CHAPTER II

LITERATURE REVIEW

1. Introduction

Firstly, this literature review explores the global burden as well as the burden in Laos related to road traffic accidents, the associated terminology as well as the causes of road traffic accidents.

Secondly, this review summarizes concepts, theory, existing knowledge and preventive measures for road traffic accidents.

The next section in this chapter will focus on adolescents and road traffic accidents in particular. In brief, this section deals with the risk behavior theory on drinking and driving among adolescents.

Finally, in conclusion this review supports the identification of specific need for further study in Laos and the formulation of research questions.

2. Global Burden of the Problem

Road crashes are ranking ninth among the leading causes of disease burden world wide, and accounts for 2.8% of all global deaths and disability. Although the number of motor vehicles per population is much higher in developed countries, the death rate due

to road traffic injuries is highest in developing countries. In 1998 more than one million (or 88% of all road traffic accidents) deaths were in developing countries. The WHO SEARO region accounts for about 29% of the global burden of road traffic deaths. Alarmingly, 50 % of road traffic fatalities worldwide involve young adults aged 15-44 years, the most economically productive segment of the population (WHO, 1998).

In 2001, deaths by cause, sex and mortality stratum in the WHO regions, estimated that the mortality rate of injuries was 5,103,000 (or 9% of the total mortality). It includes 1,194,000 (2.1%) due to road traffic accidents, with more male victims than female victims. (848,000 or 2.9% males and 346,000 or 1.3% females respectively). The burden of disease in DALYs from road traffic accidents for both genders was 37,719,000 (2.6%). In male it was more than in female 26,187,000 (3.4%) and 11,532,000 (1.6%) respectively. This burden will continue to increase in the future, according to a WHO projection the DALYs from the road traffic accidents will be ranked 3th from the present rank of 9th out of top ten causes of DALYs (WHO, 2002). Table-1 below shows the WHO estimation for 1990 and projection for 2020.

Table 1. Disease Burden Measured in Disability-Adjusted Life Years

Estimation 1990			Projection 2020		
Rank	Cause	% Total	Rank	Cause	% Total
1	Lower respiratory infections	8.2	1	Ischaemic heart disease	5.9
2.	Diarrhoeal diseases	7.2	2	Unipolar major depression	5.7
3	Perinatel conditions	6.7	3	**Road traffic accidents**	5.1
4	Unipolar major depression	3.7	4	Cerebrovascular disease	4.4
5	Ischaemic heart disease	3.4	5	Chronic pulmonary disease	4.2
6	Cerebrovascular disease	2.8	6	Lower respiratory infection	3.1
7	Tuberculosis	2.8	7	Tuberculosis	3.0
8	Measles	2.7	8	War	3.0
9	**Road traffic accidents**	2.5	9	Diarrhoeal diseases	2.7
10	Congenital abnormalities	2.4	10	HIV	2.6

(Source: WHO, The Global Burden of Diseases, 2002)

3. Burden of the Road Traffic Accidents in Lao PDR

Just over a period of one year, there was a two-fold increase in the number of casualties and deaths due to road traffic accidents in Laos. In 2000, the national figures were 2,117 for casualties and 180 deaths, while in 2001 there were 4,023 casualties and 347 deaths, a substantial increase by 100%. casualties from road-traffic accidents in Vientiane account for more than 50% of national figures every year. The population is growing in Vientiane, and vehicles and motorcycles is ever increasing in number.

That could be one of the reasons as to why there is an increasing rate of traffic accidents in Vientiane. The increasing numbers of motor drivers represent mainly adolescents, often students. Among all casualties in 2000, 28% and 2001 36 % were amongst students.

The health cost implication in road traffic accidents is extremely high. In 2000, the national cost was over 1.6 billion Kip, while skyrocketing to 11.8 billion Kip in 2001. Vientiane shares more than 25% of national cost for health injuries and deaths. (Road Traffic Police Department, Lao PDR, 2001).

4. Some Definitions on the Terminology related to Road Traffic Accidents

It is important to clarify the various terms used in the literature related to road traffic accidents.

- **Definition of accident**

Shinar (1978) described the term accident as follow:

> "An unexpected not necessarily injurious or damaging event, that interrupts a completion of activities; it is invariably preceded by an unsafe act or an unsafe condition or both, or some combination of unsafe act and/or unsafe condition" (National Safety Council, 1974 cited in Shinar,1978: 101).

Often accident, collision and crash are used interchangeably.

- **What are injuries?**

An injury is physical damage to the body. Amongst other causes, injuries result from road traffic collisions, burns, falls, poisonings and deliberate acts of violence against

oneself or others. More technically speaking, injuries result from acute exposure to various kinds of energy-mechanical, thermal, electrical, chemical or radiant- in amounts that exceed the threshold of physiologic tolerance. Public health professionals divide injuries into two categories: " unintentional injuries " that include most injures resulting from traffic collisions, burns, falls, and poisonings; and " Intentional injuries" that are injures resulting from deliberate acts of violence against oneself or others. (WHO, 2001).

For the purpose of this study injuries are defined as "unintentional physical damage to the body as a result from road traffic collisions or fall when driving a motorcycle".

- **Why are injuries not referred to as accidents?**

The word "accident" implies a degree of inevitability. The traditional view of injuries from "accidents" suggests that they are random events, an unavoidable part of the world in which we live. This resulted in the historical neglect of this area of public health. During the past few decades, public health officials have recognized that injuries are preventable. Due to the traditional view on injuries, they were taken away from the realm of science, where they could be studied and solutions for their prevention could be proposed. (WHO, 2001)

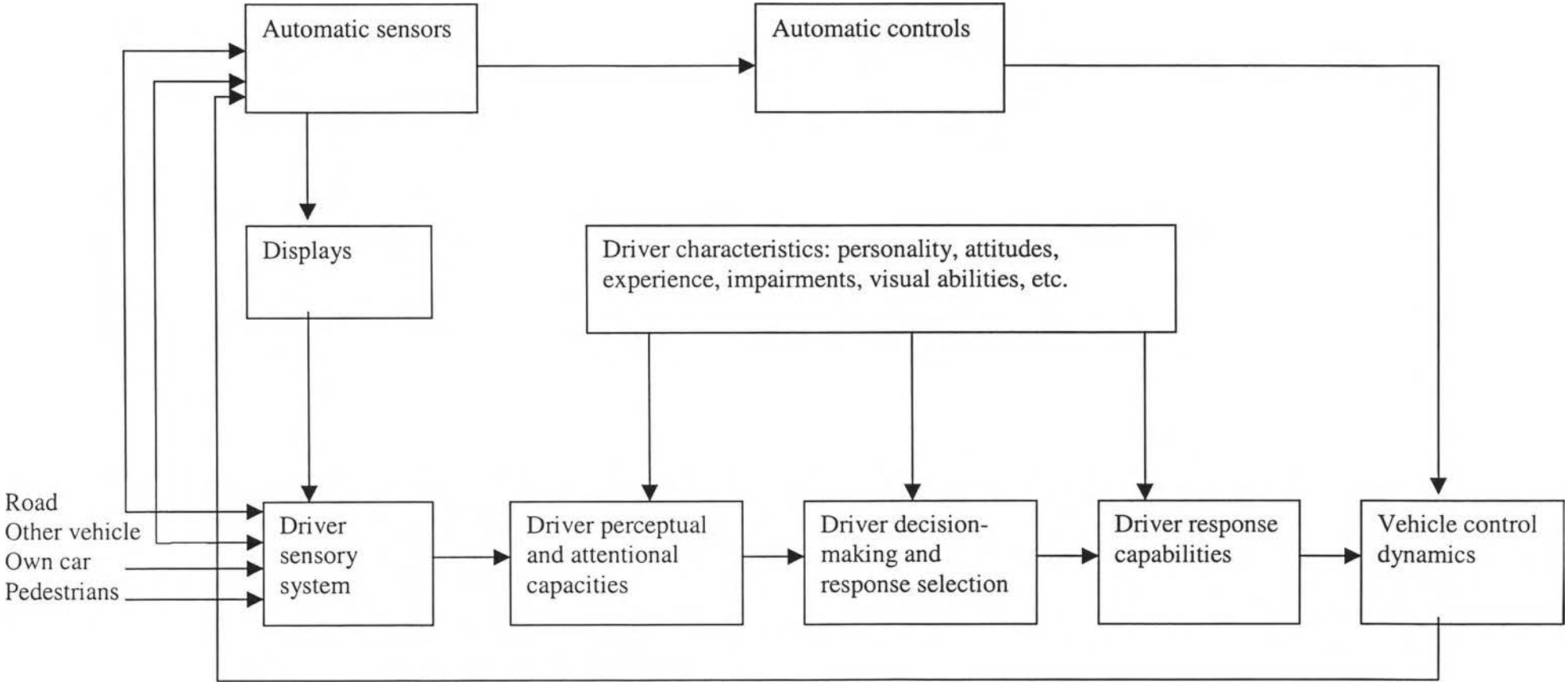
5. Causes of Road Traffic Accident

Shinar (1978, p.2) developed the driver-vehicle-road system theory as shown below in Figure-2 the driver-vehicle-road system consists of three elements: (a) the environment (road and signals), (b) the vehicles and (c) the people (drivers and pedestrians). In

road–vehicle–driver-pedestrian system the driver/pedestrian is the only decision-making component and therefore it are his or her actions or in-actions that make this system go. As the information processor in the system, the drivers' role is to process mostly visual inputs from the road, traffic, and his or her own vehicle's behavior, make decisions about appropriate control actions, execute these actions, and observe and respond to the new situation that result. Failure of the driver that makes the accident inevitable may be one of delayed recognition or perception of the impending danger, an error in the decision-making process on how to respond to that situation, or an improper response to the emergency situation. Over 90 percent of the accidents, in a study by Treat et al (1977), cited in Shinar the driver committed some error that caused the accident. Therefore, the main factor responsible for the accidents is the human factor.

For the specific human factors in accidents, a distinction can be made between direct causes and indirect causes. Direct causes means human acts and failures to act in the minutes immediately preceding an accident, which increases the risk of collision beyond that, which would have existed for conscious driver, driving to high but reasonable standard of good defensive driving practice. And it includes improper lookout, excessive speed, inattention and improper evasive action. Human indirect causes include alcohol impairments, other drugs impairment, fatigue, driver inexperience etc. (Shinar, 1978: 92-127).

In conclusion, key factors for road traffic accidents are; driving under influence of alcohol, speeding, under utilization of helmet and child restraints, poor road design and roadway environment, unsafe vehicle design and under-implementation of road safety standards.



Source: Shinar (1978)

Figure 2: A Simplified Block Diagram of the Driver Functions in the Driver-Vehicle-Road System

6. Previous Studies

Various studies have been done in the field of driving behaviors of high school students. An important study on high school students by Jessor (1987) revealed that those students who reported frequently taking risk while driving were more likely to report having driven after 'a good bit to drink'. Blecheler-Fretel and Denech-Pajouh (1986) showed that young drivers reporting that they had driven while impaired were less likely to respect speed limits and other traffic laws. Particularly the alcohol-related impaired driver groups have a higher incidence of accidents and traffic violations. Impaired driving or driving while impaired means the operation of motor vehicle while the driver's blood alcohol concentration (BAC) is over the legal limits, and impaired drivers are the people who engaged in such behavior irrespective of whether they have ever been apprehended by the police. Drivers not wearing seatbelts were more likely to have blood alcohol concentrations over 80-mg% (Brian, 1990).

'Drinking and driving' and 'reckless driving' are some causes of accidents. An investigation of the records of 9,273 drivers in Britain revealed that drinking and driving causes maximum accidents. This comparative study between 'drinking and driving' and 'reckless driving' showed that 50% of the drivers involved in a fatal or injury accident had high drinking-and-driving scores. Young drivers (aged 16-19) are more likely to drive in a high speed after drinking and driving. Vingilis, (1983) concluded that 30-50% of impaired drivers can be classified as alcoholics. They are called high-risk drivers also. There are many other studies which show the relationship between drinking alcohol and driving and road traffic accidents.

According to studies by Satsanguan, (2002.), and Phansawang, (1996) on driving behavior of motorcycle drivers in Bangkok Metropolis, there are different driving behaviors of the drivers. For example (a) violate traffic signals, (b) reckless driving behavior, (c) over-take in restricted zones, (d) park in non-parking area and (e) park and wait for customers.

A study by Murichun, (1998) suggested that gender, education level, income level, knowledge regarding traffic regulations, experiences and frequencies of traffic laws violations are related to road traffic accidents. There was no relationship of age and marital status with the accidents, but many other studies revealed that age is a major determinant of accidents. A similar study by Singsri, (1999) suggested that the younger the age and the less experience, the higher chance for accidents. There was a relationship between driver profile, alcohol drinking and accidents or injuries. Drinking behavior very often led to accidents. This study found out that 1,235/100,000 drivers were drunk while driving.

7. Prevention

Most of the causes of road traffic accidents are preventable. As suggested by the WHO (2002) these are: driving under influence of alcohol, speeding, under utilization of helmets and child restraints, poor road design and roadway environment, unsafe vehicle design and under-implementation of road safety standards. These preventable causes have a direct impact on the people's health and quality of life, therefore it road traffic accidents are considered a public health issue. The WHO has suggested some roles for public health to prevent the road traffic injuries, these are:

a) to demonstrate the health and economic impact of injuries,

b) to collect data on fatal and non fatal injuries,

c) c) to study the risk factors and protective factors,

d) to ensure appropriate care and rehabilitation for all injured persons,

e) to promote road traffic education and safer driving behavior,

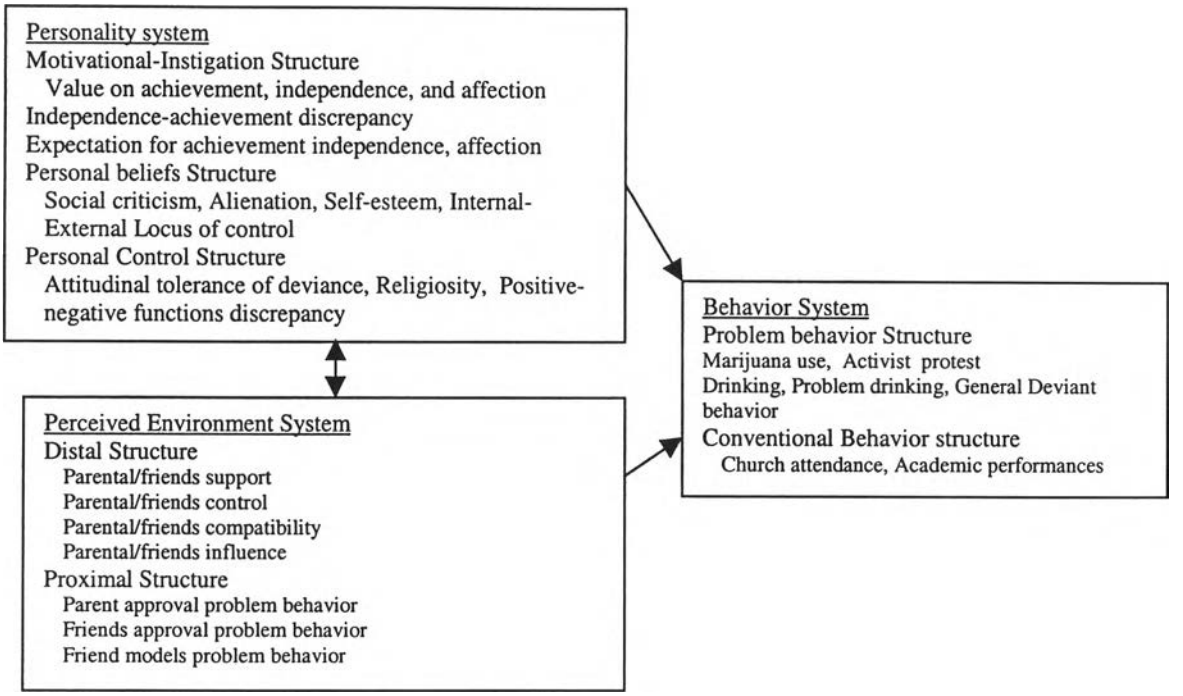
f) to monitor and evaluate road safety intervention, and

g) to promote multi-sectoral approaches to prevention of road traffic injuries.

8. The Problem Behavior Theory

According to this theory there are three independent linked systems of psychosocial influence: the behavior system, the personality system and the perceived environment system.

The behavior systems consist of a problem behavior structure that includes a constellation of behaviors such as heavy drinking, and drug use. This also includes risky driving behavior such as impaired driving, non-use of seatbelts and helmets and speeding. There are some arguments, such as problem behavior is a result of person-environment interaction whereby the personality system and the perceived environment system exert a joint influence. The problem behavior theory is shown in Figure-3 below.



Source: Jessor (1987)

Figure 3. Conceptual Framework of problem behavior theory. From " Risky Driving and Adolescent Problem Behavior: An extension of Problem behavior Theory". By R. Jessor, 1987, *Alcohol, Drugs and Driving*, 3,(3-4),p.3 cited in Brian A. Jonah, 1990.

9. Adolescents Drinking and Driving: a Theoretical Model

It is common to see adolescents involved in drinking and driving, sometimes, at epidemic proportions (Palmer and Tix, 1986; Williams include all author names, 1986). They are in a developmental stage in which drinking and driving and related behaviors are initiated and solidified. The most notable characteristic of adolescence is change, and it tends to be pervasive across various elements of personal and social developments. There is an attainment of operational thinking as well as establishment of personal identity in a social circle (Erikson, 1963; Havighurst, 1972). Driving after drinking is usually learned during adolescence. The psychological, social and environmental attributes are associated with such a behavior among adolescents.

A study carried out in Minneapolis-St. Paul among high school students pointed out that students usually find it "cool, fun and exciting" to drink and drive. They also do it due to peer pressures, personal problems, poor self-image, and at times they learn when they see parents and older siblings engaging in driving and drinking (Klepp,1987 and Perry, 1985). The finding from this studies confirm that the problem behavior theory provides a theoretical framework useful for organizing and identifying factors predictive of driving and drinking among adolescents. Personality factors, perceived environmental factors, behavioral factors, and demographic factors accounted for approximately 50% of the reported variance on driving and drinking at baseline among the students participating in this study. Driving and drinking appears to be part of a larger syndrome of driving and drinking-related behaviors, such as driving after smoking marijuana, riding with a drinking driver and drinking in cars, as well as other "problem behaviors," such as risk taking as shown in Figure-4.

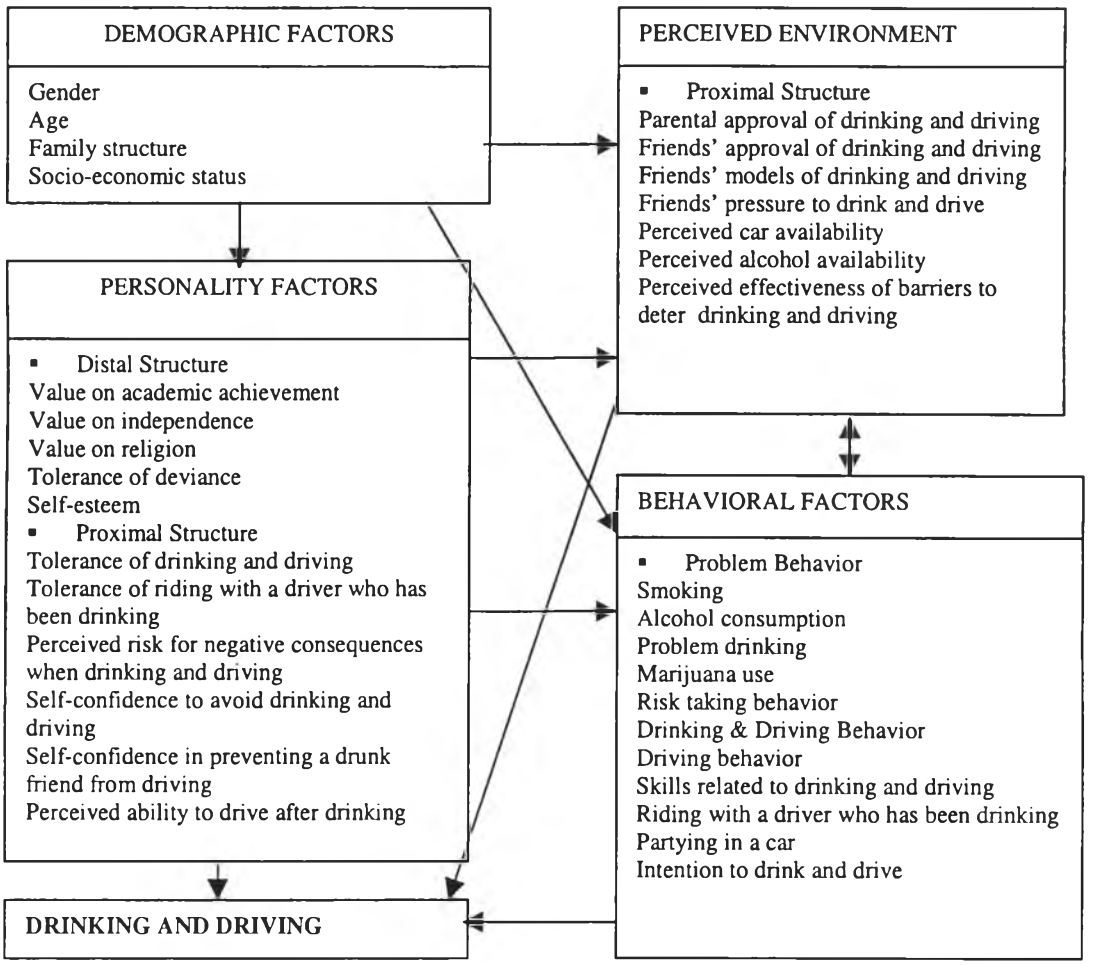


Figure 4: Factors Influencing Drinking and Driving among Adolescents.

Source : Klepp K.I and Perry C.L. (1990)

10. Blood Alcohol Concentration and Traffic Accidents

Review cited in Eighth Special Report to the U.S Congress on Alcohol and Health from the secretary of Health and Human Services September 1993: 238-241:

Zador's (1991) analysis suggests that (1) Alcohol increase fatal crash risk more for females than for males, (2) alcohol increase fatal crash risk more for younger drivers than for older ones, and (3) moderate BACs profoundly enhance crash risk among drivers aged 16 years through 20 years, and especially among females of the age group.

This analysis also suggests that more attention should be given to the effects of low and moderate BACs and to gender and age differences when considering the effects of alcohol on behavior and safety.

Risk increased sharply at higher BACs. Compared with the risk for non drinking drivers , the risk fatal injury was an estimated 11.1 times greater for drivers with BACs between 0.05 percent, 48 time greater for drivers with BACs between .10 percent and 15 percent, and 385 times greater for drivers with BACs higher than .15 percent (Zador, 1991).

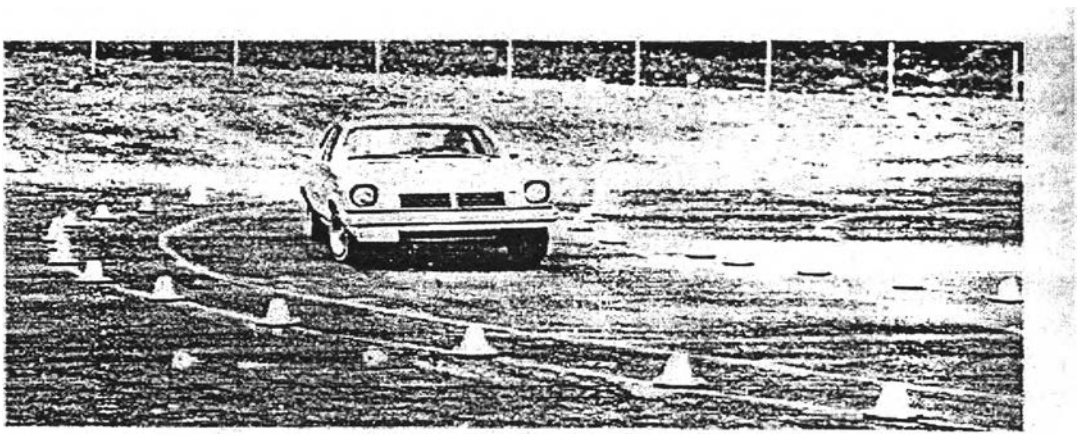
Alcohol may pose an especially serious risk for younger drivers because they have comparatively little experience with alcohol or driving. In addition , the effect of increasing BACs on relative fatality risk may vary by gender. Borkenstein et al. (1964) found that at BACs higher than .04 percent, the risk of fatal injury increase faster for females than males.

11. Alcohol and Traffic Safety: A Complex Problem

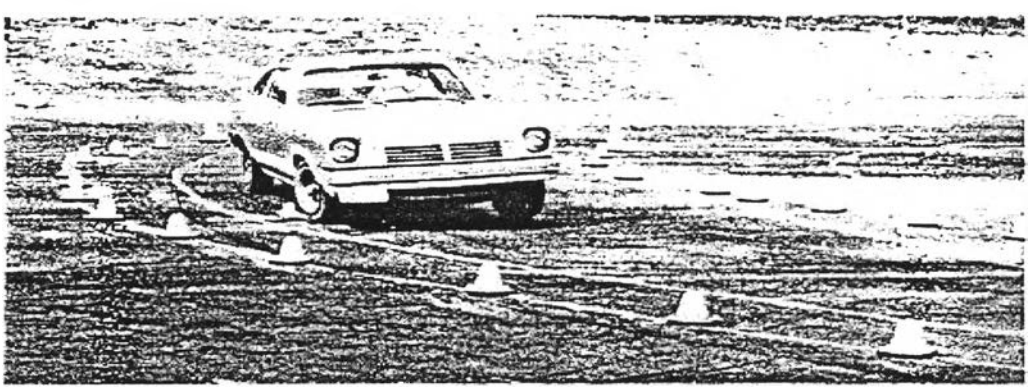
It is clear that alcohol consumption impairs many perceptual, cognitive, and motor skills needed to safely operate motor vehicles (Hind-march et al., 1991; Moskowitz and Burns, 1990; Moskowitz and Robinson, 1988).

As BAL increases, more and more driving –related functions are impaired, beginning with visual and perceptual judgment abilities at low alcohol levels, through cognitive decision making capabilities at intermediate levels and ending with gross motor incoordination at levels 0.15 or higher. In the driving task, all of these abilities interact

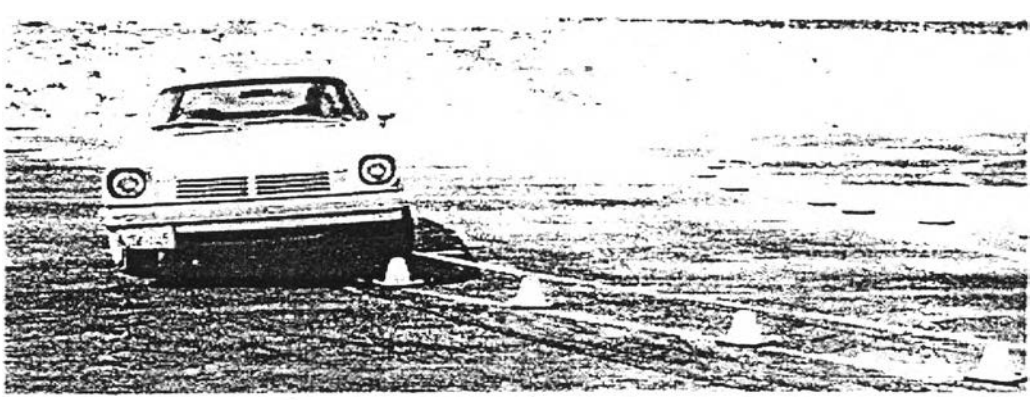
to impair the driver's performance(Levine,Kramer, & Levine,1975). Thus, in a driving simulator, Jex, DiMarco, and Wade (1974) were able to demonstrate that for moderate drinkers. The probabilities of inadvertent lane crossing increased from .0001 when sober to 0.05 with BAL=0.11 percent an increase by 500 fold. How these results can be transferred to the actual road situation is demonstrated in figure 5.



After one drink



After three drinks



After five drinks

Figure 5. :Loss in vehicular control due to alcohol. The drivers in these pictures are all professional, and as such are probably better drivers than most people. But, after three drinks they could no longer drive safely. After five drinks, each lost the ability to think clearly, see well, and control the car. They were able to walk and talk and talk well enough, but they had a hard time driving.

Source: Shinar, 1978:46.

Other driving impairment that have been observed for people with BAL≥0.10 include poor detection of roadway sigh in a simulator (Jex et al.,1974), and in actual nighttime driving (Hicks, 1976); misjudgment of speed and distance, and running signal lights and stop signs. These reduce judgmental and perceptual capabilities are eventually manifested in the kind of accidents that intoxicated drivers have.

Another effect of alcohol, that is highly relevant to driving, has been labeled as "tunnel visions" effect the narrowing of the field of view to object directly ahead of the driver. Alcohol reduces our abilities to effectively allocate our attention some thing that is constantly required in driving. The visual scanning of the intoxicated driver is less active, more limited to the center of the road (probably the same tunnel cars on the road (Belt, 1969;Moskowitz, Ziedman, & Sharma, 1976).

The impaired-driving population varies in terms of the following:

- Severity of alcohol problem
- Drinking patterns
- Demographic characteristics
- Driving related attitudes
- Driving behaviors

- Involvement in deviant and criminal behavior
- Expectations about the effects of alcohol
- Personality characteristics

(Argerious et al.1985; Arstein-Kerslake and Peck 1985;Donovan and Marlatt 1982; Donavan et al. 1986; McMellen et al. 1989; Perrin 1990; Wells-Parker et al. In press; Wieczorek and Miller in press; Wilson, 1991)

Table 2. Estimating the Blood Alcohol Level (BAL) on the Basis of Number of Drinks Ingested and Driver' Weight

	BODY WEIGHT IN POUNDS								
DRINKINGS	100	120	140	160	180	200	220	240	IMPAIRMENT
1	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	
2	0.08	0.06	0.05	0.05	0.04	0.04	0.03	0.03	Rarely
3	0.11	0.09	0.08	0.07	0.05	0.06	0.05	0.05	
4	0.15	0.12	0.11	0.09	0.08	0.08	0.07	0.06	
5	0.19	0.16	0.13	0.12	0.11	0.09	0.09	0.08	Possibly
6	0.23	0.19	0.16	0.14	0.13	0.11	0.10	0.09	
7	0.26	0.22	0.19	0.16	0.15	0.13	0.12	0.11	
8	0.30	0.25	0.21	0.19	0.17	0.15	0.14	0.13	Definitely
9	0.34	0.28	0.24	0.21	0.19	0.17	0.15	0.14	
10	0.18	0.31	0.27	0.23	0.21	0.19	0.17	0.16	
	Subtract 0.01 percent for each 40 minutes of drinking. One drink is 1 ounce of liquor, 12 ounces of beer, or a 3.5 ounce glass of wine.								

Source: Adapted from *Indiana's Driver-Manual.* Indiana Bureau of Motor Vehicles, November 1974. Cited in Shinar, 1978.