

The contribution of licensing measures to the safety of novice drivers in Germany

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Summary

Despite the introduction of a point demerit system for young drivers and an extensive driver instruction, the accident involvement of young German drivers is still unacceptably high, and therefore further measures are called for. Measures that have recently raised much interest in Germany are post-qualification restrictions and accompanied driving.

Important issues in the German discussions are:

- how effective have several restrictions shown to be?
- what safety gains are to be expected if such measures are introduced in Germany?
- will these measures be acceptable to the public in general and the novice drivers in particular?
- and what kind of side effects are to be expected?

The SWOV was commissioned by BASt (Bundes Anstalt für Strassenwesen) to review the literature on research into the effectiveness of post-qualification restrictive measures for novice drivers, and the effectiveness of accompanied driving both as part of the driver training and as part of post-qualification restrictions.

The study gives a short description of the problems associated with young drivers and provides a theoretical framework on which the safety potential of measures such as post-licence restrictions and accompanied driving can be assessed. The study deals with four systems: driving licence on probation, driving licence with restrictions only, two phase driving licences and accompanied driving. Of each system, first the prime features are presented, followed by a discussion as to which contributing factors to young driver accident involvement are influenced, and a discussion of the evaluation results of implemented systems.

In the the current system in Germany most but not not all contributing factors to young driver safety are dealt with. Those that are not addressed are:

- the occurrence of overload due to low automation;
- slowly developing skills such as hazard perception;
- overestimation of skills;
- error prone driving routines.

These limitations could be overcome by - in addition to the current measures - the introduction of:

- a compulsory second test after the probationary period:
 - testing the level of automation (behind the wheel testing);
 - testing the level of theoretical higher order cognitive skills (such as hazard perception, anticipation);
- 0 promille alcohol during the probationary period;
- a voluntary driving curfew (on the assumption that a compulsory curfew; will not be acceptable to the public;
- accompanied driving (voluntary) to practice for the second exam.

Contents

1.	<i>Introduction</i>	7
2.	<i>Young/novice driver behaviour, the limitations of driver training and the potential of provisional driving licences</i>	9
2.1.	Young driver characteristics	9
2.2.	The role of driver training	9
2.3.	The inherent limitations of driver training	11
2.4.	Important subgroups	11
2.4.1.	Young and/or new to the road	11
2.4.2.	Gender differences	12
2.4.3.	Lifestyle differences	12
2.5.	Safety potential of provisional driving licences	13
3.	<i>Driving licence on probation</i>	15
3.1.	Why could it work: reduce unsafe violations	15
3.1.1.	Traffic Violations and accident risk of young drivers	15
3.1.2.	General prevention	16
3.1.3.	Efficacy	17
3.1.4.	Identifying and treating the dangerous young driver	17
3.2.	Side effects	19
3.3.	Conclusion	20
4.	<i>Driving licences with restrictions only</i>	21
4.1.	Why could it work: prevent overload	21
4.1.1.	High exposure	21
4.1.2.	Overload and novice drivers	21
4.1.3.	Self assessment	22
4.1.4.	The objective of restrictions	22
4.2.	Effectiveness	23
4.2.1.	Speed	23
4.2.2.	Night curfew	23
4.2.3.	0 - promille	24
4.2.4.	No passengers	25
4.2.5.	Vehicle power restrictions	26
4.2.6.	Combinations	26
4.2.7.	Restrictions in combination with a point system	27
4.3.	Side effects	28
4.4.	Conclusion	28
5.	<i>Two phase driving licences</i>	29
5.1.	Why could it work: teach slowly acquired skills	29
5.2.	Skill training in Second phase	29
5.2.1.	Norway	29
5.3.	Cognitive higher order skill	30
5.3.1.	Europe	31
5.3.2.	Australia	32
5.4.	Conclusions	32

6.	<i>Accompanied driving</i>	33
6.1.	Why could it work: guide and protect	33
6.2.	Different forms	33
6.2.1.	Laymen's education	33
6.2.2.	Apprentissage	34
6.2.3.	Restriction	34
6.3.	Norway: experience with laymen's education	34
6.4.	Sweden: experiences with laymen's education	35
6.5.	France: experiences with apprenticeship	35
6.5.1.	Training safety	36
6.5.2.	Driving safety after licensing	37
6.6.	Belgium: experiences with apprenticeship	39
6.7.	Conclusions	40
7.	<i>Social acceptance of different forms of provisional driving licences</i>	41
7.1.	The meaning of car driving	41
7.1.1.	Psychogram of the young German driver	41
7.1.2.	Identity	41
7.1.3.	Culture	42
7.1.4.	Implication	42
7.2.	Associated Measures to facilitate social acceptance	43
7.2.1.	a lower instruction age	43
7.2.2.	Insurance reduction	44
7.3.	Conclusions	45
8.	<i>Discussion and conclusions</i>	46
8.1.	Introduction	46
8.2.	Effectiveness of the different options	46
8.3.	Implications for Germany	48
8.3.1.	Night curfews	48
8.3.2.	Alcohol limit	49
8.3.3.	Estimation of the effectiveness of apprenticeship in Germany	50
8.4.	To whom the measures should apply	50
8.5.	Conclusion	51
	<i>Literature</i>	52

1. Introduction

Since the 1960s it has been acknowledged that young drivers in the 18-24 age group run a greater risk of being involved in an accident. The casualty figures show that in youngsters, death in traffic is the prime cause of death, of which a large proportion are car drivers. These figures call for effective countermeasures, especially in the field of driver training and licensing requirements. The prime task of driver training is to 'produce' safe drivers. Licensing requirements determine, who is going to drive, and under which conditions and what restrictions/measures will apply.

In Germany driver training is well developed and may even be the most extensive in Europe (Lynam and Twisk, 1995 and Neuman-Opitz et al 1994)). Since 1986 a driving licence on probation has been introduced aiming to foster a safety oriented attitude in novice drivers (general prevention) and to detect those novice drivers that are in need of improvement courses (special prevention). After committing only one serious traffic offence or two minor ones, a novice driver has to participate in a driver improvement course. The introduction of this driving licence on probation has led to a 6% accident reduction for males and a 4% accident reduction for females (Weissbrodt, 1989).

Despite these measures, accident involvement of young German drivers is still unacceptably high, and therefore further measures are called for. Measures that have recently raised much interest in Germany are post-qualification restrictions and accompanied driving.

Important issues in the German discussions are:

- how effective have several restrictions shown to be?
- what safety gains are to be expected if such measures are introduced in Germany?
- will these measures be acceptable to the public in general and the novice drivers in particular?
- and what kind of side effects are to be expected?

This study aims to review the literature on research into the effectiveness of post-qualification restrictive measures for novice drivers, and the effectiveness of accompanied driving both as part of the driver training and as part of post-qualification restrictions. Information will be sought on side effects of the measures. The outcomes of the evaluation studies are also assessed on methodological grounds.

As it is likely that both the feasibility of the introduction of these instructions and the realisation of their safety potential is dependent on social acceptance of the measure, information will be sought on the social acceptance of the measures in the countries in which the measures have already been implemented (e.g. Belgium, U.S, Australia, New Zealand, Norway, Sweden).

The study is structured as follows. Chapter 2. gives a short description of the problems associated with young drivers and provides a theoretical framework on which the safety potential of measures such as post-licence restrictions and accompanied driving can be assessed.

The subsequent chapters 3, 4, 5, 6 deal respectively with, driving licence on probation, driving licence with restrictions only, two phase driving licences and accompanied driving. These four chapters are structured as follows. First the prime features of the system are presented, followed by a discussion as to which contributing factors to young driver accident involvement are influenced, and concludes with a discussion of the evaluation results of implemented systems.

In chapter 7 information is presented on the conditions under which systems proved to be successful or failed, such as social acceptance, police enforcement, political support or rejection. Relevant questions are: what features led to acceptance or rejection of the system, how was the measure 'packaged' and how has that influenced acceptance.

Also the possible effects are discussed: both positive and negative, such as delayed licensing, hit- and run accidents, unlicensed driving, and also the effect it may have on social and economical opportunities of novice drivers. Attention will be paid to the question how these measures may induce frustration in young people and may lead to compensatory behaviour. In the concluding chapter an assessment will be presented of the safety potential of restrictions and accompanied driving in Germany, whereby factors affecting social acceptance will be discussed.

2. Young/novice driver behaviour, the limitations of driver training and the potential of provisional driving licences

2.1. Young driver characteristics

Driving performance of young/novice drivers falls short in many aspects, such as adequate speed choice (Van de Velde Harsenhorst & Lourens, 1988,1989; Forsyth, 1992b and Schlag et al 1986), visual search (Mourant and Rockwell, 1971; Cohen, 1985) and safety margins (Quimby and Watts, 1981). These inadequacies may certainly contribute to the high accident risk of young/novice drivers. However, the next question is: “why do they drive in this manner?” There are many factors that are contributing to inadequate performance on the one hand and accident risk on the other hand. These factors are associated with:

- immaturity (Hale & Glendon, 1987);
- limited hazard perception skills (Soliday & Allen, 1972; Brown, 1982);
- high risk acceptance (Moe & Jensen, 1993);
- overestimation of driving skills (Moe, 1987) in combination with underestimation of the complexity of the traffic situation (Matthews and Moran,1986; Brown & Copeman, 1975);
- lack of robust driving routines;
- high exposure: youngsters drive a lot, especially young men often under more dangerous conditions such as the weekend nights (Weissbrodt, 1989; Forsyth 1992b; Van Kampen, 1989);
- overload due to limited capacity to attend to all stimuli (Milech et al. 1992);
- Life style: explore new situations, seek company of friends, show off and enjoy competition, conform to peer group standards.

2.2. The role of driver training

Driving is a complex task that requires fast responses to fast changing situations, in which attention should be paid to many aspects simultaneously. Driving is not complex in terms of vehicle control, such as steering, braking, shifting gears etc. The complexity of the task is more of a cognitive nature. It implies the ability to detect and evaluate dangers and to foresee that an apparently ‘normal’ traffic condition, may change in seconds into a ‘dangerous’ one. This is a cognitive ability that needs to be developed. Moreover its application should also be more or less automatic, otherwise, the task of driving may exceed the resources of human attention and awareness. As a result drivers may become exhausted after only a short while (Shiffrin & Schneider, 1977).

Furthermore, behaviour that is not automatic (= needs attention and controlled processing) is more prone to errors, in conditions of high information load and time constraints. This proneness to errors is intensified by stress factors. Stress factors negatively affect driver performance, especially the performance of inexperienced drivers. Examples of stress factors with known effects include haste, tiredness, but also alcohol in low doses.

With experience, that is practice on the task, driving (not only vehicle handling but also higher order skills such as hazard perception and

application of traffic rules) becomes automatic, so that attention can be devoted to other matters. "The major difference between novice drivers and experienced drivers is that the novices have an inadequate repertoire of routine actions (automated actions) at their disposal therefore have to perform many driving activities at the lower level of functioning of conscious behaviour" (Heinrich, 1990).

The other side of the concept of automation is that it can lead to inadequate and inappropriate behavioural routines becoming 'ingrained'. Erroneous routines will easily creep in, if feedback on the quality of the performance is low. Not only routines have to be trained. It is even more important to teach, to which classes of traffic situations these routines apply. Or to state it more broadly, training experiences in specific traffic situations need to be generalised to other similar traffic situations (Rothengatter, 1985). The prevention of errors in these generalisations might be of more importance to traffic safety than to prevent errors in the action routines themselves.

The above illustrates the important role of feedback with the correct acquisition of new skills. Learning through experience is the adaptation of behaviour because of feedback.

In the daily traffic environment, feedback will not consistently 'occur' in every situation. Furthermore as a car driver, one is in a physical and social sense isolated from others. Physical isolation can lead to a driver not noticing signals from outside. Social isolation can lead to feelings of 'detachment' from the rest of the system, and this may reinforce the illusion that one is invincible (Hale and Glendon, 1987). Moreover, the novice driver lacks the cognitive ability to identify and evaluate the signals that might suggest inadequate performance on his part.

This indicates that 'learning' on one's own is seriously confined due to the absence of essential feedback. It is unlikely that learners will receive appropriate feedback and this may lead to reinforcement of undesirable driving behaviour.

In contrast, in driver training, the instructor can provide immediate feedback and can show the pupil the correct behaviour. This teaches the correct behaviour at the initial stage of skill acquisition, before the bad habits are formed and ingrained. In this respect it is to be expected that driver training is superior to 'practice on one's own'. Furthermore, the instructor may play an important role in structuring the task of the learner, so that his task load is not so great that it makes him unable to assimilate and process the feedback. He may organise his instruction, so that skill acquisition is built up hierarchically and in modular fashion. First the basic skills must be learnt, after which more complex skills can be trained. The learning process should therefore not simply aim to having the novice imitate the expert's example. He should learn in a stepwise progress, with a set strategy per phase adapted to the level of skill acquired.

Additionally, the instructor may be an influential model (Bandura, 1977) for the transmission of 'safety related behaviour and attitudes'. The small number of studies that relate to the learning of safe behaviour shows that the instructors of security devices represent the most important factor in explaining the difference between groups of students with respect to the use of security devices (Hale & Glendon, 1987). There is no known study regarding such effects about the behaviour of drivers. It is recommended that we study the effects of 'model behaviour' on the behaviour of young

drivers. An obvious object of study in this context could be the 'driving behaviour' of driving instructors.

2.3. **The inherent limitations of driver training**

A driver training course is subject to inherent limitations. For example, there is limitation in course duration. The skill must be acquired in a restricted number of lessons. Certainly after a limited period of lessons taken, one may assume that 'learning' as a process does not stop. The novice learns new behaviour and so modifies behaviour (De Velde, Harsenhorst & Lourens, 1988). Particularly higher order skills, such as taking decisions, develop slowly and require much more practice. Apart from limitations in time, a limitation in circumstances is also applicable. Not all critical traffic situations present themselves during the lesson time and consequently after the driving exam the novice driver has to master and cope with these situations on his own.

So, after the driving exam, teaching may stop, but learning continues. Some studies have addressed the question of how the novice driver responds to this period himself with respect to attitude development, skill developments, and developments in mobility.

The results show that:

- driving style is changing considerably over time: driving speed goes up and errors in driving routines develop (De Velde Harsenhorst & Lourens, 1988,1989; Forsyth, 1992b, Rolls et al, 1991);
- Driving performance falls below test standards after qualification (Vissers, 1990; Forsyth, 1992b, Rolls et al, 1991).

So these findings suggest that only improving driver training will not be sufficient. Besides the improved driver training, in the post-exam period safe driving circumstances should be created to enable young/novice drivers to gain experience safely and to stimulate a safety-oriented attitude. A problem of all drivers or only a subgroup?

2.4. **Important subgroups**

2.4.1. *Young and/or new to the road*

Mayhew and Simpson (1990) reviewed studies on the relative importance of factors associated with age and driving experience in collision involvement. They conclude: "given the apparent importance of the issue, relative few studies have actually attempted to disentangle the effects and have clearly established the separate roles of youthfulness and experience in collision involvement. Those few studies that have been conducted defined driving experience in different ways and most often produced contradictory results. Several studies have found that age is the more important factor in collision involvement; others have shown that the accumulation of driving experience plays the dominant role, and still others contend both factors - age and driving experience - in collision rates. While no clear picture emerges the review of the literature suggests that both age related factors and lack of driving experience account for some of the higher crash rated of young drivers- the relative contribution of these factors remains unknown. This is partly attributable to the fact that other mediating factors in the relationship,

such as exposure and self-selection are seldom accounted for in the analysis” (p. 92).

Mayhew and Simpson consider the relative contribution of age and experience important as “changing demographics and licensing patterns (in Canada) indicate that older people constitute a relative larger share of the new driver population.”

2.4.2. *Gender differences*

The above mentioned factors are applicable to all young and novice drivers. However not all young drivers have the same accident risk and some identifiable groups of young drivers are more at risk than others.

One such a subgroup is the male young driver. His accident risk is about twice as high as that of the young female driver (Twisk, 1994).

The difference becomes even more distinct in specific driving circumstances, such as driving during the weekend-night.

2.4.3. *Lifestyle differences*

Also more detailed studies of background variables show that at a group level, particular values, preferences, attitudes and behaviours (lifestyle) are associated with good or poor traffic safety records.

These studies have shown that deviant driving styles may be concentrated in small sub groups (Jonah, 1986b), such as DWI (Elliott, 1987), and that motives for DWI differ so widely that marketing techniques should be used to become more acquainted with the target groups in the interest of effective education (Lastovicka et al, 1987). Furthermore, within these subgroups combinations of risky traffic behaviour occur, e.g. no use of safety belts, DWI, high speed. Jonah and Dawson (1987) call this the ‘risk syndrome’. A large scale four-year longitudinal study showed that young people who became involved in motor vehicle collisions were more likely than non-crash involved youth to engage in a variety of high risk, and health compromising behaviours such as drug use, heavy drinking and other negative health behaviours (Beirness et al, 1993). Also a relationship with petty crime was found (Maron, et al 1986, cited in Jessor, 1987).

A German study showed that the presence of extra driving motives was connected with particular lifestyles that differed in leisure preferences, choice of clothes and music choice (Schulze, 1990). A Swedish study managed to relate lifestyle to accident risk. Lifestyle groups accident risk (accidents per licence holder) varied from 150% over-risk and 75% under-risk (Gregerson and Berg, 1993). This pattern may be the result of different levels of exposures between the lifestyle groups but also reflect differences in driving style.

In keeping with previous work, Ingham et al (1994) reported that there is a large within age group variation, showing that about 2/3 of the young driver group did *not differ* from the older more experienced age groups, with respect to self reported violations, attitudes and at fault accidents. Roughly about one-third are particularly risky. A comparison of the most safe young drivers with the least safe drivers showed that:

- there were no clear differences with respect to social class or level of education received;
- unsafe drivers had higher ratings of their own ability;
- they did not believe that they were unsafe, and they underplayed their own potential contribution to accident involvement

- they are more affected by social influences such as the presence of passengers;
- differences between the group are related to motivation rather than to (lack of) skills.

It may be concluded first, that different lifestyles are associated with different accident risks, and that prevention could aim at the underlying personality and environmental factors that predispose particular groups to risk-seeking behaviour. It also implies that preventive measures do not need to be related to traffic and participation in traffic, but may focus on an entirely different field.

Secondly, prevention may already start at the pre-driver training stage, for instance in secondary school. Ingham et al (1994) developed a teaching module aimed at affecting social norms about safe driving and directed at the final year of secondary school. An evaluation study showed that especially those youngsters at risk (that is with negative safety attitudes) changed towards more positive attitudes.

2.5. Safety potential of provisional driving licences

The application of a provisional driving licence is about the only possibility to assure safe driving conditions after licensing. Such a provisional driving licence is characterised by measures directed at *novice drivers*, that do not apply to holders of a full driving licence.

The objectives of provisional driving licences are:

- a. to accomplish a protected (safe) learning environment after licensing;
- b. to safeguard and to automate correct driving routines (e.g. correct visual search, accurate vehicle skills etc.);
- c. To foster a safety oriented attitude, which implies that novice drivers do not engage in wilfully committed traffic violations such as DWI, red light violations and speeding;
- d. to teach and train higher order cognitive skills such as hazard perception and anticipation.

Taking the inherent limitations of driver training into account, it seems likely that provisional driving licence systems combining all four objectives will be the most effective in reducing accident involvement.

To achieve these objectives there are several components used in provisional driving licences, single or in combination. These are:

- the application of restrictions, to reduce exposure;
- the application of special enforcement regimes (penalty point system). Often in these situations one speaks about a licence on probation. That is if one does not misbehave, during a limited period, the probationary driving licence turns into a full licence;
- additional training (second phase in education);
- continuous guidance (accompanied driving).

A combination of components with the identified problem fields in young/novice drivers enables us to understand how these components may contribute to more safe novice drivers (see *Table 2.1*). The cell fillings are not based on empirical findings but are estimates of the potential of a component to positively affect the phenomenon. The table provides a guideline to discuss the different programs that empirically have been tested.

The complete programs can often not directly be compared as the elements of programs differ as well as the criteria used in evaluations.

Phenomenon	Cause	Provisional driving licence				
		Delay	Point	Restrict	Train	Guide
Immaturity	biological development	+++	+	+	0	+
Limited hazard perception skill	insufficient practice	+	+	+	+++	++
Overestimation skills	youthful optimism	+	0	+	+	++
Overload	limited automation in combination with high task demands	0	0	+++	0	++
Error prone driving routines	lack of feedback	0	0	0	++	++
High risk acceptance	a. not recognised	+	0	0	++	++
	b. high utility	0	+++	+	0	++
	c. thrill	0	-	-	0	+
High exposure	life style adolescence	+++	0	+++	++	++

Table 2.1. *Estimated effect of the five components of provisional driving licences on the contributing factors to the novice/young driver risk.*

Many countries already have applied a provisional driving licence. This study concentrates on those systems that have been evaluated, either in terms of 'process' (that is 'how the system works in practice') and/or the 'product' (that is how effective the system has been in changing driving behaviour and reducing accident involvement). In the following chapters a comparison will be made between different systems using the four objectives as described above.

Germany introduced november 1986 a driving licence on probation. Its prime objective is the prevention of traffic violations and consequently enhances traffic safety. In order to understand what contribution other forms of provisional driving licences may have, in the next chapter a short analysis of driving licences on probation are presented. .

3. Driving licence on probation

3.1. Why could it work: reduce unsafe violations

3.1.1. *Traffic Violations and accident risk of young drivers*

There is a weak but positive relationship between safety and traffic violations; as many traffic violations are often unsafe acts. However not all violations are noticed by the police and the actual violations that in the end *result in a booking* are only a unrepresentative sample of all violations. For this sample the relationship with safety becomes weak and is even further weakened by the fact that:

- not all traffic rules have a traffic safety objective;
- the safety risk associated with the violation is dependent on the traffic situation.

So it is to be expected that a reduction in traffic violation will have a limited but positive effect on safety, and consequently the prevention of traffic violations is an important countermeasure.

Moreover, this is even more important for young/novice drivers, as the following findings show.

Utzelman (1985) found that in the relationship between traffic violation and accidents was stronger in the age group younger than 24. This finding is supported by Robertson and Baker's research (1975). In studying the driving history of car drivers involved in fatal accidents, they detected that young drivers under twenty and booked for only *one* traffic violation, had a 3 to 6 times higher accident involvement rate than older age groups (21-24 and 25-older) with only *one* traffic violation.

Such a pattern did not show up in a control group composed of car drivers of these age groups involved in fatal accidents, but who were not previously ticketed for traffic violations. In this control group age did not seem to be a relevant factor. To conclude, being young, inexperienced and being booked are in combination a serious risk factor. A similar finding was reported by Chipman (1979). She conducted a study in which the relationship between traffic violations and exposure (kilometres driven a week) on the one hand and accident involvement on the other was studied. The result of this study showed a modifying role of exposure. Drivers who drove less than 180 km a week and who were ticketed by the police had a higher accident risk than comparable drivers who were not booked. The relationship did not hold in high exposure groups. Ticketed high mileage drivers did not differ in accident rates from unbooked high mileage drivers.

These findings show that for inexperienced drivers traffic violations are significant indicators of increased risk, and to conclude for inexperienced drivers one single violation is sufficient to commence corrective actions. The current point system in Germany is exactly doing this.

In the next paragraph the effectiveness of point systems with respect to general prevention and selection of problem drivers is discussed.

3.1.2. General prevention

General prevention is based on the mechanism that driver from fear of punishment will not violate the traffic laws. The question is whether all traffic violations will be affected. In this paragraph, different types of risky rule violating behaviours are discussed and conclusions are drawn whether or not a point system will change that behaviour.

a. Risk utility

Risky traffic violations may be the result of weighing its advantages and disadvantages (risk utility). For example, youngsters are very much aware that DWI is associated with extra risk. They also know that the likelihood of an accident is small and that they are more likely than not to arrive home unscathed. The observed disadvantage of 'not driving' after consuming alcohol is., (because of the distribution of power within the family) that the younger member must admit that he has drunk too much if he arrives home without a car. This is an almost certain outcome. The parents then often punish the fact alcohol was consumed and fail to reward the decision not to drive (Rothe, 1987). An other example is peer group membership. To become accepted within a group, a youngster has to adopt a certain driving style. In this case, it is not so much that youngsters enjoy *driving in this manner*. They enjoy *being accepted as a group member*.

b. Risk-seeking

Risk seeking refers to deliberate risk taking *just for the thrill* of it. There is a sub group of young drivers who can be identified as being deliberate risk takers. These drivers often have personalities with a high need for sensory stimulation, which generates a search to satisfy this need. About 25-30% of young men is in this group along with 5-10% of young women. They have greater confidence in their own skills, do not think activities are so dangerous, are more often prosecuted for traffic violations and are more frequently involved in accidents (Moe and Jensen, 1993). Deliberate risk-seeking happens most often during the night, after alcohol consumption and encouraged by friends. Women play a secondary role and are not able to stop men from entering into risk-seeking behaviour (Farrow, 1989).

c. Risky driving because of errors

Young and novice drivers may commit traffic violations and engage in risky behaviours without knowing that they put themselves and others at risk, and without intentionally breaking the law. Because of their inexperience, they may drive too fast for prevailing conditions, fail to see a red light in complex traffic situations, go too fast into a curve. Such unintentional violations and errors creep into driving routines quite easily (Van de Velde Harsenhorst & Lourens 1988,89), and are a characteristic of any newly acquired skill (Reason, 1990).

On the basis of this description is to be expected that a point system primarily affects 'risk utility'. Because it increases the disadvantages of risky behaviour and the penalty may tip the balance in the desired direction. This may only happen, if the youngsters believe there is a considerable chance of being apprehended, and this is influenced to the extent by which:

- one is personally confronted by police controls;
- friends and acquaintances are confronted by such controls.

In other words, by an actual increase in the objective risk of being apprehended (Goldenfeld, 1994).

If the subjective risk is low, the general deterring effect wears off over time.

A point system is not likely to deter youngsters from *thrill-seeking*. Even the opposite, the system might not deter the risk-taker but the chance of being caught and the subsequent point accumulation may only *enhance* the thrill. It is to be expected that this group will only stop 'fooling' around when confronted with an almost certain booking after a violation. In addition, the withdrawal of the driving licence may only be a threat if unlicensed driving is discouraged by forceful means.

3.1.3. *Efficacy*

How large is the general deterrent effect on young drivers in practice, and what is the effect on road safety?

Utzelmann (1985) studied general deterrence of point accumulation in young drivers. The study showed that young drivers with a high point total (18 or more) did accumulate fewer points in the following period (4,9% increase) than young drivers in the lower point bracket (14-17) This group increased their point total with 17,5%.

Utzelmann concluded that the threat of a withdrawal of their driving licensed youngsters in the 'danger zone' attempted to reduce their risk of being booked. This also shows that a point system is primarily a deterrence when relatively high point levels have been reached and licence withdrawal becomes a serious possibility.

Germany, France and the United States have carried out evaluation studies. These studies demonstrate that with regard to young drivers the introduction of a point system can realise a 10% reduction in offenses. And possibly an associated accident reduction of about 5 %.

Ontario introduced a driving licence on probation. All novice drivers (not only young drivers) receive a probationary driving licence. This licence is revoked for 30 days if the driver is found guilty of safety related violations (6 points). A permanent licence is granted if a driver has held his probationary licence for one year at a stretch without revocation. An evaluation study (Scotchmer, 1984) showed that in the first year after implementation a 7% reduction in accidents and an 11% reduction in traffic violations could be observed.

The implementation of the German driving licence on probation led to positive effects, although the decrease was slightly less. Weissbrodt (1989), based on a before and after study with 25-35 year old drivers as a control group, reported a 6 % reduction in accidents in young men and a 4% reduction in young women. In contrast to the canadian study, in Germany the violation frequency was affected to a lesser extent than accident frequency was, namely about 4%.

3.1.4. *Identifying and treating the dangerous young driver*

For the group that frequently engages in risky behaviour, the point system may be used to identify these 'problem' drivers, and by treating these drivers make these drivers more safe. However this is only possible if dangerous drivers can be discriminated from safe drivers, and if point accumulation or accident frequency in the past at an individual level are 'good' predictors of accident involvement in the future.

Effectivity of selection

Peck (1993) in a review of the literature about predictors of future accident involvements states: "It is safe to conclude that a number of human factors influence driver accident propensity, but that no single variable or combination of variables account for a substantial percentage of the variation in the accident frequency of general driving populations. The same conclusion has been reached by numerous other investigators over the past 30 years. Among the variables which have been found to be associated with accident risk are: prior traffic convictions, prior accidents, age gender experience, socio economic status, miles driven, and type of exposure and certain personalities and attitudinal traits. Of these, prior driving record variables, in particular a driver's prior traffic citation history are the most consistent and powerful predictors of the subsequent accident risk."

Drummond (1994) reviewed the literature with particular reference to young drivers. He concluded: "The focus of the ' problem driver approach research has been to define subgroups over represented in crash statistics who can be recognised by a certain collection of personal variables". The research shows that it is hard to identify problem drivers and that treatment is not very successful.

To conclude the reviews show that one has not been very successful in identifying high risk drivers. Only about 9% of the variance can be explained by the factors. Griep (1972) computed that expelling problem drivers would reduce the total number of accidents with about 0,07%. So the identification of problem drivers will not contribute greatly to safety. It should be borne in mind however, that this conclusion, only refers to traffic safety objective. There can be many more objectives served with the identification of problem drivers, but a discussion of these objectives is outside the scope of this study.

However, there is one that is not outside the scope of this study and that is the influence punishment/treatment has on the values and norms in society. The treatment/punishment of repeat offenders shows all members of a community that deviancy is not accepted, and this knowledge may motivate others to stick to the rules. If violators are not caught and punished, the motivation of others to comply is not reinforced but weakened. So perhaps the identification of problem drivers will not deter the thrill-seeker, will not contribute to traffic safety, but most likely it will reinforce correct traffic behaviour, and in this way contribute to the process that strengthens general prevention.

Treatment effectivity

Various forms of treatment/punishment have been used: driver improvement being one of the most common. A review of the literature showed that the effects of driver improvement up to now still needs confirmation. Lund and Williams, 1985 found that studies that claimed positive effects frequently were weak from a methodological point of view, while strong studies sometimes came to opposite conclusions. Struckman-Johnson et al (1989) only included 'strong' studies (19 studies applying to 59 not-alcohol related courses) and concluded that:

- Twenty-six driver improvement courses led to about 5 to 10% reduction in violations. Only six of those also reduced accident involvement.
- in some courses the changes in accident frequency and violation frequency were in opposite directions.

The authors concluded: “The current review suggests that driver improvement programs cannot be solely justified on the basis of their effect on violation experience. The success of the programs in reducing new violations entered on driver records does not imply similar success in new crashes, the factor most relevant to the safety of motor vehicle travel.” In contrast to these conclusions, a German study, comparing two courses, showed a positive effect on accident involvement, without an effect on violation frequency. The most effective course emphasised attitude and risk perception while the less effective course also included practical skill training (Utzelman, 1985).

Crettenden and Drummond (1994) in their review of the literature on ‘young problem drivers’ conclude:

“On first principles, a young problem driver subgroup does exist. The crash heterogeneity of the young driver population is acknowledged and the very concept of an average young driver crash risk means that a proportion will operate at levels above the average (just as a proportion will operate at lower than average levels of crash risk). It is reasonable to suggest that membership of these groups is relatively consistent over time.”

The existence of such a sub-group does not in itself, justify specific counter-measures development attention.

If multiple crash involvement are considered to represent the majority of young problem drivers, crash data analyses indicate that this sub-group contributes a very small proportion of total young driver crash involvements

If it is assumed or contended that the young problem driver sub-group warrants specific attention due to their frequency of crashing two further problems remain:

- There is no agreed definition of a young problem driver and even very good, current identification procedures using crash, violation and demographic information are very inefficient. While managing to successfully identify some problem drivers, they only do so with a large false alarm rate (that is, substantial numbers of non-problem drivers are falsely included as problem drivers).
- Currently there is very limited ability to actually treat identified ‘problem’ drivers through driver improvement programs and the like which are designed to reduce their risk of crash involvement. Even if effective programs could be developed they would be unlikely to be cost-beneficial due to a combination of small treatment effects and the application of such programs to drivers who do not warrant inclusion in the treatment program (the false alarm drivers).

On this basis, action designed to focus specific attention on young problem drivers should be accorded low priority relative to the development and implementation of other young driver safety initiatives.

3.2. Side effects

A point system can also have a negative side effect especially for young drivers. Although it cannot be certain in advance which side effects will result, the following responses may be anticipated:

- A relatively heavy punishment, such as a (temporary) retraction of the driving licence, can lose its inhibitory effect when in practice one can

still drive with an invalid driving licence without fear of being apprehended.

- A penalty can also be so severe that offenders will go to extreme lengths to avoid punishment. Although no study into this phenomenon has been performed, it is likely that the following offenses will increase:
 - ignoring stop signals by police;
 - not stopping after an accident.
 - tampering with numberplates
 - unlicensed driving or driving while suspended

We have not found studies that have included these possible side effects in the evaluation.

3.3. Conclusion

Point systems have in the short term a positive effect on the safety of young drivers. Long term effects have not been studied till now. Its effectiveness is based on general deterrence and general prevention, in that youngsters for fear of punishment don't commit driving offenses.

The treatment problem drivers with poor driving records will not directly contribute to traffic safety but will indirectly support the process underlying general prevention.

It is anticipated that a point system will be less effective in reducing offenses the more transgressors:

- primarily offend because of personal restrictions, such as lack of driving experience;
- commit traffic offenses because of thrill seeking
- have experienced they were not apprehended for offending against the traffic code;
- do not adhere to personal standards that condemn offenses;
- are not exposed to public standards that condemn offenses.

4. Driving licences with restrictions only

4.1. Why could it work: prevent overload

4.1.1. High exposure

The risk associated with driving in different circumstances varies, for instance:

- driving on a motorway is far less risky than driving on a rural road;
- driving during darkness is more risky than driving during daylight;
- the more one participates in traffic, the higher the chance of an accident.

Therefore, the high accident risk of novice drivers may partly be associated with driving behaviour itself, but also partly with the circumstances under which the young drivers choose to drive, and the amount of kilometres driven. Study of young driver travel patterns show that they drive under different circumstances than more experienced drivers. Youngsters drive frequently under the more *dangerous conditions*, such as, during darkness, for leisure purposes (Weissbrodt, 1989; Forsyth, 1992b; Van Kampen, 1989), often accompanied by friends (Van Kampen, 1989; Forsyth, 1992b). In Germany young males drive on average more kilometres than more mature men (Weissbrodt, 1989). Being with friends outside the family home is an important motive for youngsters to drive, in combination with the privacy they experience inside the car (Rothe, 1987).

4.1.2. Overload and novice drivers

Novice drivers have to carry out new tasks, fast and without errors. After licensing the task complexity in traffic is the same for novice and experienced drivers. In these conditions, task demands may easily exceed the driving capacity of the novice and as a result sensory overload may occur, showing in the missing of significant information and thus making inappropriate responses. Overload can be prevented, if the pace of the task can be set by the driver himself. In theory, by choice of speed, and position on the road, the driver can adapt the driving task to fit his capabilities, and under these conditions the driving task is self-paced (Brown, 1982).

The expert driver is able to balance task demands and his capacity to cope with the situation that arises (Brown, 1989). This is probably what an expert driver actually does.

The novice driver being inexperienced, is in a different class altogether. He does not possess the necessary skills to anticipate future events and to perceive and encode the relevant signals. It is therefore, unlikely that a novice can drive in such a manner that driving is self-paced. Up to now, no study has scrutinised this in more detail and consequently no information is available on how the relevant (yet unknown) skills can be acquired by training.

It may be because of the problem of (cognitive) overload that novice drivers are not able to benefit from any improvement in driver training (Gregerson, 1994), and positive effects of training on accident involvement may only show several years after licensing.

4.1.3. *Self assessment*

When asked to assess driving competence, most drivers would consider their own competence to be above average (Svenson, 1987). This also applies to young drivers. Young men in particular attach most value to 'courage and sensation' and 'vehicle control', while these skills contribute little to traffic safety as was illustrated by the study of rally drivers showing high accident frequencies of this group in 'daily' car driving. Furthermore young men underestimate the traffic complications, (Moe, 1987; Spolander, 1983, Rolls et al. 1991; Forsyth, 1992b) and overestimate the possibility of correction in an the 'accident process' (Brown & Copeman, 1975). This in contrast to young females who tend to underestimate their skills and overestimate the complexity of the traffic situation (Spolander, 1983). Young men do not modify their opinions of themselves on the basis of accident statistics, but take their personal experiences as a guide (Matthews and Moran, 1986). In males, differences in self-assessment are probably associated with exposure. That is, the more one drives, the more positive self-assessment one has. Females tend to drive less, when they initially have negative self-assessment. (Hattakka et al, 1992).

4.1.4. *The objective of restrictions*

The problem of young drivers are threefold. They choose to drive under dangerous conditions, they overestimate their skills resulting in driving styles (speed and safety) margin that lead to situation in which task demands easily surpass their severely restricted driving capacity.

Restrictions aim "to minimise exposure to those conditions or circumstances that have been shown to increase the risk of collision. But strict control over the amount of driving exposure is not the primary intent of restrictions since it is assumed that experience increases proficiency (reduces risk collision) so, driving perse is implicitly encouraged. But it is encouraged at low-risk times. The principle objective therefore, is to provide experience which is believed to decrease the likelihood of collision involvement, under conditions that minimise exposure to risk. As experience and competence are gained, the opportunity for exposure to risky situation is gradually phased in" (Mayhew & Simpson, 1990).

The assumption underlying the rationale is that there will be a linear decrease in accidents with increasing experience. This means that the accident risk is highest in the first year and than gradually decreases. However there is some evidence that the critical terms of road safety is not the first but rather the second year of holding a driver licence. Moukhwas (1993), on the basis of accident data from Israel, concludes: "It seems that even with the interference of the authorities some strong mechanisms reduce the risks for beginners during their *first* year as drivers, whereas these mechanisms disappear later., when a partly uncontrolled learning process increases excessively the drivers self confidence, particularly amongst young drivers who have obtained their driving licence at their minimum legal age."

A similar line of argument has been put forward by others (Brown, 1982, and Chatenet & Simomnet, 1982). But other extensive accident studies that shown a linear decrease from the first year onward for both males and females (e.g. Forsyth et al., 1994).

So the potential of restrictions and graduated driving licences in mainly dependent on the fact to what extent there is voluntary compensation during

the first year. If such a compensation does occur, there is not so much to be expected from a legally imposed instruction and is more to be gained from supporting the natural tendency by providing the necessary information (publicity campaigns and driver training) and should other measures focus on the second year.

4.2. Effectiveness

Several countries have implemented combinations of restrictions, that are gradually lifted as the drivers gains more experience. These countries are North South Wales, Victoria, New Zealand and Ontario (Mayhew and Simpson 1990; Haworth, 1994). In this paragraph a description will be presented of which restrictions have been implemented and how successful they have been.

4.2.1. Speed

Different Australian States employ a provisional driving licence based on restriction. All states (except for Southern Australia, de Australian Capital territory and the 'Northern territories'), have introduced a provisional driving licence with the restriction that a first-year car driver is *not allowed to drive faster than 80 km/h*, has to use a P- number plate and if severe traffic violations are committed, his driving licence will be withdrawn and he has to re-enter driver examination (Davis, 1976).

The effectiveness of the driving licence system was hard to evaluate as one year after the introduction of this system, also the use of safety belts was made compulsory. Davis has doubts about the effectiveness of the speed restriction, as it increases speed variations. Davis (1976) concludes that a positive effect of the licensing system could not be shown because of confounding factors, and the applications of speed restrictions could be counter productive as it forces novice drivers to drive at a lower than the average speed.

4.2.2. Night curfew

In the US, the effectiveness of night curfews for 16 year old car drivers has been studied. Preusser e.a. (1984) compared four states where a night curfew was introduced with similar states without a night curfew. In states with a night curfew, significantly less (about 25 to 69%) 16 year old drivers were involved in accidents. In the hours just before and after the curfew hours, a small increase of accidents could be observed, but this was only a slight increase in comparison to the large decrease during the curfew hours. Furthermore, there were no indications of accident migration due to the use of other means of transport or the carrying of more passengers. In addition it was shown that in 'curfew' states the proportion of 16 year olds in possession of a provisional driving licence was lower than in other states. The authors also present evidence that the restrictions imposed, delayed licensing. Probably, for this age group a restricted licence was not something worthwhile having. This finding was supported by the results of a study by Williams (1985). He studied the relationship between licence related law and licensing rate, and found that night curfews were associated with low licensing rates. The operation of a night curfew did not affect the mobility and leisure time of youngsters.

Williams & Lund (1985) studied the extent to which the night curfew was violated. They reported that most of the youngsters knew about the details of

the curfew law. Most of them had violated the curfew law, but only once or twice. The parents were most frequently enforcing the law, primarily because they set the rules about car use. The parental involvement showed to be more effective in deterring the under-aged from driving than police enforcement.

Even those situations in which youngsters violate the curfew laws may be less detrimental to traffic safety as it seems. Hurst (1980) argues that a possible side effect of night-curfews may be that in cases of transgression youngsters will behave immaculately and avoid being noticed by the police. This good behaviour is intrinsically rewarding and will repeat itself according to what is known in the 'psychology of learning' as the 'law of effect'. Due to repetition this good behaviour will become a habit.

"The value of the curfew depends on whether the collision that would have occurred at night are now shifted to daytime hours". Night curfews have only be applied to *young 16 year* old drivers.

4.2.3. 0 - promille

As even a lower blood/alcohol concentration than the legal limit, leads to a higher accident risk in novice/young drivers than for experienced and more mature drivers (Mayhew, 1986), the introduction of a restriction on alcohol use (0- promille) may be considered.

In several countries a specific alcohol limit for young/ novice drivers is in operation. The 22 may 1984 the state of Victoria (Australia) introduced a blood alcohol limit of 0 promille, for novice car drivers. This measure was combined with several measures in use, such as the use of p-plates to enable identification of novice drivers. It was believed that the combination of both measures would increase the objective and subjective chance of apprehension. The measures were evaluated (Haque and Cameron, 1987). The results were that only 40 to 60% of the novice drivers used a P-plate. The introduction of the 0-promille measure did not lead to a reduction in P-plate use.

Furthermore, an accident reduction of about 4% was observed. However, this reduction was not statistically significant and far below the expected 10%. The researchers believe that the following factors negatively influenced the results:

- low police enforcement;
- absence of information campaigns;
- a general decreasing tendency in the target group to Drink and Drive, that is not related to the introduction of the restriction.

No data are available on the extent to which the measure actually affected the frequency drinking and driving behaviour by young drivers.

Hingson et al (1989) (cited in Haworth, 1994) reported the effects of the introduction of a .02 BAC limit for drivers under 20 years in the US state of Maine in 1983. After even two years of the law, most teenager did not know that their licence could be withdrawn if they drove after two or more drinks. Despite this lack of information, a statistically significant decline in teenage accidents could be observed. Despite an increase in mileage, the proportion of teenage accidents dropped from 22% prior to the law to 13% after the introduction.

An interview study about beliefs and actions of the police officers in Main, showed that they believed that the 0.02 BAC was too strict and it discouraged officers to stop teenage drivers who drove after drinking.

A survey of drinking drivers on the road before and after a intensification of random breath testing in South Australia (study cited in Haworth, 1994) showed that before the increase, of drivers younger than 21 22,9% had a B.A.C. higher than zero and after the introduction this percentage dropped to 16.8%. The measure - intensified random breath testing- had no effect on the percentage of drivers under 21 who were over the then legal limit of .08 (4%)

This finding supports the view that the effectiveness of the measure is dependent on the tolerance to deviancy. If there is a general tendency in an individual or in society as a whole to drink and drive, it is unlikely that as Mayhew & Simpson (1990) put it “individuals already willing to break one drinking law will not be greatly deterred by the imposition of another one”.

Study	State	Limit	Effect
Haque & Cameron, 1987	Victoria (Australia)	zero BAC	4% (n.s.)
Maisey (1984)	Western Australia	from 0.08 to 0.02	a 17% reduction casualty night time crashes > 18 drivers (n.s)
Smith, 1986	Tasmania	? to 0 BAC	reduction in crashes 17-20 year old drives
Smith, 1986	Western Australia	? to 0.2 BAC	No effect on casualties
Hingson et al., 1989	US Main	? to .02	9% less crash involvement
Smith, 1986	South Australia	? to 0.05	Significant fewer crashes in male not female driver

Table 4.1. *An overview of the findings on a lower BAC after Howarth. In this review a critical evaluation of the applied methodology is missing.*

Zero BAC is conceptually a direct method of reducing risk but onroad exposure surveys reported by Drummond et al. (1986) have shown that the legislation appears to have discouraged drivers from driving at times when otherwise they would have been both drinking and driving - and exposure effect. This finding is confirmed in the study on the Victorian zero BAC legislation. It was found that first year drivers reduced their driving during weekend nights when DWI is most prevalent.

4.2.4. *No passengers*

It is reasonable to assume that the presence of passengers in the car may influence driver behaviour because:

- the increase in load changes the driving characteristics of the car;
- the interaction between driver and passengers and between passengers may distract the driver;
- the presence of friends may increase the chance that a driver may want to exhibit his skill and courage. He might want to impress them.

In addition the presence of passengers in the car of novice drivers lead to more severe outcomes in case an accident might occur. Not only the driver is at risk but also his passengers. However no country or jurisdiction has implemented this measure, according to Mayhew and Simpson (1990) because of lack of social support.

A possible side effect may be, that this measure may lead to early licensing for others that can't be passengers any more, and to more cars on the roads with less occupants. Early licensing will not increase the young driver problem in Germany, as about 80% (Pfund et al., 1993) get already licensed at the earliest opportunity.

4.2.5. *Vehicle power restrictions*

According to Drummond (1994) Victoria has implemented a vehicle power restriction. " 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.

The effectiveness of the measure has not been evaluated as yet. However, looking at the accident statistics it can be argued that such a measure will have limited effect.

Work reported by Drummond and Healy (1986) indicated that increased vehicle power appeared to elevate the risk of crash involvement for both experienced and inexperienced drivers. It is understood that rationale of this measure was partially derived from this study. However, Drummond (1994) points at the limitations of the study, showing that both experienced and inexperienced drivers have a higher crash involvement per million kilometres travelled in high powered cars and that inexperienced drivers are not over represented. So it may be concluded that a power restriction across the entire vehicle fleet may have merit. Furthermore, if a vehicle power restriction targets the upper tail of the vehicle power distribution, the probable effect would only be marginal at best. This because of the relative few numbers of novices driving this type of car, and the slight rise in accident risk.

The Australian studies have only considered the accident risk associated with high powered cars irrespectively of the power/weight ratio and the consequences of crashes when these have occurred. A French study (Fountaine and Gourlet, 1995) took these factors into account. Their analysis shows that young drivers are more sensitive to the type of vehicle both in terms of involvement rate in certain type of crashes and in terms of increase in seriousness related to performance of the vehicle driven. The category of young drivers with light, high performance sports-type cars emerges as having a high risk of crash involvement, particularly outside built-up areas. However both the Australian and French studies point at the importance of driver factors in relation to vehicle characteristics. It may be a particular type of driver who fancies these sport-like type of car. Banning the car or reducing access to it, does not change the driver's behaviour, and may result in risk migration.

4.2.6. *Combinations*

Haworth (1994) reviewed the evaluation studies on Graduated licensing systems in which the above described measures were combined. In New Zealand a graduated driving licence system was introduced in August 1987. Night curfew, 0.03 BAC and restrictions on the carrying of passengers were among the components of the system. Accident analyses showed a decrease in accident frequency and this effect lasted for about 3.5 years. A limitation

of the evaluation was, that exposure (milage) was not studied and as a result the effect could have been caused by other factors such as:

- a rush to licensing in the year previous to the introduction of GDL;
- the increase in unemployment just after the introduction of GDL, which may have led to a lower milage by young people (Frith and Perkins, 1992; cited in Hawarth, 1994). Further study showed that there was a low level of compliance in particular with respect to the passenger restriction. Many violated this restriction on a weekly basis.

4.2.7. *Restrictions in combination with a point system*

In two states of the US restrictions in combination with restrictions were applied. In *California* a provisional driving licence was introduced in 1984. It includes a 'zero BAC', in case an accident happens or two traffic rule violation were committed, the driver is obliged to drive during a one month period. If 3 violations were reported the driving licence is withdrawn for a period of 6 months, followed by a 12 months probation period. Hagge and Marsh (1986) evaluated the new system. They concluded on the basis of a time series analysis that although the accident frequencies in both the young group and the older 'control' group increased, the accident frequency in the younger group only showed a slight increase (0.3%) while that of the older age group increased with 13%. The difference between these increases was shown to be statistically significant ($P < 0.09$). The authors postulate a 13% decrease in injury accidents as a result of the introduction of the system. No differences were observed on the frequency of single accidents and fatal accidents. But that may be due to the nature of these types of accidents and how they are reported. Fatal accidents are relatively rare events and the registration of single accidents (without severe accidents) may be biased and may not be stable over time.

This affects the reliability of the criterion and as a consequence decreases the chance that a change can be - statistically - demonstrated.

In *Maryland* on an experimental footing a provisional driving licence was introduced consisting of a night curfew and a point system. An evaluation showed that accidents were reduced with 5% and traffic violations with 10% (Tannahill, 1986).

Jones (1994) evaluated the effectiveness of Oregon's provisional licensing program, created by the 1989 Oregon legislature. Provisional driving licensing imposes a set of special requirements for obtaining and keeping a driving licence for drivers younger than 18. Elements of the program fall logically into two categories that can be described as driver testing and control elements that apply to the post road test period. Driver testing elements included a theory test about safe driving practices and a 28 day - waiting period between attempts for drivers who fail the road test.

The control elements (which are relevant here) are:

- a suspension for any measurable blood alcohol;
- a suspension until age 18 for a major traffic conviction;
- a four-stage driver improvement program.

The findings of the study indicated that male drivers issued provisional driving licences had about 16% fewer reported accidents in their first year of driving compared to male drivers licensed just prior to the implementation of the provisional driving licence. However no differences in reported

accidents were evident for female licensees and no differences in traffic violations were evident for either sex.

4.3. Side effects

It is to be expected that youngsters will not accept restrictive measures. They will experience these measures as authoritarian and unnecessary.

Unnecessary, because they view themselves as excellent car drivers, better even than average. Furthermore, they have optimistic views about the seriousness of accidents, and they believe that they can easily recover from errors. Even if a young driver is aware of the high accident risk of young drivers as a group, he will believe this risk does not apply to him, but rather to clumsy peers.

Therefore, introduction of restriction will be experienced as being unreasonable, unjust and unfair, and these feeling may lead to large scale violations. A combination of information campaigns and police enforcement are essential components to combat these large scale violations. The use of special numberplates for novice drivers may increase both the subjective and objective chance of apprehension.

Although social resistance is to be expected, these resistance may be overcome once the 'public' becomes aware of the unacceptable nature of the problem and the rationale underpinning the restrictions. The Australian experience (Neilson, 1986) shows that community groups after initial rejection, after discussion accept the concept of graduated licensing in which restrictions are gradually elevate. Especially 0-BAC is a measure supported by both parents and youngsters.

An objection to restrictions may be that restrictions hamper novice drivers in gaining experience. However the restrictions should be combined and also lifted in such a manner that drivers only drive in situations they can cope with. In this way novice drivers become gradually exposed to more complex driving conditions. A restriction is waived if a driver is competent enough. Competency may also be stimulated by training and result in a lifting of the restriction.

4.4. Conclusion

Restrictions have not widely been used and primarily apply to the very young (16 year of age). The effectiveness of most restrictions have not been conclusively demonstrated.

Despite the absence of conclusive evidence of its effectiveness the rationale of step by step learning in a safe environment is a very powerful one and both intuitively and scientifically correct.

5. Two phase driving licences

5.1. Why could it work: teach slowly acquired skills

After driver instruction (about 30 hrs of training) and driver examination, expert levels of performance have not been achieved yet (section 2.3.). Learning continues after training and it has been shown that this learning period not necessarily results in safe driving practices. This because of the lack of adequate and immediate feedback after errors, and the obscurity of danger signals. If no correction takes place and errors or potential errors are not recognised, the driver may incorrectly assume that he drives safely. Moreover, not all traffic situations he encounters have been experienced during the instruction period, and new solutions have to be found. In this way unsafe driving actions may become ingrained. They become a habit and habits are very hard to change and correct.

A second phase in driving instruction enables:

- the teaching of more complex and slowly acquired skills such as hazard perception;
- provide feedback on driving performance;
- correct errors in driving routines before they become fully ingrained.

5.2. Skill training in Second phase

5.2.1. Norway

Norway has a two phase driving licence system since 1979. Recently (November 1994) this system has been abolished in favour of a system of accompanied driving. The new system is dealt with in the next chapter. Because of a solid evaluation study the Norwegian experiences are of interest to assess strength and weaknesses of two phase driving licence systems. The 'old' Norwegian system consisted of:

● Phase 1

- A basic driving course (both practical and theoretical), partly on public roads and partly on a closed range. Although professional driving instruction was not compulsory in Norway, about 95% of candidates go to driving schools.
- A driving test (theory and practical). After passing the driving test a candidate receives a provisional driving licence without restrictions, which is valid for 2 years.

● Phase 2

Within two years after licensing a novice driver has to enrol in two courses:

- Course a: driving in the dark.
- Course b: driving on slippery roads.

Results

A before and after comparison of accident involvement was carried out. This comparison showed that accidents in the after period on slippery roads had

increased while the accident during darkness had decreased (Glad, 1988). Although the evaluation study did not allow conclusions to be drawn about why these two courses had led to such contrasting results the following hypothesis was put forward. The 'course driving on slippery roads' had trained the novice driving in skid control. The emphasise of the course was on handling not on avoiding these dangerous driving situation. Novice drivers incorrectly believed that after the course they could cope with these dangerous conditions and had no reason to avoid them or only drive with very low speeds (Glad, 1988). This may have led to more exposure, both quantitatively (more kilometres on slippery roads) and qualitatively (higher speeds). Especially for young drivers, courses of these types may be counter productive, as young drivers have shown to possess very optimistic views about changing the course of events during the accident process (Brown and Copeman, 1975). Such a problem did not arise in the 'darkness' course as there the *recognition of danger* was emphasised and no practical skills were trained.

From these findings it may be concluded that:

- the effectiveness of a two phase course is dependent on the type and content of the courses involved;
- evaluation studies are of prime importance in order to avoid contra productive results, as has also been shown in other fields of driver training (Struckman-Johnson e.a. 1989).

5.3. Cognitive higher order skill

Novice drivers are poor in 'hazard perception' as was shown in the following studies. If a driver is explicitly asked to identify hazards it was found that young/novice drivers spot fewer hazards and concentrate on non-moving objects (Soliday & Allen, 1972) at close range (Brown, 1982) and spotted children less often as a source of hazard (Oude Egberink, 1986). Both experienced, and novice drivers, regard a condition as non-hazardous, if the situation is unchanging, the information input is low, and no control action is needed. However, novice drivers mention hazards *more* frequently when related to the infrastructure such as narrow roads, road conditions, and the presence of intersections. They concentrate *less* on the other traffic participants (Benda & Hoyos, 1982). Young inexperienced men regard driving at high speeds as less hazardous than more experienced drivers, whereas they considered snow covered roads to be more hazardous, than experienced drivers do (Bragg & Finn, 1982). When young males become more familiar with a route, they tend to lower their hazard estimates (Bragg & Finn, 1982). Familiarity with a route not only affect these estimates, but also the perceived level of control. Young males have lower estimates of hazard as drivers than when they are passengers. (Bragg & Finn, 1985). Furthermore young/novice drivers are less able to detect sudden changes in the task condition, which would require a lower driving speed (Wilson and Anderson; 1980).

McKenna and Crick (1992) state that novice drivers have an under-developed mental model of the traffic situation, tend not to anticipate future events, and fail to respond to those events in good time. Novice drivers acquire this mental model by experience, and the under-developed mental account for the poorly developed hazard perception.

However, there are indications that 'learning by experience' this is not an efficient way of learning hazard perception skills. Although in traffic,

accidents and 'near accidents' are sources from which information about hazards can be obtained, there are indications that these experiences hardly affect the learning process. The reactions of youngsters discussing near misses and accidents indicated that after the accident or near miss they have not consciously altered their driving behaviour. (Rothe, 1987). Novices believed they did not make a error and the other party's behaviour was unpredictable. Furthermore becoming involved in an accident without serious consequences may give the person the impression that 'it isn't so bad after all'. The same applies with respect to 'near accidents'. The fortunate outcome of a risky activity can lead to the impressions that there is 'no harm in it after all', so that the risky behaviour is not altered.

5.3.1. Europe

Training

A second training phase could be directed at hazard perception. McKenna and Crick (1992) postulate that a training programme that concentrated on forcing the novices to develop a more sophisticated mental model by engaging them on anticipation tasks could have positive effects. They developed a training program based on the presentation of sequences of road scenes and asked novices to make predictions about what would happen next. This course was evaluated and the results showed that novice driver who had taken the hazard perception course performed better on a hazard perception test than the control group, which had undergone advanced on-the-road-training. This result indicates that hazard perception skills can be trained in class, and that in-car training is not a necessary requirement.

This study has only analysed the differences in test performance. A similar Swiss study on the effect of 8 hrs of training on traffic sense (which included hazard perception) failed to show a positive effect on hazard perception and actual driving performance. However, there was a positive effect on 'attitude'. Those candidates who had followed the training did have a lesser tendency to over-rate their driving abilities, than candidates of a control group (Bächli-Biétry, 1990).

Test

In Europe, *no country has a standard test of cognitive skills*, that are believed to be a prerequisite of safe driving. Most often, tests are limited to the knowledge of traffic rules. Some countries, are in the process of developing a test of cognitive skills (Switzerland, United Kingdom and Denmark). Switzerland (Bächli-Biétry, 1991) is developing a test to assess how well the goals of traffic sense instruction have been reached. The goals are as follows:

- expansion of danger cognition;
- training of the ability to perceive and process information;
- the influence of attitudes relevant to safety.

In Denmark, apart of many other measures, a traffic sense test was implemented leading to a fall in accident involvement (Carstensen, 1994). However, these measures were all in connection with the basic driver training course.

5.3.2. *Australia*

In Victoria (Australia) a new test was developed and introduced on 1 August, 1992. "Rather than assessing motor skills and 'intellectual' knowledge of road law and road craft, the new test aims to assess those elements of cognitive functioning which affect the driving task. This test is known as the 'Hazard Perception Test' and is proposed as a mass screening test for all Victoria's drivers wishing to proceed from a Probationary to a full licence. The test would be taken most often by novice drivers between the ages of 20 and 21 after two to three years of unsupervised driving. Test items have been developed on the basis of the analysis of crashes and are presented as real time moving images on computer screens. The candidate has to assess dangerous situations which are shown on film."

A difference between the different versions of hazard perception tests as described, is the way the candidate has to respond. In the Australian and Swiss tests the candidate has to detect and assess a hazard, while in the McKenna test the candidate has to react as fast as possible on detecting a hazard. So the latter is emphasising hazard-perception latency. In a review of research on hazard-perception Elander et al. (1993) concluded "The evidence points to slower detection of hazards as one source of individual differences in crash frequency but not simply as a result of slower reactions in general" [...]. "Hazard-perception latency appears to play an important role, and this may be attributable to generalised abilities to identify visual targets in a complex background and with switching attention rapidly".

5.4. **Conclusions**

The two phase driving licence intertwines formal training and gaining experience in that more difficult skills are trained and tested at a later stage. The Norwegian experience has showed that advanced skill training may be detrimental for young drivers. Fewer complications are foreseen in cognitive skill training. But training and tests are still in an experimental phase, and their effectiveness needs confirmation.

6. Accompanied driving

6.1. Why could it work: guide and protect

Accompanied driving can be applied in three different moments in the learning process: as laymen's education, as apprenticeship and as restriction. The latter could have been dealt with in the previous chapter on restrictions. But as it covers the same teaching methods as the other forms of accompanied driving, it fits better in this chapter.

In all three forms, the basic function of accompanied driving is that under the guidance and protection of a more experienced driver.

- The novice driver gains more experience, without the risk that he has to learn by trial and error and the error proves to be a fatal one. His actions will become to a larger degree automated and thereby fewer errors and less overload of attention.
- Motivations to behave safely can be strengthened if the accompanying driver is held in high prestige by the novice driver (Bandura, 1977).
- The feedback of the accompanying driver, makes the novice drivers aware of errors in driving routines.

6.2. Different forms

6.2.1. Laymen's education

It can take the form of *laymen's education*. In this form no formal instruction in a professional driving school is required, and one is allowed to prepare for the driving exam with the aid of an accompanying driver. Such systems are in operation in Britain, Sweden and Norway.

In most other countries in Europe laymen's education was abolished, in favour of professional instruction, assuming that professional instruction would result in better trained drivers. In this view the good safety records of Britain come as a surprise, although many other factors besides driver training may contribute to this.

In an overview of different licensing systems in Europe (Lynam and Twisk, 1995) it was concluded that in Europe simultaneously two different trends can be observed. One in the direction of a more thorough and broader professional driver training (e.g. Germany and Holland), and one in the direction of less professional driver training and more practise by opening up the option of laymen's education (Norway and Sweden). In Norway and Sweden thorough evaluation studies are in progress, and these will also enable other countries to profit from the Nordic experience. Although the topic of laymen's education is slightly outside the scope of this literature review as it primarily deals with licensing measures the experiences with it are of interest. The systems have been documented in detail elsewhere (Lynam and Twisk, 1995)

6.2.2. *Apprentissage*

It can take the form of professional instruction followed by a period of apprenticeship, which ends after passing a driving test. The function of apprenticeship is to gain experience *and* to practise in order to pass the exam. Such a system is in operation in France, since

- 1984 on an experimental basis;
- 1987 implemented in all regions in France for young drivers;
- 1991 implemented in all regions for all candidate drivers (not only the young ones. The training and teaching method is combined with an instruction age of 16, whereas the instruction age for the traditional driver training remains 18.

Belgium has recently introduced apprenticeship in four different procedures to prepare for the exam.

6.2.3. *Restriction*

Accompanied driving can take the form of a restriction, in the sense that after the driving exam a person is fully qualified to drive, but a set number of months, driving is only allowed in the presence of a more experienced driver. We did not find any county in which such a restriction has been implemented (Mayhew and Simpson, 1990; Haworth, 1993; Heinrich et al 1994, Pfundt, 1993).

6.3. **Norway: experience with laymen's education**

Norway has recently (01-10-1994) lowered its minimum age for training to 16 years, and the restrictions on where private training can take place was removed. When training privately, the car has to be marked with an 'L'. Minimum licensing age is as before, 18 years. For a description of the old system see the previous chapter. *The prime objective of the system is to encourage more behind-the-wheel training*

Aside of this changes in training some additional measures were introduced (01-02-95). These changes include:

- a new curriculum with reduced mandatory training (9,5 hours);
- a new extended practical test;
- a two year probation period after licensing. Certain traffic violations result in withdrawal of the licence and the driver has to pass a new test and start on a new 2 year probation period.

To obtain the necessary knowledge and skills to pass the test, the pupil may attend a driving school, train privately or combine private practice with driving school education. The accompanying person has to be at least 25 years and has held a driving licence for at least 5 years.

Evaluation design

An evaluation study is underway. Data collection has started in august 1994 and will be terminated in July 1997.

The evaluation is divided into 3 parts:

- The effect on actual training;
- The effect on accident risk;
- The economic consequences for drivers and for society at large.

It will cover on the training process:

- extent and type of driving school training;
- when training started;
- cooperation between driving school, accompanying person and pupil.

After licensing:

- exposure and accidents.

6.4. Sweden: experiences with laymen's education

In Sweden the age limit for practising was lowered from 17,5 to 16 years in September 1993. The Swedish 'normal' system has always allowed the learner driver to make his own choice whether he would go to a professional school or use some laymen as instructors. Youngsters are allowed to practice with a private tutor. This tutor has to be 24 years old, have a licence for 5 years and having a clean driving record (no withdrawal or warning). The practising period is completed after a theory and driving test at the age of 18.

The objectives of the system are:

- increased experience in traffic
- automation of behaviour
- better cooperation with others
- insight in informal rules
- better visual search
- better safety margins

The forthcoming evaluation covers:

a: the learning process

- the type of education chosen (driving school or private)
- the content and order of training
- appreciation
- amount of practice
- accidents during practice

b: the quality of driving after licensing

- attitudes
- driving style (violations and errors)
- accidents and exposure
- cognitive capacity (indication of automation)
- visual search and safety margins

The complete evaluation will be reported in 1999.

6.5. France: experiences with apprentissage

In France the apprentissage system and a traditional driver training operate side by side.

Phase 1.

At 16 years of age a student enters into a highly structured basic professional driving instruction of 15 hours in car training and 5 hours theory classes. The student's progression is documented in a student's book.

Phase 2.

After passing a mock driving exam in which a level of driving performance should be demonstrated that equals performance levels in a traditional driving exam, a candidate is allowed to drive accompanied by an experienced driver. The accompanying driver is supervised by the driving school and during the period of accompanied driving the student and his accompanying driver participates in several refresher courses at the driving school (Twisk and Gieszen, 1992).

During the apprenticeship period several restrictions apply:

- a speed restriction of 90 km/h;
- a curfew for the weekend nights between 18.00 and 8.00 o' clock;
- driving abroad is not allowed;
- a special shield by which one can be identified as being in the apprenticeship scheme.

This phase is concluded with an official practical test, this in contrast to the first exam at the start of the apprenticeship period. The former is solely the responsibility of the driver school, the latter is supervised by the French Ministry of Transport.

With respect to safety in the apprenticeship system two periods are to be distinguished:

- The period of apprenticeship itself. The question being: "Is accompanied driving a safe way of learning to drive a car?"
- The period after licensing. The question being: "Is a car driver trained according to the apprenticeship system a more safe driver in comparison to car drivers trained in a traditional manner?"

A relevant question, that will not be dealt with here but in the next chapter, is

- What are the safety consequences of a lower instruction age (16 instead of 18)

6.5.1. *Training safety*

A first version in a small scale implementation was evaluated in 1984. In two years about 1,000 youngsters participated in the scheme. At the age of 18 these youngsters had driven on average 4900 km (accompanied). About 90% passed their exam on their first attempt. As a group they drove about 3,000,000 km during the apprenticeship period and none of the youngsters were involved in accidents with casualties. Also in an additional sample of 15.00 youngsters no accidents with casualties happened during the apprenticeship period (Chevillot, 1988).

From 1984 onwards, only two fatal accidents happened. An in-depth study of these accidents indicated that it was the other party that was at fault, and that the young driver nor his accompanying driver were to blame.

The records of the insurance companies demonstrate that the total number of insurance claims does not increase for cars that are used for accompanied driving. In interpreting the insurance data, it should be borne in mind that insurance data are not of a nature that shifts in accident frequencies can be reliably demonstrated. Whether an accident is reported to the insurance company is dependent on many factors and is the result of a decision of the insured. The age of the insured or the general condition of the car before the accident can be such factors. It is conceivable, that a family only participates

in the apprentissage scheme if a car can be used that is not brand new, and an extra hump or bump is no reason to claim and lose one's bonus. More thorough comparisons of types of claims before and during the apprentissage period would provide a more reliable picture of the accident involvement of these drivers.

It also seems to be an effective way of training as about 70% pass their exam at first attempt. This is about 20% less than was found in the pilot study in 1984.

Attractiveness

A survey by Belloc and Ivaldi (1991) establishes that only 10% of the total cohort of 16 year olds participate in the apprentissage scheme.

Demographically, these candidate drivers come from middle and higher class families. The AAC programme only affects a relatively well-off section of the adult population who can afford to pay for their children to learn to drive two years before the normal age, while parents in the 'socially highest' professional group are assumed to have a much greater propensity to educate their children.

6.5.2. *Driving safety after licensing*

The system was evaluated in 1990, 1994, and 1995, to determine the influence of this driving instruction method on the accident rate of young drivers. A review of these studies (Observatory, 1995) concludes: "Today none of these studies enables us to maintain with any degree of certainty that a young driver aged 18,19 or 20 who holds a class B driving licence and who has had AAC instruction has reduced his risk of having a traffic accident as a result of this instruction. Nor do any of these studies enable us to maintain the contrary: the complexity of the conditions under which populations of young people are compared according to the way they learn to drive, the difficulty of collecting reliable statistics on driving licences, the exposure of young people on the road and their accident experience only allow us to assume that the AAC programme does not decrease this accident experience while at the same time it does not increase it either. The studies included in the review are: Ivaldi & Belloc (1992); Lagadec & Bontemps (1993); Chollet (1994); APSAD(1994), Page (1995).

Belloc and Invaldi, (1991) evaluated the effects of the apprentissage system on post licence driver safety. A questionnaire about accident involvement and mileage was sent to apprentissage drivers. The results were compared with official police accident records of young drivers in general. In addition, a comparison was made with the official police accident records of an older age group. Based on these comparisons the following conclusions were drawn:

- the young apprentissage drivers drive about 30% more kilometres without accidents than the traditionally instructed young drivers;
- the young apprentissage driver has about the same accident involvement frequency at which he is at fault as the more experience and older car driver.

These conclusions are very much in support of the apprentissage system. However, the methodological weaknesses of the study do not allow firm conclusions to be drawn:

1. The Belloc and Ivaldi study shows clear evidence of the mechanism of self-selection. That is that a group - unrepresentative for the whole population - decides to participate in this scheme. The positive results may be due to group characteristics rather than training results.
2. Two different data sources are compared: self report for the apprenticeship system and official statistics for the traditional system. Both data sources may suffer from different biases and comparisons based on different data sources may bring out these differences. As the study does not control for these biases, the observed difference can not be attributed to the effects of the two training forms.

The Sylab (Lagadec & Bontemps, 1993) compared two populations of young people aged between 20 and 22 and who had obtained their driving licence in 1990.

	AAC	Traditional
mileage first year	12.700	10.400
1 accident first year	12.3%	11,5%
accident second year	15%	14%
accident third year	20%	15%

Table 6.1. *A comparison of AAC and the traditional instruction in France (Source Sylab, 1993).*

The reviewer (Observatory, 1994) concludes: "Bearing in mind that the AAC drivers had a higher mileage, these results seem to show that the accident experience of young people which was equivalent in the first two years after obtaining a driving licence, is highest amongst AAC drivers from the third year onwards: it is as if gaining experience between the ages 16 and 18 during the accompanied phase enables them to reach a risk level that is more or less equivalent to the risk level of drivers who have not yet gained any experience; this risk then seems to increase until the third year of driving with a licence while amongst traditionally trained drivers it seems to stabilise during this third year. These results contradict the well-known fact that increased risk decreases as more driving experience is gained measured in terms of the number of years the driving licence has been held, and inevitably call the very principle of AAC into question." The reviewer expresses the same doubts over the accident curves as Moukhwas (1994) did in reference to the principle of restrictions as has been discussed in chapter 4.

A study conducted by several insurance companies also came to the conclusion that: "AAC does not represent a significant criterion with regard to risk reduction."

In conclusion:

The French studies are not conclusive about the effectiveness of the system. The more recent studies are less optimistic than the initial ones that estimated the effectiveness in the early days. Though some conclusions may still hold:

- the system only attracts 10% of the whole age cohort;
- the apprenticeship period guarantees relatively safe driving as no serious accidents were registered;- it leads to relatively high pass rates on the driving exam;
- the effects of the system on safety in the post-exam period are dubious and most likely the system leads to an increase in mileage;
- part of the effect may not be due to the apprenticeship period itself but to improved instruction during the basic training. Before the introduction of AAC the traditional driver training was not well structured nor well organised. Lately the traditional training has with respect to structure and contents greatly benefitted from the experiences with AAC, and many requirements that previously only applied to AAC are now formally implemented in traditional driver training (Assaily, personal communication).

6.6. Belgium: experiences with apprenticeship

Belgium introduced in 1992 four different procedures to prepare for the final exam. All four procedures allow private practice before licensing. However, there are restrictions with respect to the conditions under which a person is allowed to practice, such as a practice curfew during the night hours. In addition, if a person has started driver training at the age of 17 or if he is 18 or older and had less than 20 hours of professional training at a registered driving school he is only allowed to practice with an accompanying person.

In the old system after passing the theory test, a person was allowed to take the practical exam after 8 hours of professional training *or* 2 months of private practice for instance with a parent.

In the new system, the four training procedures can be characterised as follows:

Procedure 1.

training at 17 year of age at a professional driving school followed by a period of accompanied driving in combination with restrictions.

Procedure 2.

for > 18 year olds: no professional training, but instead 9 to 12 months of accompanied driving.

Procedure 3.

for > 18 year olds: 10 hours of professional training and 6 to 9 months of accompanied driving.

Procedure 4.

for > 18 year olds: 20 hours of professional training at a registered driving school followed by a practice period of 3 to 6 months in which one may drive without an accompanying person but restrictions are in force during this practice period restriction.

Evaluation

Up to now only a limited evaluation has been carried out (Pauwels, 1993) using a sample consisting of university students, to study the effects of the different procedures on exam performance. It was limited to the procedures open to the 18 year olds: procedures 2,3,4 and did not include the procedure open to the 17 year old youngster.

The results of the study showed that:

- the introduction of the 3 procedures has led to a statistically significant increase in pass-rates on the off the road driving test;
- those who have taken professional training (perform significantly better than those who only used private practice in the off the road test;
- there was no difference between procedure 3 and 4 with respect to pass rates on the ‘off the road test’;
- there were no significant differences between the different procedures in pass rates on the ‘on the road test’.

The author explains the absence of differences by the current practice of driving schools in which the manoeuvres that are tested in the off the road driving test are ‘over practised’ and easily taught and acquired. *Accident frequencies have not been studied.* Also the effect of a lower training age (17) has not been assessed yet.

6.7. Conclusions

With respect to the effectiveness of the different forms of accompanied driving:

- There is no conclusive evidence about the effectiveness of laymen’s education, but evaluation studies are underway, that might shed light on this, and be informative about the underlying principles like the rise in automated skills as a result of increased practice.
- There is no conclusive evidence about the effectiveness of apprentissage. Most likely the positive effects are off set by the negative effects of early training (at 16), leading to an increase in exposure (mileage). An evaluation on the basis of a comparison between the Belgian 4 procedures may show us the relative importance and interaction of formal instruction, low practising age and apprentissage. No such evaluation has yet been undertaken.
- There is no information available on the effectiveness of accompanied driving as a restriction, as such a measure has not been implemented yet.

7. Social acceptance of different forms of provisional driving licences

Most provisional driving licences restrict the right of novice drivers to full access to the traffic system. It is to be expected that such restrictions lead to resistance especially for young drivers. To understand the nature and background of the resistance, the meaning of car driving for young drivers is of importance and will be documented in this chapter.

7.1. The meaning of car driving

7.1.1. *Psychogramm of the young German driver*

As most novice drivers are also young, in evaluating licensing measures it is of importance how youngsters think and feel, in other words what makes them tick. The following description is based on the papers presented at the "First interdisciplinary Conference on Young drivers, Cologne, 1994.

The contributions show that between 16 and 25 years of age major changes occur in their lives. In this period they change from socially and economically dependent children into socially and economically independent adults. They will leave the family, live on their own, find their 'spouse', choose a profession, compete for jobs.

Socially accepted traditional norms and values are questioned, and youngsters try to find their own identity and lifestyle, primarily in interaction with the peer group they wish to belong to. The highest desired achievement is not 'social' prestige and economic wealth, but rather 'Self-actualisation' defined as the 'motivation to fulfil their potential within the limits of their capabilities'. Youngsters have a critical attitude towards the achievements of the older generation. They expect to do 'better' than their parents, are invincible and death is not part of their life scheme yet. Most youngsters are born survivors, with high hopes and expectations. The other side of the coin is that it is very much uncertain in this period of their life whether they will be able to meet these expectations. It is hard to find a job in a period of high unemployment, to find living quarters without a steady income. Adolescence has become more and more characterised by early maturing youngsters that more and more remain economically dependent.

This leads to stress and frustration, and the wish for self-fulfilment leads to compensation behaviour, that is also shown in the way they participate in traffic.

7.1.2. *Identity*

The young adult 'uses' driving to create an image of themselves, with the intention of supplying a particular image of himself to others. Goffman (1956). Boys, believe driving to be a natural (male) skill; they do not have to learn it, they are born with it. Driving lessons and exams are obstacles that have to be taken in style, in order to eventually be allowed to do what they were always capable of. For boys, it is important to be good 'drivers'. They believe that they should be good at controlling the vehicle, in order to give them status within the peer group (Rothe, 1987). Driving style is important for reputation and identities (Rolls et al., 1992). Other people (members of the peer group) do not actually need to be present, to motivate the driver to

show the peer group valued driving style. Thus styles of driving, even when alone reflect individual identities which are to a large extent shaped by social processes (Rolls et al., 1992 pp. 78). Young men in particular consider traffic offenses to be associated with little hazard, and so punishment is regarded as disproportionately severe by this group. Social pressure can most effectively be exerted by their peer group (Brown & Copeman, 1975).

Not only is driving style and identity closely related, but also, the way driving style is interpreted by others is influenced by the image that it creates. For example, driving errors made by young female drivers are most frequently seen as a result of incompetence whereas errors made by male drivers are seen as a result of deliberate risk-seeking (Rothe, 1987). A further example shows that young drivers are more frequently breathalysed than older drivers (Markey, 1993, Homel, 1988). While roadside surveys show that youngsters DWI less frequently than older drivers do (e.g. Markey, 1993, Matthijsen, 1990, Homel, 1988).

7.1.3. *Culture*

Cars and car driving have a symbolic meaning in industrialised countries. The symbolic meaning and the attitudes related to it, are handed down within families to the next generations. The way youngsters participate in traffic, drive their cars, their preferences and beliefs, are also a result of their socialisation (Evans, 1987; Sheppard, 1987).

From the socialisation process of children within the family it is a small step towards influences from outside the family. Evans (1987) warns against the imitation of driving behaviour shown on television. Though, Aitkin (1989) having reviewed the literature on DWI and media portrayal, concluded that the socialising influence of TV on risk-related driving behaviour of teenagers is rather modest and mixed in directionality.

Other studies point to the negative influences that sales promotion literature of cars may have, as youngsters are especially interested in these materials (Jung & Huguenin, 1992; Pfafferot, 1984; Huguenin et al, 1985). In contrast, Hale & Glendon (1987) quote studies which show that one learns more from friends, acquaintances and neighbours recognising hazards in the surroundings than from media messages.

7.1.4. *Implication*

Most licensing measures discussed in the previous chapters imply that one way or the other the access of novice drivers to the traffic system is restricted to how, when, where and with whom.

Their strive for independence and their wish for self-actualisation will be frustrated and they will feel that they are treated as children instead of responsible adults. Most likely the discussed measures will lead to deep resentment, if they are implemented in a top-down manner, regulated by law. In this respect the German situation differs from the US and Australia in that in these countries the restrictions apply to the very young frequently the 15 and 16 year old learner car driver high school kids. An 18 year old driver is in a different period in his life as was described in the previous section.

This resentment however does not abdicate society from its responsibility to protect their young members. The most effective way is (analogue to social marketing) to seek the cooperation of the target group negotiating 'voluntary behaviour change', in combination with 'low key' preventive measures

implemented by law. To make up for the experienced loss because of the law - based preventive measures , also measures should be introduced that are attractive for this age group. In the next paragraph we will discuss two frequency used options: 1. lower instruction age and 2. insurance reductions.

7.2. Associated Measures to facilitate social acceptance

7.2.1. *a lower instruction age*

A lower legal instruction age might have two effects. On the one hand it may counteract social opposition against restrictive measures, and on the other hand it may bring parents into play as guardians and enforce the restrictive measures (see Williams and Lund, 1985 in par x) At the age of 16/17 many youngsters might still live in their parent' house. In many countries (Sweden, Norway, Belgium and France) that have restricted novice driving have combined the measure with a lowering of the age at which driving instruction is allowed. This paragraph deals with the effects of this measure on safety.

Safety effects of a lower instruction age

So far, no European study has specifically addressed this question of licensing age. The reported studies are primarily from Canada, United States, New Zealand and Australia. This may be partly due to the fact that within Europe there is less variation in licensing age, and also the licensing age of 18 years is rather high from a world wide perspective. Nevertheless, recent developments such as the introduction of the accompanied driving scheme in France which allows driving at the age of 16 years, calls for a European discussion regarding an optimum licensing age.

A European discussion might be quite different in content. In Australia and New Zealand the wish to lower the driving age is the result of a need to separate the legal drinking and driving ages. Such a need is not present in Europe as in none of the European countries are laws on legal drinking ages in force.

According to Drummond (1989) the initial choice of licensing age is a historical artifact. However, according to Drummond: "It is age, that plays a central role in novice driver safety, in terms of both absolute safety outcomes and potential strategies for improving novice driver safety. Given its centrality, there have been relatively few studies which have addressed the issue directly".

There have been two levels of results, in answering the question: is there an optimal licensing age? Some results indicate that drivers aged 16-18 do not have a worse accident record than the 18 year olds (Cameron, 1972) and those who commenced driving at the age of 16-17 had most accidents at 18 years, but less than the 18 year olds who commenced driving at 18 (Pelz and Schuman, 1971). In a Canadian accident study Laberge-Nadeau et al. (1992) demonstrated that experience does not lead to the same effects in male and females and that driving experience of 1 year or more even may have a negative effect. Young male drivers with at least one year of experience have higher accident rates than the ones with less than one year of experience. This difference however may be the result of differences in mileage rather than differences in skills and attitudes. The authors postulate that in males only after 2,5 years of driving does experience reduce the

accident rates (that is accidents per thousand licence holders). A French study (Simomnet, 1985) came to similar conclusions, estimating that it is necessary to drive 3,000 kilometres before experience becomes profitable. The above mentioned studies have used rates (accidents/kilometres or accidents/licence holder) to compute the effects of licensing age. Other authors have argued that in evaluating the effect of licensing age on accident only the absolute number of accidents are valid measures. They argue that simply because of the fact that more youngsters will drive, licensing at 16 to 17 years of age will lead to higher absolute numbers of accidents (e.g. Henderson, 1972). Toomath and White (1982) taking both exposure and accident frequency into account, reported a nett benefit of a lower licensing age, on absolute accidents. However a similar accident study could not establish such a benefit (Drummond, 1986). In the latter study it was concluded that "the additional accidents resulting from allowing persons to drive below the age of 18 years were not offset by their lower accident rates at ages 18 to 20 years Also a Finnish study on accident involvement, shows that older novice drivers could drive the same amount of mileage with fewer accidents than younger drivers, which was especially true for males (Keskinen et al., 1992).

Such mechanisms may also negatively affect the outcome of the apprenticeship system. Despite the fact that no data are available about exposure, we may postulate that the lower age entry leads to extra kilometres. These kilometres are relatively safe during the apprenticeship system. But after licensing it is to be expected that these youngsters will use a car more frequency than their age group, because of the experience of the convenience of car driving. They also will make longer trips as they have experienced already how to drive long distances, find their way in unfamiliar cities etc. This increased exposure may lead to an increase in absolute numbers of casualties. In a Dutch study (Twisk and Gieszen, 1992) using these assumptions about increased exposure due to a lower age, it was estimated that the introduction of apprenticeship in the Netherlands might lead to an increase of absolute numbers of 18-24 year old accident involved drivers of about 1,000 (5,5%) for men and 600 (11%) for women.

7.2.2. Insurance reduction

An other way to influence driver choices and which might be used to boost the attractiveness of training options or the adoption of restrictions is a cut in the over premium young drivers have to pay for their car insurances. Two different forms have been used: low premium, low returns in case of loss due to an accident

Norway: a premium restitution

A Norwegian insurance company introduced in 1989 an arrangement with repay of part of the premium of young car owners who had no accidents in a given period. (Vaaje, 1992). The objectives were to combine the potential accident reducing effect of incentives for accident - free driving *with* the request to keep the insured loyal to the insurance company. These new conditions introduce an extra reward for 3 to 5 accident-free years in addition to the sanctions of the bonus - malus system. The results so far are very promising with a noticeable reduction in reported accidents. The target group (18 year - 22 year old car owners) included in the incentive group had about 28% fewer reported accidents per car than the control group. It is not

likely that underdeclaration can explain this improvement. How attractive the option is for youngsters has not been studied.

France: a premium reduction in advance

In France the insurance companies offer a premium reduction to youngsters that have followed a intense training programme (AAC, see previous chapter). However this reduction even in combination with a lower instruction age is not attractive as only 10% of the 16 year of age cohort participates in AAC.

7.3. Conclusions

Because of the age of the novice driver in Germany, his ambitions and believes, any licensing measures will hurt him deeply and lead to deep resentment. However, his maturity also gives him the possibility to weigh options, and to give up some privileges for the common good. For that reason it is important to seek his cooperation and approval. Measures restricting his driving, should be introduced with care.

In negotiations the option of an earlier instruction age should not be used unless there is a clear insight into the future effects on exposure. It is recommended to wait for the forthcoming evaluation studies in Sweden en Norway.

Insurance companies can be interesting partners as they have the possibility to reduce premiums. Especially the premium restitution is to be considered as it influences accident claims, and reduces the risks for insurance companies.

8. Discussion and conclusions

8.1. Introduction

In the previous chapters different licensing measures were described within the context of the factors contributing to young driver unsafety, and evaluation results were presented. These different measures were:

- driving licence with restrictions;
- two phase education;
- accompanied driving.

To understand whether these measures would be additive to the current German system or duplicate important features, also ‘driving licence on probation’ was discussed. To understand how measures would affect the young German driver, essential features of the young driver was discussed and also which attractive measures could be used to compensate for restrictive access.

In this chapter the implications of the findings are discussed with particular reference to the German situation, resulting in list of measures that are potentially useful contribution to the safety of young drivers in Germany.

8.2. Effectiveness of the different options

Table 8.1 summarises the effectiveness (in brackets) of different types of provisional driving licences in relation to contributing factors and underlying causes of young driver accidents. Also the criterion variable (accidents) is presented.

Firstly, from the overview it can be concluded that we have not found many studies in which also the intermediate variables were studied. This greatly hampers the interpretation of the findings about accidents. For example, given that evaluation studies show that there is no effect on accidents, it is by no means clear, why a reduction did not take place. Was it because the measure did not change the behaviour in the desired direction? If this were the case then a reduction in accidents would have been an unexpected result. In case the behaviour changed in the preferred directions and an accident reduction did not occur, than perhaps the effects were masked by some other unknown process or the behaviour does not seem to be that relevant for traffic safety.

Frequently, a description of the process is absent. For instance a 0 promille restriction is implemented and no change in accident frequencies were observed. The absence of information on actual DWI frequencies and on important factors such as police enforcement, information campaigns, public awareness etc, makes that we cannot reject the measure. Especially when several laboratory studies have shown that even low doses of alcohol negatively affect skilled performance of novices, and alcohol may make the youngsters aware of the new measure.

Phenomenon	Cause	Provisional driving licence types				
		Delay Licensing	point system	restricted driving	training	accom. driving
1. immaturity	biological development	+ (?)	+(?)	+(?)	0	+(?)
2. limited hazard perception skill	insufficient practice	+ (?)	+(?)	+(?)	+ (+/-)	+(?)
2. overestimation of skills	youthful optimism	+ (?)	0	+(?)	+(?)	+(?)
3. overload	limited automation in combination with high task demands	0(?)	0(?)	+(?)	0	+(?)
4. error prone driving routines	lack of feedback	0(?)	0(?)	0(?)	+(?)	+(?)
5. High risk acceptance	a. not recognised	+(?)	0	0	+(?)	+ (?)
	b. high utility	0	+(?)	+(?)	0	+(?)
	c.. thrill	0	--	--	0	+(?)
6. High exposure	life style adolescence	+(+)	0	+(+)	+(?)	+(?)
7. Accidents		+(++)	+(+)	+(++)	+ (+/-)	+ (+/-)

Legend

- 0 no effect expected because measure does not directly influence this factor
- + effect expected because measure is intended to influence behaviour
- (?) no empirical studies available
- (+) (++) empirical study shows (large) positive effect
- (-) empirical study shows effect in undesired direction
- (-/+)
- empirical studies have shown positive **and** negative effects

Table 8.1. *The expected versus the empirically confirmed effectiveness of different licensing systems in relation to the contributing factors to the young driver accident risk.*

Without information about the intermediate variables and the processes involved the outcomes of evaluation studies are hard to interpret, and it is difficult to decide on this type of information what the best countermeasure is. As a consequence, for the purpose of this review and the subsequent recommended measures we rely on evaluation results in combination with 'theoretical' knowledge of the relevant processes.

A second conclusion, drawn from the table, is that measures that effectively have reduced exposure - for example by means of delaying licensing (also voluntary by making early licensing less attractive) and only allow restrictive driving - seem to have had significant effects on safety records. In comparison, those measures directed at training and accompanied driving

have been less effective in demonstrating effect. Point systems are in the middle of the two. They have had some effects (especially) the first year after licensing. No information is available on their effectiveness over time.

8.3. Implications for Germany

The current system in Germany is characterised by an extensive driver training system, with professional instructors followed by a probationary period. A look at the table in which the “young drivers problems are summarised shows, that not all factors are dealt with in the point system: overload, slowly developing skills such as hazard perception, overestimation of skills and error prone routines.

These limitations could be overcome by the following measures:

- To include a second professional training stage (a two phase driving system). However, up to now the evaluation studies have not been conclusive about the effectiveness of professional training.
- Up to now the French research on Accompanied driving has not been very encouraging. Perhaps the forthcoming evaluation results from Norway and Sweden might shed some light on the effect of practising on automation, overload etc.

A weakness of accompanied driving as restriction, is the absence of an incentive to practice. Drivers may use it as a ‘waiting period’ and loose routine. A combination with a *second test* may motivate novice drivers to practice especially if the second test is known to be difficult to pass. For instance by including a dual task in that drivers have to find their destination in a unfamiliar town. In the framework of this study we have not encountered any licensing system with a second test. And therefore it is not possible to empirically assess its potential.

Nonetheless, from a theoretical point of view a combination of professional training, accompanied driving and a second test, is an interesting option, and might have more to offer than solely expanding behind the wheel professional training.

- reduced exposure. It is the most powerful option, as evaluation results show. At the same time it is also the weakest, as accident prevention is achieved by restricting access to the traffic system. This is especially true for exposure reduction as the result of restrictions such as night curfews etc. Although, there is a theoretical sound base for such restriction (see the relevant chapter on restrictions) this limited access is politically and socially hard to accept. As it means:

- for youngsters an important right is taken away (see the previous chapter)
- economically youngsters might be hit if for their job they need to drive at night
- it might lead to a shift to other perhaps more dangerous types of transport (mopeds etc)
- in rural areas there might not be alternative transport available.

8.3.1. Night curfews

Only in the US have curfew restrictions been implemented for the youngest age group (15 year old drivers). Up to now we do not know of any country

that has been able to introduce a (weekend) night curfew for 18 year olds. Possibly because such a compulsory curfew is hard to implement, as it will be perceived as a considerable loss and substantial rewards will be demanded. It will be hard to find a reward that will outbalance the perceived loss. However, aside of accompanied driving it is the only option achieving the prevention of overload. And therefore it cannot simply be discarded as being too unpopular even to think about it. It is based on that simple and intuitively correct principle of 'step by step learning'; starting off with the simple tasks first and gradually progressing to more complex situations. Because of its attractive logic and high effectiveness in combination with the fact that it is unacceptable to the public, a strategy should be designed to convince novice drivers to restrict their driving on a voluntary basis. Although, it is not possible on the basis of the available material to design such a strategy, the driver training may play an important role in this, by showing the driver his limitations (VTI has designed interesting practises to achieve such insights in drivers), informing him about the relative safety of conditions and by providing him with materials that enables him to design his own : "how to survive the first 2 unsafe years program". The insurance companies may also play a role. They may charge lower premiums in return for a clause that excludes driving at weekend night.

8.3.2. *Alcohol limit*

Less public outcry is to be expected with a lower alcohol limit for the novice drivers. As has been demonstrated even blood levels lower than the legal limit does deteriorate driving performance in novice drivers and probably more so in younger persons because of their alcohol metabolism. Furthermore in Germany like in many other countries shows that alcohol causes problems for young drivers (Kretschmer-Baumel & Kroj (1986)). In 1983 40% of drunken drivers involved in accidents were between 18 and 24 year old. These proportions were confirmed in a more recent German study (Kühnen & Pöppel-Decker, 1995). This study shows that in approximately 40% of all alcohol related accidents young drivers (18-24) were involved. And that 1 in 5 accident involved young drivers were under the influence of alcohol. So, DUI is still a serious problem in young drivers. And many of them report to have driven under the influence of alcohol. Between 9 month and 13 month of driving the percentage of novice young drivers that report never to have DWI falls from 69% (before 9 month of driving experience has been reached) to 56% (Kretschmer-Baumel & Kroj (1986)). This implies that after about a year even 1 in every 2 drivers has fallen into the alcohol trap, and that the problem increases with increasing driving experience. Therefore a lower alcohol limit should not apply to the first year on'y but should also be in operation in the second year.

Furthermore, the alcohol restriction nicely ties in with the point system. If the point system still functions as a deterrence, it is to be expected that a lower alcohol limit is as strictly adhered to as the current legal limit. From the literature there is no indication of the effectiveness of the measure. But one report mentioned that probably the absence of police enforcement made the measure powerless. An alcohol clause in the insurance may partially compensate for relatively low levels of police enforcement.

The introduction may lead to reduction in weekend night car travel as was found in Victoria Australia (Drummond et al. 1986). This might imply that going out becomes less attractive or alternatively youngsters still go out,

leading to highly occupied cars, with possibly drunk passengers and a sober driver. Accident data show that the risk of accidents of cars with two or more passengers is higher than that with fewer or no passengers especially in the weekend nights and for young inexperienced drivers (Drummond et al 1986). Such a phenomenon may be a negative side effect, reducing the safety effect. However if DWI incidence and accident proportions of drunk young drivers are still as high as in 1980-84, it is unlikely that this side-effect will completely overshadow the main effect.

8.3.3. *Estimation of the effectiveness of apprenticeship in Germany*

Aside of accompanied driving:

- if structured education is primarily responsible for effect then it is not likely that Germany will gain from introducing such a system, as Germany has already a highly developed driver training system;
- if the apprenticeship system leads to a large number of practice hours in combination with a thorough driver training program at a professional driving school then safety gains are to be expected.

The positive safety effects due to increased driving experience in safe conditions may be off set by more exposure. The French evaluation studies show a higher mileage for AAC drivers in comparison to traditionally educated youngsters. In the end, the higher mileage may even result in an increase in the absolute numbers of casualties

8.4. **To whom the measures should apply**

young and/or inexperienced drive

The previously described contributing factors that are not dealt with in the current German system, are not age related but are characteristics of the learning process itself and therefore apply both for young and older novice drivers. The additional measures proposed in the previous chapter should therefore apply to all novices of all age groups.

Thrill seekers

None of the five variants of the provisional driving licence systems seem to influence thrill-seeking behaviour.

From the survey we did not find any description of how *licensing systems* may influence this type of behaviour. Because of its complexity, relatively small number, relation to youth culture age and gender, it is perhaps also unlikely that formal systems like licensing systems may be effective. Probably more research is needed especially directed at this subgroup to identify the correct approach. As most of them (with the exception of those who drive unlicensed) go through driving school perhaps that is the right moment to provide them with a special training program. After licensing this opportunity seems to have gone for ever. We do not know of any special programs yet, but first of all the question needs to be answered of how successfully potential thrill seekers in traffic can be identified. Up to now such a screening device has not been used on a routine basis.

Males versus Females

There are clear differences between males and females in accident involvement and also in engaging in risky driving behaviours. Males have higher accident rates than females. This difference is of interest in designing special measures for young males, but it is unlikely that these measures

could lie in the field of formal licensing measures. Addressing these gender related problems should be done in driver training, using special methods as described elsewhere (Woltring, 1994). Driver training should capitalise on its unique feature of one to one education. This enables the instructor to provide teaching and training tailored to the needs of the learner.

8.5. Conclusion

In Germany in addition to the components of the current system, safety gains are to be expected from:

- a compulsory second test after the probationary period:
 - behind the wheel (automation);
 - theoretical higher order cognitive skills ;
- 0 promille alcohol during the probationary period;
- a voluntary driving curfew (on the assumption that a compulsory curfew; will not be acceptable to the public;
- accompanied driving (voluntary) to practice for the second exam.

Literature

Aitkin, C.K. (1989). *Television socialisation and risky driving by teenagers*. Alcohol, drugs and driving 5 (1), 1-21.

APSAD (1994). Internal report.

Bächli-Biétry, J. (1990). *Erfolgskontrolle von theoretischem Verkehrs-sinnunterricht im Verlauf der Fahrausbildung*. BfU-Report 15k. Schweizerische Beratungsstelle für Unfallverhütung BfU, Bern.

Bandura, A. (1977). *A social learning theory*. Prentice Hall, Englewood Cliff, N.J.

Beirness, D.J., Simpson, H.B., Mayhew, D.R. (1993). *Predicting crash involvement among young drivers*. In: Utzelmann, Berghaus & Kroj (1993).

Beirness, P.J. & Simpson, H.M. (1988). *Lifestyle correlates of risky driving and accident involvement among youth*. Alcohol, drugs and driving 4 (3-4), 193-204.

Benda, H.V. & Hoyos, C.G. (1983). *Estimating hazards in traffic situations*. Accid. Anal. & Prev. 15 (1), 1-9.

Belloc, B. & Ivaldi, M. (1991) *Evaluation de L'apprentissage Anticpe de la conduite*. Universite des Sciences Sociales de Toulouse.

Bragg, B.W.E. & Finn, P. (1985). *Influence of safety belt usage on the perception of the risk of an accident*. Accid. Anal. & Prev. 17 (1), 15-23.

Bragg, B.W.E. & Finn, P. (1982). *Young driver risk-taking*. ABT Associates Inc., Cambridge, Mass.

Brown, I.D., Groeger, J.A. & Biehl, B. (1987). *Is driver training contributing enough towards road safety?* In: Rothengatter & De Bruin (eds.) (1987).

Brown, I.D. & Copeman, A.K. (1975). *Drivers' attitudes towards the seriousness of road traffic offences considered in relation to the design of sanctions*. Accid. Anal. & Prev. 7 (1), 15-26.

Brown, I.D. (1982). *Exposure and experience are a confounded nuisance in research on driver behaviour*. Accid. Anal. & Prev. 14 (5), 345-352.

Brown, I.D. & Groeger, J.A. (1988). *Risk perception and decision taking during the transition stage between novice and experienced driver status*. Ergonomics 31 (4), 585-597.

Cameron, C. (1972). *The optimum age for driver licensing*. Proceedings of National Road Safety Symposium, 384-387.

Carstensen, G. (1993). *Evaluation of a New Driver Education in Denmark*. Proceedings of the conference Strategic Highway research Program (SHRP) and Traffic Safety on Two continents. The Hague, The Netherlands.

Chatenet, F. & Simomnet, M. (1982). *Die jungen Autofahrer: Erstes Fahrjahr*. In: Huguenin & Hess (eds.) (1982).

Chevillot, P. (1988). *Description de l'apprentissage anticipé de la conduite*. In: Proc. International Days of Road Safety 1988, Brussels.

Chipman, M.L. (1979). *Are all drivers who drive at high risk? The role of exposure in determining the risk of collision*. In: Proc. 23rd. Conf. Am. Ass. Autom. Med.

Chollet, J.C. (1994) Summary report Insurers data.

Cohen, A.S. (1985). *Visuelle Informationsaufnahme während der Fahrzeugsteuerung in Abhängigkeit der Umweltmerkmale und der Fahrpraxis*. Schweizerische Z.f. Psychologie 44 (4), 249-288.

Colbourn, C.J. (1978). *Perceived risk as a determinant of driver behaviour*. *Accid. Anal. & Prev.* 10, 131-141.

Crettenden, A & Drummond (1994). *A The young driver problem versus the young problem driver*. Prepared by Monash University Accident research Centre. FORS CR 151.

Davis, G.C. (1976). *The effectiveness of the probationary licence scheme*. Royal Automobile Club of Victoria.

De Velde Harsenhorst, J.J. & Lourens, P.F. (1989). *Het onderwijsleerproces bij een leerling-automobiliste: Enkele extra analyses en eindverslag*. VK 89-23. Verkeerskundig Studiecentrum (VSC), R.U. Groningen, Haren.

De Velde Harsenhorst, J.J. & Lourens, P.F. (1988). *Het onderwijsleerproces bij een leerling-automobiliste en specifiek rijgedrag van jonge automobilisten*. VK-88-25. Verkeerskundig Studie-centrum (VSC), R.U. Groningen, Haren.

Drummond, A. E. and Healy, D. J. (1986). *The risk of driver crash involvement per distance travelled in metropolitan Melbourne*. 13tg ARRB/5th REAAA, 149-159.

Drummond, A. E. (1994). *Young driver Research program: a technical and strategic overview of exposure measures as a means of reducing Young driver Crashes*. Accident Research Centre Monash University, Clayton, Federal Office of Road Safety CR 130.

Drummond, A.E. (1986). *Driver licensing age and accident involvement rates of young drivers*. Report no. GR/86/15, Road Traffic Authority, Melbourne.

Drummond, A.E., Cave, T.C., Healy, D. J. (1986). *The risk of accident involvement by time of week - an assessment of the effect of zero BAC legislation and the potential of driving curfews*. In: Benjamin (T).

Elander, J., West, R., French, D. (1993). *Behavioral correlates of individual differences in road-traffic crash risk; An examination of methods and findings*. Psychological Bulletin 113 (2), 279-294.

Elliott, D. (1987). *Self reported driving while under the influence of alcohol/drugs and the risk of alcohol/drug-related accidents*. Alcohol, drugs and driving 3 (3-4), 31-43.

Evans, L. (1987). *Young driver involvement in severe car crashes*. Alcohol, drugs and driving 3 (3-4), 63-78.

Farrow, J.A. (1989). *Young driver risk taking: A description of dangerous driving situations among 16- to 19-year old drivers*. Intern. J. Addictions 22 (12), 1255-1267.

FORS (1993). *Driving Licensing Practices in Australia*. Federal Office of Road Safety

Forsyth, E. (1992b). *Cohort study of learner and novice drivers. Part 2: Attitudes, opinions and the development of driving skills in the first 2 years*. Research Report 372 Transport Research Laboratory (TRL).

Forsyth, E, Maycock, G. & Sexton, B. (1995). *Cohort study of novice drivers part 3: Accidents and offence and driving experience the in the first three years of driving*. TRL research report,

Forsyth, E. (1992a). *Cohort study of learner and novice drivers. Part 1: Learning to drive and performance in the driving test*. Report 338. Transport Research Laboratory (TRL).

Fontaine, H. & Gourlet, Y. (1995). *Drivers, Cars and crash types: exposure, risk and severity factors*. Paper presented to: Transportation Research Board. 74th Annual meeting January 22-28, 1995 Washington, D.C.

Frith, W.J. & Perkins, W.A. (1992) *The New Zealand Graduated Driver Licensing System*. Road Traffic Safety Research Council Seminar Wellington

Glad, A. (1988). *Phase 2 in the driver education; Effect on accident risk*. Oslo Institute of Transport Economics.

Goffman, E. (1956). *The presentation of self in everyday life*. Penguin Books, Harmondsworth.

Goldenbeld, Ch. (1994) *De invloed van pakkans en straf op verkeers-overtredingen; Een inventarisatie van onderzoek en modellen over de mogelijke relaties tussen bestraffing, pakkans, beslissen en verkeers-overtredingen*. R-94-15. SWOV, Leidschendam.

Gregerson, N.P. & Berg, H.Y. (1993). *Lifestyle and accidents among young drivers*. Accepted for publication in Accident analyses and prevention, March 1993.

- Gregerson, N. P. (1994). *Systematic cooperation between driving schools and parents in driver education*. *Accid. Anal. and Prev.* vol 26 no. 4 pp. 453-461.
- Gregerson, N. P. (1995) *Prevention of road accidents among young novice car drivers*. Linköping University Medical Dissertations No. 44. Linköping
- Griep, D.J. (1972). *Het strafpuntensysteem en de verkeersveiligheid*. *Tijdschrift voor de politie* 34 (5), 126-129.
- Groeger, J.A. & Brown, I.D. (1989). *Assessing one's own and others' driving ability; Influences of sex, age, and experience*. *Accid. Anal. & Prev.* 21 (2), 155-168.
- Hagge, R.A. & Marsh, W.C. (1986). *An evaluation of the traffic safety impact of provisional licensing*. Interim report. Department of Motor Vehicles, Sacramento, Ca.
- Hale, A.R. & Glendon, A.I. (1987). *Individual behaviour in the control of danger*. Industrial safety series 2. Elsevier, Amsterdam.
- Haque, O. & Cameron, M. (1987). *Evaluation of the effect of the Victorian Zero BAC legislation*. GR/87/11. Road Traffic Authority, Hawthorn, Vic.
- Haworth, N. (1994). *Young driver research program: evaluation of Australian graduated licensing scheme*. Monash University accident research centre CR 136 Federal Office of Road Safety.
- Heinrich, H.C. (1990) *Behavioural changes in the context of traffic safety*. IATTS research vol 14. no 1. 1990.
- Henderson, R.L. (1972). *The young driver*. Report 3/72. Traffic Accident Research Unit, Dept. of Motor Transport, Sydney.
- Henning, H. J. & Chaselon, F. M. (1994). *Schlussbericht zur wirksamkeitsuntersuchung zum Modellversuch 'Jugend fahrt sicher'*. In preparation.
- Heussenstamm, F.K. (1971). *Bumper stickers and the cops*. *Transaction* 8, 32-42.
- Hingson, R. Heeren, T. & Morelock, S. (1989). *Effects of Maine's 1082 .02 law to reduce teenage driving after drinking*. *Alcohol, Drugs and Driving*, 5, 25-36.
- Homel, R. (1988). *Policing and punishing the drinking driver; A study of general and specific deterrence*. Springer-Verlag. New York.
- Huguenin, R.D., Bauer, M. & Mayerhofer, K. (1985). *Das Automobil in den Massenmedien - Der Einfluss auf die Sicherheitseinstellung*. bhfu-report 8, Schweizerische Beratungsstelle für Unfallverhütung. BfU, Bern.
- Huguenin, R. (1993). *Bessere Ausbildung durch neue Unterrichtsinhalte und Modelle*. International Days of Road Safety. Brussels, 26-28 October 1993.

- Hurst, P.M. (1980). *Can anyone reward safe driving?* *Accid. Anal. & Prev.* 12, 217-220.
- Ivaldi, M. & Belloc, B. (1992). *Evaluation of the early driving instruction programme, June 1990 survey.* Gremac (Research group on Mathematical and Quantitative Economics). University of Social Sciences, Economic Science Faculty
- Jessor, R. (1987). *Risky driving and adolescent problem behaviour: An extension of problem behaviour theory.* *Alcohol, drugs and driving* 3 (3-4), 1-11.
- Jonah, B.A. (1986b). *Accident risk and risk-taking behaviour among drivers.* *Accid. Anal. & Prev.* 18 (4), 255-272.
- Jonah, B.A. & Dawson, N.E. (1987). *Youth and risk: Age differences in risky driving, risk perception and risk utility.* *Alcohol, drugs and driving* 3 (3-4), 13-29.
- Jonah, B.A. (1986a). *Youth and traffic accident risk: Possible causes and potential solutions.* *Accid. Anal. & Prev.* 18 (4), 253-254.
- Jones, B. (1994). *The effectiveness of provisional licensing in Oregon: an analysis of Traffic Safety Benefits.* *Journal of Safety Research*, vo 25 no 1 pp 33-46 (1994).
- Jones, B. (1994). *The effectiveness of provisional licensing in Oregon: An analysis of Traffic Safety Benefits.* *Journal of Safety Research* vol 25, no 1.
- Jung, H. & Huguenin, R.D. (1992). *Behaviour analysis of young drivers.* *International Journal of Adolescent Medicine and Health* 5 (3-4).
- Kampen, L.T.B. van (1988). *Analyse van de verkeersonveiligheid van jonge, onervaren automobilisten; Een probleemanalyse.* R-88-45. SWOV, Leidschendam.
- Kirkham, W.R. & Lindauer, A.A. (1985). *Sex differences in the distribution of traffic law enforcement.* *Accid. Anal. & Prev.* 17 (3), 211-215.
- Kühnen, M. A. & Pöppel-Decker (1995). *Regionalstruktur nachtlliche Freizeitunfalle junger Fahrer.* Bundesanstalt für Strassenwesen. Heft M 38. Bergisch-Gladbach, Germany.
- Laberge-Nadeau, C., Maag, U & Bourbeau, R. (1992). *The effect of age and experience on accidents with injuries: Should the licensing age be raised.* *Accid. Anal. & Prev.* 24 (2), 107-116.
- Lagadec, J. & Bontemps, T. (1993). *The effectiveness of the early driving instruction programme in decreasing the accident rate amongst young drivers* (Sylab September 1993).
- Lastovicka, J.L. et al. (1987). *A lifestyle typology to model young male drinking and driving.* *J. Consumer Res.* 14, 257-263.

Leutbach, W. et al. (1988). *Vergleich der Verkehrssicherheit in der Bundesrepublik Deutschland und Gross Britannien*. BASt-Bericht zum Forschungsproject 8507. Bundesanstalt für Strassenwesen. Bergisch-Gladbach, Germany.

Lund, A.K. & Williams, A.F. (1985). *A review of the literature evaluating the defensive driving course*. *Accid. Anal. & Prev.* 17 (6), 449-460.

Lynam, D. & Twisk, D. (1995). *Car driver training and licensing systems in Europe*. Report on behalf of Forum of European Road Safety Research Institutes supported by European Commission Transport Directorate (DG VII).

Maisey G.E. (1984). *The effect of lowering the statutory alcohol limit for first year drivers from 0.08 to 0.02 gm/100ml*. Research report 84/2. Perth: Research and Statistics section. Police Department.

Markey, K. (1993). *Younger driver casualties after injury road accidents*. In: *Road accidents Great Britain, 1992. The casualty report*. pp. 28-35 HMSO.

Maron, D.J. et al. (1986). *Correlates of seat belts use by adolescents: Implications for health promotion*. *Preventive Medicine* 15, 614-623.

Marsh, W.C. (1978). *Educational approaches to driver improvement; An experimental evaluation with negligent drivers*. Department of Motor Vehicles, State of California, Sacramento.

Marsh, P.E. & Collett, P. (1986). *Driving passion; The psychology of the car*. Jonathan Cape, London.

Marthiens, W. & Schulze, H. (1989). *Disco-Unfälle; Fakten und Lösungsstrategien. Teil 1: Analyse nächtliche Freizeitunfälle junger Fahrer*. Unfall- und Sicherheitsforschung Strassenverkehr, Forschungsbericht nr. 198. Bundesanstalt für Strassenwesen. Bergisch-Gladbach, Germany.

Mathijssen, M.P.M. (1990). *Rijden onder invloed in de provincie Noord-Brabant*. R-90-17. SWOV, Leidschendam.

Matthews, M.L. & Moran, A.R. (1986). *Age differences in male drivers' perception of accident risk: The role of perceived driver ability*. *Accid. Anal. & Prev.* 18 (4), 299-313.

Maycock, G., Lockwood, C.R. & Lester, J.F. (1991). *The accident liability of car drivers*. RR 315 TRRL Crowthorne.

Maycock, G., Lockwood, C.R. & Lester, F. (1991). *The accident liability of car drivers*. TRRL-report 315. TRRL.

Mayhew, D.R. & Simpson, H.M. (1985). *Alcohol, age and risk of road accident involvement*. In: *Proc. 9th Int. Conf on Alcohol Drugs and Traffic Safety*, San Juan, Puerto Rico, pp. 937-947. U.S. Department of Transportation, Washington D.C.

Mayhew, D.R. & Simpson, H.M. (1990). *New to the road: young drivers and novice drivers: similar problems and solutions?* Traffic injury research foundation of Canada, Ottawa, Ontario.

Mayhew, D.R., Simpson, H.M. & Donelson, A.C. (1985). *Young drivers accidents. In search of solutions.* Traffic Injury Research Foundation, Ottawa.

Mayhew, D.R., Donelson, A.C., Beirness, D.J. & Simpson, H.M. (1986). *Youth, alcohol, and relative risk of crash involvement.* *Accid. Anal. & Prev.* 18 (4), 273-287.

McKenna, F.P. & Crick, J.L. (1990). *Experience and expertise in hazard perception.* In: Behavioural research in road safety. Proceedings of a seminar held at Nottingham University, 26-27 September 1990, p. 39-64.

McKenna, F.P. & Crick, J.L. (1992). *A cognitive approach to driver training: the use of video technology in developing the hazard perception skills of novice drivers.* In: Behavioural research in road safety III. Proceedings of the seminar at the University of Kent, 22-23 September, 1992.

McKnight, J.A. & Edwards, M.L. (1987). *A taste of suspension: The preventive and deterrent value of limited licence suspension.* In: Proc. 31st Conf. Am. Ass. Autom. Med., New Orleans, Louisiana.

Milech, D., Glencross, D. & Hartley, L. (1989). *Skills acquisition by young drivers; perceiving interpreting and responding to the driver environment.* Report. MR 4. Federal Office of Road Safety, Canberra, 1989

Moe, D. (1987). *Das Image des guten Fahrers.* *Z.f. Verkehrssicherheit* 33 (1), 5-10.

Moe, D. & Jensen, D.G. (1993). *Youth, risk taking and car driving.* SINTEF, Trondheim, Norway.

Moukhwas, D. *Age and experience and restrictions imposed to young drivers* Paper presented at the international days of Road Safety 26-27-28 October 1993, Brussels.

Mourant, R.R. & Rockwell, T.H. (1971). *Visual scan patterns in novice and experienced drivers.* In: Symposium Psychological aspects of driver behaviour, Noordwijkerhout, Volume 2: Applied Research. SWOV, Leidschendam.

National Interministerial Observatory for Road Safety (1995). *Young drivers and the early driving instruction programme.*

Wittink, R.D. & Twisk, D.A.M. (1990). *Een cursus voor beginnende automobilisten in aanvulling op de rijopleiding; een experiment om het rijgedrag beter af te stemmen op veiligheidseisen en gebrek aan ervaring.* R-90-33 SWOV, Leidschendam 1990.

Neilson Associates PTY LTD Lansley, Hayes and Storer (1986). *Implementation of Graduated Licensing for Young drivers Federal office of Road Safety*. CR 53 1986

Neumann-Opitz, N. & Siebenhaar, L. Heinrich, C.C. (1994). *Driver training systems in Europe; Results of a Survey carried out in 27 countries*. Berichte der Bundesanstalt für Strassenwesen: Mensch und Sicherheit, Heft M 49. Bergisch-Gladbach, Germany.

Noordzij, P.C. (1987). *Verkeerswetgeving, -gedrag en -veiligheid*. Werkgroep Veiligheid R-87/12. R.U. Leiden.

O'Connor, P.J. (1986). *Report on graduated driver licensing and other road accident counter-measures focusing on young drivers*. Report 6/86. Road Safety Division, South Australia Government. OECD (1975). *Young driver accidents*. OECD, Paris.

Olson, P.L. & Sivak, M. (1986). *Perception-response time to unexpected roadway hazards*. Human Factors 281, 91-96.

Oude Egberink, H., Lourens, P.F. & Molen, H.H. van der (1986). *Driving strategies among younger and older drivers when encountering children*. *Accid. Anal. & Prev.* 18 (4), 315-324.

Page Y. (1995). *Effect of training program on speeding offences*. DSCR-ONISR.

Markey, K. (1993). *Younger driver casualties after injury road accidents*. In: *Road accidents Great Britain 1992; The casualty report*. pp. 28-35. HMSO.

Pauwels, J. & Helsen, W. (1992) *The influence of alcohol consumption on driving behaviour in simulated conditions* In: Utzelman, Berghaus & Kroj (ed).

Peck, R.C. (1993). *The identification of multiple accident correlates in high risk drivers with specific emphasis on the role of age, experience and prior traffic violation frequency*. *Alcohol Drugs and driving*, Volume 9, nrs 9-10.

Pfafferott, I. (1983). *Fahrzeugwerbung und Verkehrssicherheit - Problemstudie: inhaltsanalysen und Folgerungen*. Bundesanstalt für Strassenwesen (BASt). Bergisch-Gladbach, Germany.

Pfundt - Büro für Verkehrssicherheit, (1993). *Untersuchungen zu den Möglichkeiten und Erfolgsaussichten einer zweiten Phase der Fahrausbildung*. Schlussbericht, Dezember 1993.

Preusser, D.F., Williams, A.F., Zador, P.L. & Blomberg, R.D. (1984). *The effect of curfew laws on motor vehicle crashes*. *Law and Policy Quarterly* 6, 115-128.

Quimby, A.R. & Watts, G.R. (1981). *Human factors and driving performance*. LR 1004. TRRL, Crowthorne.

- Reason J.T. (1990). *Human Error*. Cambridge University Press, New York.
- Robertson, L.S. (1983). *The teenage driver*. *Travel and Traffic Medicine* 1, 22-25.
- Robertson, L.S. & Baker, S.P. (1975). *Prior violation records of 1447 drivers involved in fatal crashes*. *Accid. Anal. & Prev.* 7 (2), 121-128.
- Rolls, G. & Ingham, R. (1992). *'Safe' and 'unsafe' drivers - a comparative study of younger male drivers*. Fanum House, Basingstoke, Hampshire. AA Foundation for Road Safety Research.
- Rolls, G.W., Hall, R.D., Ingham, R. & McDonald, M. (1991). *Accident risk and behavioural patterns of younger drivers*. AA Foundation for Road Safety Research.
- Rothe, J.P. (1987). *Rethinking young drivers*. Insurance Corporation of British Columbia, North Vancouver, B.C.
- Rothengatter, J.A. (1985). *Gedragbeïnvloeding in het verkeer: Methoden en modellen*. *Verkeerskunde* 36 (7) 335-337.
- Saarin, O. (1984). *Mootiajoneuvon kuljettajan ilo jaajokokennus kuolemaan Johtaneissa kiikennesonnettomuiksissa*. 85/1984. Helsinki University of Technology (zie Summala, 1987).
- Schlag, B., Ellinghaus, D. & Steinbrecher, J. (1986). *Risikobereitschaft junger Fahrer*. Unfall- und Sicherheitsforschung Strassenverkehr, Heft 58, Bundesanstalt für Strassenwesen. Bergisch-Gladbach, Germany.
- Schulze, H. (1990). *Lifestyle and traffic behaviour of young drivers*. In: *Proceedings of road safety and traffic environment in Europe*, Gothenburg, Sweden, September 26-28, 1990.
- Scotchmer, D.M. (1984). *The Ontario Probationary System*. Ministry of Transportation and Communications, Ontario.
- Shaoul, J. (1975). *The use of driving knowledge and driving practices as a criteria for evaluating the effectiveness of driver education*. University of Salford.
- Sheppard, D. (1987). *Children's view on road safety and on adults driving*. CSR Paper no 5. Centre for Safety Research.
- Shiffrin, R.M. & Schneider, W. (1977). *Controlled and automatic information processing II. Perceptual learning, automatic attending, and a general theory*. *Psychol. Rev.* 84 (127),
- Siegrist, S & Ramseier, E. (1992). *Erfolgskontrolle von Fortbildungskursen für Autofahrer; der Einfluss auf der Unfalbeteiligung, am Beispiel des Verkehrssicherheitszentrums Veltheim VSZV*. BfU-Report 18. Schweizerische Beratungsstelle für Unfallverhütung BFU, Bern.

- Simomnet, M., Delaunay, S.F.M. & Forestier, M. (1982). *Recently qualified drivers; A comparison of two methods of driving instruction*. *Ergonomics* 25 (10), 925-934.
- Simpson, H.M. & Mayhew, D.R. (1987). *Demographic trends and traffic casualties among youth*. *Alcohol, drugs and driving* 3 (3-4), 45-62.
- Sivak, M., Soler, J., Trankle, U. & Spaghol, J.M. (1989a). *Cross-cultural differences in driver risk-perception*. *Accid. Anal. & Prev.* 21 (4), 355-362.
- Sivak, M., Soler, J. & Trankle, U. (1989c). *Cross-cultural differences in driver self-assessment*. *Accid. Anal. & Prev.* 21 (4), 371-375.
- Sivak, M., Soler, J. & Trankle, U. (1989b). *Cross-cultural differences in driver risk-taking*. *Accid. Anal. & Prev.* 21 (4), 363-369.
- Skelly, G.B. (1968). *Aspects of driving experience in the first year as a qualified driver*. RRL Report LR 149. Road Research Laboray, Crowthorne.
- Smith, D.I. (1986). *Effect of low proscribed blood alcohol levels (BALs) on traffic accidents among newly licensed drivers*. *Medicine, Science and Law*, 26, 144-148.
- Soliday, S.M. & Allen, J.A. (1972). *Hazard perception in automobile drivers; Age differences*. Highway Safety Research Center, University of North Carolina.
- Spolander, K. (1983). *Accident risk among drivers; A model tested on man and woman*. Rapport 260. Swedish Road and Traffic Research Institute (VTI), Linköping.
- Struckman-Johnson, D.L., Lund, A.K., Williams, A.F. & Osborne, D.W. (1989). *Comparative effects of driver improvement programmes on crashes and violations*. *Accid. Anal. & Prev.* 21 (3), 203-215.
- Summala, H. (1987). *Young driver accidents: risk taking or failure of skills*. *Alcohol, drugs and driving* 3 (3-4), 79-79.
- Svenson, O. (1989). *Are we all less risky and more skillful than our fellow drivers*. *Acta psychol.* 47, 143-148.
- Tannahill, W.J. (1986). *Provisional driver licensing system for young novice drivers*. DOT-HS-806-891. National Highway Traffic Safety Administration, Washington, D.C.
- Tannahill, W.J. & Tarrants, W.E. (1982). *Effectiveness and efficiencies in driver licensing and improvement*. DOT-HS-806-136. National Highway Traffic Safety Administration, Washington, D.C.
- Toomath, J.B. & White, W.T. (1982). *The New Zealand survey of driver exposure to risk of accidents*. *Accid. Anal. & Prev.* 14 (5), 407-411.
- Twisk, D. A. M. (1994). *Young driver accidents in Europe; Characteristic young driver accidents in the member states of the EU*. R-94-18. SWOV, Leidschendam.

Twisk, D. A. M. & Gieszen (1992). *Een studie naar de overzetbaarheid van de principes van het Franse begeleid-rijden opleidingsstelsel*. R-92-44. SWOV, Leidschendam.

Utzelman, H.D., Berghaus, G. & Kroj, G. (1993). *Alcohol, drugs and traffic safety - T92*. Proceedings 12th International conference on Alcohol, drugs and traffic safety, Cologne, 28 sept- 20oct. 1992. Verlag TUV Rheinland.

Twisk, D.A.M (1990). *De verkeersonveiligheid van jonge, onervaren automobilisten en de invoering van een voorlopig rijbewijs; Een literatuurstudie*. R-90-44. SWOV, Leidschendam.

Utzelmann, H.D. (1985). *Evaluation der Kurse für mehrfach auffällige Kraftfahrer*. Unfall- und Sicherheitsforschung Strassenverkehr, Heft 53. Bundesanstalt für Strassenwesen. Bergisch-Gladbach, Germany.

Quimby, A.R. (1987). *Younger driver involvement in at-the-scene accidents*. Unpublished working paper. TRRL.

Vaaje, T. (1992). *Rewarding youth drivers after claim-free period by return of part of premium*. International conference on Automobile Insurance and Road Accident Prevention. Amsterdam 6th-8th 8 april, 1992.

Kampen, L.T.B. van (1988). *Analyse van de onveiligheid van jonge, onervaren automobilisten; een probleem analyse*. R-88-45. SWOV, Leidschendam.

Wasielwsky, P. (1984). *Speed as a measure of driver risk: Observed speeds versus driver and vehicle characteristics*. *Accid. Anal. & Prev.* 16 (2), 89-103.

Weissbrodt, G. (1989). *Fahranfänger im Strassenverkehr*. Unfall- und Sicherheitsforschung Strassenverkehr, Heft 70. Bundesanstalt für Strassenwesen. Bergisch-Gladbach, Germany.

Williams, A.F. (1994). *Restrictive Measures for young beginning drivers*. Insurance Institute for Highway Safety, Arlington, VA.

Williams, A.F. & Karpf, R.S. (1984). *Teenaged drivers and fatal crash responsibility*. *Law & Politics* 6, 101-113.

Williams, A.F. & Lund, A.K. (1985). *Night driving curfews in New York and Louisiana: Results of a questionnaire survey*. *Accid. Anal. & Prev.* 17 (6), 461-466.

Williams, A.F. & Lund, A.K. & Preusser, D.F. (1985). *Teenage driver licensing in relation to state laws*. *Accid. Anal. & Prev.* 17 (2), 135-145.

Williams, A.F. & O'Neill, B.F. (1974). *On-the-road driving records of licenced race drivers*. *Accid. Anal. & Prev.* 6 (3-4), 263-270.

Williams, A.F. (1987). *Effective and ineffective policies for reducing injuries associated with youthful drivers*. *Alcohol, Drugs and Driving*, 3 (3-4), 109-117.

Williams, A.F. (1985). *Nighttime driving and fatal crash involvement of teenagers*. *Accid. Anal & Prev.* 17 (1), 1-5.

Wilson, R.J. & Jonah, B. (1988). *The application of problem-behavior theory to the understanding of risky driving*. *Alcohol, drugs and driving* 4 (3-4), 173-192.

Wilson, W.T. & Wilson, P. (1984). *Typology of rated driving and the relationship between self and the other driver ratings*. *Accid. Anal. & Prev.* 16, 351-370.

Wilson, W.T. & Anderson, J.M. (1980). *The effects of tyre type on driving speed and presumed risktaking*. *Ergonomics* 23 (3), 233-235.

Woltring, L. (1995) *Sex & Genderspecific aspects of young male risktaking behaviour 'nature and nurture' intertwined*. Paper presented at the first interdisciplinary conference on young drivers, Köln, 12-14 December 1994.