking a balance between the amount of current exposure affected (and hence the costs of the measure) and the estimated magnitude of the crash reduction benefits to be derived. It should be noted that this balance will be difficult to achieve and that the preferred, final balance need not necessarily be achieved at the first attempt.

Indeed, given the nature of the measure, the initial introduction of a relatively mild form of nighttime driving restriction to allow both a process and outcome evaluation may be the most acceptable option. Staysafe (1990b) recommmended for New South Wales:

"That a 12 month trial prohibition on driving and riding motor vehicles between 1am and 5am on Saturday and Sunday mornings be introduced for Provisional Licensees aged under 25 years, and be subject to review and report by STAYSAFE within 9 months of commencement".

- (Recommendation 27)

This recommendation is yet to be implemented.

Further information on nighttime driving restriction options derived from community surveys is provided in Section 5.2.4.

5.2.3 Previous evaluations of nighttime driving restrictions for novice drivers

Williams, Zador, Preusser and Blomberg (1982) examined the impact of the introduction of a nighttime driving restriction on crash frequencies in the four States set out below:

State	Curfew Period
Louisiana	11pm - 5am
Maryland	1am - 6am
New York	9pm - 5am
Pennsylvania	Midnight - 5am

Analysis of crash data for both novice and experienced drivers found reductions from expected crash numbers during restricted periods of between 25 and 69 per cent. This was a statistically controlled evaluation, and these outcomes took into account both the crash involvement of older drivers in States with and without the nighttime restriction and the crash involvement of affected drivers in the non-restricted period of the day. It should be noted, therefore, that the above percentage reductions were derived from the extent to which crash involvement reductions in the restricted period exceeded nett crash involvement reductions outside the restricted period, and so they represent the effect of the restriction alone.

The overall absolute benefit was actually greater as benefits were found across all hours of day and it was suggested that this was due to lower licensing rates. Williams, Lund and Preusser (1985) indicated that a curfew was a factor in delaying licensure, although this varied as a function of the severity of the restriction (the less restrictive the measure, the less likely it was to affect licensing rates). Although it is not known to what extent this delay of licensure would apply in Australia, Drummond (1986) has noted that road safety benefits are not just accrued from the absence of driving exposure at lower ages but also from relatively lower levels of exposure after the licensing age. This appears to be due to a similar rate of licensing (per year), irrespective of the legal licensing age.

McKnight, Hyle and Albrecht (1983) evaluated the full graduated licensing scheme in Maryland using time series analysis methods and concluded that the nighttime driving restriction failed to significantly reduce crashes during the hours of restriction. The authors suggested that the sub-group of drivers who were responsible for the (small) number of very late night crashes in the restricted period were not deterred from driving.

In August 1987, New Zealand introduced a graduated licensing scheme which incorporated a 10pm to 5am nighttime driving restriction. Formal evaluation results are yet to appear, although interim evidence suggests that the nighttime restriction has had a substantial effect on nighttime crash frequencies. Staysafe (1990) presented a graph, sourced from the New Zealand Ministry of Transport, which shows an sharp, approximately 20% reduction in the incidence of total reported injury accidents for 15-17 year old drivers while Perkins (1992) has informally reported that there appears to be a reduction of more than 30% in accident rate for restricted licence holders during the hours of the nighttime restriction. The actual result will be formally provided in the evaluation report.

5.2.4 Indicators of Response to Nighttime Driving Restrictions - Community Surveys

Neilson Associates Pty Ltd Lansley, Hayes and Storer (1986) conducted group discussions in Melbourne, Adelaide, Mildura and Wollongong as part of a project designed to identify the range of factors relevant to the implementation of graduated licensing. The groups comprised young drivers, parents and other interested community members. The response to the concept of a nighttime driving restriction was summarised by the authors and is presented below verbatim:

"Curfews. This is probably the most contentious issue. People can see the reasons for a curfew. Country people consider a curfew to be difficult because of its impact on employment (particularly early morning starts), sport and recreation. In metropolitan areas, if a curfew were too early it would seriously restrict time available for teaching driving. A 10pm to 5am curfew would be an acceptable compromise for metropolitan and country, enabling evening courses, sport and recreation, much evening employment and learning to drive". (page iv)

Van Brakel (1987) reported a survey on a variety of road safety issues in Western Australia, including the feasibility of a nighttime driving restriction. Results were obtained for two samples, a random sample of all licence holders and a sample of probationary licence holders. Almost 60% of general respondents supported the concept of a nighttime driving restriction, while only 39% of probationary licence holders were in favour.

The two samples showed opposing patterns for the possible starting times for the restriction. For probationary licence holders, the proportion in favour of any starting hour from 9pm till midnight was approximately equal at about 15%, while a starting time of 1am was by far the most preferred, with some 37% nominating this time. In contrast, the most frequent response for the random sample of all drivers was 9pm (approximately 25%), with each successive hour attracting a smaller proportion of responses. The most preferred end time was 5am, with just under 50% of both samples nominating this time.

Not surprisingly, there was also a difference of opinion on the duration of such a measure. Some 55% of the probationary licence holder sample nominated a period of 6 months, whereas a 12 month nighttime driving restriction was nominated by 42% of the random sample.

Staysafe (1990a) reported the results of a series of group discussions with some 600 students, predominantly 16 and 17 years of age. They noted that the reaction from students to the concept of a 10pm to 5am curfew was strongly negative. There was a belief that such a restriction would affect social and employment opportunities and would be grossly unjust.

In a 1990 survey of 392 young drivers and 202 parents conducted in New Zealand, 48% of young drivers reported that they were affected by the nighttime driving restriction. Sixty-two per cent of parents reported that they made some attempt to enforce graduated licensing restrictions, although they reported that they needed to make more trips (presumably due to the passenger restriction on new drivers as well as the nighttime driving restriction). Seventeen per cent of restricted drivers indicated that they did not comply with the nighttime restriction at least once a week.

In general, it would appear that older drivers tend to have a more positive attitude towards the concept of a nighttime driving restriction than do younger drivers (who are more likely to be affected). The pattern of these results emphasises the importance of placing any discussion on a nighttime driving restriction in a proper, and comprehensive, context.

5.2.5 Innovative Policies on Nighttime Driving Restrictions

The preceding sections have demonstrated that the concept of a nighttime driving restriction is a multidimensional one and, thus, the road safety system needs to address the issue at a systemic level. It involves the interplay of safety and mobility issues, relative benefits and costs and the appropriate structuring of mechanisms, penalties, enforcement levels, duration and scope of measure etc.

One variation which has not been directly canvassed in discussion to date is the possibility of attempting to achieve a reduction in the risk of nighttime crash involvement through apparent exposure reduction measures. That is, can the potential (or threat) of a nighttime driving restriction be used to encourage young drivers to adopt driving behaviours, as well as self-limit their late night exposure, to reduce the probability of crash involvement?

Such an approach could be designed to:

- primarily discourage rather than prohibit nighttime driving.

- provide a range of nominal penalties, if any, for nighttime exposure but more severe penalties for young drivers who come to the attention of the police through driving behaviour (driving at excessive speeds or with illegal BACs) or crash involvement.

- promote the riskiness of nighttime driving and portray nighttime driving as a "reward" for lower risk driving.

- apply to a much wider target group than perhaps could be the case if nighttime exposure was prohibited.

However, such an approach raises a variety of questions related to its feasibility and viability. The most successful road safety interventions have usually been direct and unambiguous: it is not known whether such a mixed message on nighttime driving could be reliably communicated and whether it is possible to encourage compliance with the spirit of such a measure (with lower associated costs) rather than the letter (which is, by definition, more restrictive).

It may be that there are a range of innovative approaches to the definition, structure and intent of a nighttime driving restriction. Discussion of these approaches should also be encouraged, in addition to the more traditionally defined approaches.

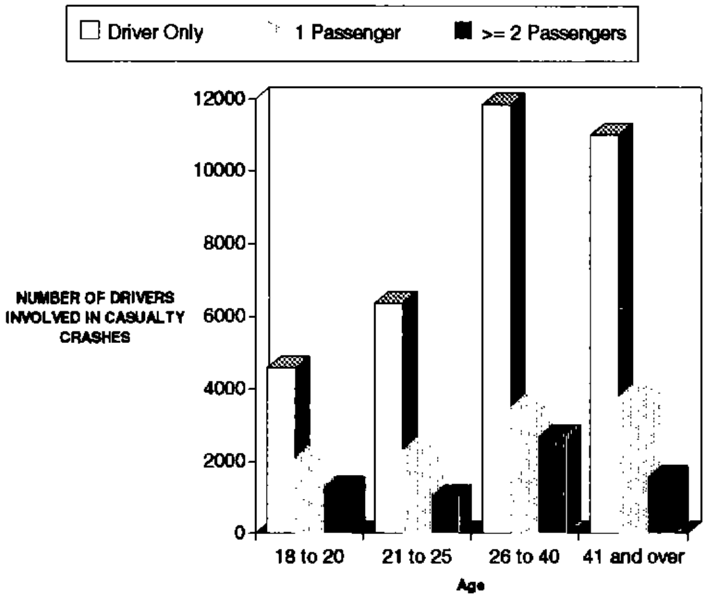
5.3 OCCUPANCY RESTRICTIONS

5.3.1 Relevant Crash Data Analyses

The first series of graphs in this section present the frequency of driver crash involvements for the last two years in Victoria as a function of the number of passengers in the driver's vehicle and the severity of the crash. From the data in the first graph, all crashes, drivers aged under 26 years had 2336 crash involvements during 1990 and 1991 while carrying two or more passengers, or 13.2% of their total reported crash involvements. The figures for drivers under 21 years were 1,290 and 16.2% respectively.

FIGURE 15

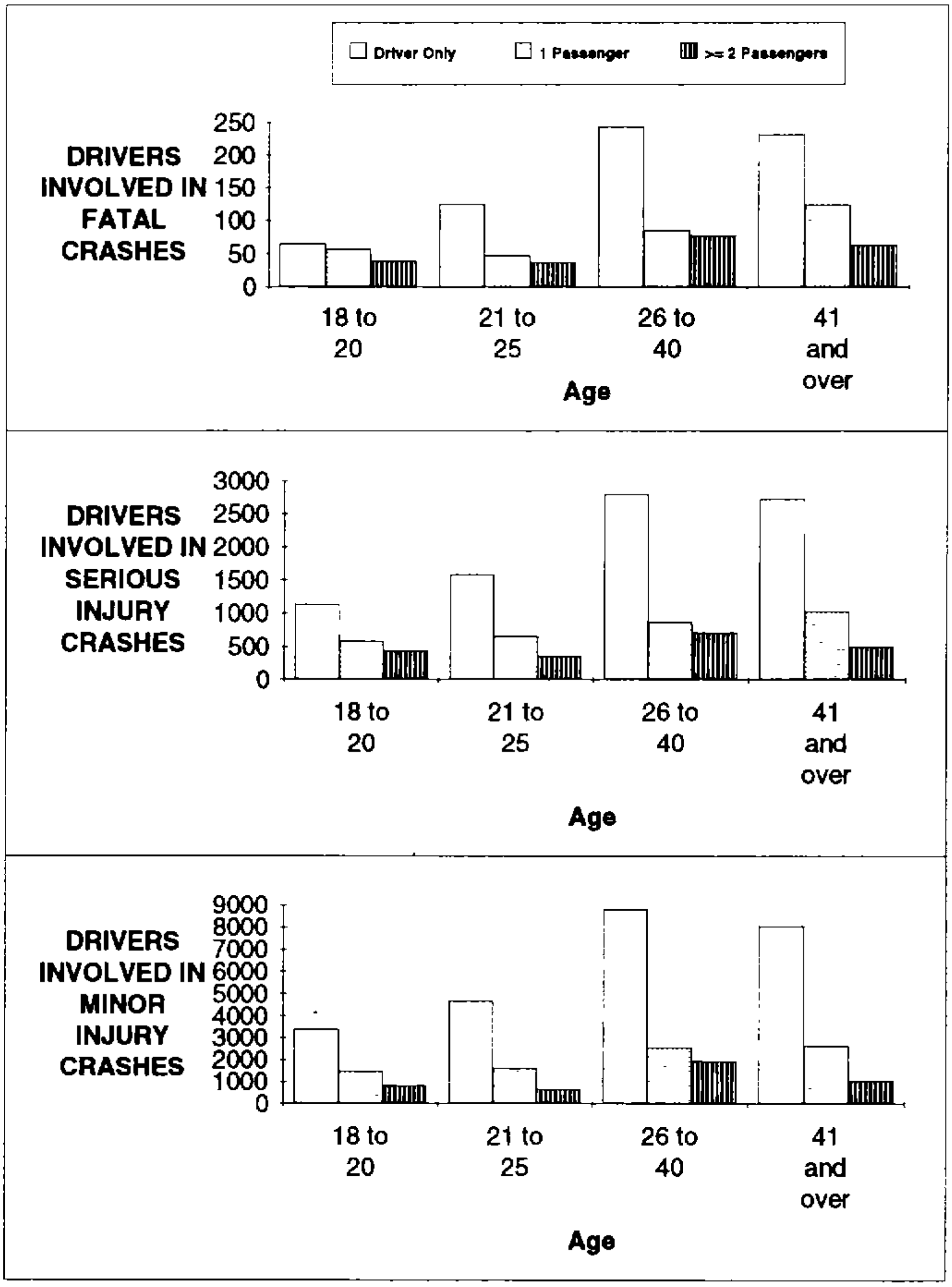
DRIVER INVOLVEMENTS IN CASUALTY CRASHES BY AGE GROUP AND VEHICLE OCCUPANCY, VICTORIA, 1990 AND 1991



The next three graphs, in which crash severity is controlled for, indicate that young drivers have a higher proportion of their crashes while carrying multiple passengers and that, as crash severity increases, the probability that young drivers will be carrying multiple passengers also increases. Drummond and Torpey (1984) also demonstrated the proportional overinvolvement of young drivers carrying multiple passengers. Some 23% of novice driver crashes involved the carriage of two or more passengers, compared to just 12% for 21-25 year old drivers on a standard licence.

FIGURES 16A - 16C

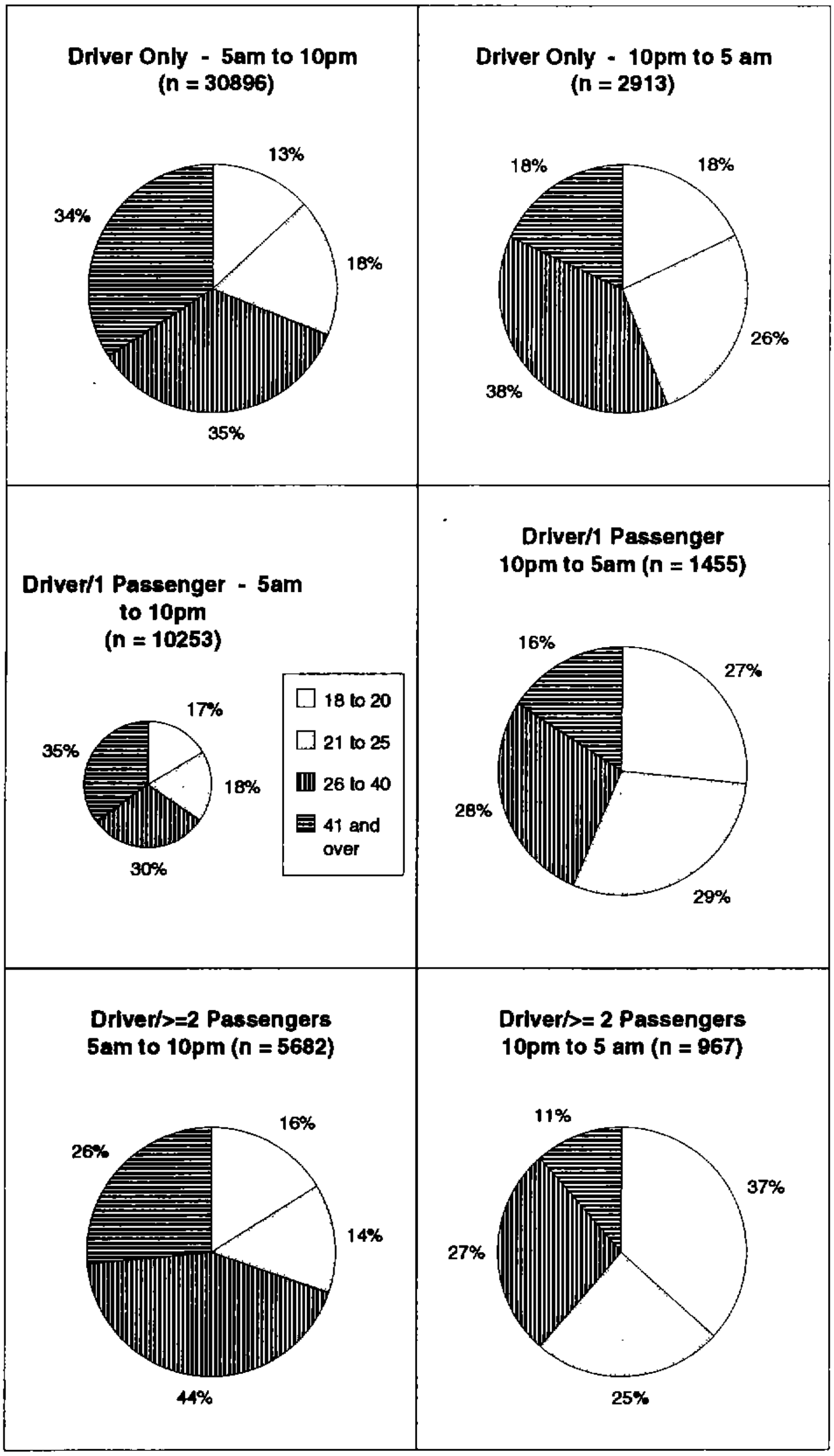
DRIVER INVOLVEMENTS IN CASUALTY CRASHES BY AGE GROUP, CRASH SEVERITY AND VEHICLE OCCUPANCY, VICTORIA, 1990 AND 1991



The next series of graphs presents the proportions of driver involvements by age group within a time block (5am to 10pm, 10pm to 5am) and vehicle occupancy category.

FIGURES 17A - 17F

PROPORTION OF DRIVER INVOLVEMENTS IN CASUALTY CRASHES WITHIN A TIME BLOCK/VEHICLE OCCUPANCY CATEGORY BY AGE GROUP, VICTORIA, 1990 AND 1991



The points to note from the above pie charts (in addition to the higher young driver proportions of crash involvements between 10pm and 5am for all occupancy classifications) are:

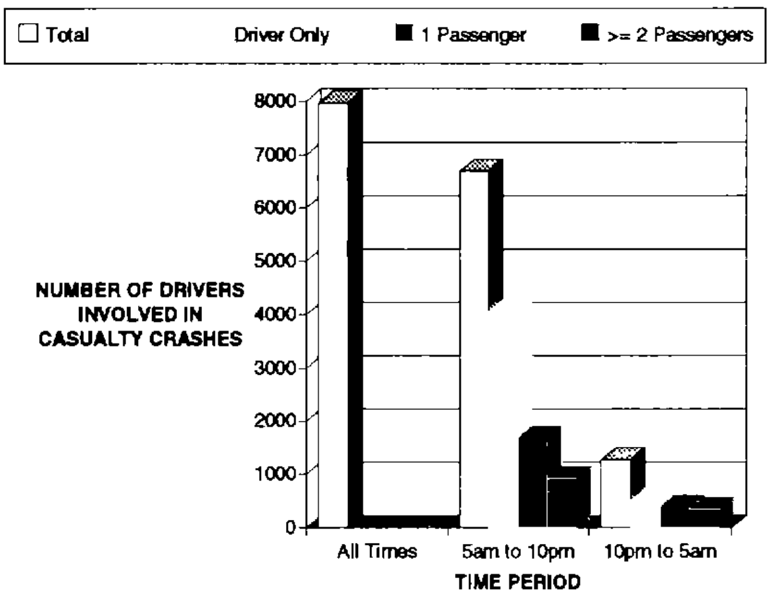
- the relatively stable proportion (between 31 and 35%) of young driver crash involvements between 5am and 10pm for all occupancy classifications.

- the increasing proportion of young driver crash involvements (44.4, 56.5 and 61.5% respectively) between 10pm and 5am as vehicle occupancy increases.

The final graph places the incidence of crashes as a function of vehicle occupancy for the youngest age group of drivers into context. It can be seen that, as previously noted, 16.2% of this age group's driver crash involvements involve the carriage of two or more passengers. In the late night period, this proportion is 28%, a small proportion (and absolute number) of late night crashes which would be targetted by a late night passenger restriction, even if this restriction applied to the whole age group (which is considered unlikely). This issue is discussed in more detail in the next section.

FIGURE 18

18 - 20 YEAR OLD DRIVER INVOLVEMENTS IN CASUALTY CRASHES BY TIME PERIOD AND VEHICLE OCCUPANCY VICTORIA, 1990 AND 1991

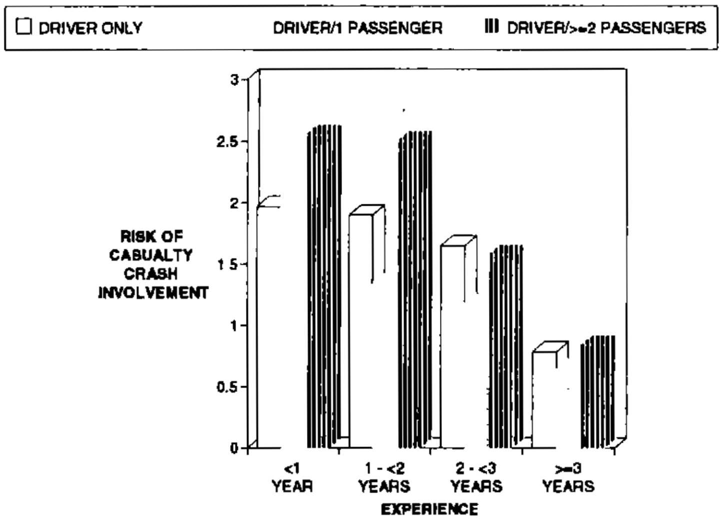


5.3.2 The Riskiness of Young Drivers Accompanied by Passengers

When novice driver crash frequencies, controlling for the number of passengers in the car, are adjusted for distance travelled, it provides evidence that novice drivers carrying two or more passengers operate at a higher level of risk than when driving solo or with one passenger in the car (refer Figure 19).

FIGURE 19

RISK OF CASUALTY CRASH INVOLVEMENT (PER MILLION KILOMETRES) BY DRIVER EXPERIENCE AND VEHICLE OCCUPANCY



However, there is a strong time of day effect on this level of risk, as the following two graphs demonstrate. Figure 20 presents risk estimates by vehicle occupancy for the hours 5am to 10pm, a period excluding what could be considered to be the "late night" period, that is, a potential nighttime driving restriction period. As the graph demonstrates, there is little variation in crash risk for any driver group as a function of vehicle occupancy.

FIGURE 20

RISK OF CASUALTY CRASH INVOLVEMENT (PER MILLION KILOMETRES) BETWEEN 5AM AND 10PM BY DRIVER EXPERIENCE AND VEHICLE OCCUPANCY

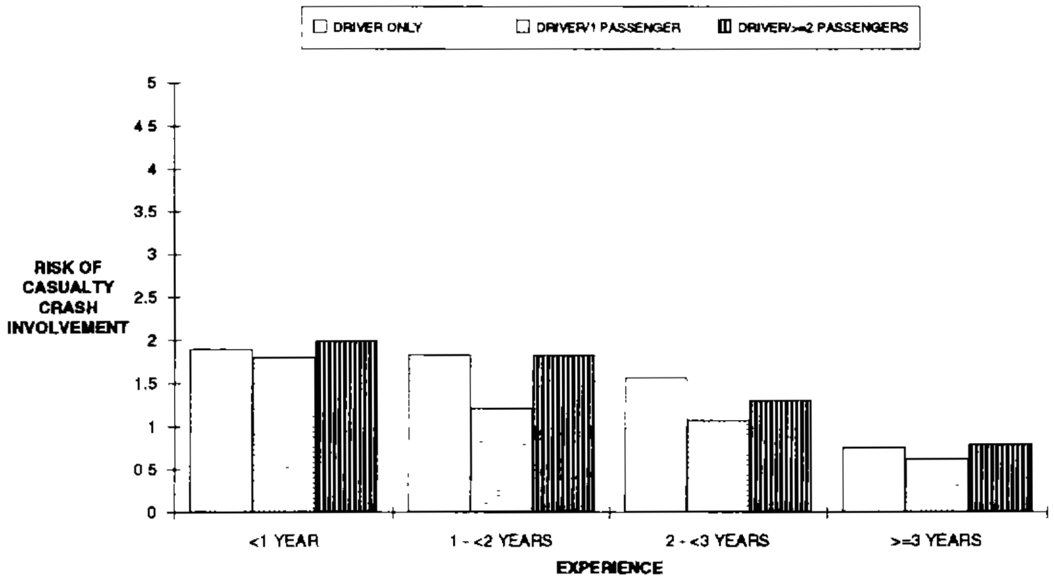
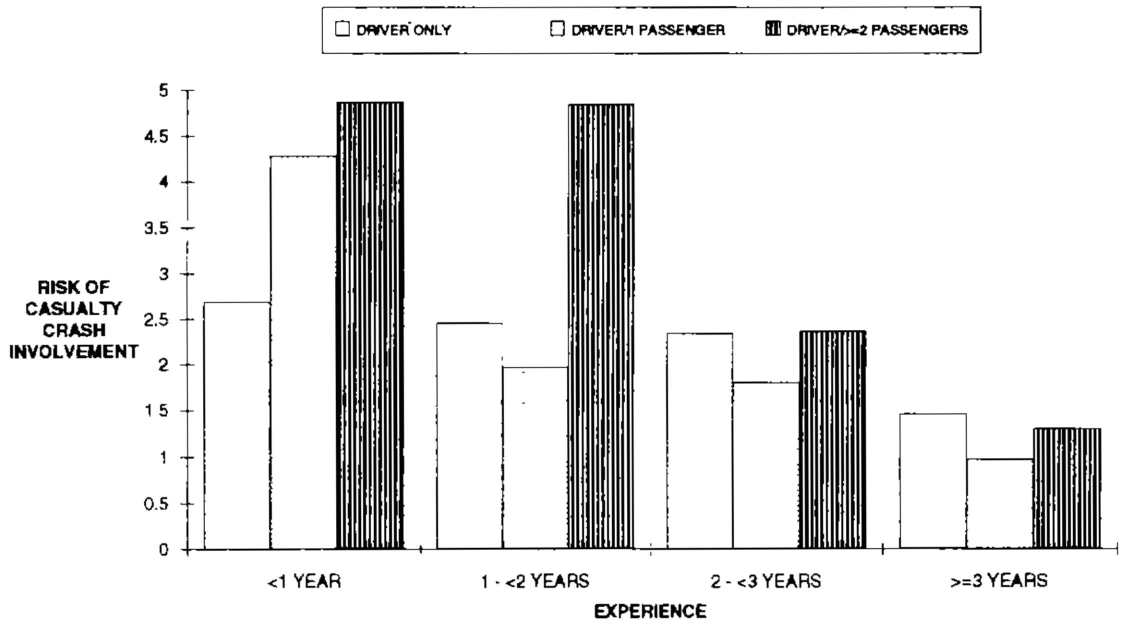


Figure 21 presents crash risk by vehicle occupancy for the late night period (10pm to 5am); the increase in crash risk with the carriage of passengers for the two driver groups with the least experience is very marked.

FIGURE 21

RISK OF CASUALTY CRASH INVOLVEMENT (PER MILLION KILOMETRES) BETWEEN 10PM AND 5AM BY DRIVER EXPERIENCE AND VEHICLE OCCUPANCY



Thus, based on these data, during the bulk of the day, a passenger restriction will not make young drivers barred from carrying passengers any safer (that is, their level of risk will remain essentially the same). However, every banned passenger in this period who consequently becomes a driver will produce increased exposure, and hence generate an increase in aggregate driver risk and therefore an increase in the number of crashes. While these crashes should theoretically produce fewer casualties, the actual outcome of any particular crash is subject to a range of factors which may not produce any crash severity benefits.

In addition to potential benefits being confined to only a limited part of the day, the second major problem is that there are no data available to model the effect on driver exposure (and especially young driver exposure) of the implementation of such a restriction in the late night period alone. Based on Victorian data, restricting a novice driver to only one passenger in the late night period lowers the average novice driver's risk of crash involvement by some 12%. A relatively low rate of exposure transfer by passengers would offset this level of risk reduction and result in a nett disbenefit in this time period.

Barring the carriage of passengers by novice drivers **completely** in the late night period generates larger reductions in crash involvement risk but, at the same time, increases the potential for exposure transfer. In these circumstances, the risk of novice driver crash involvement is reduced by:

- 45% for novice drivers currently carrying two or more passengers

- 37% for novice drivers currently carrying one passenger.

However, the equity and viability of a total restriction on the carriage of passengers by novice drivers is questionable. Additionally, the potential for exposure transfer by the passengers of young drivers increases, as all passengers would be affected.

In addition to exposure transfer by passengers, the effect on the exposure of other persons (e.g. parents) and the possibility of exposure and/or behavioural changes by the original driver also needs to be taken into account. Thus, there are a number of elements for which reliable data are required in order to model the likely outcomes of a passenger restriction. This is in direct contrast to a nighttime driving restriction in which the direct safety benefits to be derived from such a measure are proportional (but not necessarily linear) to the amount of exposure reduced. **Given that the elevation of crash involvement risk when carrying passengers is confined to the late night period, it would appear that a nighttime driving restriction should always be preferred to a passenger restriction on the basis of first principles.**

At a general level, the information presented above is sufficient to indicate that an exposure reduction countermeasure restricting the carriage of passengers by young and/or inexperienced drivers is unlikely to be effective. Whether it has some deterrent or punitive value as a sanction for young drivers who have committed traffic offences is not known; given the marginal nature of the intervention and the difficulties of enforcement, the value of such an approach resides more in it being one element of an integrated and comprehensive graduated licensing system rather than its independent value as a young driver crash countermeasure.

5.4 LICENSING AGE

Raising the legal licensing age could be viewed as the ultimate method for reducing the opportunity for young people to be involved in crashes as drivers. Despite the centrality of licensing age to young driver safety (and particularly young driver crash frequencies), however, the licensing age issue is only infrequently addressed in its own right in the literature (Drummond, 1989).

Harrington (1972) confounded crash frequency with crash risk in his assessment of the evidence for raising the Californian driver licensing age. He concluded that·

> ".......the average number of accidents showed little change in the first four years of driving........(therefore).........the difference between the accident means of 16-17 year olds and 18-19 year olds do not support increasing the licensing age"

This is a surprising conclusion on two counts:

a) drivers aged 16-17 years had 17% more reported crash involvements than when they were 18-19 years of age.

b) although information on exposure (mileage driven) was not collected directly in the study, it was indicated that exposure increased with increasing driver age. This would have the effect of reducing the risk of crash involvement as driver age increased.

Coincidentally, a paper published in the same year, 1972, confounded a further two issues which are central to a discussion on licensing age, viz, public health outcomes and crash risk. Cameron (1972) defined the optimum age for driver licensing as that which achieves a balance between public health and mobility. However, he went on to say that:

> ".......the young driver.......is innocent until proven guilty. That is, we should not deny driving privileges to 16 or 17 year olds unless they can be shown to be more dangerous than 18 year olds. If they are no worse, they should be permitted to obtain driving licences."

Such a stance overlooks the fact that there is a public health disbenefit flowing from the increased exposure of younger (than current licensing age) drivers. Further, there is evidence that such a disbenefit is not overcome by subsequently reduced crash risk due to the accumulation of more experience. Drummond (1986) evaluated the effect of the different licensing ages in the various Australian States, controlling for differences in levels of ambient safety and crash reporting rates by standardising the crash involvement rates of 26 to 59 year old drivers and accordingly adjusting young driver crash rates. It was found that in other States (with lower licensing ages) the additional crashes resulting from allowing persons to drive below age 18 were not offset by their lower crash rates at ages 18-20. Furthermore, the proportion of 18-21 year olds who held a licence in Victoria was lower than that in most other States. It was concluded that the higher licensing age results in a nett road safety benefit (in public health terms), even though the crash involvement rate of 18 and 19 year old drivers in Victoria is generally higher than that of first and second year drivers in other States.

Hurst and Badger (1987) investigated the same question using a different method of analysis and concluded that, from a public health perspective, a higher licensing age should probably be chosen. However, they also pointed out the need for a systems approach to be adopted in order to determine the actual effect of exposure denial to young drivers, including the extent to which this potential exposure is replaced by other drivers. Williams and Lund (1986), reporting an earlier U.S. study, provided further evidence of a nett public health benefit from higher licensing ages. A recent article which examined Canadian data concluded that, because drivers aged 16-18 years have the highest injury crash rate, the Canadian licensing age should be raised to 18 years (Laberge-Nadeau, Maag and Bourbeau, 1992).

Waller (1988) took the contrary view by noting that proponents of a raised licensing age fail to take two important issues into account, viz:

- the costs associated with reducing the mobility of 16 and 17 year olds and,

- the need to address the higher error rate associated with the early stages of learning to drive

It is difficult to take reduced mobility costs of younger people into account, however, when they are never quantified. While Waller cites three instances of mobility value for 16 and 17 year olds, namely, improved employment opportunities, reduced parental chauffeuring and the ability to participate in after-school activities, there is no evidence presented to support the proposition that this value is both positive and substantial.

The House of Representatives Standing Committee on Road Safety (1982) noted that the strongest argument in favour of reducing the licensing age is that 18 years of age is also the legal drinking age. The theory of this approach is that the accumulation of experience for a year or two before being legally allowed to drink is a good idea. However, Drummond (1987a) concluded that a positive effect, if any, due to the separation of the legal drinking and licensing ages is diluted by under-age exposure to alcohol and swamped by the safety disadvantages of increased exposure.

Graduated licensing systems are sometimes proposed as an intermediate technique for reducing the driver licensing age by imposing additional restrictions on younger drivers as a means of offsetting the additional crashes from a lower licensing age. There is some evidence that even very severe graduated licensing restrictions are not sufficient to prevent an increase in crashes if the licensing age is lowered (Drummond, 1986), but further work in this area may be warranted.

It is perhaps appropriate that this section concludes by quoting from Drummond (1989), a quote which captures the essence of the licensing age debate:

> "In summary, the choice of licensing age is a crucial determinant of the public health outcomes of young driver driving. However, licensing age is often viewed as a given in any jurisdiction rather than a variable which can be manipulated to achieve optimal safety outcomes. It is an issue which transcends the road safety perspective but, while the benefits in terms of accident reduction can be reasonably estimated, there is little information on the value of novice driver mobility to be used for comparative purposes."

5.5 LEGAL DRINKING AGE - ZERO BAC*

* While the actual reduced BAC levels vary across States, the term Zero BAC is used for convenience.

One graduated licensing element which is common to all Australian States is the requirement for novice drivers to comply with either a zero or reduced BAC limit. There have been a limited number of evaluations of such requirements in Australia. While the evidence of specific effectiveness is not conclusive, this should be taken to indicate that there is probably room for improvement in the application of such requirements rather than support for the contention that reduced BAC laws for novice drivers are unnecessary.

Haque and Cameron (1987) evaluated the effect of the 1984 introduction of Zero BAC legislation in Victoria. They found a 4% reduction in serious casualty crashes during "high alcohol hours" which was not statistically significant. It was not possible to disentangle the known lack of statistical power in the analysis from the possible effect of the legislation; thus, the -4% measured effect could not be attributed to the intervention rather than chance.

Maisey (1984) evaluated the effect of the lowering of the statutory alcohol limit for first year drivers from 0.08 to 0.02 gm/100ml. All nighttime casualty crashes and casualty crashes on Thursday, Friday and Saturday nights were used as surrogate measures of alcohol-related crashes. Daytime crashes and crashes involving older drivers were selected for comparison purposes. There was a 17% nett reduction in the number of nighttime casualty crashes involving drivers under the age of 18 years, but this reduction was not statistically significant.

Smith (1986) evaluated the introduction of lower BAC limits in three Australian States (Tasmania, South Australia and Western Australia) using relatively simple evaluation designs and analysis techniques The comparisons were all very coarse (the reduced BAC limits were experience-based but the analysis was age-based), but significant reductions in the hypothesised direction were found for some comparisons. As noted, attribution of such effects to the intervention should be (very) tentative.

It should be noted that Zero BAC legislation can be evaluated and/or supported in other, less formal ways. While the only 'evidence' tends to be anecdotal and/or derived from first principles (e.g. the lower the BAC of the driver, the better it is from a road safety perspective), such evidence has been used extensively in the policy domain (and much more so than the formal, quantitative evaluations). There is a belief that Zero BAC legislation is being effective in the following three ways:

- at the behavioural level, it is a possible motivating factor and/or a justification for the modification of drinking behaviour. That is, it provides an explicit reason or incentive to modify alcohol use patterns in circumstances where the young driver will be driving.

- in addition to those who comply with the zero BAC requirement and as a (partial) outcome of behavioural change, the existence of such a requirement is thought to shift the BAC distribution of novice drivers towards the origin.

- having established this foundation, the benefits of a Zero BAC requirement may continue (to some degree) after formal compliance with the requirement is no longer necessary. Compliance with the spirit (and perhaps the letter) of the requirement does not then rely on the perceived risk of detection and/or punishment; rather, such "safe" behaviour becomes self-regulated. This is what Elliott (1992) termed "compliance beyond coercion".

There have been a variety of evaluation studies conducted in the United States on the effect of either lowering or raising the legal drinking age. Such studies have used a variety of methods and a range of evaluation criteria but the consensus of these studies is generally that lowering the legal drinking age leads to an increase in target group crashes while raising it leads to a decrease in the number of target group crashes (see, for example, Brown and Maghsoodloo, 1981, MacKinnon and Woodward, 1986, Williams, 1986, Wagenaar, 1981, Womble, 1989). However, it is unrealistic to conclude that such a legislative change is a panacea for alcohol-related young driver crashes and, by extension, the solution for the overinvolvement of young drivers in crashes.

This point has been made by Williams (1986) who noted that the specific benefits potentially attributable to alcohol purchasing age changes have been derived in a set of circumstances which represent a much more comprehensive anti-drink driving strategy. Thus, this particular countermeasure targetting younger drivers is generally one measure in a package of road safety initiatives. The potential synergism of multi-facetted approaches to road safety problems should, therefore, not be overlooked.

Smith, Hingson, Morelock, Heeren, Mucatel, Mangione and Scotch (1984) indicated that legislative change by itself may not be sufficient. While this is probably true for all age groups and different types of countermeasures, it may be particularly relevant to a young driver, alcohol-related countermeasure. The authors report the results of surveys in which, after the legal drinking age had been raised from 18 to 20 years, approximately one-third of 16 to 18 year olds were not asked for proof of age at point of purchase and about 50% of 16-18 year olds were able to have other people buy alcohol on their behalf.

The relevance of the above two points, viz, a multi-dimensional approach and the possible insufficiency of a legislative change alone, are demonstrated in the set of figures presented below. Table 2 shows the proportion of fatally injured (car) drivers with illegal BACs by age group and year in the United States (source: IIHS (1992)).

TABLE 2

PROPORTION OF FATALLY INJURED CAR DRIVERS WITH ILLEGAL BLOOD ALCOHOL CONCENTRATIONS* BY AGE GROUP AND YEAR, UNITED STATES

	Driver age group		
	16-20	21-30	31+
1980	53	63	48
1981	50	63	44
1982	49	63	42
1983	46	61	39
1984	41	56	38
1985	35	54	36
1986	37	56	35
1987	29	55	36
1988	31	56	34
1989	33	53	34
1990	33	56	35
1991	33	55	34

* **Illegal BAC = 0.10 percent or higher**

There are two ways of looking at the above table. The first is to note that there appears to be a downward trend in both the youngest and oldest age group over the time period: for 21-30 year old fatally injured drivers, the proportion with illegal BACs is both relatively stable and very high.

However, the second way to look at the table (and the reason why it was presented) is to note that, in recent years, one in three fatally injured drivers under 21 years of age in the United States has had a blood alcohol concentration of 0.10 percent or higher. This outcome is much worse than it may superficially appear because all of these drivers are below the current legal drinking age in the United States and the threshold for an illegal BAC level is twice that of Australia (that is, 0 10% compared with 0.05%).

By way of contrast, Table 3 presents aggregated Victorian data for the three years 1990-1992 for fatally injured drivers by BAC category (when BAC known).

TABLE 3

PROPORTION OF FATALLY INJURED DRIVERS BY BAC CATEGORY (WHEN BAC KNOWN) AND AGE GROUP, VICTORIA, 1990 - 1992

BAC Category	Age Group		
	18-20	21-25	26+
Less than 0.051	66%	62%	77%
0.051 or more	34%	38%	23%

(Source: Transport Accident Commission)

In 1983/84 and 1989/90, a small number (9) of U.S. States established lower driver BAC limits for young drivers. In a recent study, Hingson, Heeren, Howland and Winter (1991) investigated the effect of such reduced driver BAC limits on nighttime fatal crashes. While there were large reductions in criterion crashes in both treatment and comparison States, the reductions were significantly larger in the treatment States (34% compared with 26%). The evaluation method can only support indicative outcomes and the authors concluded that the results were suggestive of lower BAC limits helping to reduce target group crashes.

The information presented above suggests that there are three issues which warrant further consideration, namely:

- should the legal drinking age in Australia be raised from 18 years and, if so, to what age?
- to what extent does Zero BAC legislation serve as a de facto raised legal drinking age from a road safety perspective?
- is it possible to increase the (crash reduction) effectiveness of Zero BAC legislation?

From a road safety perspective, the answer to the first question is probably no, and for a number of reasons:

- in the USA, reductions in the legal drinking age to 18 years were relatively short-lived. While 29 States had reduced their legal age from 21 to 18 years between 1970 and 1975, a number raised it to 19, 20 or 21 years from 1976 onwards. As a result of Federal legislation in 1984 tying a legal age of 21 years to Federal highway funding, the large majority of States had a legal age of 21 by mid-1986. All 50 States now have a legal drinking age of 21 years.

  The table set out below (Table 4) shows that legal drinking ages of 18 years have been established in every Australian State for a considerable time.

TABLE 4

ESTABLISHMENT DATE OF 18 YEARS AS THE LEGAL DRINKING AGE BY STATE/TERRITORY

STATE/TERRITORY	ESTABLISHMENT DATE
New South Wales	1905
Victoria	1906
Australian Capital Territory	1929
Northern Territory	1929
Western Australia	1970
South Australia	1971
Queensland	1974
Tasmania	1974

- there are substantial differences in the history, level of integration and elements of the anti-drink driving strategy in the United States and Australia. The legal BAC limit is generally 0.10% in the U.S., double that of the current, uniform level for the general driving population of 0.05% (reduced limits for novice drivers are dealt with below). Australia has pioneered the use of random breath testing (RBT) as the primary enforcement tool which, together with co-ordinated publicity, has succeeded in raising the level of general deterrence. Such an approach is not applied in the U.S.

  As Homel (1988) has noted, there is support for the notion that the general deterrence process for drink-driving has acquired a moral dimension in Australia, due in part to substantial increases in the social unacceptability of drinking and driving.

- in the U.S., there has been a very limited (to date) implementation of lower BAC limits for young drivers. In the nine States which Hingson et al (1991) report as having differential BAC limits, five implemented the lower limit for young drivers **after** the legal drinking age was raised to 21 years.

Doing it the other way around (as would need to be the case in Australia) would be very difficult, particularly if such a change was being recommended on road safety grounds alone. The possibility exists that it would reduce to an either/or decision, that is, one option but not both. Given the great difficulties of modelling the outcomes of significant social changes, it would be risky to change the status quo (especially if there is potential for strengthening the application of Zero BAC requirements).

- in Australian conditions, the potential benefits from a raised legal drinking age would probably be significantly less than those outcomes reported in U.S. evaluation studies.

  It is possible that similar (or greater) incremental road safety benefits could be achieved through strategies to optimise current Zero BAC legislation.

The answer to the second question, "To what extent does Zero BAC legislation serve as a de facto raised legal drinking age from a road safety perspective?", is probably to the full extent in principle, but to a much lesser extent in practice.

In theory, there should be little, if any, road safety difference between young drivers not being able to drink legally (due to a raised legal drinking age) and young people not being able to drink if they are driving (due to the existence of a Zero BAC requirement). A raised legal drinking age would also theoretically prevent young people from being able to drink when they are not driving; while this is not a direct road safety concern, it is possible that road safety may accrue some benefits through transfer effects (if, in fact, the raised legal drinking age has any effect on alcohol use by those aged 18-20 years when they are not driving).

In practice, however, the empirical safety dividends from Zero BAC requirements have been equivocal at best. Nevertheless, based on the information presented above, the logical conclusion is to seek ways to increase the road safety benefits from such legislation by improving it in practice rather than seek to achieve greater effectiveness from an alternative (or supplementary) principle. It should be recognised that the effective application of a raised legal drinking age relies to a much greater extent on the efforts of agencies/agents outside the road safety system.

The third question concerned the possibility of increasing the effectiveness of Zero BAC requirements. There have been a small number of Zero BAC evaluations, all of which have been equivocal in outcome (although, as noted previously, it is possible to evaluate the concept of Zero BAC on first principles).

In the absence of empirical support, the need to examine the application of Zero BAC at the strategic and tactical level is increased. However, there has apparently been little or no direct attention paid to Zero BAC since inception. It would appear that the enforcement of Zero BAC has been subsumed under the general enforcement umbrella of random breath testing. It is difficult to determine what the nett effect of such an approach has been. While it could be speculated that the effectiveness of Zero BAC laws has been substantially diluted as a result of RBT procedures, this may reflect a desire to increase RBT testing throughput which, as one element of the general deterrence process, may have contributed to an overall greater nett benefit. This indicates that there is a need to review priorities for the enforcement of Zero BAC legislation, relative to the enforcement of BAC levels applying to the great majority of drivers.

One of the general principles of effective RBT is the certainty of detection, that is, once in the 'RBT line', the test cannot be avoided (penalties for refusal are high), measurement is both accurate and reliable and the breath-resting process involves no discretion. However, the current enforcement of Zero BAC may involve a greater degree of discretion (both in practice [when dealing with individual drivers] and in principle [individual police officers placing their interpretation on the concept of Zero BAC]) and requires an additional step for the certainty of detection, viz, the knowledge that a differential BAC level applies to the driver being tested.

However, implicit in the above statements is the equivalent desirability of detecting novice drivers with positive BAC levels below 0.05 (that is, those who may not be identified solely on the basis of the BAC reading) and novice drivers with positive BAC levels above 0.05 (that is, those who will always be identified solely on the basis of the BAC reading). The table below (Table 5) presents information on evidential breath tests for Victoria from 1989 to 1992. It shows that the average BAC reading for the youngest age group, all of whom should have been complying with a Zero BAC requirement, is around 0.10%, an average level which is not dramatically lower than that for all other age groups.

TABLE 5

EVIDENTIAL BREATH TESTS BY AGE GROUP AND AVERAGE BAC READING, VICTORIA, 1989 - 1992

Age Group	Number of tests				Average BAC			
	1989	1990	1991	1992	1989	1990	1991	1992
15-19	1688	1644	1323	1147	0.104	0.100	0.101	0.101
20-24	5019	4445	4180	3805	0.118	0.116	0.116	0.116
< 25	6707	6089	5503	4952	0.115	0.112	0.113	0.113
>=25	11357	11595	11098	9923	0.133	0.128	0.127	0.125

(Source: Victoria Police Traffic Alcohol Section)

It is difficult to put these data into a proper perspective because the actual number of novice (Zero BAC) drivers who should have had an evidential test (because their preliminary reading, ignoring operational tolerances, was between 0.01 and 0.05) but didn't, is not known. Without knowing what sampling fraction the above represents of the positive BAC novice driver group (and therefore how well non-compliance with Zero BAC is being detected when the BAC reading is below 0.05%), no conclusions on the effectiveness of enforcement of Zero BAC can be reached. However, the data do show that the average BAC level for (detected) novice drivers is relatively high, high enough to perhaps suggest that, for such drivers, a Zero BAC requirement is an irrelevancy.

If, as has been suggested, Zero BAC is being enforced as an exception rather than a rule, and that it is agreed that this should be changed, there are a number of consequent issues for investigation. These include:

- the extent to which Zero BAC legislation can (and should) be enforced through both general RBT operations and mobile PBT operations.

- the priorities to be assigned to the enforcement of each BAC limit, and the respective benefits and costs likely to be derived from a change to current practices.

- the development of reliable methods for the efficient identification of target group drivers, including the possibility (raised by Police in discussions) of changing the criterion from a person-based to a vehicle-based identifier. That is, vehicle registration procedures would be modified to allow an identifying mark to be affixed to the vehicles registered by drivers required to comply with Zero BAC requirements. Persons driving such vehicles would be required to demonstrate that they do not have to comply with Zero BAC (rather than the converse, as at present).

  It may also be necessary to review operational policies on mandatory carriage of licence. At this stage, South Australia, Tasmania and Western Australia do not have an absolute rule which explicitly requires probationary licence holders to carry a licence at all times. Even in States with mandatory licence carriage for probationary licence holders, it is reasonable to suggest that enforcement of this requirement carries a varying degree of operational discretion. The extent to which such discretion dilutes the deterrent impact of a Zero BAC requirement is not known.

  Information on the rate of licence carriage by driver age/experience and/or P-plate display by novice drivers is not available (Victorian surveys on P-plate display when a Zero BAC requirement was introduced (that is, in 1984) indicated that some 40-60% of 'P-plate' drivers who reported vehicle ownership were not displaying P-plates (Bowen, 1985)).

  The development of any such methods requires substantial discussion prior to implementation.

- the possibility of changing the Zero BAC criterion from (licence) experience-based to age-based (as in New South Wales and Queensland), on the basis that age is a more practical basis for decision-making.

- extending the age range for compliance with Zero BAC (to, say, 25 years of age, as in New South Wales and Queensland) in order to achieve a lower rate of 'true misses' (that is, those with a positive BAC below 0.05% who are not detected committing a Zero BAC offence). This would also potentially reduce the relative road safety costs of a 'true miss', given that such misses would apply, on average, to drivers below 0.05% who are older and possibly more experienced.

- investigating mechanisms for generating general deterrence of non-compliance with a Zero BAC requirement, specifically targetting young and/or inexperienced drivers.

- reviewing RBT procedures in order to achieve higher levels of Zero BAC enforcement with minimum levels of disruption to standard breath testing.

5.6 VEHICLE COUNTERMEASURES

It should be noted that this section deals only with car driving (novice motorcyclist countermeasures are not addressed).

This section concludes with a brief look at two vehicle countermeasures, vehicle power and vehicle transmission type. The review is necessarily brief because both initiatives have received very little technical or policy attention.

5.6.1 Vehicle Power Restrictions

Victoria has implemented a vehicle power restriction for novice drivers as one element of its graduated licensing system. In Victoria, probationary licence holders are prohibited from driving vehicles that have:

- a power mass ratio over 125 kilowatts per tonne or,

- a capacity mass ratio over 3.5 litres per tonne.

It is understood that this measure was partially derived from work reported by Drummond and Healy (1986), indicating that increased vehicle power appeared to elevate the risk of crash involvement for inexperienced and experienced drivers. Table

6 presents the relevant data. This study should be regarded as a preliminary one with only tentative conclusions being drawn because of small sample sizes in the high powered vehicle groups.

TABLE 6

RISK OF CRASH INVOLVEMENT (per million kilometres travelled) BY DRIVER EXPERIENCE AND VEHICLE POWER

Vehicle Power	Time Held Licence			
	<1yr	1 - <2yrs	2 - <3yrs	3+yrs
<150 brake horsepower	2.05	1.79	1.51	0.70
>150 brake horsepower	2.47	1.42	1.29	1.12

By themselves, these data do not appear to provide sufficient justification for the implementation of a novice driver vehicle power restriction as (high) vehicle power does not seem to contribute disproportionately to inexperienced driver crash risk. The concept of a vehicle power restriction across the entire vehicle fleet may have merit, but much more detailed research would be required before valid decisions could be taken.

The second possible 'problem' with a vehicle power restriction is that, if it targets the upper tail of the vehicle power distribution, the probable effect on novice driver crash frequencies would be marginal at best. If results similar to motorcycle power restriction applied to cars, a maximum overall crash involvement reduction of less than 2% could be expected (that is, a 17% reduction in the 10.4% of novice driver crashes involving high-powered (>150 bhp) vehicles). However, it could be argued that driver factors are relatively more important than vehicle factors for car drivers. In these circumstances, the safety benefits to be derived from such a measure would be even less (indeed, if the excess risk associated with higher powered vehicles is due to the type of person who drives such a vehicle rather than the characteristics of the vehicle itself, there may be no crash risk reduction at all. However, there may be a benefit from a lower average crash severity).

Further research would be required to establish the most appropriate vehicle power criteria and the extent to which vehicle power contributes directly to crash involvement (rather than such crash involvement being a consequence of a correlate(s) of (high) vehicle power. However, the marginal potential safety benefits of a vehicle power countermeasure, together with current disincentives (for example, higher comprehensive insurance premiums), indicate that such research is not of high priority.

5.6.2 Transmission Type Restrictions

The licensing condition that a driver is restricted to a vehicle with automatic transmission if the practical driving test was undertaken in such a vehicle has always applied in Tasmania and Queensland. The endorsement of Victorian driver licences for automatic transmission was abolished in July 1984, but subsequently re-introduced in December 1989 (see below).

An automatic transmission vehicle restriction for the period of the probationary licence (unless a second test in a vehicle with manual transmission is subsequently taken or other conditions are satisfied) is an element of the Federal Government's graduated licensing scheme.

A Victorian study (Rogerson, 1989) examined the relative risk of crash involvement by vehicle transmission type by classifying crash involved young drivers into one of four groups relating to transmission type during the practical licensing test and transmission type at time of crash, that is, where A=automatic transmission and M=manual transmission, the four groups were AA, MM, MA and AM. The last group, AM, was the group of most interest. Expected values in each of these four cells were estimated from an on-road exposure survey (although it was noted that licensing transmission proportions obtained in this way were different from a random sample of licensing records).

Results indicated that the AM group comprised some 22% of all young driver crashes (including an overall unknown transmission type category) and had a risk of crash involvement some seven times higher than the other three groups combined (when confidence limits were applied, the relative risk was estimated to be between 0 and 10 times higher). Significance testing indicated that this higher relative risk was "weakly significant" ($p = 0.06$).

It is likely that the use of an automatic vehicle transmission simplifies the driving task and consequently reduces driver workload. It is also reasonable to suggest that this would be of particular benefit to young/inexperienced drivers. While there are a number of issues to be clarified, these data indicate the need for further investigation of the potential safety benefits of driving task simplification and/or aiding, of which the use of automatic transmissions in vehicles driven by young drivers is but one example.

6.0 CONCLUSION

To date, the discussion of exposure reduction countermeasures as a means of reducing young driver crashes has been superficial and fragmented. This report has attempted to place exposure reduction countermeasures in an appropriate context and identified a range of technical and strategic issues which are relevant to a comprehensive and valid discussion of such measures. The road safety system has the immediate capacity to reduce the incidence of crashes involving young drivers by reducing their exposure, primarily through restrictions on the amount of nighttime driving.

As noted in the report, however, this is an area in which there are no "right" answers. Even though most road safety practitioners would place greatest emphasis on the potential public health benefits, a reduction in the number of young driver crashes does not necessarily indicate the best outcome from a community perspective. Ultimately, an effective, efficient and equitable balance must be reached between a range of competing objectives in order to reach a consensus policy position on the desirability of exposure reduction countermeasures as one method for reducing young driver crashes.

On the basis of this review, it appears that young driver exposure reduction measures fall into one of four categories, viz:

- measures likely to be effective but which are unlikely to be implemented, despite strong technical support. In this first category fall measures such as raising the driver licensing age, raising the legal drinking age and nighttime driving restrictions;

- measures which are unlikely to be effective and may, in fact, be disbeneficial, but which have some policy support. Occupancy restrictions would be in this category;

- measures which may be effective, especially if developed further, but which are likely to have marginal effects on young driver crash frequencies. Vehicle power limits fall into this category;

- measures which have the potential to reduce young driver crashes but which may require further research and development. Measures in this category include vehicle transmission type restrictions and Zero BAC legislation.

The alternative strategy, specifically reducing the young driver risk of crash involvement, remains an 'in principle' strategy at this point in time; there are no strategies currently available which have technical support, although research is proceeding.

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