Changes in Traffic Safety Policies and Regulations in 7 Countries (1950-2010)

March 2012

IATSS International Association of Traffic and Safety Sciences

Preface

This report, a project of the International Exchange Department Planning Committee for FY2011, summarizes the general situation with regard to traffic accidents and changes to traffic safety policies and regulations in various countries (areas) over the last 60 years (1950–2010). The reports were authored by young researchers who were recommended by IATSS Overseas Invited Members, and as for Japan, who were recommended by the Planning Committee.

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Changes in Traffic Safety Policies and Regulations in 7 Countries (1950-2010)

Changes in Traffic Safety Policies and Regulations in China (1950-2010)

1. Road Traffic Safety in China

1.1 Economic Growth, Urbanization and Transport Development in China

Since the founding of People's Republic of China (PRC) in 1949, the country has been experiencing profound changes in its economic development. In the last 60 years, the average annual economic growth rate reached 8%. Economic growth has accelerated since 1978, when China started the policy of economic reform and opening-up. In three decades (1979-2009), gross domestic product (GDP) increased by approximately 83 times from 406.3 billion to 34.05 trillion yuan, while the per capita GDP increased from 419 to 25,575 yuan. During this period, China was the country with the fastest GDP growth rate, which was 9.76% calculated at 1978 constant price.

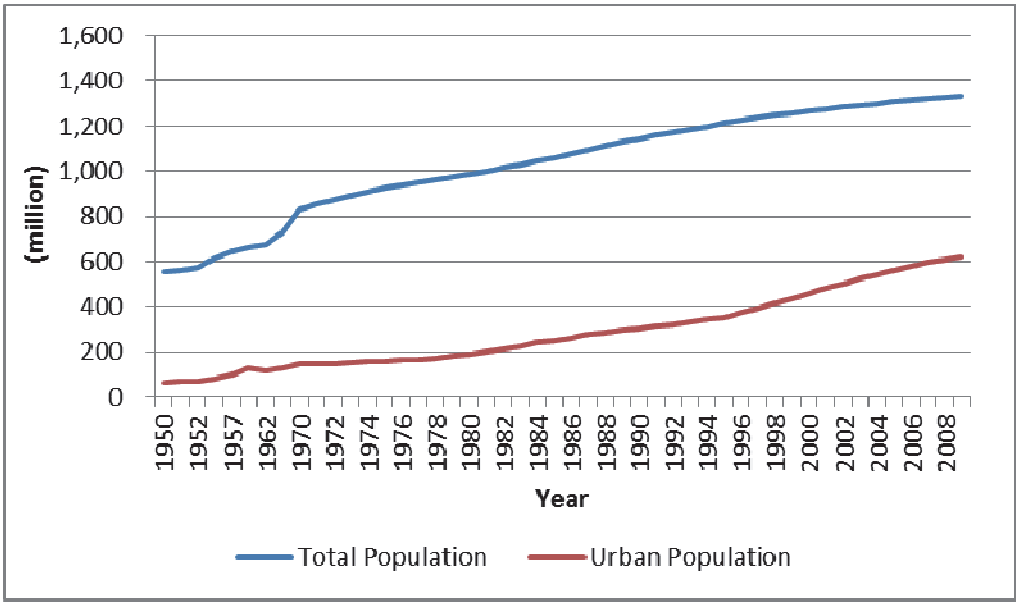

Figure 1 Changes in the total population and urban population of the PRC, 1950-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/D0301e.htm)

The rapid economic development was accompanied by a dynamic urbanization process. In the last 60 years, the total population has more than doubled, reaching 1.33 billion in 2009. Meanwhile, the urban population increased by nearly 10 times from 57.65 million to 0.62 billion. As a result, the proportion of urban population reached 46.6% at the end of 2009.

During the last three decades the Chinese government made transportation development one of the priorities in its national economic strategies, aiming at building an integrated transport infrastructure system. This had become particularly important since 1997, when the Asian economic crisis broke out. The Chinese government introduced proactive fiscal policies and strengthened the investment in infrastructure development (for example, the proportion of highway investment in GDP reached around 3% in 2005). The investment in transportation infrastructure contributed to national economic

growth and greatly improved the transport systems. Since then road transport has been developing rapidly in China.

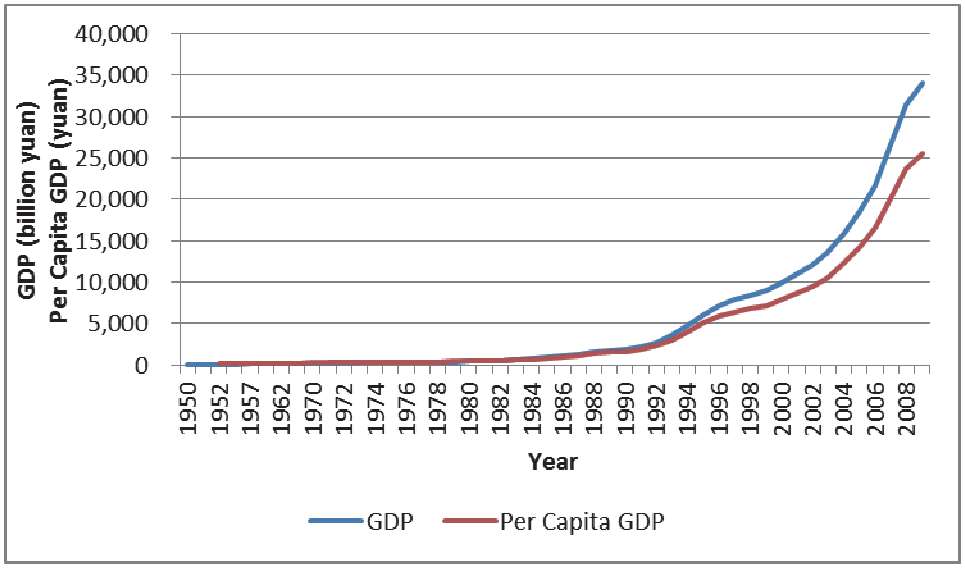

Figure 2 Changes in GDP and per capita GDP, 1950-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/C0201e.htm)

As shown in Figure 3, in 1978 the total length of highways in China was about 0.89 million km; the highway network density was 9.3 km/100 km^2. At the end of 2009 the total length of highways reached 3.86 million km (excluding Hong Kong, Macao and Taiwan) with the density close to 40.2 km/100 km^2. Freeways have developed rapidly since 1988, when the first one, the 18.5 km-long Shanghai-Jiading Freeway, was completed and opened to traffic. In the ensuing 20 years the total length of freeways continued to grow, reaching 65,100 kilometers in 2009. Meanwhile, the total length of urban roads in China reached more than 0.26 million km, increasing by 28% from 2003.

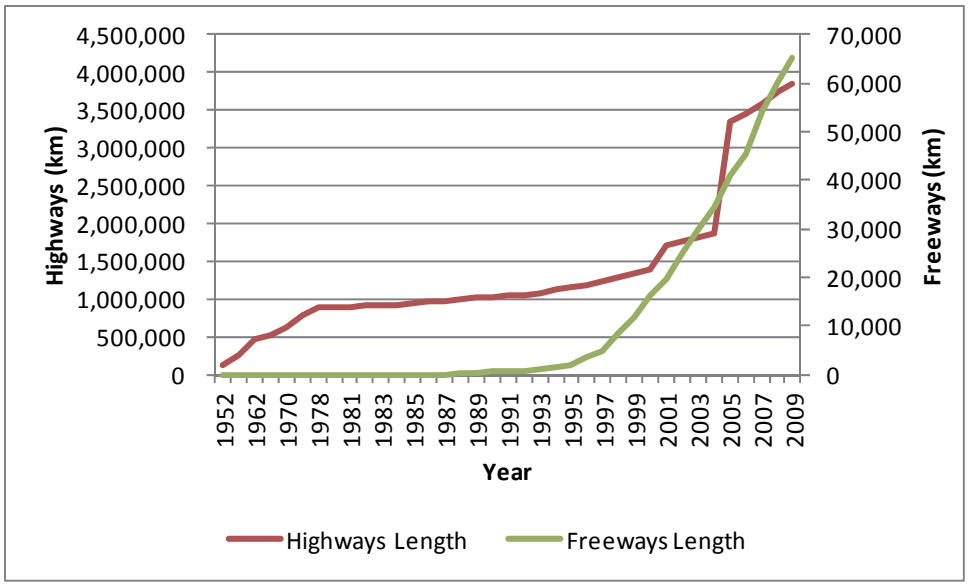

Figure 3 Highway and freeway development, 1952-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/P1604e.htm)

Note: Highways are major roads connecting important destinations, such as large towns and cities. Freeways are access-controlled highways designed exclusively for high-speed vehicular traffic, with all traffic flow and ingress/egress regulated.

The ownership of civil vehicles grew relatively slowly before 1990. From 1990 to 2000, however, it began to increase rapidly and exceeded 10 million during this period. After 2000, it increased even faster and exceeded 30 million in 2005. At the end of 2009, the total number of vehicles was more than 62.8 million in China.

There were no privately owned vehicles before 1980. Thereafter, the number of private vehicles experienced a mild increase through 2000 to 6.25 million. By the end of 2009, this number had grown by more than 6 times to 45.75 million, and its proportion on overall vehicles had increased from 39% to 73% in less than ten years.

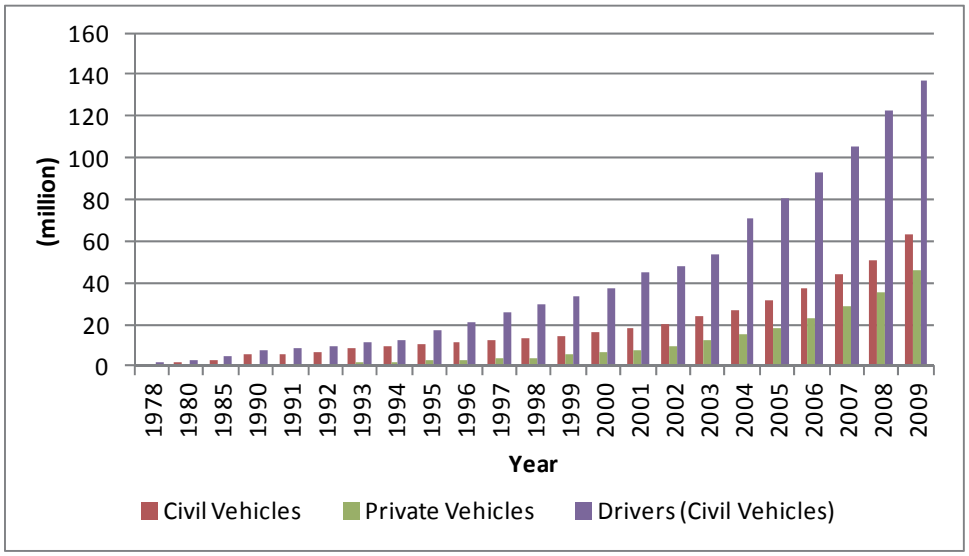

Figure 4 Civil and private vehicles and drivers, 1978-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/P1624e.htm; http://www.stats.gov.cn/tjsj/ndsj/2010/html/P1625e.htm)

Note: Civil vehicles are vehicles used for civil purposes, including passenger vehicles (large, medium, small and mini size) and freight trucks (heavy, medium, light and mini size). Private vehicles are privately-owned civil vehicles.

The number of motorcycles was 675.41 million in 2004.Within five years the number increased by about 40%, reaching 945.31 million in 2009.

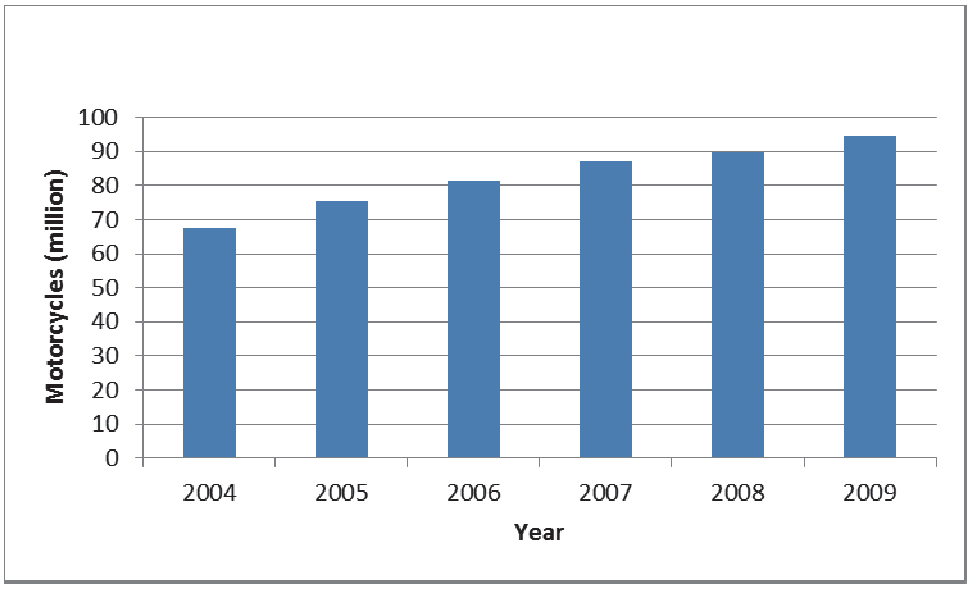

Figure 5 Number of motorcycles, 2004-2009

(Source: China Road Traffic Accident Statistics Yearbook 2004-2009)

The number of motor vehicle drivers increased by 70 times during the last three decades. In 2009, the total number of motor vehicle drivers was 137.4 million, of which drivers with less than 3 years of

experience accounted for 34.76% and drivers with less than one year of experience accounted for 10.46%.

As to passenger and freight transport, Figures 6 and 7 show the changes of share by each transport mode since 1952. As a result of the road infrastructure improvement and rapid motorization, road transport developed rapidly. The passenger-kilometer share of highways increased from 9.1% in 1952 to 54.4% in 2009, while the freight ton-kilometer share of highways increased from 1.9% in 1952 to 30.4% in 2009. Railways and waterways remained major modes for transporting heavy cargo over long distances.

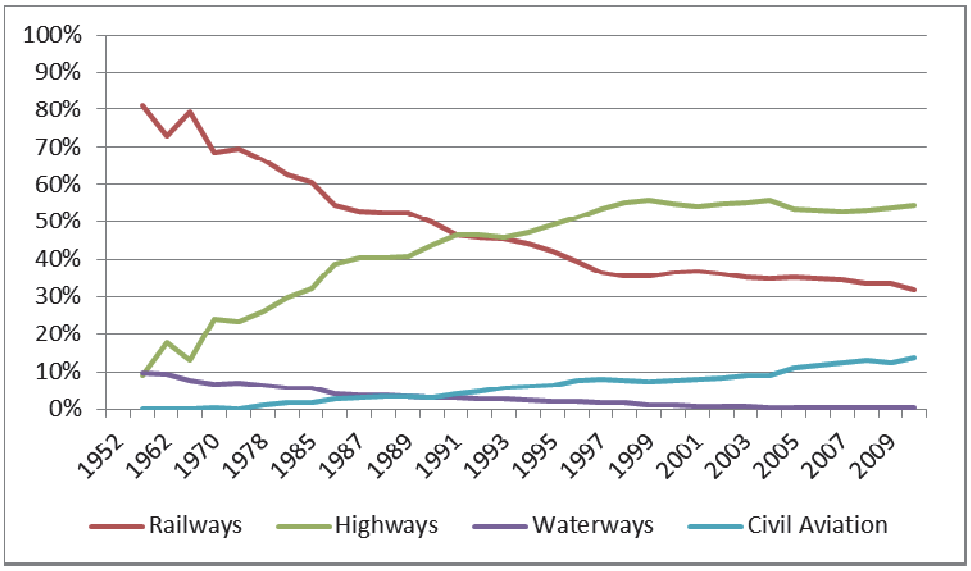

Figure 6 Passenger-kilometers by mode (%), 1952-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/P1607e.htm)

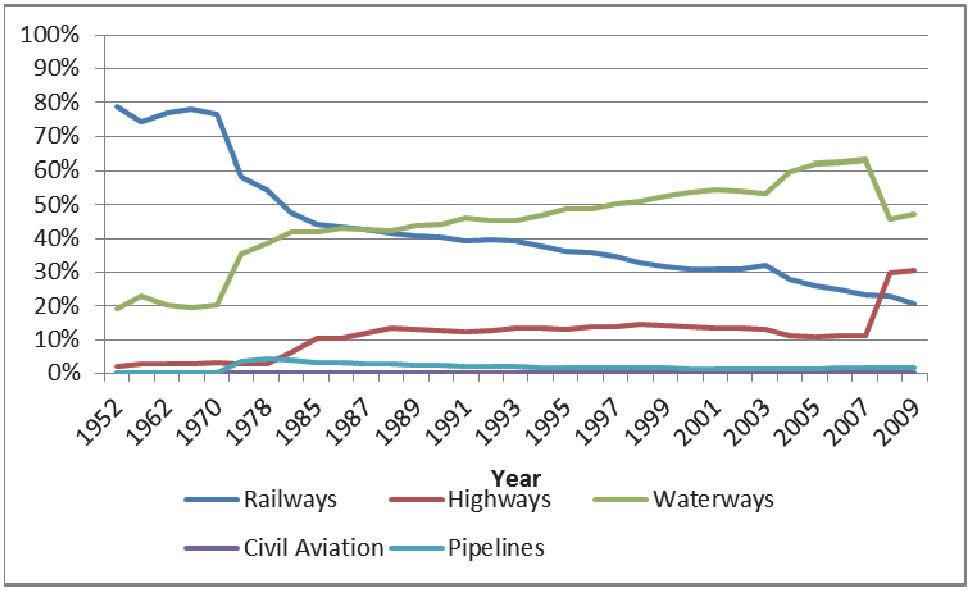

Figure 7 Freight ton-kilometers by mode (%), 1952-2009

(Source: http://www.stats.gov.cn/tjsj/ndsj/2010/html/P1607e.htm)

1.2 Trends of Traffic Accidents and Casualties in China

(1) Changes in the number of traffic accidents and casualties and fatality rates

As can be seen in Figure 8, the numbers of traffic accidents, fatalities and injuries in China increased continuously since the founding of the PRC (note that traffic accident fatalities include those who die within seven days after the accident). Compared to 1951, the number of fatalities increased by 5.7 times in 1960, 10.3 times in 1970, 24.6 times in 1980, 56.8 times in 1990, 109.2 times in 2000, and 75.6 times in 2010. Basically, the number of fatalities doubled every ten years before the year 2000.

As shown in Figure 8, during the periods of 1982–1987 and 1995–2002, China experienced a rapid increase in the numbers of traffic accidents and casualties. The number of accidents, deaths and injuries increased by 1.8, 1.4 and 1.6 times respectively within the first period, and by 1.8, 0.5 and 2.5 times within the second period. In 2001 the number of deaths exceeded 100,000 for the first time and peaked in 2002, reaching 109,381fatalities a year.

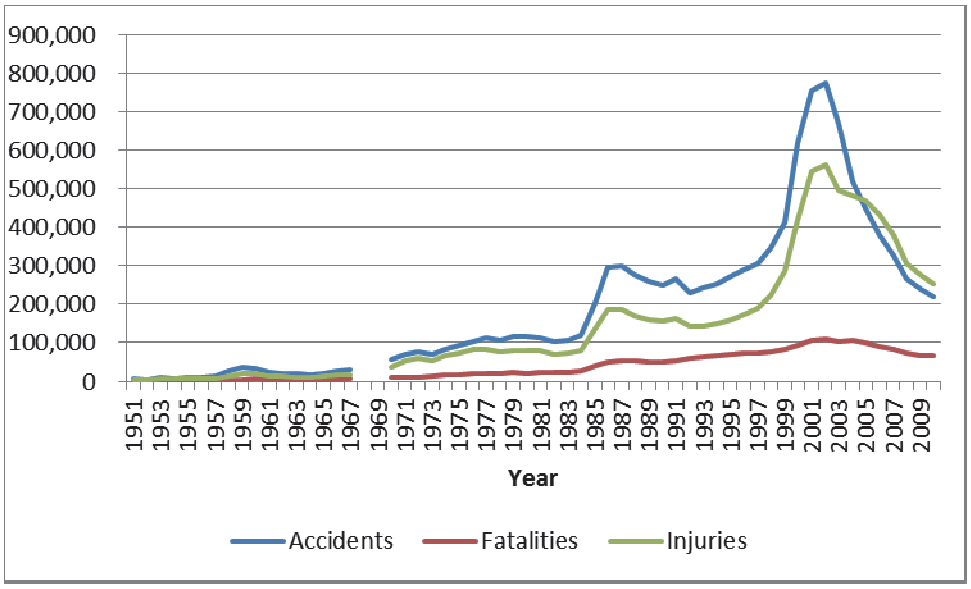

Figure 8 Road traffic accidents, fatalities and injuries, 1951-2010

(Source: China Road Traffic Accident Statistics Yearbook 2010, pp. 146-147: data are not available for 1968 and 1969)

In 2005, the number of deaths dropped below 100,000 again and since then there has been a rapidly decreasing trend in the number of accidents and casualties. However, the absolute number is still high. In 2010 the numbers of accidents, fatalities and injuries were 219,521, 65,225 and 254,075 respectively. The average of traffic fatalities in the last five years was 75,514, which ranked the second largest in the world, following India.

The fatality rate per ten thousand vehicles also decreased continuously from the 1970s onward, reaching 3.15 in 2010. On the other hand, the fatalities per one hundred thousand population kept

rising until 2003, when it peaked at 8.08 and then dropped to 4.89 in 2010. The different patterns in the fatality rate changes were probably due to the rapid motorization and relatively slow increase in the nation's population. The decrease in the fatality rates was achieved in a period of rapid growth in both the economy and motorization, which indicates that traffic safety had improved in recent years. However, compared with developed countries, the accident rates were still high in China. For example, in 2009 the fatality rate per ten thousand vehicles was 3.63 in China, contrasting with 0.66 in the UK and 0.64 in Japan. Moreover, considering China's population of 1.3 billion and the huge number of vehicles, the absolute number of fatalities caused by traffic accidents was still much higher compared to other countries. For example, in 2009 the number of fatalities in China was 67,759, about twice of that in the US. Moreover, the fatality rate (fatalities/casualties) is about 20%, which is much higher than that of developed countries.

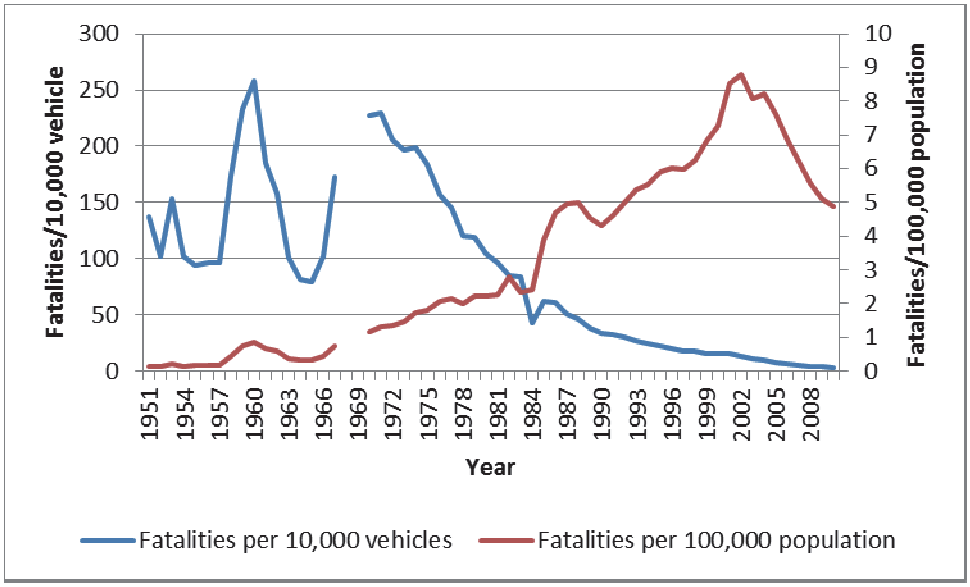

Figure 9 Fatalities per 10,000 vehicles and per 100,000 population, 1951-2010

(Source: China Road Traffic Accident Statistics Yearbook 2010, pp. 146-147: data are not available in 1968 and 1969)

(2) Traffic fatalities on highways and freeways

Highways had much higher fatality rates than did urban roads. During 2000-2010, the numbers of fatalities on highways were generally about 3 to 4 times of those on urban roads. The total number of fatalities on highways started declining in 2005. However, the number on freeways continuously increased from 2,162 in 2000 to 6,647 in 2006, corresponding to the rapid development of freeways. Then it began to drop slightly. In 2010, the number of fatalities on freeways was 6,300. The top three causes for fatalities on freeways were speeding, driver fatigue and inappropriate maneuvers.It is also shown in Figure 10 that fatalities on class 2 and 3 highways were reduced but still accounted for more than 50% of the total fatalities. In 2010, the number of fatalities on these two types of roads reached 26,419, which was about 57% of the total.

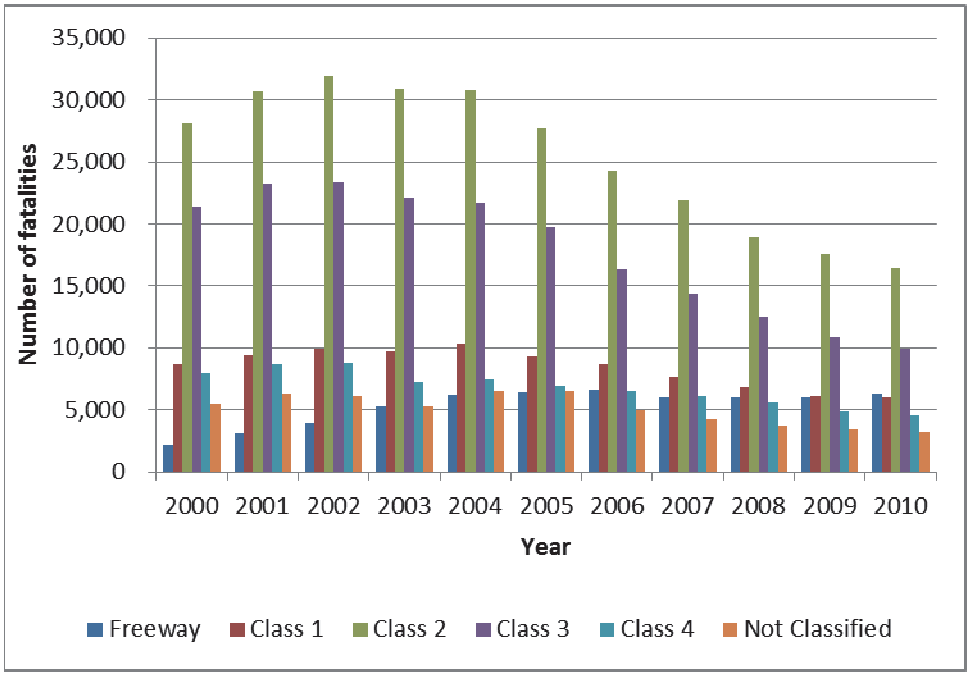

Figure10 Number of fatalities by highway type, 2000-2010

(Source: China Road Traffic Accident Statistics Yearbook 2000-2010)

(3) Newly licensed and less experienced drivers

The percentage of accidents and fatalities attributed to new drivers (with less than one year of licensed driving) and less experienced drivers (with 2-3 years of experience) rose in 2003. This is partly because the SARS outbreak in 2003 prompted travelers to shift from public transportation to private automobiles. As a result, there was a huge number of new and inexperienced drivers on the road. They had less time and fewer opportunities to develop good hazard perception skills required for safe driving. In 2005, the number of fatalities caused by new and less experienced drivers was 31,534, which accounted for 43.9% of the total number of fatalities. During 2007–2010, the percentages decreased to about 30%. Meanwhile, drivers of 6–10 years of experience generally caused more than 25% of the total fatalities each year since 2003.

On the other hand, the percentages of fatalities caused by experienced drivers (with more than 10 years of experience) increased from 2003 onward. However, considering the large population of drivers in this group, they were still safer drivers compared to others. Generally speaking, driving experience accumulated through either on-road driving or reeducation at driving school contributes to road traffic safety.

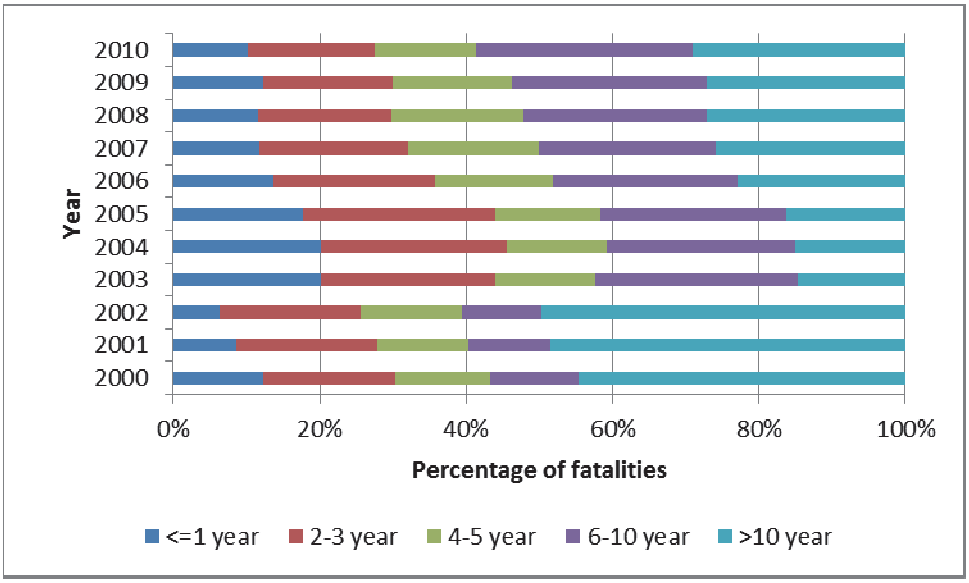

Figure 11 Percentages of fatalities caused by drivers of different experience levels

(Source: China Road Traffic Accident Statistics Yearbook 2000-2010)

(4) Safety of pedestrians, bicyclists and motorcyclists

As vulnerable road users, pedestrians, motorcyclists and bicyclist were the main victims in road traffic accidents. China was still at the early stage of motorization, and thus walking and riding bicycles and motorcycles were still major transportation modes for many people in the country. The mixed traffic pattern in China not only intensified the conflicts with motor vehicles but also increased the casualties of pedestrians, bicyclists and motorcyclists. Since 2005, the government had adopted a series of policies to improve road safety, and the fatalities and injuries of pedestrians, bicyclists and motorcyclists had decreased year by year. In 2010 the fatalities of pedestrians, bicyclists and motorcyclists were 16,281, 8,968 and 14,264, respectively, decreasing by 39%, 38% and 37.5% from 2004. However, the proportions of fatalities and injuries were still high. In 2010, pedestrians, bicyclists and motorcyclists accounted for about 25%, 14% and 22% of the total fatalities in road traffic accidents.

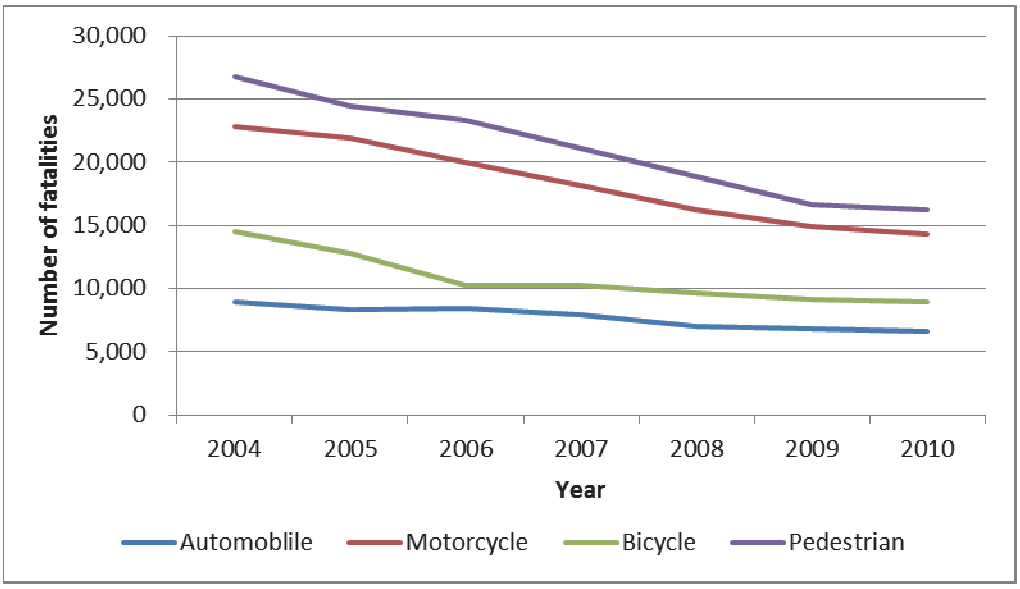

Figure 12 The number of fatalities by traffic mode, 2004-2010

(Source: China Road Traffic Accident Statistics Yearbook 2004-2010)

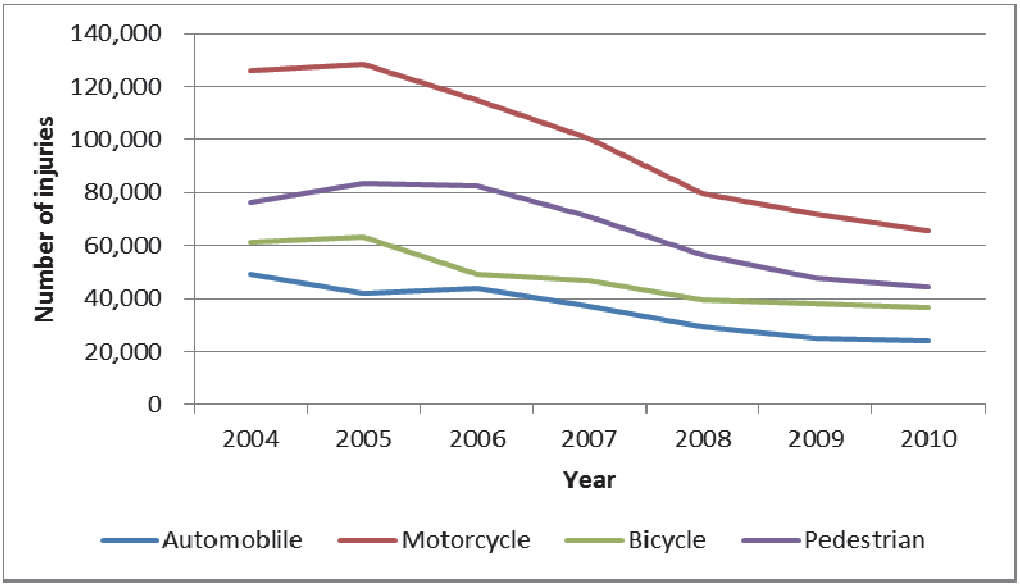

Figure 13 Number of injuries by traffic mode, 2004-2010

(Source: China Road Traffic Accident Statistics Yearbook 2004-2010)

(5) Severe traffic accidents causing a large number of casualties

Severe traffic accidents that caused more than ten fatalities in one accident happened every year. Although the proportion of such accidents was not large, they led to very serious consequences and induced bad social impacts. In recent years, the number of severe accidents has been decreasing. However, the average number of fatalities in one accident was about 15, indicating that the severity of those accidents was not mitigated. Severe accidents frequently happened in mountainous areas. Figure 14 shows the number of accidents causing more than ten fatalities in recent years. In 2010, there were 34 severe accidents causing 461 fatalities and 432 injuries. The fatality rate (fatalities/casualties) was

55%. Compared to 2000, the number of severe accidents, fatalities and injuries decreased by 41%, 49% and 55% respectively.

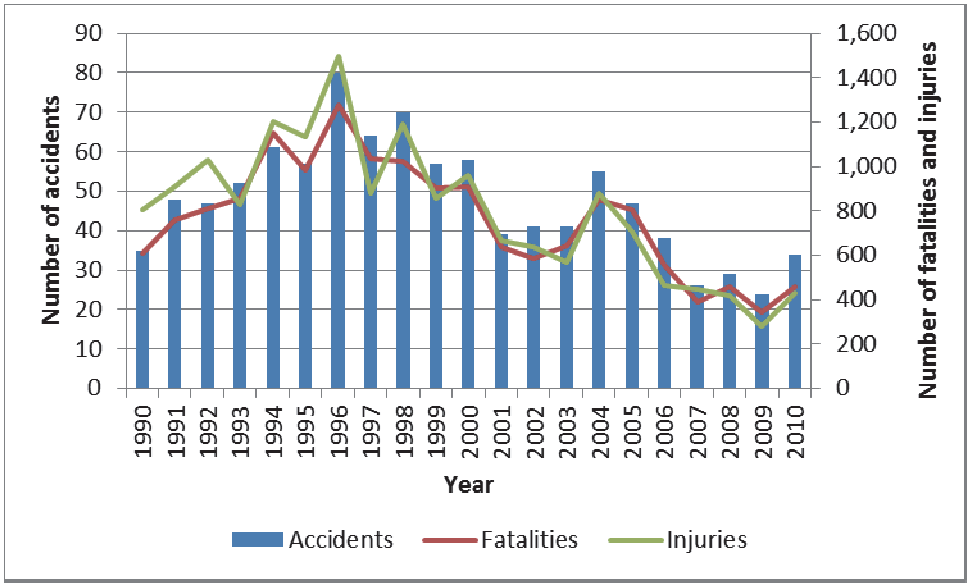

Figure 14 Severe accidents causing more than ten fatalities, 1990-2010

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 153)

1.3 Characteristics of Fatal Traffic Accidents

(1) Time distribution of fatal accidents

The number of fatal accidents by month may be influenced by the season, climate, economic activities, festivals and so on. Figure 15 shows the number of fatalities due to road traffic accidents by month in 2010, from which some patterns can be observed. March was the month with the lowest number of fatalities, and thereafter fatal accidents generally increased month by month. November and January had the highest fatalities in the year. The total number of fatalities from November to January was close to 20,000, accounting for about 30% of the total number of fatalities during the year.

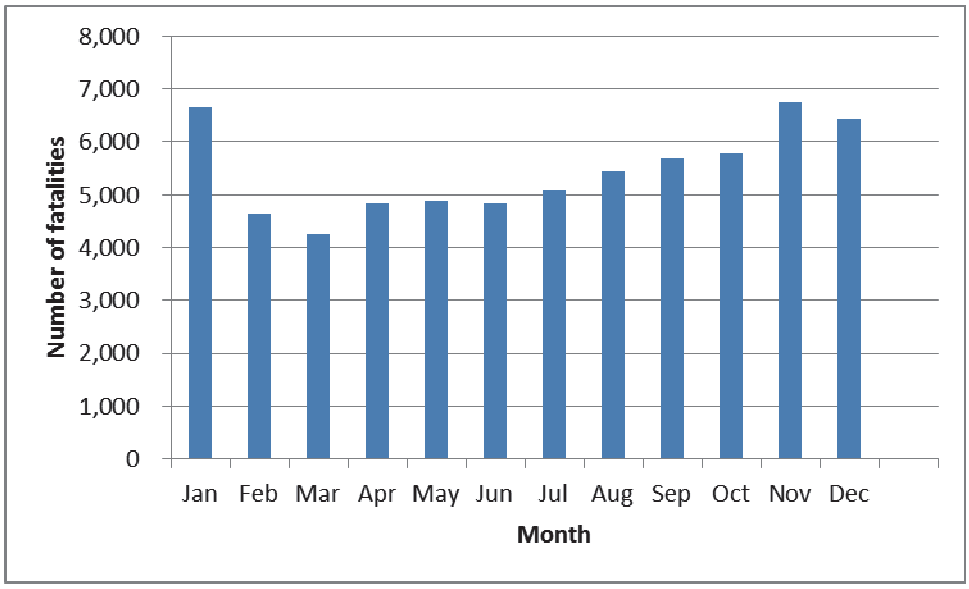

Figure 15 Number of fatalities by month

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 9)

The number of fatal accidents by day of the week in 2010 shows that there were fewer accidents on Fridays and Saturdays. However, the differences between accidents on these two days and other days were generally less than 2%.The high proportion of fatalities on weekend may be caused by the increase of entertainment and recreation activities.

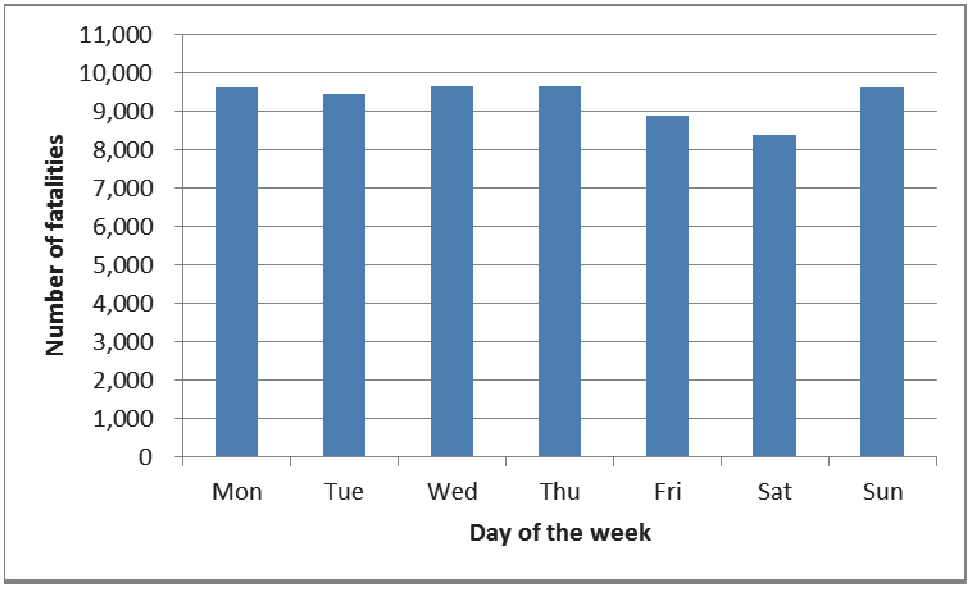

Figure 16 Number of fatalities by day of the week

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 10)

Figure 17 shows the number of fatalities due to traffic accidents by hour of the day in 2010. The peak periods were 6-9 a.m., 1-4 p.m. and 5-9 p.m., during which about 52% of the fatalities occurred, while from 1 to 6 a.m. the number of fatalities caused by traffic accidents was around 14%.

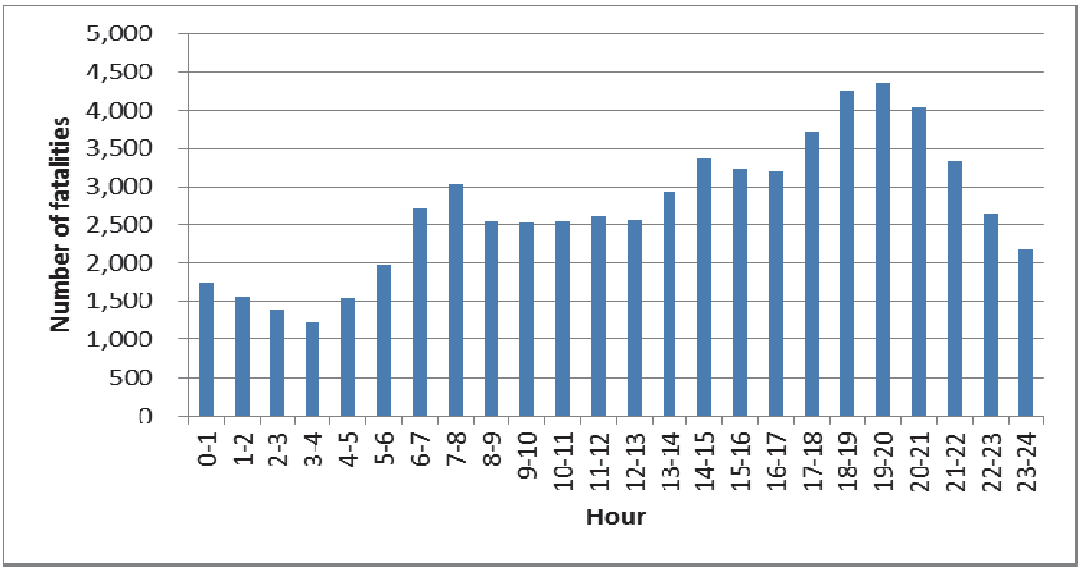

Figure 17 Number of fatalities by hour of the day

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 13)

A large proportion of fatal accidents happened in the nighttime, especially when there was no lighting. A driver's judgment could be affected by darkness, and reduced visibility increased accident risks. Another reason could be driver fatigue. In 2010, 29% and 17% of all fatalities happened in the nighttime with and without lighting respectively. Necessary safety facilities could reduce the risk of nighttime driving and prevent many traffic accidents.

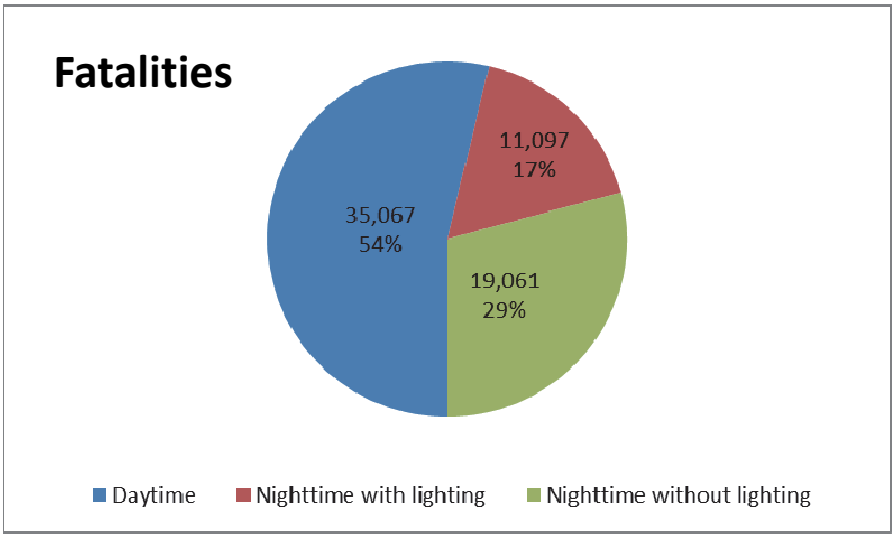

Figure 18 Number of fatalities by daytime and nighttime

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 47)

(2) Space distribution of fatal accidents

Developed areas in China had many more accidents and fatalities. Table 1 shows the fatalities and fatality rates by province (including municipalities directly under the central government) in 2010. Guangdong, Zhejiang, Jiangsu, Shandong and Sichuan were the top five provinces with respect to the

number of traffic fatalities, accounting for 37% of the total fatalities in the year. One possible reason was the rapidly increasing passenger and freight traffic induced by the economic development in these areas. On the other hand, Xizang, Qinghai, Gansu, Xinjiang, and Shanxi provinces, as less developed regions located in western China, had the highest fatality rates. The fatalities per 10,000 vehicles for these provinces were 18.16, 9.49, 7.09, 6.58 and 5.79 respectively, which were much higher than the national average of 3.15. The fatality rates of Henan, Hebei and Beijing were 1.11, 2.05 and 2.06 per 10,000 vehicles, which were the lowest in the country. It is also found that the fatality rate per 10,000 vehicles was negatively correlated with the density of high-grade roads. More fatalities happened in rural areas, where high-grade roads were poorly developed and traffic rules were not well followed by drivers.

Table 1 Number of fatalities and fatality rates by province

Province	Fatalities	Fatalities/10,000 vehicles	Fatalities/100,000 population
Guangdong	6,203	3.22	6.44
Zhejiang	5,382	4.79	10.39
Jiangsu	5,031	3.45	6.51
Shandong	4,268	2.09	4.51
Sichuan	2,931	3.06	3.58
Anhui	2,877	3.00	4.69
Fujian	2,822	3.82	7.78
Hebei	2,693	2.05	3.83
Shanxi	2,449	5.79	7.15
Guangxi	2,342	2.84	4.82
Hunan	2,162	3.29	3.37
Liaoning	2,129	3.98	4.93
Xinjiang	2,023	6.58	9.37
Hubei	1,944	2.55	3.40
Shanxi	1,944	3.96	5.15
Yunnan	1,886	2.60	4.13
Henan	1,825	1.11	1.92
Jiangxi	1,603	2.72	3.62
Gansu	1,506	7.09	5.71
Jilin	1,454	3.77	5.31
Heilongjiang	1,395	4.15	3.65
Neimenggu	1,375	3.10	5.68
Guizhou	1,136	3.93	2.99
Chongqing	1,017	3.76	3.56
Shanghai	1,009	4.04	5.25
Beijing	974	2.06	5.55
Tianjing	950	5.30	7.74
Qinghai	573	9.49	10.28
Hainan	471	2.80	5.45
Ningxia	442	3.11	7.07
Xizang	409	18.16	14.10

(Source: China Road Traffic Accident Statistics Yearbook 2010, pp. 15-16)

(3) Accidents by age and gender

In 2010, the numbers of traffic fatalities caused by males and females were 62,972 (97%) and 2,253 (3%) respectively. On the other hand, males also seemed to be more at risk than women. About 76% of the fatalities and 72% of the injuries were males.

In terms of age, 31,211(48%) of the fatalities were between 21-45 years old. On the other hand, the same age group (21-45 years old) also caused 78% of the fatalities in traffic accidents. Fatalities among those over 65 years old rose every year. Elderly people may suffer from reduced visual acuity and reaction ability, and it may be more difficult for them to recover from a severe accident; thus the fatality rate was high for this age group. In 2010, about 7,386 (11%) of the fatalities were elderly people over 65.

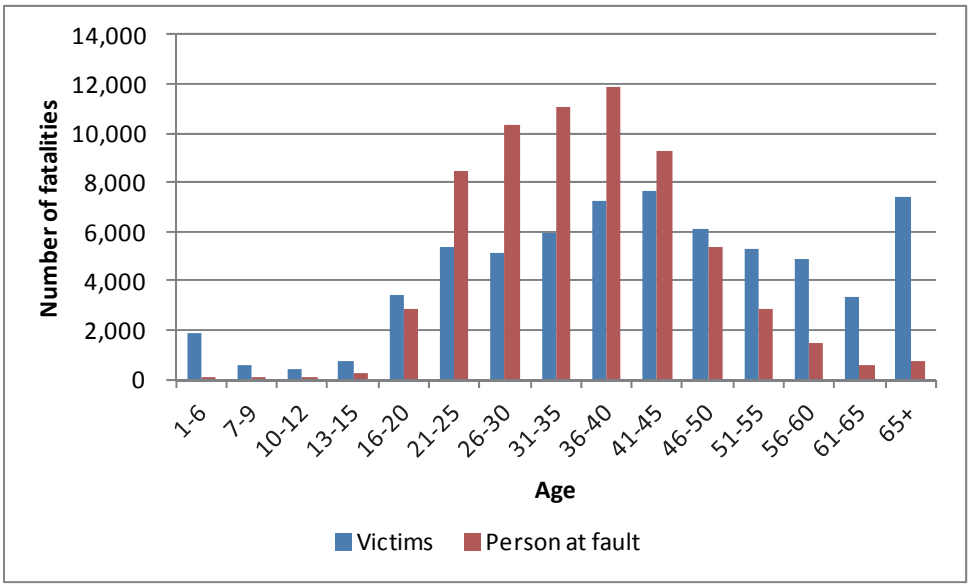

Figure 19 Number of fatalities by age of victim and by age of person at fault

(Source: China Road Traffic Accident Statistics Yearbook 2010, pp. 56, 59)

(4) Accident types

The most common accident types were head-on, intersecting paths and rear-end, which together accounted for 72% of all accidents in 2010. These types also resulted in severe outcomes. As can be seen in Table 2, head-on, intersecting paths and rear-end accidents accounted for about 27%, 25% and 13% of all fatalities in 2010.

Table 2 Numbers of accidents and fatalities by accident type

Accident type	Accidents	Percentage	Fatalities	Percentage
Head-on	54,491	24.82%	17,531	26.88%
Intersecting paths	81,862	37.29%	16,497	25.29%
Rear-end	22,273	10.15%	8,957	13.73%
Sideswipe: opposite direction	4,696	2.14%	1,009	1.55%
Sideswipe: same direction	6,948	3.17%	1,588	2.43%
Pedestrians	26,422	12.04%	7,484	11.47%
Overturn	5,440	2.48%	3,570	5.47%
Fixed object	5,993	2.73%	2,697	4.13%
Parked vehicle	2,355	1.07%	1,130	1.73%
Animal	53	0.02%	18	0.03%
Others	8,988	4.09%	4,744	7.27%

(Source: China Road Traffic Accident Statistics Yearbook 2010, p. 8)

(5) Causes of accidents

The road transport system consists of humans, vehicles, roadways and the environment. Any defects in these elements may cause accidents. According to the 2010 road accident statistics, the number of accidents and fatalities caused directly by road conditions was small, about 0.01% of all accidents. Lack of road safety facilities contributed to most of the road-related accidents. Vehicle-related accidents accounted for less than 0.11 % of all accidents, and were mostly attributable to technical malfunctions, including brake, steering, and light malfunctions. However, it should be pointed out that the number of accidents and fatalities caused by road and vehicle factors may be underestimated. Many accidents due to both the road or vehicle factors and human factors were recorded as human-related accidents.

Human factors include all factors related to drivers and other road users that may contribute to an accident. Traffic violations of motor vehicle drivers, bicyclists, pedestrians, etc. were generally the main reason of traffic accidents. For example, the number of accidents resulting from violations by road users was 211,042, which accounted for 96% of all road traffic accidents in 2010. Of these accidents, 199,934 (91%) was caused by the motor vehicle drivers, 8,745 (4%) by non-motorized vehicle riders, and 2,363 (1%) by pedestrians and passengers. Compared to 2009, the number of accidents caused by these three groups of road users decreased by 8%, 8% and 13% respectively. In terms of casualties, 62,646 died and 244,492 were injured from accidents caused by road user violations, which accounted for 96% of the total fatalities and 96% of the injuries. Accidents caused by motor vehicle drivers accounted for 92% of the fatalities and 91% of the injuries, making motorist violations the major factor behind road traffic accidents.

The top three violations of traffic laws and regulations for motor vehicle accidents are speeding, failing to yield and unlicensed driving. In 2010, the numbers of accidents and fatalities caused by speeding were 21,755 and 9,134, which accounted for 10% and 14% of the total accidents and fatalities respectively. Failing to yield where required by traffic laws caused 37,928 accidents and 7,788 fatalities, accounting for 17% of the total accidents and 12% of the fatalities. Unlicensed driving cannot be neglected either, in that it caused 12,637 accidents and 4,443 fatalities, which were 6% and 7% of the total accidents and fatalities respectively. Other motorist violations that were major reasons for traffic accidents, included traveling in the wrong direction, illegally occupying exclusive lanes and overtaking-related violations, which caused 3,521 (5%), 2,224 (3%) and 2,101 (3%) fatalities respectively in 2010. Moreover, 3% of the fatalities were associated with alcohol use.

The top three reasons for accidents and fatalities caused by non-motorized vehicle riders were failing to travel as required by regulations, take-up of vehicle lanes, and traveling in the wrong direction. Major violations by pedestrians and passengers that caused traffic accidents included walking on roads prohibited to pedestrians and failing to follow traffic signals.

1.4 National Organization with Jurisdiction over Traffic Safety

Road traffic safety directly involves at least three ministries at the central government level: the Ministry of Public Security, the Ministry of Transportation, and the Ministry of Housing and Urban-Rural Development (formerly known as the Ministry of Construction).

The Ministry of Public Security is the sole administration in charge of road traffic accidents in China. All road traffic accident data is collected by the public security administrations in each district or county, and then the data is aggregated and reported to the upper public security administration. The Traffic Administration Bureau of Ministry of Public Security then analyzes the data and publishes the annual China Road Traffic Accidents Statistics.

The Ministry of Transportation establishes the development strategies, policies and regulations for the highway industry. It is also in charge of planning, construction, operation and maintenance of highways and freeways.

The Ministry of Housing and Urban-Rural Development is in charge of urban and rural planning and related infrastructure construction. It is responsible for the planning, design, construction and maintenance of roads in the urban areas.

Coordination among these ministries is very important in effectively addressing road traffic accident problems. The National Inter-Ministry Joint Conference Institute on road traffic safety was established in 2003. The institute is led by the State Council. Its major responsibilities include but not limited to the following:

- analyze the current situations of traffic accidents,
- develop medium- and long-term strategic safety plans,

- propose and carry out countermeasures,
- provide guidance and supervise the road safety work, and
- promote coordination among different agencies and sharing of information.

It is important to enhance the road traffic safety administration system and formulate a national road safety strategy to enhance the influence of the institute on road traffic safety at both the national and provincial levels. The key point is whether or not the plan made by the institute can be effectively implemented at the local level. In addition, coordination among agencies at the provincial and municipal levels is also critical for addressing road traffic safety issues. The National Inter-Ministry Joint Conference Institute should play a more active role so as to strengthen the coordination among different levels of government and to ensure the successful implementation of the road safety policies and strategies.

1.5 Special Issues Concerning Road Traffic Safety in China

(1) Lack of safety awareness of road users

Drivers in China are very different from those in developed countries who have "grown up" in vehicles. Chinese drivers may possess good driving skills but lack awareness of traffic safety. Chinese drivers are deeply affected by their experience of riding a bicycle. For example, they tend to change lanes frequently to overtake other cars, which can save a little travel time but with greatly increased risk of collision. Most motor vehicle users have poor safety awareness; for example, many drivers and passengers do not fasten their seat belts. Traffic law violations, such as jaywalking, speeding and drunk driving are very common, and many offenders go unpunished, so they are likely to continue taking the same risk. Thus, cultivating common awareness of traffic safety is the first step toward reducing traffic accidents.

In addition, other road users, including pedestrians and bicyclists, do not have much traffic safety knowledge either. Thus, it is essential that traffic safety education be conducted at home, school and the community, from children to adults, in order to realize widespread safety awareness. Furthermore, strict law enforcement and punishment of traffic violations will enhance the effectiveness of safety education.

(2) Mixed traffic pattern and lack of traffic safety facilities

The mixed traffic pattern on most national highways causes traffic congestion and severe traffic accidents. Traffic safety features are often neglected in road design. The investment in road traffic safety facilities was 2 billion yuan in 2004, equivalent to 0.5% of the total highway investment. This is much lower than that of developed countries such as Japan (during 1975–1986, the percentage of investment in road safety measures in total road investment was approximately 13–18%, and the percentage of investment in road safety measures to GDP was approximately 0.2–0.4%). The highest priority for China is to increase the investment in road safety facilities such as guardrails, speed bumps,

median barriers, overpasses, etc. Meanwhile, it is important to introduce a cost-benefit approach to allocate the limited funding to the most effective measures. It is a common practice to choose high-tech countermeasures to address road traffic accidents in China. However, some low-cost measures—such as mandatory seat belt usage or strict enforcement of penalties on speeding, overloading, drunk driving and so on—might also be very effective alternatives.

(3) Overloaded and oversized trucks and unsafe vehicles

Due to unfair competition and relatively expensive tolls, many freight carriers run overloaded and oversized trucks. Those trucks not only cause heavy damage to the roads (it is estimated that such damage may reduce the road maintenance cycle from 15 years to 6–8 years) but also cause many traffic fatalities. It is estimated that 70% of traffic accidents are related to overloaded and oversized trucks. Since April 30, 2004, seven ministries, including the Ministry of Communication and the Ministry of Public Security, have jointly implemented a nationwide program of strict enforcements on overloaded and oversized trucks. This program is reported to have substantially reduced road traffic accidents.

Vehicles that fail to pass the required inspections are prohibited from running on roads. However, some of these vehicles are illegally sold to rural areas, where such regulations are not strictly enforced. These vehicles bring a high risk of traffic accidents and cause emission problems as well.

(4) Traffic accident analysis and data sharing

In China, transport agencies have road departments but few have traffic safety departments. Although the techniques of road design and construction keep improving, the expertise needed to analyze and deal with traffic accidents has not developed strongly. Moreover, very few public agencies have a complete accident database and reliable statistics on traffic accidents. None of them has accumulated information from hospitals and insurance companies. Due to insufficient human and technical resources, accident recording outside the urban areas is highly defective, with presumably a large number of unreported accidents in rural areas.

It is necessary to establish a separate department in charge of road traffic accidents at the municipal and provincial levels. It is also important to establish a traffic accident investigation system with joint efforts from the police, medical personnel, psychologists, traffic engineers, automobile engineers, and insurance companies. Information from hospitals and insurance companies can be used to reexamine the accident data collected by the public security administration and to complete the accident database. The database should be open to traffic safety researchers who need these “medical records” to diagnose the traffic accidents.

2 Traffic Safety Policies and Regulations in China

2.1 Laws, Regulations and Rules on Traffic Safety

Before the reform and opening-up of China's economy in 1978, traffic accidents were not a severe problem because of the low motorization rate. However, as the number of traffic accidents increased rapidly in the 1980s, the government began to realize the importance of improving road safety to protect peoples' lives, and has played an active role in this field ever since. In 1986, the State Council announced the *Reform of Road Traffic Management Structure*, which stated that the public security agencies had jurisdiction over road traffic in urban and rural areas. In 1988, the State Council promulgated *Road Traffic Management Regulations*, and followed up with *Disposition of Road Traffic Accidents* in 1991. Against this backdrop, the Ministry of Public Security began to draft the *Road Traffic Safety Law*, the first law on traffic safety in China. The law was passed in 2003 and took effect on May 1, 2004. Accompanying it was the *Implementation Rules of the Road Traffic Safety Law* enacted by the State Council. The *Road Traffic Safety Law* provides that:

- Motor vehicles have to reduce speed when passing through crosswalks. When pedestrians are crossing the street, vehicles have to stop and yield to the pedestrians.
- Motor vehicle liability insurance is mandatory.
- Enforcement against drunk driving is to be strengthened.
- Enforcement against overloading is to be strengthened.
- Driving without a driver's license is punishable with less than 15 days' detention.
- Motor vehicle drivers should be responsible for the accidents involving motor vehicles and non-motorized vehicles or pedestrians. If there is evidence that non-motorized vehicle riders or pedestrians have violated the laws/regulations in accidents, the motor vehicle drivers are to take part of the responsibility.
- Hit-and-run accidents will result in permanent revocation of the driver's driving license.
- The driving speed on freeways is not allowed to exceed 120 km/h.

Local regulations and rules on traffic safety are established based on the *Road Traffic Safety Law*. So far, a relatively comprehensive system of laws and regulations on road traffic management in China has been formed, including the *Road Traffic Safety Law* and other laws and regulations promulgated by related ministries and departments, and local governments.

2.2 Inter-Ministry Joint Conference on Road Traffic Safety

In October 2003, the State Council founded the Inter-Ministry Joint Conference on Road Traffic Safety, which was made up by 15 ministries and departments, including the Ministry of Public Security, the Ministry of Propaganda, the Ministry of Construction and the Ministry of Transportation. In 2009, the Conference membership was enlarged to comprise 19 ministries and departments. The major responsibilities of the Conference include:

- Analyzing traffic safety issues
- Proposing countermeasures
- Developing medium- and long-term strategic plans
- Guiding and supervising road traffic safety programs at the provincial and municipal levels
- Promoting coordination, cooperation, and information sharing among different departments and agencies
- Establishing a long-term mechanism to reduce the number of road traffic accidents and improve traffic safety in a comprehensive way

2.3 Traffic Safety Campaigns

Since 2003, the public security agencies in many areas of the country have launched a series of campaigns to eliminate traffic violations, especially speeding, overloading, drunk driving, fatigue driving, driving without a license and so on. These campaigns have proved to be effective in reducing road traffic accidents.

(1) "The Five Improvements and Three Enhancements"

In January 2004, the Ministry of Public Security launched the first nationwide road traffic safety campaign across the country, namely, "The Five Improvements and Three Enhancements." It was aimed at reducing road traffic accidents, especially severe accidents, in order to protect people's lives and properties. In 2008, the Inter-Ministry Joint Conference reviewed and passed a motion for extending the campaign. The major focuses of the campaign have been as follows:

1) Improve the quality of driver training and education; the rules on driving tests and driver's license issuance should be strictly followed; the qualifications of drivers of operational motor vehicles should be carefully examined.

2) Improve traffic management, especially the transport of dangerous chemical goods; enhance traffic safety management for severe weather or emergent events; improve emergency rescue mechanisms.

3) Improve the management of transportation corporations; strictly enforce the *Road Transport Regulation* and other stipulations; urge the transport businesses to supervise their drivers and motor vehicles dynamically.

4) Improve the management of businesses engaged in motor vehicle production and reconfiguration; improve motor vehicles' safety performances and improve vehicle registration and examination procedures.

5) Inspect the roads regularly and improve the road conditions to reduce traffic accidents and casualties; improve traffic safety in work zones.

6) Enhance the role of government agencies in promoting the traffic safety programs; related

departments in charge of traffic safety should actively take the responsibility of supervision and law enforcement.

7) Enhance traffic safety propaganda and education; develop the traffic safety propaganda and education system led by the government and implement the program on a long-term basis.

8) Enhance traffic safety law enforcement; complete the traffic safety law and regulation system and technical standards; provide training to police officers to improve enforcement and punishment of traffic offenses.

(2) "Counties and Districts with Safe and Smooth Traffic"

In November 2005, the Ministry of Public Security and the Ministry of Transportation decided to conduct "Counties and Districts with Safe and Smooth Traffic" campaign in all counties and municipal districts in the country. By 2008, this campaign had been carried out in most counties and districts. The goals set up in 2008 were that:

- The number of accidents and casualties would decrease;
- The number of accidents with 10 or more fatalities would decrease;
- Fatalities per 10,000 vehicles would be no more than 4.7;
- More than 60% of the counties and districts would be those with safe and smooth traffic.

The following measures were proposed to achieve these goals:

1) The government should attach great importance to road traffic safety programs and provide guidance and support to the programs. The provinces are supposed to hold inter-department meetings to discuss the implementation of traffic safety management in the rural areas and propose implementation plans to carry out the campaign of "Counties and Districts with Safe and Smooth Traffic."

2) Traffic management departments within public security agencies are the major forces to supervise the campaign and they should spare no effort to prevent and reduce severe road traffic accidents. Their responsibilities include: developing road traffic safety evaluation system and freeway surveillance system; conducting research on measures to prevent severe road traffic accidents; improving management of motor vehicles and drivers in the rural areas and so on.

3) Enhance coordination and cooperation among different agencies, such as those in charge of transportation, safety supervision and quality inspection. Motor vehicles failing to pass the inspections should be prohibited from running on the roads. Conduct a complete examination of freeway signs and markings as well as road traffic safety facilities in the rural areas.

4) Reinforce the education and propaganda of road traffic safety in the counties and municipalities.

5) Since 2005, goals for safe and smooth traffic have been achieved by 1,826 counties and districts nationwide.

(3) "Enhancement of School Bus Safety"

In November 2006, the Ministry of Education and the Ministry of Public Security announced the *Emergent Notice of Examining School Buses in Primary and Middle Schools*. The notice required that：

1) A large-scale examination of primary and middle school buses be carried out;
2) The qualifications of school bus drivers be examined and safety education be given to the drivers;
3) Safety education be carried out in schools;
4) Schools take the responsibility of traffic safety management; and
5) Traffic violations be punished according to the relevant laws and regulations.

With the joint efforts of education departments and traffic management department of public security agencies, this campaign proved to be successful. During November and December of 2006, 87,031 school buses at 116,986 primary and middle schools were examined, and 6,225 of those buses did not pass the inspection. In addition, 3,337 school bus drivers were determined to be unqualified and were prohibited from driving school buses, and 6,327 school buses were found to be operating illegally. Violations of traffic laws, such as overloading (7,095 incidents), speeding (3,268 incidents), and fatigue driving and drunk driving (58,813 times) were punished.

In August 2007, the Ministry of Education, the Ministry of Public Security and the National Safety Supervision Bureau issued the *Notice of Improving the School Trip Safety for Primary and Middle School Students and Kindergartens in Rural Areas*. The following measures were proposed：

1) Improve safety management of trips to and from schools in rural areas in conformity with the relevant laws and regulations.
2) The government should take more responsibility and enhance cooperation among different departments.
3) Continue to conduct examination and inspection of the school buses.
4) Reinforce the role of education and propaganda on road traffic safety.
5) School buses that are illegally operated should be banned.

2.4 Improvement of Driving Skills

The human factor is one of the major causes of road traffic accidents. Therefore, improving drivers' safety awareness and knowledge is of great importance in the reduction of traffic accidents and

casualties. In recent years, transportation departments have adopted many measures to improve drivers' driving techniques and traffic safety awareness.

(1) Enhance supervision of driving schools

The qualifications of the driving schools as well as the coaches were examined to ensure the quality of training. Violations of relevant laws and regulations during training or testing would be investigated and dealt with accordingly. During 2004 and 2008, about 1,900 driving schools were below the standard and canceled; more than 9,700 coaches were found to be unqualified and dismissed.

(2) Enhancement of driver education

Taking lessons from the advanced experience and practices in developed countries, the transportation departments formulated a syllabus for drivers' training in China. In September 2007, the Ministry of Transportation issued the revised syllabus for training motor vehicle drivers. According to the syllabus, there are four steps to the training: the first step is teaching the laws, regulations, and theoretical knowledge of driving; the second is training basic driving skills; the third is practicing the practical driving skills on roads, and the last step is giving instruction on the handling of malfunctions and then prevention of traffic accidents. The four steps are correlated with each other and constitute a complete training system.

Meanwhile, a book series called *Safe Driving Starts Here* was published in March 2005. This book series is suitable for all kinds of people, regardless of whether or not they are drivers. It plays a positive role in promoting traffic safety awareness across society.

Transportation department personnel went to schools, businesses, libraries, and homes to publicize the concept of safe driving and give away *Safe Driving Starts Here* book series, so as to formulate strong awareness of traffic safety across society.

2.5 Enhancement of the Management of Transportation Corporations

(1) Overloaded vehicles

Since the 1990s, overloaded vehicles on the roads have become a serious problem in China, particularly for having caused many traffic accidents. In 2004, the Ministry of Transportation and the Ministry of Public Security proposed a variety of measures regarding policies, economy, law enforcement and propaganda and education. These measures proved to be effective with the overloaded vehicle rate decreasing significantly.

- Principles:

1) Propose both short- and long-term measures to prohibit overloaded vehicles.

2) Carry out a nationwide campaign to implement the measures and strengthen coordination among

different departments and regions.

3) Reasonably consider the freight transport market's level of acceptance.

4) Conduct propaganda in advance and then carry implementation of the measure forward.

- Goal:

Create a healthy, standardized, fair, and orderly transport market. In about one year's time, effectively reduce the number of overloaded and oversized vehicles on the road; in three years, basically eliminate the overloaded and oversized vehicles, establish a reasonable pricing system and build an open, fair and healthy market.

- Actions:

1) Conduct large-scale propaganda.

2) Prohibit illegal reconfiguration of the vehicles.

3) Prohibit overloaded vehicles.

4) Take economic measures to balance the relationship between cost of transportation and benefit of overloading.

5) Promote an orderly transport market.

The following criteria were used to decide whether a vehicle was overloaded:

1) For two-axle vehicles, the total weight of vehicle and freight was over 20 tons;

2) For three-axle vehicles, the total weight of vehicle and freight was over 30 tons;

3) For four-axle vehicles, the total weight of vehicle and freight was over 40 tons;

4) For five-axle vehicles, the total weight of vehicle and freight was over 50 tons;

5) For vehicles with six or more axles, the total weight of vehicle and freight was over 55 tons;

6) The total weight of vehicle and freight was more than permitted on the license of transport.

- Results:

Between 2004 and 2007, the transport market witnessed the following results:

1) The number of overloaded vehicles declined dramatically. The overloaded vehicle rate decreased from 80% to less than 10%. In Beijing and many other cities, the rate was brought below 3%.

2) Road traffic safety improved. Although the total number of motor vehicles increased by 15% annually, the accident rate decreased by about 15% per annum. The number of accidents caused

by freight vehicles was reduced significantly.

3) The production and reconfiguration of motor vehicles was further standardized.

4) Road infrastructure was protected and road quality improved. The mitigation of overloaded vehicle damage to highways and bridges reduced the economic losses by 16 billion yuan every year.

5) Highway capacity increased and the average operational speed of freight vehicles rose by 20%.

6) The number of multi-axle and large-tonnage freight vehicles increased continuously. In 2006, the sales of heavy trucks reached 0.28 million, climbing by 15% from 2005. In the first half of 2007, the rate even surpassed 60%.

In October 2007, nine ministries of the State Council issued the *Notice of Long-Term Measures to Reduce Overloaded Vehicles*, which proposed the creation of a long-tem mechanism to reduce overloaded vehicles over the subsequent three years.

(2) Transport of Dangerous Goods

Traffic accidents involving vehicles transporting dangerous goods pose enormous risks, including endangerment of people's lives and contamination of the environment. To counter these risks, the Ministry of Transport released three national and industry standards: the *Rules on Transport of Dangerous Goods*, the *Regulations of Transport and Loading of Dangerous Goods*, and the *Symbol of Motor Vehicles Transporting Dangerous Goods*. Personnel in charge of the transport of dangerous goods are required to be trained and assessed for their qualifications. Businesses with an incomplete safety system, motor vehicles not meeting the technical requirements, and unqualified personnel are not allowed to transport dangerous goods.

The Ministry of Transportation and related departments carried out nationwide inspections targeting dangerous goods transportation five times, resulting in revocation of the operating licenses of 25,186 unqualified transport corporations. As of April 2006, there were 6,038 corporations qualified for transporting dangerous goods, with 130,478 certified motor vehicles and 0.35 million licensed employees.

2.6 Improvement of Motor Vehicle Performance

(1) Prohibit production and sale of substandard counterfeit motor vehicle parts

On December 2003, the Ministry of Commerce, the Ministry of Public Security, and some other ministries issued the *Notice on Management of Motor Vehicle Market*, which requires that illegal production and sale of counterfeit vehicle parts be prohibited and punished according to the relevant laws and regulations.

(2) Adjustment of the composition of motor vehicle types

The Ministry of Transportation promoted the evaluation system for operational passenger vehicles to upgrade the passenger vehicles on the roads. The toll for large-tonnage vehicles and

container-transport vehicles was lowered. The composition of freight vehicle types was adjusted to reduce energy consumption and improve transport efficiency and safety.

(3) Vehicle inspection

On February 2006, the National Quality Inspection and Quarantine issued the *Regulation on the Safety Inspection Agencies of Motor Vehicles*, which took effect in the following May. The aim of the regulation is to supervise the motor vehicle inspection agencies to ensure the authenticity of the inspection results.

(4) Management of vehicles used for agricultural purposes

On October 2007, the Ministry of Agriculture issued the *Proposal on Strengthening the Supervision of Vehicles for Agricultural Purposes*. This is aimed at improving the technical skills of drivers of vehicles for agriculture purposes, enhancing the mechanical safety of agricultural machines, and increasing the registration rate of agricultural vehicles.

(5) Establishment of the China New Car Assessment Program (C-NCAP)

The China New Car Assessment Program was established by the China Automobile Technical Research Center. Every year, the center selects candidate car models for assessment through a battery of tests, including fuel consumption and crash tests. The results are released to the public to guide consumers' choices. The program operates under rigorous assessment rules, and assigns each car model examined a star rating based on the testing results, with 5+ being the highest and 1 the lowest. It provides consumers with useful information and encourages car manufacturers to design and produce cars with higher safety standards. As a result, the program has the potential to reduce both the incidence of traffic accidents and the damage they cause.

(6) Establishment of a defective car recall system

On March 2004, the National Quality Inspection and Quarantine, the National Commission of Development and Reform, the Ministry of Commerce, and the General Administration of Customs jointly issued the *Regulation on Recall Management of Defective Motor Vehicles* to establish a recall system for defective motor vehicles in China. Since 2004 about 3.2 million motor vehicles were recalled due to potential safety defects.

2.7 Improvement of Road Infrastructure

(1) Highway Safety Enhancement Project

In December 2003, the Ministry of Public Security and the National Safety Supervision Bureau urged the improvement of dangerous highway segments. In 2004, the Ministry of Transportation launched a three-year Highway Safety Enhancement Project, and expanded the program in 2007 to include county and rural roads. Between 2004 and 2006, the investment in the program reached 9.01 billion yuan.

Approximately 278,000 road segments with a cumulative length of 83,000 kilometers were improved. In 2007 and 2008, a further 4.85 billion yuan was invested into the program to improve 163,000 road segments totaling 55,000 kilometers in length. As a result, the program has effectively enhanced highway safety. Furthermore, in 2007, the Technical Research of China's Road Safety Program received the second-place award of the European Road Safety Prize bestowed by the International Road Federation (IRF).

(2) Reconstruction of dangerous bridges

At the end of 2009, there were 621,900 highway bridges in China, most of which were constructed in the preceding two decades. Some bridges had become dangerous due to aging, structural damage and the relatively low design standards of the past. Improving the safety of these bridges was made the top-priority mission of road safety authorities. Between 2001 and 2005, the Ministry of Transportation invested 1.5 billion yuan to reconstruct 7,000 dangerous bridges, and issued the new *Highway Bridge Maintenance Regulations* to require highway administrative agencies to inspect and assess bridge conditions on a regular basis. In 2007, the Ministry of Transportation decided to further its efforts by setting the goal of basically completing, in the three years from 2008 to 2010, the reconstruction of all dangerous bridges on national and provincial highways, as well as important ones on county and rural roads.

2.8 Emergency Management

(1) Forecast of severe weather conditions

Road traffic safety can be greatly affected by adverse weather conditions (such as fog, snowstorms and torrential rain) and natural disasters (such as mud-rock flows and landslides in mountainous areas, and floods). On July 2005, the Ministry of Transportation and the Bureau of Weather Forecast signed a memorandum pledging to jointly carry out highway weather forecasts. According to the memorandum, relevant weather information would be released in advance based on rain forecasts in the rainy season and inspection of fog conditions along the highways. The relevant emergency response, information feedback and evaluation mechanisms were established.

On January 2007, the Ministry of Public Security and the Bureau of Weather Forecast issued the *Notice of Establishing a Road Traffic Weather Information Exchange and Release System*, which requires weather forecast agencies and public security agencies to: share information on road traffic and weather; establish a channel for information exchange; and create a system for broadcasting advisories, traffic management information and travel safety information via media such as television, the Internet, short message services and display screens.

(2) Pre-planning for emergencies

Since 2003, public security agencies have been establishing plans for emergencies of different levels based on different road traffic situations. To date, all provinces, 97.9% of all cities and 92.8% of all

counties have established about 1,813 plans for traffic management during emergencies to reduce the adverse impact of severe weather and unexpected incidents. The Ministry of Public Security formulated the a plan for freeway emergency rescue, established an emergency rescue team consisting of mainly firefighters and police officers, and promoted coordination and cooperation among different departments. In 2008, 25,000 traffic accident victims were saved due to prompt rescue. Transportation agencies established the ministerial and provincial highway network emergency management platform for the network supervision and traffic information broadcasting.

2.9 Traffic Safety Propaganda and Education

From October 2004 to February 2005, the Ministry of Public Security conducted nationwide traffic safety awareness campaign themed "Care for your life and have a safe trip." Traffic safety propaganda and education were positioned as key measures for preventing road traffic accidents.

In April 2006, the Ministry of Propaganda, the Ministry of Public Security, the Ministry of Education, the Ministry of Law, and the Bureau of Safety Production Supervision decided to conduct the nationwide propaganda and education project "Protect life and have a safe trip" from 2006 to 2008. The goal of the three-year effort was to: formulate a mechanism for traffic safety propaganda involving various departments, including public security, education, law administration and safety supervision at the provincial, city and county levels; carry out propaganda in rural areas, communities, businesses, schools and homes; reduce significantly traffic violations such as unlicensed driving, fatigue driving, speeding, overloading, drunk driving and so on. The project for 2006 was themed "Pay attention to the traffic and protect people's lives" and was mostly targeted at conducting propaganda and education on road traffic safety laws and regulations, and on basic safety knowledge. In 2007, an "Obey the law anytime anywhere" project was implemented to focus mainly on deterring traffic violations and creating a safe, convenient and sustainable traffic environment. The project for 2008 was "Welcome the Beijing Olympics and be civilized," which promoted civilized and safe road travel under the circumstances of the Beijing Olympic Games.

2.10 Traffic Safety Technology

In order to reduce the trend of increasing accidents and provide technical support to road safety improvement in China, the Ministry of Transportation organized and carried out a series of basic studies on traffic safety, and then applied the findings to road safety improvement. In 2004, the "Highway Traffic Safety Technology Research" project was conducted to solve the most significant technology issues at that time and to develop safety design methods for improving road traffic safety. The project focused on the following technical needs in China:

- Research for creating a highway safety manual
- Highway safety database technology
- Safety technology for roads with long, steep slopes

- Safety technology for fog areas on freeways
- Development and testing of highway protective facilities
- Formulation of methods for roadside safety evaluation and protection
- Safety analysis of highway tunnel entrances
- Safety analysis of tourist highways in forested areas
- Intersection safety improvement technology
- Improvement of sign legibility and the effectiveness of supporting facilities
- Import of foreign standards and specifications
- Development of test standards and regulations for highway traffic engineering projects
- Establishment of traffic management information system standards for highways in western China

On February 2008, the Ministry of Science and Technology, the Ministry of Public Security and the Ministry of Transportation launched a program entitled "Science and Technology Action Program for National Road Traffic Safety." This program integrated the resources of the Ministry of Transportation and the Ministry of Public Security for the first time and established a mechanism for data and resource sharing. As the largest cooperative program for road traffic safety in China, its goal was to improve road accident prevention, advance warning and emergency rescue for road traffic accidents and effectively prevent severe traffic accidents causing more than ten fatalities. The key technology research and demonstration projects are listed below.

- Intervention technology for road users, including behavioral analysis or road users, supervision and prevention of risky behavior, abnormal behavior identification and advance warning, driver adaption to the environment and so on.
- Vehicle safety and transportation operational technology, including vehicle surveillance, overloading control, active and passive safety technology for vehicles, supervision of dangerous goods transportation and so on.
- Road infrastructure safety technology, including safety design, operation and evaluation of road infrastructure, surveillance, advance warning and improvement of bridges and tunnels, and surveillance of traffic operations under severe weather conditions.
- Road traffic management and safety technology, including the handling of traffic accidents, emergency management, traffic information broadcasting, traffic guidance on dangerous road segment, traffic operations under abnormal conditions, traffic accident analysis, identification of restricted vehicles and information exchange and control.

Following the launch of this program, a task force consisting of senior experts decided that the first phase would focus on implementation of the "Severe Road Traffic Accident Prevention and Treatment Technology Development" project to target the following key technologies:

- Traffic Safety information integration and analysis platform
- Safety technology for highway networks in mountainous areas
- Freeway safety technology

- Commercial vehicle safety technology
- Human behavior and traffic safety
- Regional highway network safety surveillance and evaluation, and emergency management
- Road traffic law enforcement technology

The project seeks to develop a mountain highway safety system that will reduce traffic accidents by 30% and severe traffic accidents by 50% on the demonstration highway segments. Also, a freeway safety system is being created to realize traffic guidance and weather services over distances longer than 100 km and with response times less than 15 minutes. At the same time, the project is developing a traffic law enforcement and emergency management system covering more than 1,000 km, and an interactive long-distance traffic safety education system.

Using existing databases of the public security and transportation departments, the project team is conducting research on a mechanism for data sharing and exchange, designing a traffic safety sharing and exchange system, and developing a traffic safety analysis and decision support system for the aiding the formulation of policies, laws, regulations and safety measures.

It is expected that implementation of the first phase of the project will lead to annual decreases in the number of traffic accident fatalities, bringing the fatality rate per 10,000 vehicles close to the level of developed countries.

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Changes in Traffic Safety Policies and Regulations in Indonesia (1950–2010)

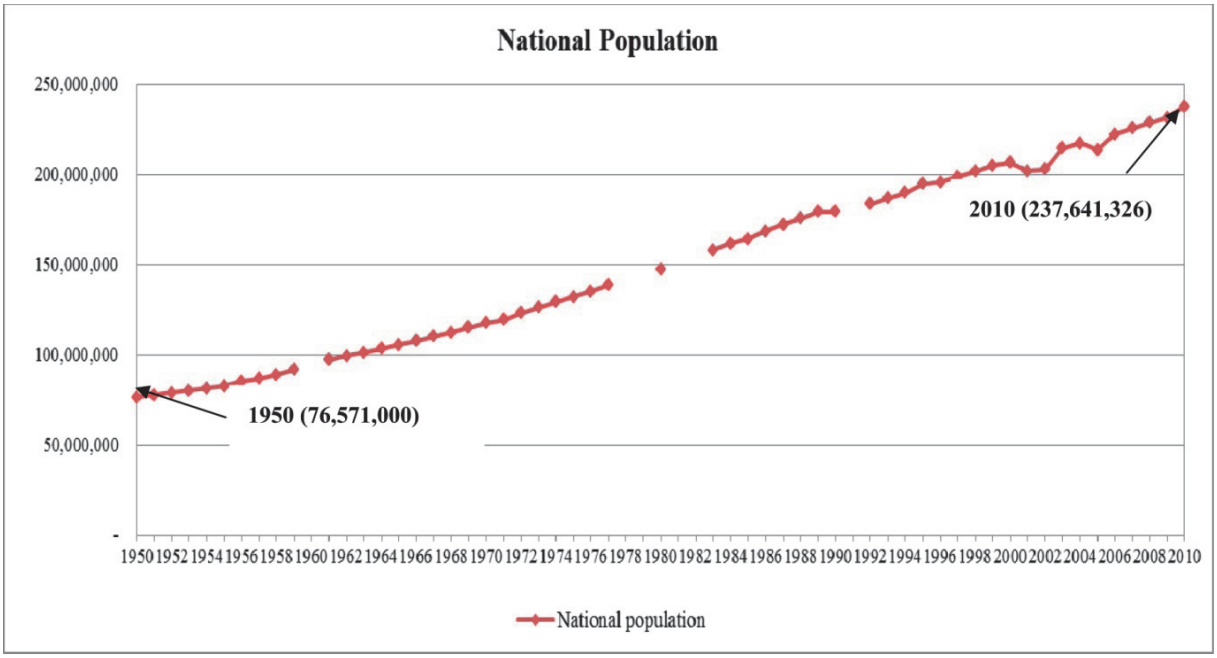
1. Background

Traffic safety policies and regulations in Indonesia are recognized as inseparable from the regulations and policies that govern road transport and traffic issues. Following its independence in 1945, Indonesia produced in 1951 its first supreme law concerning road transport and traffic, enhancing a law enacted earlier by the Dutch colonial government. Afterwards, further legislation on road transport and traffic was passed in 1965, 1980, 1992 and 2009, with the aim of providing safety, security, smoothness and orderliness to road transport and traffic. In addition, various government regulations were established to endorse the implementation of specific provisions of those laws (except the ones enacted in 1951 and 1965). As the Indonesian government increasing turned its attention to road traffic safety, it produced other regulations dealing with specific safety issues in order to minimize road traffic accidents.

This study examines such regulations in the context of traffic accident data for the period 1950–2010. The structure of this paper is as follows: Section 2 presents time series data related to road traffic safety; Section 3 reviews the traffic accident situation; Section 4 discusses organizations involved in the road traffic safety; Section 5 presents the laws, regulations and programs related to traffic safety, and Section 6 reviews them; Section 7 provides conclusions.

2. Data Related to Road Traffic Safety

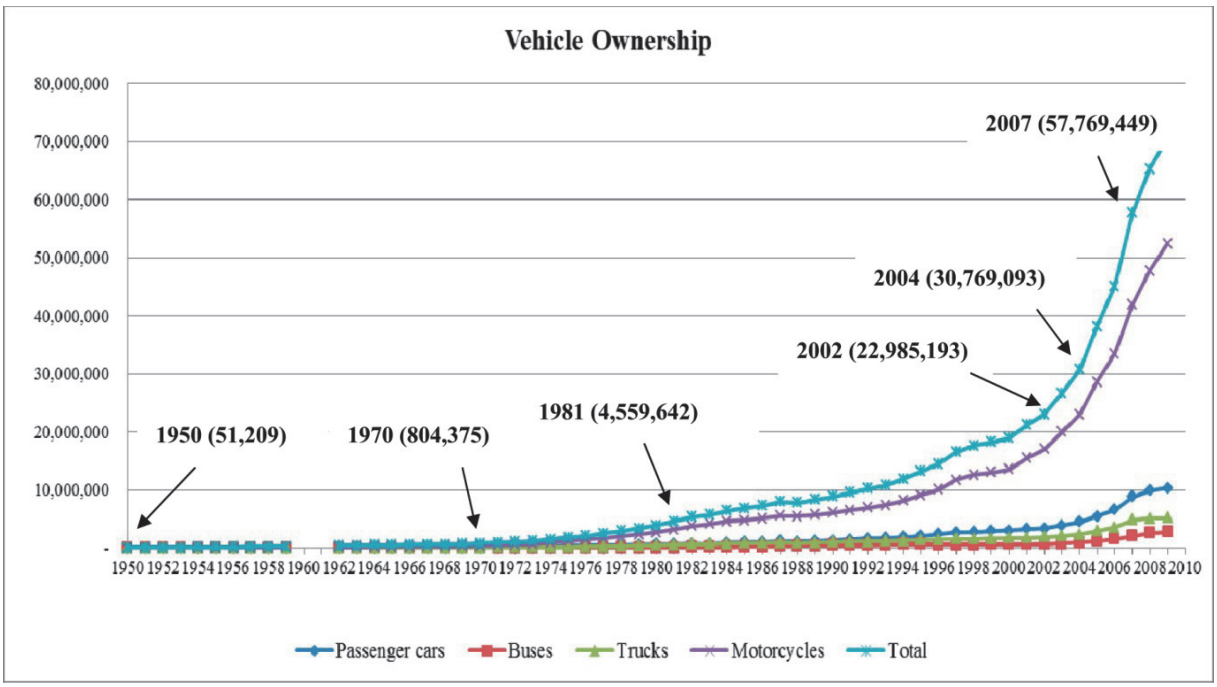
2.1 National Population



Sources: [1], [7], [8], [9], [10] (Note: Some data are not available.)

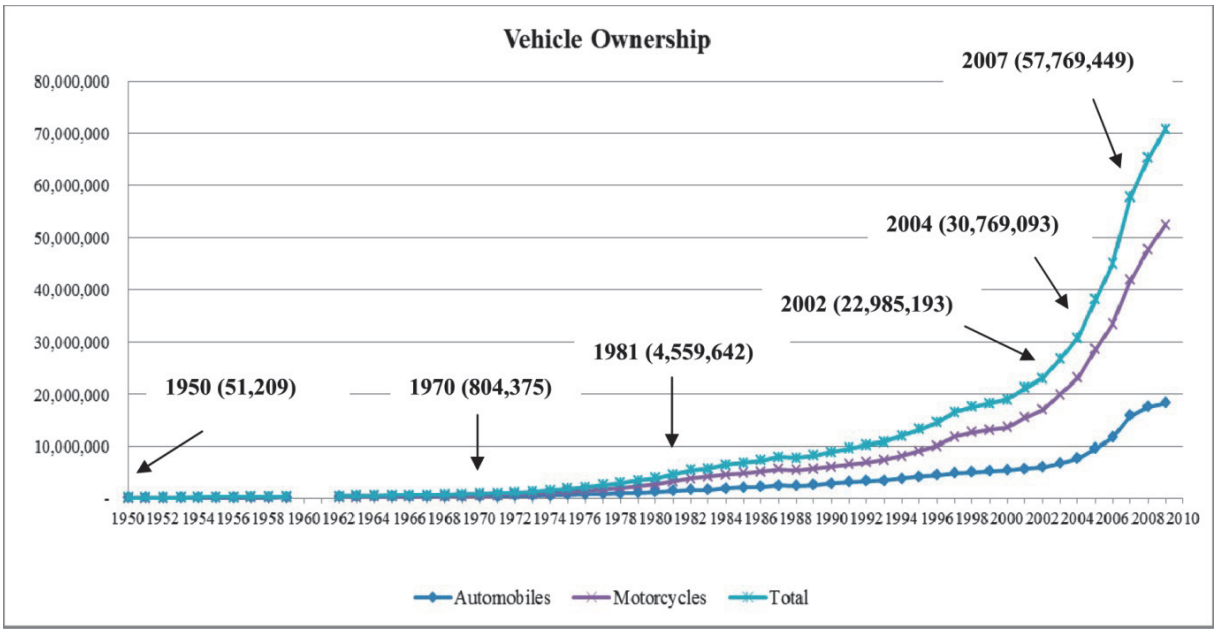
Figure 1 National population

2.2 Vehicle Ownership



Sources: [1], [7], [8], [10], [11] (Note: Some data are not available.)

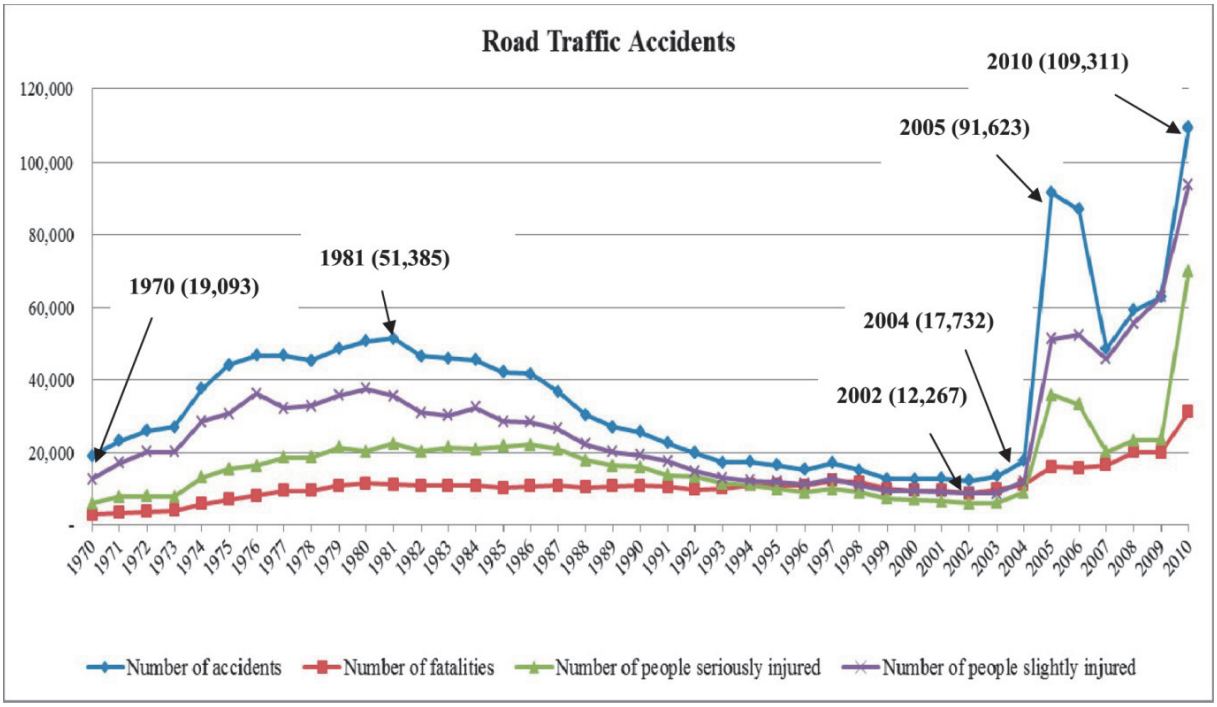
Figure 2a Vehicle ownership (4 classes of motorized vehicles)



Sources: [1], [7], [8], [10], [11] (Note: Some data are not available.)

Figure 2b Vehicle ownership (2 classes of motorized vehicles)

2.3 Road Traffic Accidents

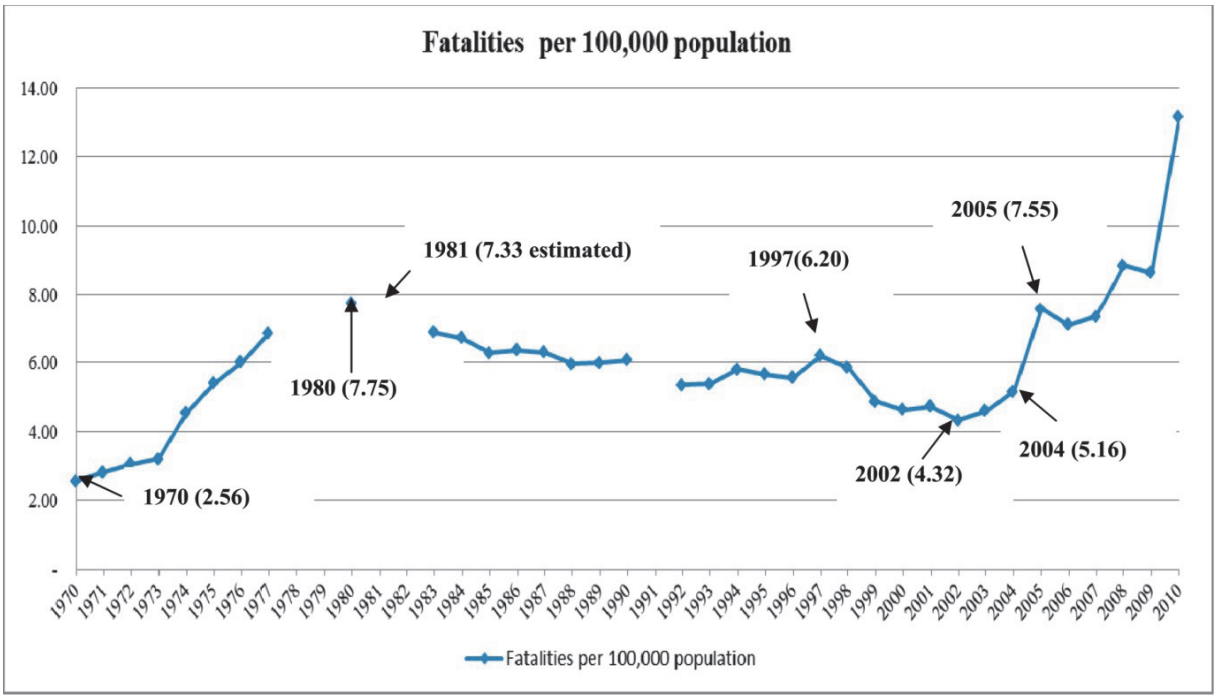


Sources: [1], [6], [10] (Note: Some data are not available.)

Figure 3 Road Traffic Accidents

2.4 Fatalities

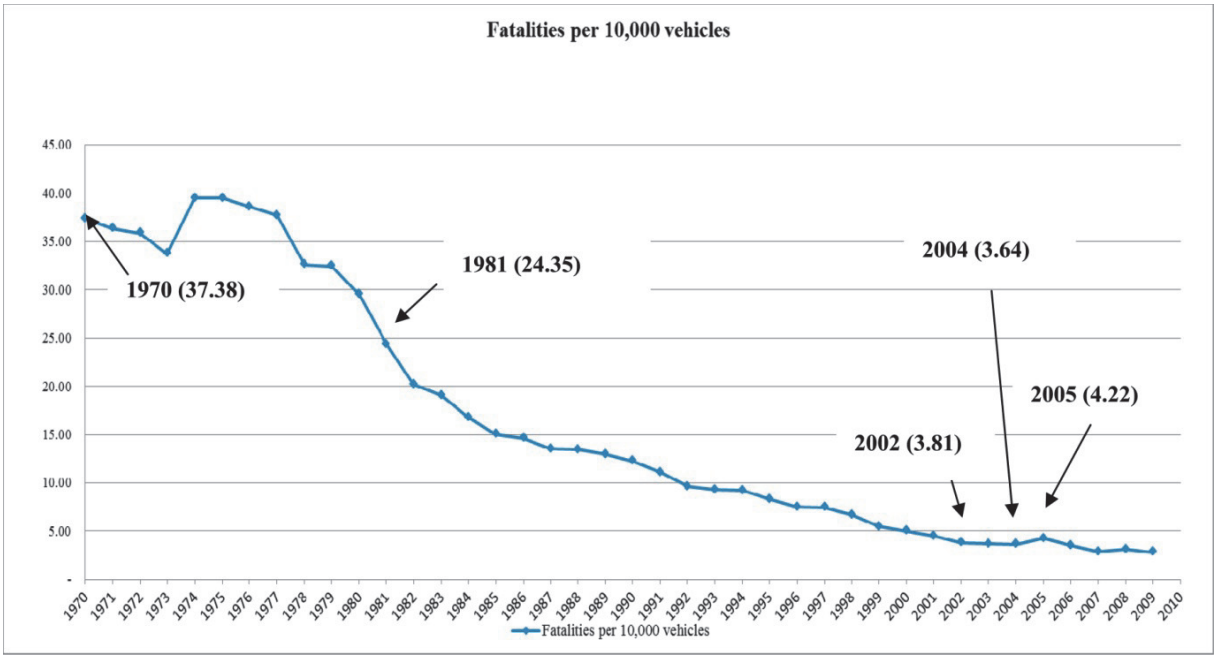
2.4.1 Fatalities per 100,000 population



Sources: Compiled using data from [1], [6], [7], [8], [9], [10]. (Note: Some data are not available.)

Figure 4 Number of fatalities per 100,000 population

2.4.2 Fatalities per 10,000 motorized vehicles

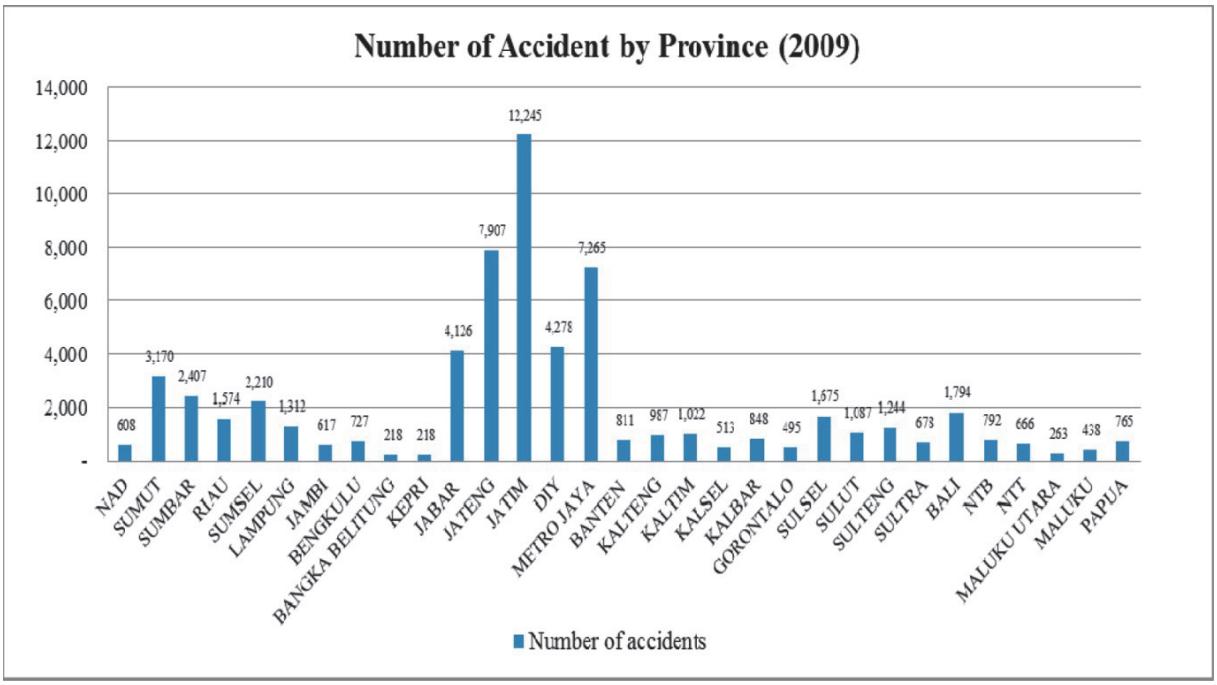


Sources: Compiled using data from [1], [6], [7], [8], [10], [11]. (Note: Some data are not available.)

Figure 5 Number of fatalities per 10,000 vehicles

2.5 Accident Data in 2009

2.5.1 Number of Accidents by Province in 2009



Source: [6]

Figure 6 Number of accidents by province (2009)

2.5.2 Number of Motor Vehicles Involved in Traffic Accidents in 2009

The following bar charts show the number of traffic accidents in 2009 by vehicle type and provinces. Since Indonesia consists of many islands, the province accident data are classified into the following six groups:

(1) Nationwide total (Figure 7a)

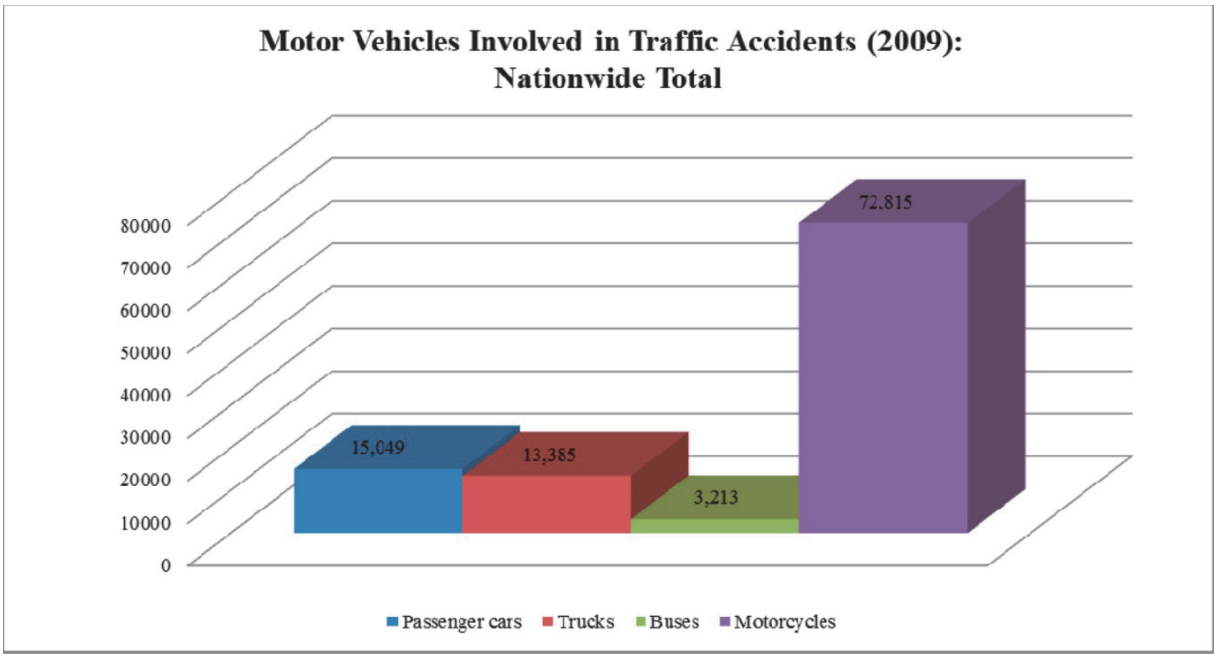
(2) Sumatra (Figure 7b)

(3) Kalimantan (Figure 7c)

(4) Sulawesi (Figure 7d)

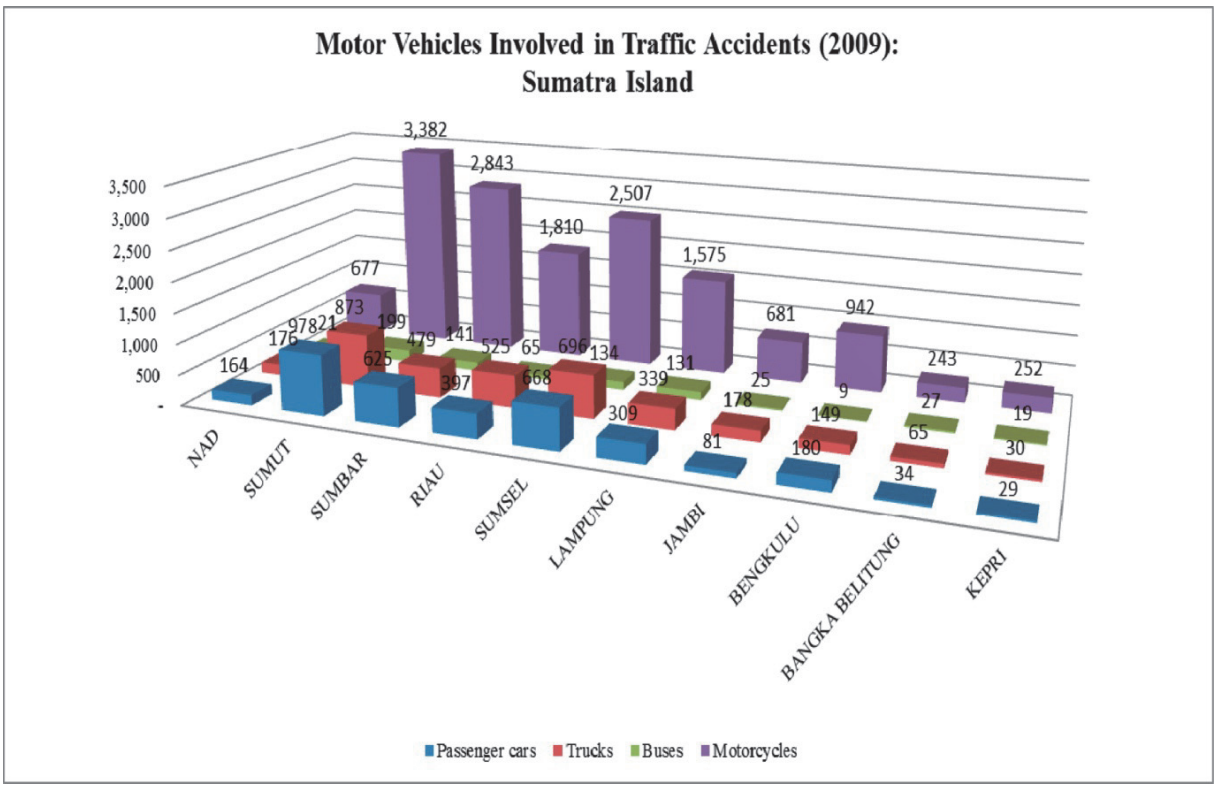
(5) Java (Figure 7e)

(6) Other islands (Figure 7f)



Source: [6]

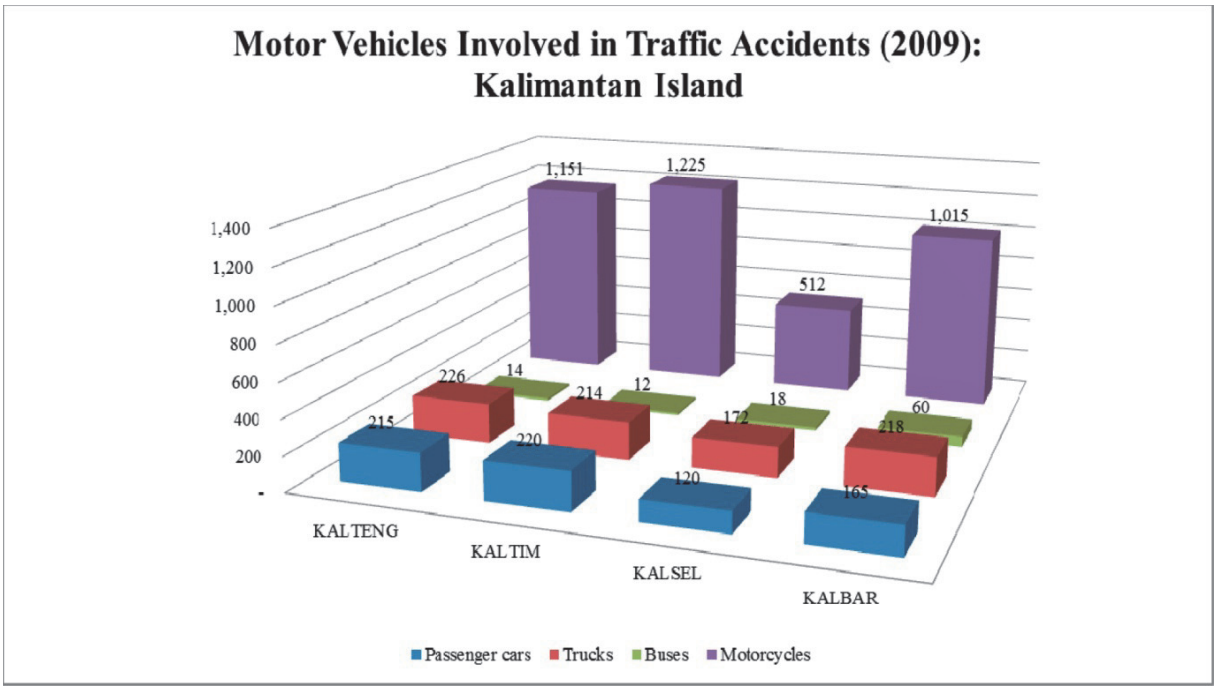
Figure 7a Number of motor vehicles involved in traffic accidents in 2009 (nationwide total)



Source: [6]

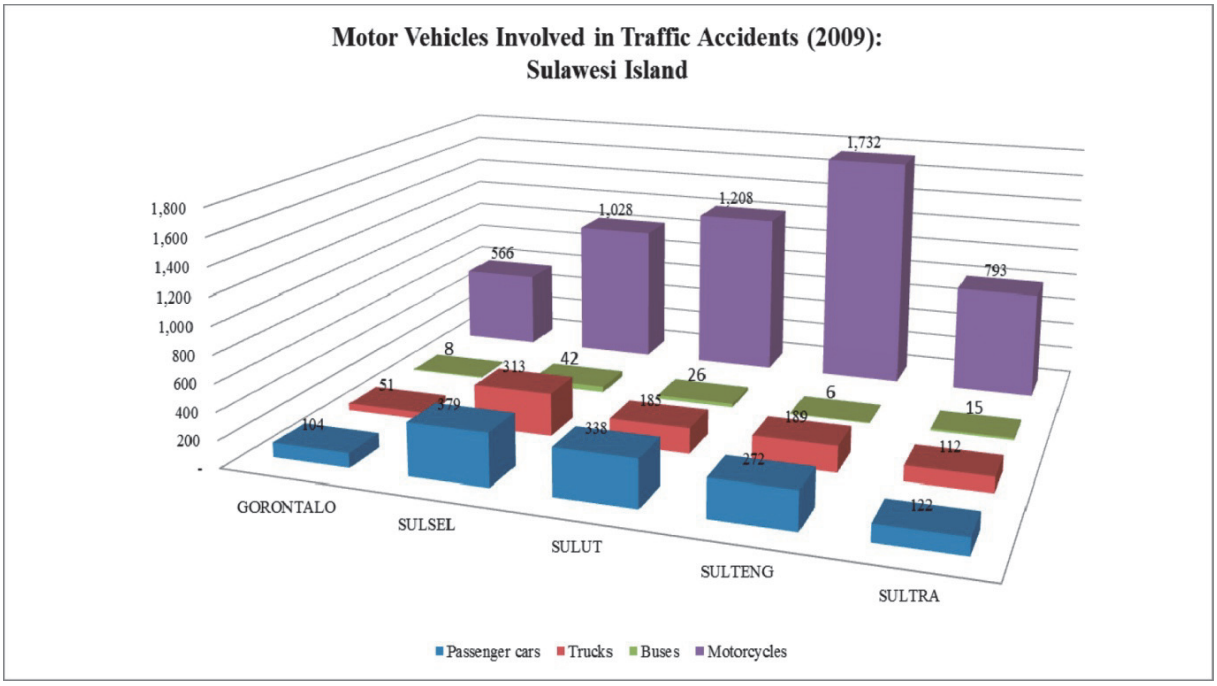
Figure 7b Number of motor vehicles involved in traffic accidents in 2009 (Sumatra Island)

Source: [6]



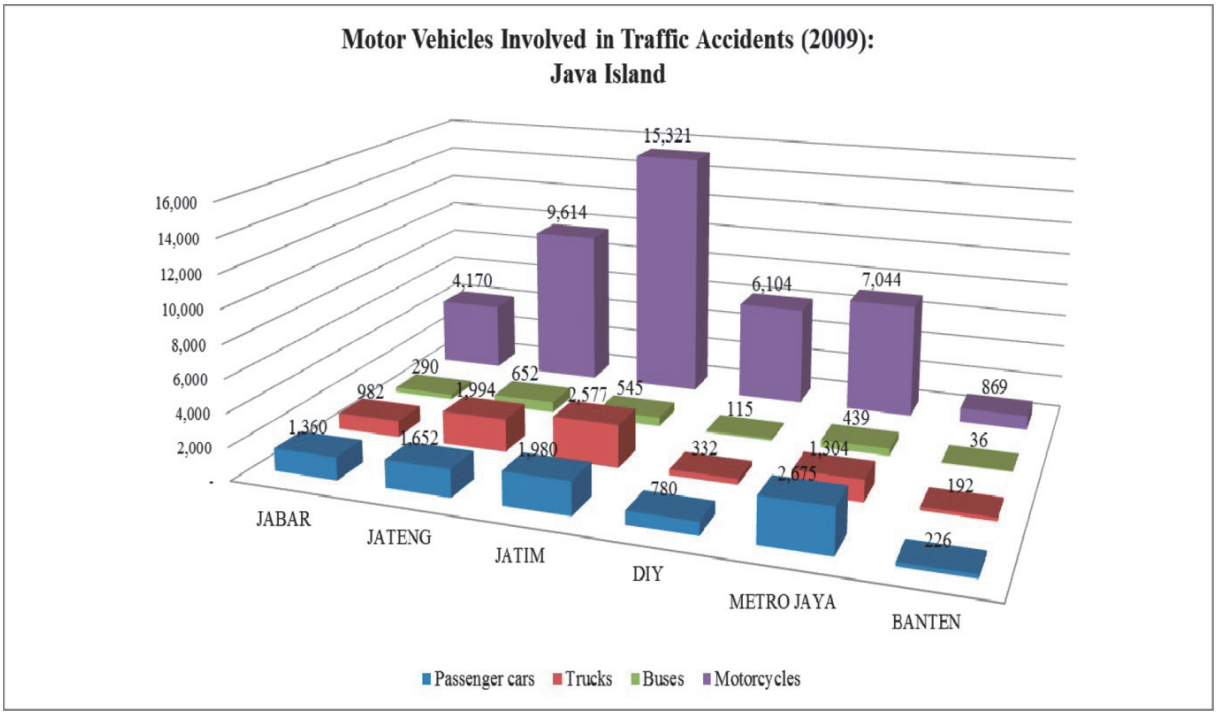
Source: [6]

Figure 7c Number of motor vehicles involved in traffic accidents in 2009 (Kalimantan Island)



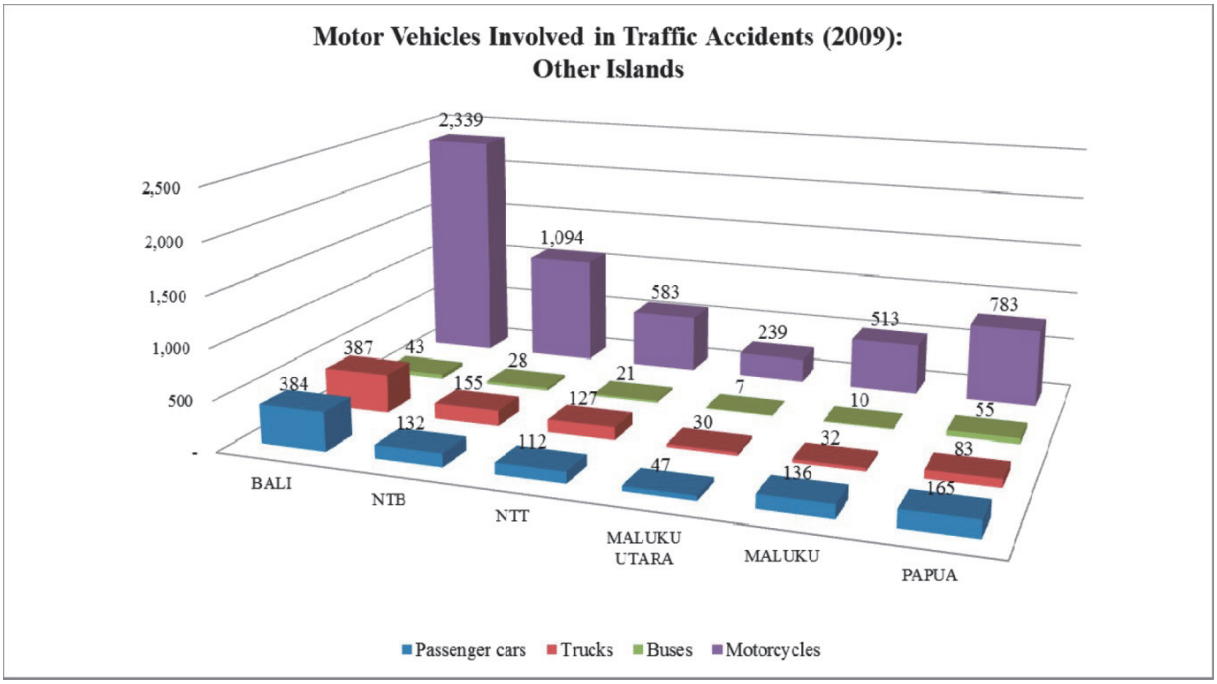
Source: [6]

Figure 7d Number of motor vehicles involved in traffic accidents in 2009 (Sulawesi Island)



Source: [6]

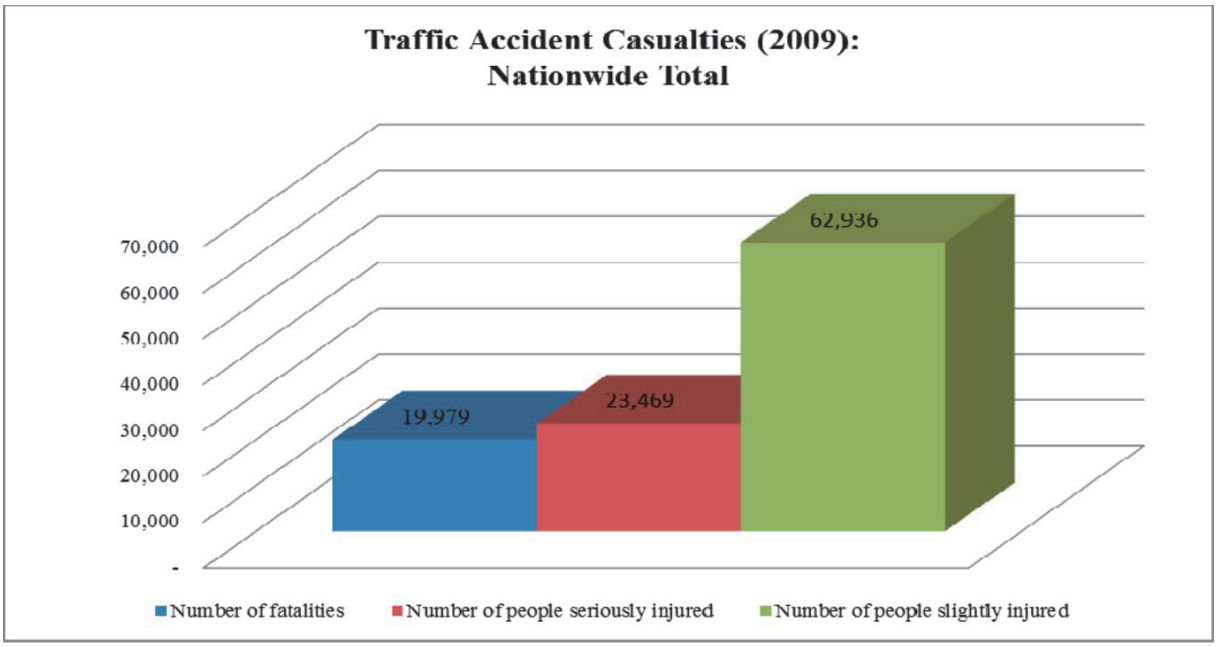
Figure 7e Number of motor vehicles involved in traffic accidents in 2009 (Java Island)



Source: [6]

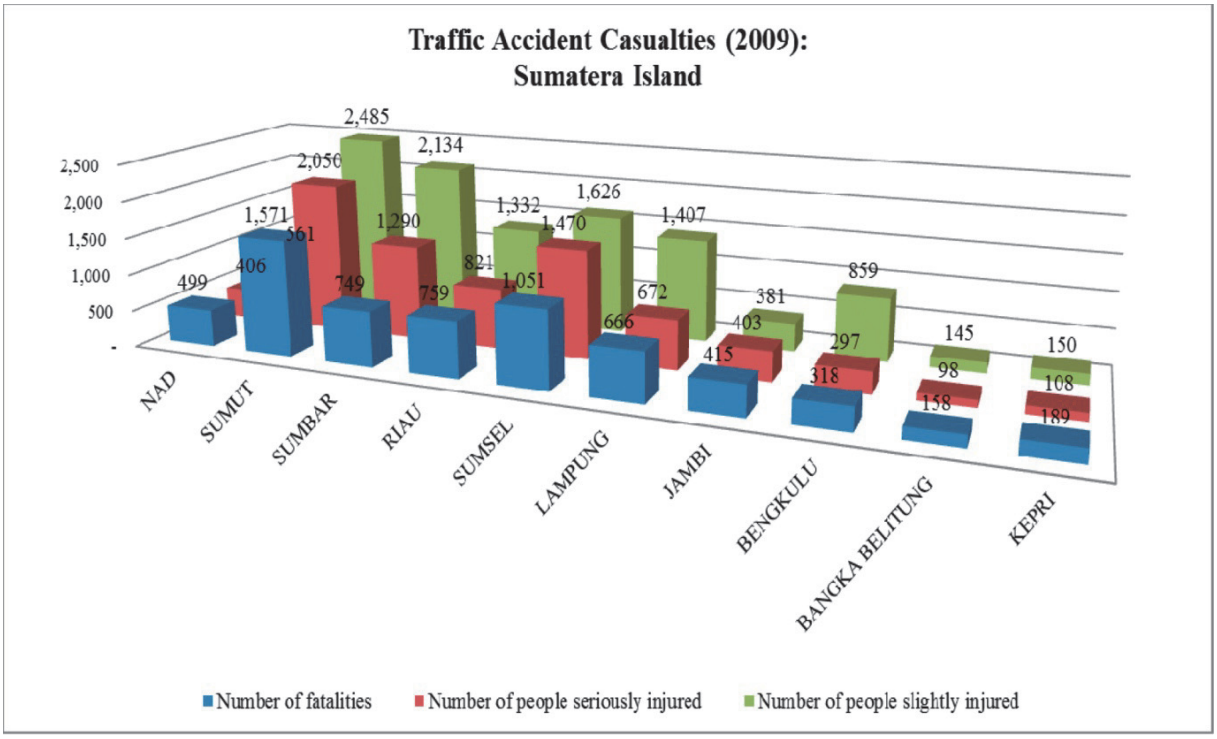
Figure 7f Number of motor vehicles involved in traffic accidents in 2009 (other islands)

2.5.3 Traffic Accident Casualties in 2009



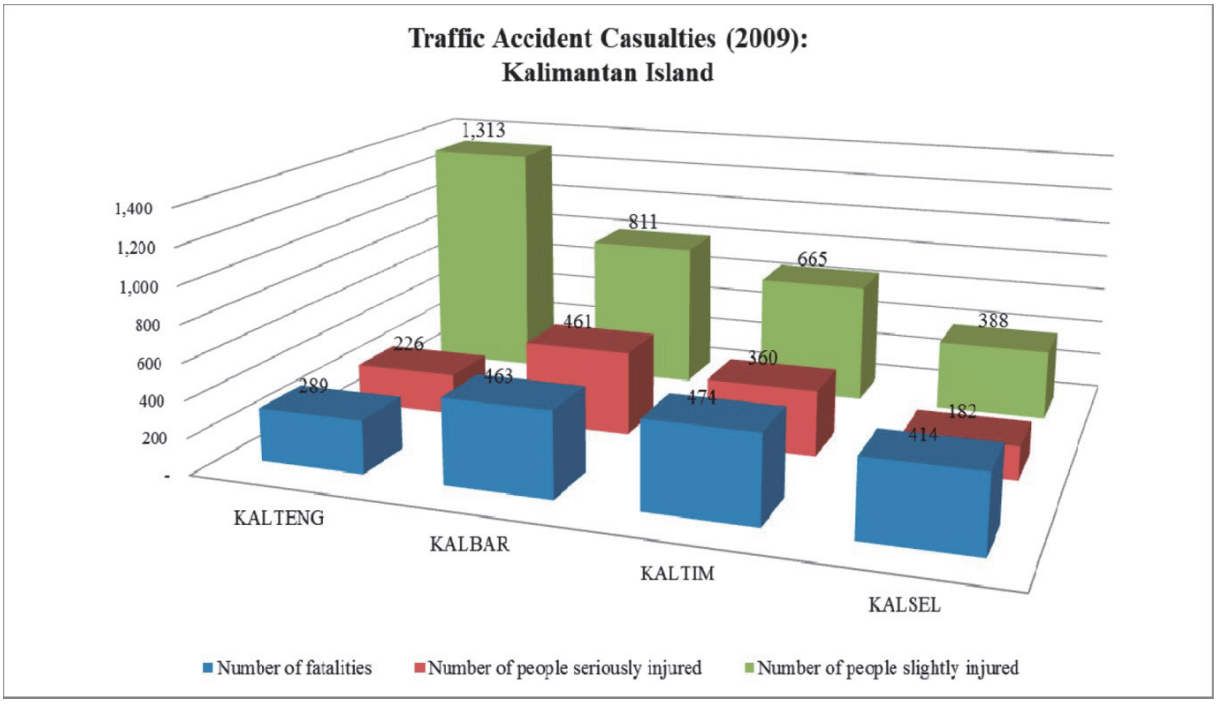
Source: [6]

Figure 8a Traffic accident casualties in 2009 (nationwide total)



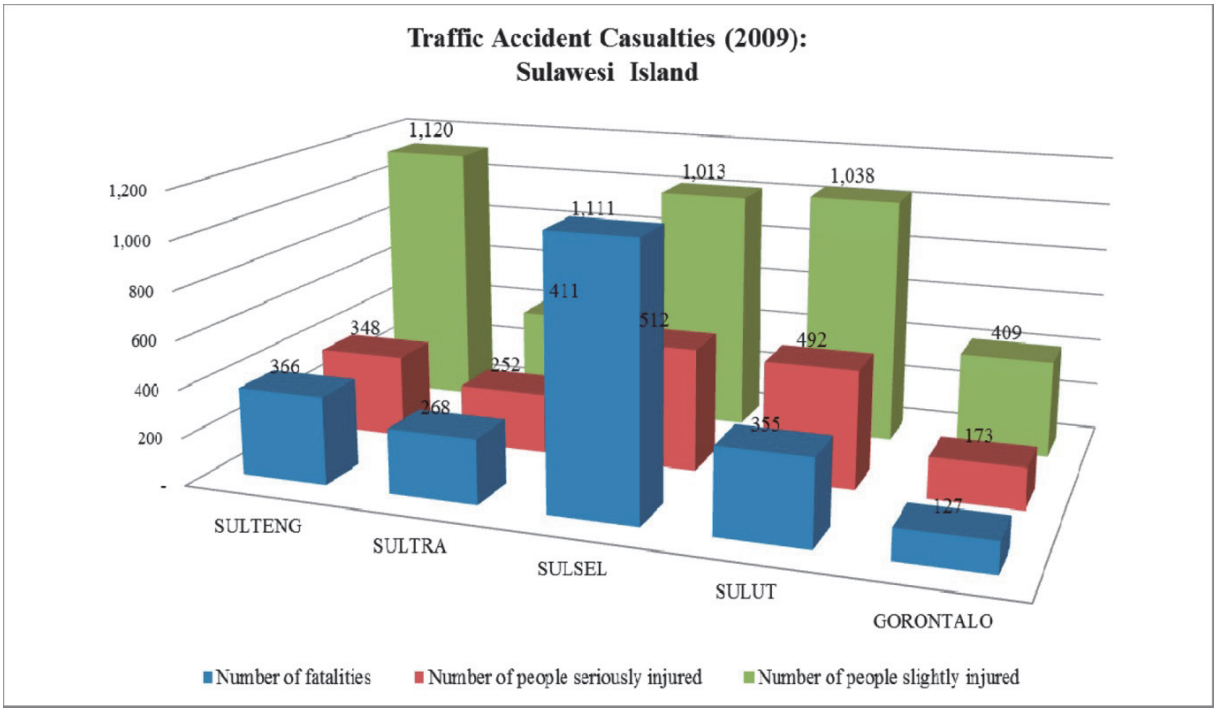
Source: [6]

Figure 8b Traffic accident casualties in 2009 (Sumatra Island)



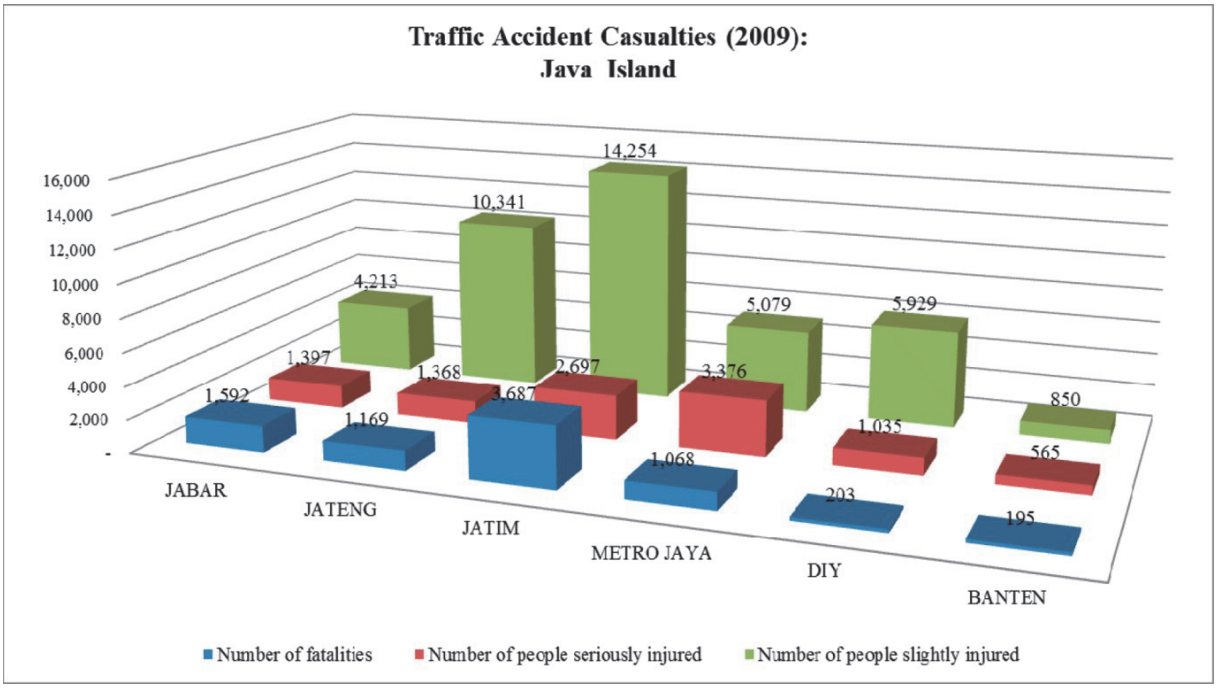
Source: [6]

Figure 8c Traffic accident casualties in 2009 (Kalimantan Island)



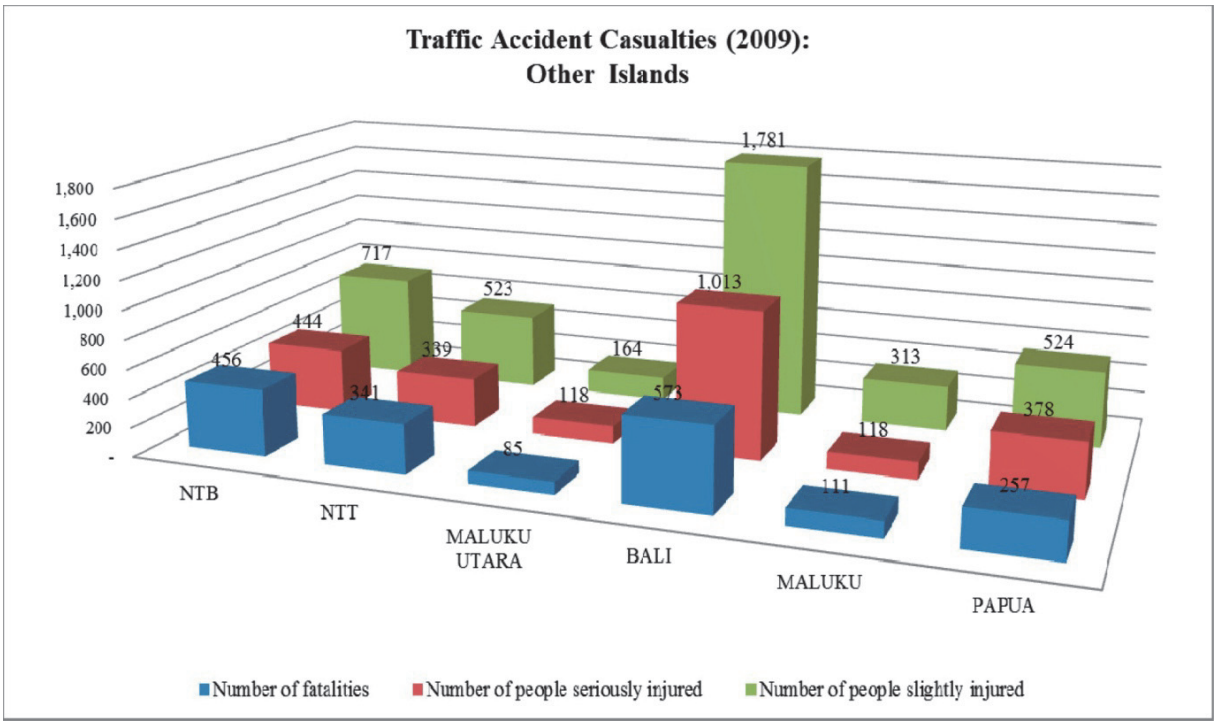
Source: [6]

Figure 8d Traffic accident casualties in 2009 (Sulawesi Island)



Source: [6]

Figure 8e Traffic accident casualties in 2009 (Java Island)



Source: [6]

Figure 8f Traffic accident casualties in 2009 (other islands)

3. Review of Traffic Accident Situation

3.1 General Review

In general, annual data on population and vehicle ownership in Indonesia have been collected relatively effectively since 1950 and have been documented by the Central Bureau of Statistics. However, the same cannot be said for the reporting and documentation of data on traffic accidents, especially road traffic accidents. The collection and documentation of time series data on road traffic accidents was started in 1970, but was initially poor in quality, with many accidents going unreported for various reasons. One of those reasons was that the use of an unaudited reporting process gave police officers the potential to refrain from reporting accidents to the higher echelon in order to keep the reported accident rate low in their areas of duty. Moreover, only the numbers of accidents and resulting casualties were recorded, with no documentation of other accident details.

As the Indonesian government became more concerned with traffic safety, the Indonesian National Police started devoting greater attention to traffic accident prevention, and recognized that the establishment of a proper database of accident information was the key to reducing the number of accidents. An intensive effort to document traffic accidents was launched on 2005. The data collected showed extreme growth in the annual number of traffic accidents, with the number for 2005 (91,623) totaling nearly five times that of 2004 (17,732). However, it is clear that this rise was not the result of an increase in accident incidence, but was rather the effect of intensive reporting by the police. Consequently, studies on traffic accidents in Indonesia must also consider this important phenomenon.

3.2 Trends in Road Traffic Accidents

3.2.1 Growth Rate

The following analysis on road traffic accidents is initially based on the trends in the variables related to traffic accidents. Such trends are represented by the average growth rates of some variables that are developed from data presented in sections 2.1 to 2.4. The growth rates are shown in Table 1. The growth rates of some variables are also represented in bar charts that show the rate fluctuation throughout the time of observation (Figures 9 to 11).

Due to the problem of poor accident reporting and documentation described in section 3.1 and based on the patterns of the time series of variables related to traffic accidents, we decided to divide the time series data into the following six periods of observation:

(1) 1950–1970
(2) 1970 –1981
(3) 1981–2002
(4) 2002–2004
(5) 2004–2007

(6) 2007–2010

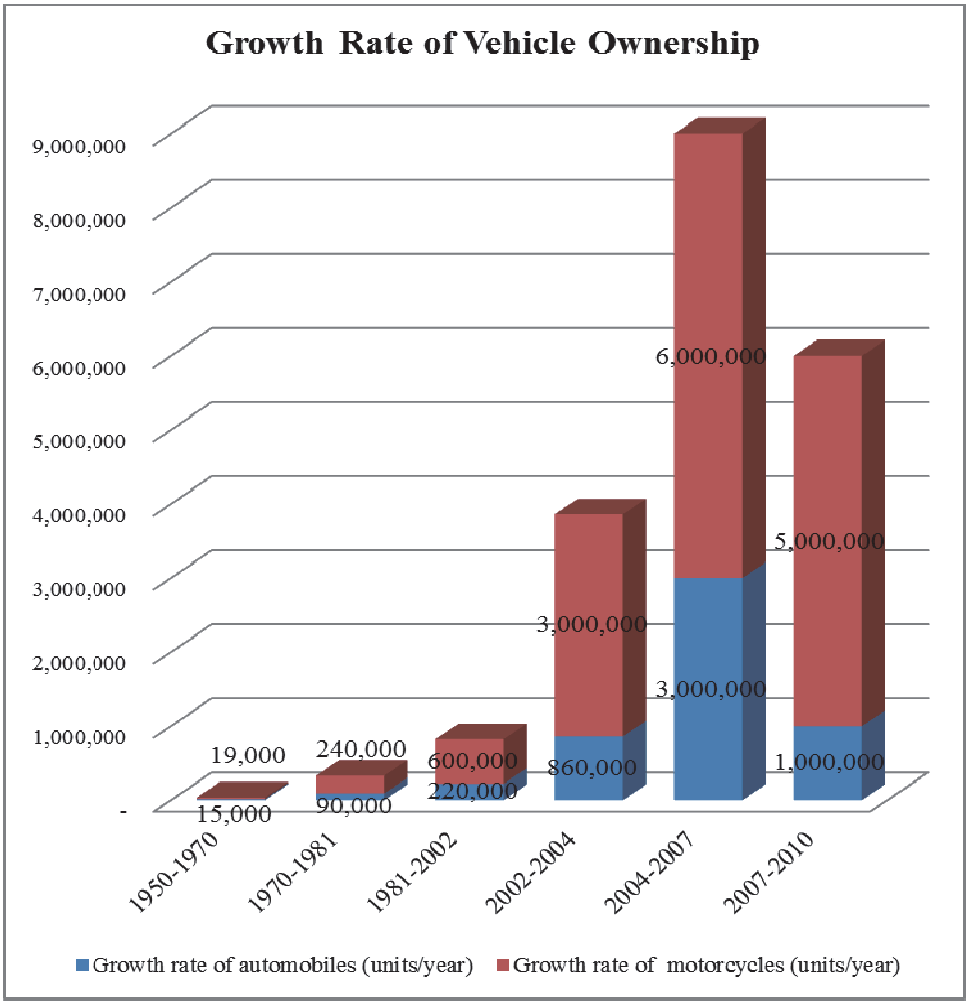
Analysis is carried out based on the figures in the following table and bar charts, as well as the data and graphs presented in Section 2.

Table 1 Average growth rate of selected variables

AVERAGE ANNUAL GROWTH RATE	PERIOD					
	1950-1970	1970-1981	1981-2002	2002-2004	2004-2007	2007-2010
Population	3,000,000					
Number of automobiles**	15,000	90,000	220,000	860,000	3,000,000	1,000,000
Number of motorcycles**	19,000	240,000	600,000	3,000,000	6,000,000	5,000,000
Total number of vehicles**	35,000	330,000	820,000	4,000,000	9,000,000	6,000,000
Number of road traffic accidents		3,000	-1,980	2,700		16,089
Number of people seriously injured		1,669	-880	1,485		11,987
Number of people slightly injured		2,187	-1,331	1,577		13,622
Total number of people injured		3,857	-2,212	3,063		25,609
Number of fatalities		877	*)	1,221		3,792

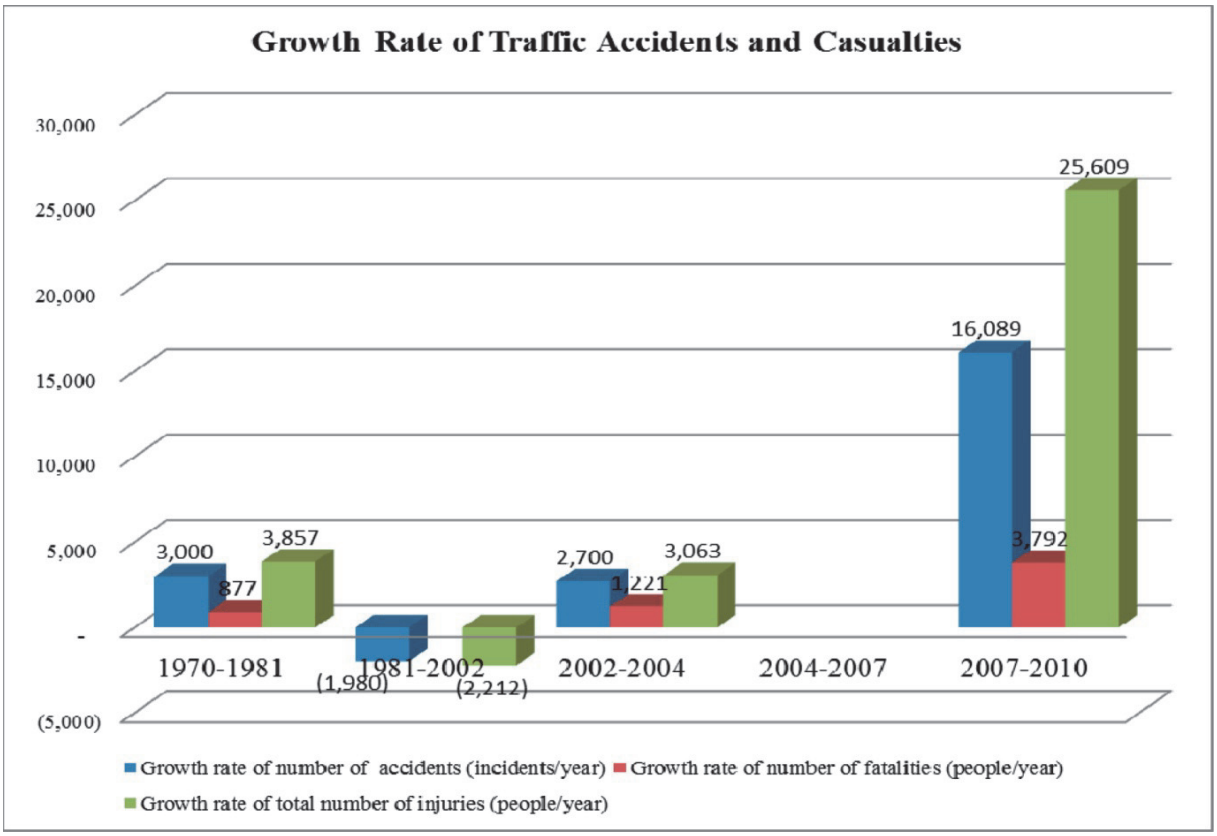
Sources: Compiled using data from [1], [6], [7], [8], [9], [10], [11].(* Not defined due to random fluctuation)

** Data for 2010 are not available.



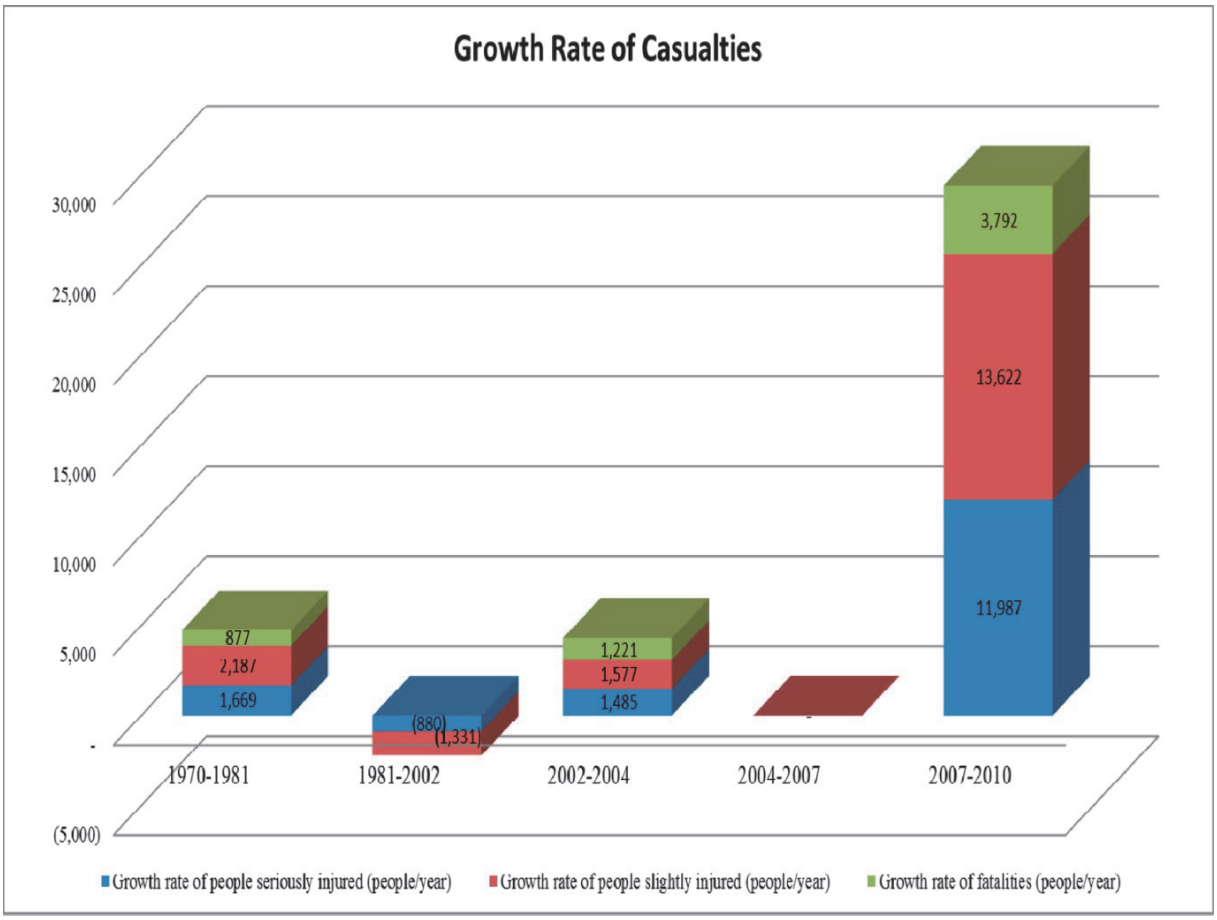
Sources: Compiled using data from [1], [6], [7], [8], [9], [10], [11].

Figure 9 Growth rate of vehicle ownership



Sources: Compiled using data from [1], [6], [7], [8], [9], [10], [11].

Figure 10 Growth rate of traffic accidents and casualties



Sources: Compiled using data from [1], [6], [7], [8], [9], [10], [11].

Figure 11 Growth rate of casualties

3.2.2 Analysis of Traffic Accident Time Series

(1) 1950–1970

The only accident-related data available during this period are vehicle ownership and population. The number of automobiles and the total number of motorcycles increased at the rate of 15,000 units/year and 19,000 units/year, respectively. There were 45,663 automobiles in 1950, rising to 364,730 in 1970. The number of motorcycles in 1950 was only 5,546, but this climbed to 440,005 in 1970. The population grew steadily at an average rate of 3 million people/year, reaching around 117 million in 1970.

(2) 1970-1981

Collection and documentation of time series data on traffic accidents started in 1970. Before 2005, the number of traffic accidents peaked in 1981 at 51,385, with the number of fatalities per 100,000 population estimated at about 7.33, and the number of fatalities per 10,000 vehicles at 24.35. The accidents in 1981 resulted in 11,105 fatalities, 22,529 serious injuries and 35,645 minor injuries. Due to the problem of underreporting before 2009, it is not appropriate to compare those indicators of

safety with the ones of other countries. The underreporting problem will be discussed in detail in Section 6.

From 1970 to 1981, the number of accidents and the number of fatalities increased at the rate of 3,000/year and 877 people/year, respectively. Given that both the number of deaths and the population grew during this period, the increase in the number of fatalities per 100,000 population (health risk) shows that road safety in Indonesia was in poor condition. This implies that the increase in fatalities is more dominant than the increase in population.

Despite the rise in fatalities during this period, one indicator of traffic safety, the fatalities per 10,000 vehicles (traffic risk), tended to decrease. In the same period, the total number of vehicles increased at the average rate of 330,000/year. The greater growth rate of vehicle ownership compared with that of fatalities during that period led to the decrease in traffic risk.

(3) 1981–2002

In the years 1981–2002, the number of traffic accidents tended to decrease, reaching the minimum point of 12,267 in 2002, with the health risk and the traffic risk standing at 4.32 and 3.81, respectively. During this period, the number of accidents and the number of injuries decreased, falling by 1,980 incidents/year and 2,212 people/year, respectively.

The number of fatalities fluctuated randomly, reaching a minimum of 8,762 in 2002, and a maximum of 12,308 in 1997. The annual average was 10,574, with a standard deviation of 769.

Meanwhile, the growth rate of vehicle ownership accelerated at an average of about 820,000 units/year (248% of the average for 1970-1981). This growth continued to lower the traffic risk indicator.

(4) 2002–2004

In the period 2002-2004, traffic safety tend to worsen, with the number of accidents rising to 17,732 in 2004 (growing at 2,700/year), and the number of fatalities increasing to 11,204 in the same year (growing at 1,200/year). During this period, however, the number of fatalities per 10,000 vehicles hovered at about 3.6 to 3.8, mainly due to the significant growth rate of vehicle ownership, which averaged 860,000 units/year (391% of the rate for 1981-2002). Moreover, motorcycle ownership rose by 3,000,000 units/year, which was 500% of the rate for 1981-2002. Given these figures, it is reasonable to presume that vehicle ownership was a factor behind the deterioration of traffic safety during this period, and this point deserves careful investigation.

The other important figures for the years 1995-2004 are the number of fatalities and the number of people seriously injured. During this period, the number of fatalities outweighed the number of serious injuries in some years, while the contrary was the case in the other years.

(5) 2004–2007

In 2005, the number of accidents abruptly rose from 17,732 in 2004 to 91,623 in 2005 (517%). As described in the previous section, the reporting and documentation of road traffic accident was

intensively improved in 2005, including enhancements to accident report formats and to the database system. For this reason, this study excludes the accident data for 2004–2007.

During this period, vehicle ownership continued to increase, growing at the rate of 3 million/year for automobiles, 6 million/year for motorcycles, and 9 million/year for all motorized vehicles. These figures show that this was a period of explosive growth for vehicle ownership, particularly motorcycles. Again, this may have worsened the traffic accident problem.

(6) 2007-2010

Between 2007 and 2010, the number of traffic accidents kept worsening, increasing at the rate of 16,089/year (596% of the rate for 2002-2004). In 2010, the total number of accidents rose to 109,311 and the number of fatalities increased to 31,234. Fatalities per 100,000 population and fatalities per 10,000 vehicles in 2009 were 8.64 and 2.83, respectively.

Vehicle ownership during 2007-2010 continued to increase, albeit at rates lower than those of the preceding period (2004-2007). The rates were 1,000,000 units/year, 5,000,000/year and 6,000,000/year, for automobiles, motorcycles and all motorized vehicles, respectively.

The other important figure is the significant growth in the number of minor injuries, which averaged 13,622 people/year (864% of 2002-2004) and was near the growth rate of accidents. Also, the growth rate of serious injuries was quite similar to that for fatalities.

3.2.3 Analysis of Traffic Accidents by Province and Mode in 2009

As shown in Figure 6, traffic accidents in Indonesia in 2009 were dominated by the provinces on Java Island, namely, East Java (19.45%), Central Java (12.56%), Jakarta Special District (11.54%), West Java (6.55%) and Yogyakarta Special District (6.79%). Given these figures and the fact that most of Indonesia's big cities are located on Java, further investigation should be made to validate the data of the provinces outside Java, since their data may be skewed by underreporting.

In general, motorcycles were the dominant vehicle involved in traffic accidents in all provinces. As shown in Figure 7a, the nationwide total of motorcycles involved in traffic accidents in 2009 was 72,815 (69.7% of all motorized vehicles involved in accidents). This percentage was even larger in some provinces, such as 75% on Java Island (East Java Province), 73.3% on Kalimantan island (East Kalimantan Province) and 78.9% on Sulawesi Island (Central Sulawesi Province).

In contrast, 15,049 passenger cars and 13,385 trucks were involved in traffic accidents in Indonesia in 2009, accounting for 14.4% and 12.8% of the total, respectively. However, in terms of vehicle ownership, passenger cars and trucks made up 14.7% and 7.3% of the total number of vehicles, respectively. From those figures, it can be presumed that trucks are relatively more prevalent in traffic accidents than are passenger cars.

In Central Java and East Java, the accident involvement of trucks exceeded that of passenger cars. Attention should be given to this fact in investigation of the causes of accidents.

In term of casualties, slight injuries outweighed serious injuries and fatalities in all provinces except South Sulawesi (Figure 8d), where minor injuries were on par with fatalities (1,013 and 1,111 people, respectively). In East Java, the province with the biggest number of accidents, the breakdown of casualties 69% for slight injuries, 17.9% for fatalities, and 13.1% for serious injuries.

4. Organizations Involved in Road Traffic Safety

Organizations involved in road traffic safety and their responsibilities are specified in the following laws and regulations.

(1) Indonesian Government Regulation No. 32 of 2011 on Traffic Engineering and Management, Traffic Impact Analysis, and Traffic Demand Management

This regulation prescribes the following responsibilities for the heads of organizations involved in road traffic safety.

a. Minister of Transportation

The Minister of Transportation holds responsibility for transportation-related matters, including:

- Road space utilization
- Road capacity
- Use of roadside land
- Road facilities directly related to road users
- Traffic management
- Traffic performance
- Potential locations of traffic accidents and congestion

b. Minister of Public Works

The Minister of Public Works is responsible for road-related problems, such as:

- Highway and intersection geometry
- Highway structures
- Road facilities indirectly related to road users
- Potential locations of traffic accidents and congestion
- Utilization of parts not utilized by road users

c. Head of Indonesian National Police

The Head of the Indonesian National Police is responsible for:

- Traffic operation performance
- Traffic safety culture
- Traffic management
- Areas with potential for

- Security violations
- Traffic accidents
- Traffic congestion
- Traffic violations

- Operation of traffic engineering

d. Governors, heads of regency, and city mayors are locally responsible for:
   - Highway and intersection geometry
   - Highway structures
   - Road facilities directly and indirectly related to road users
   - Potential locations of traffic accidents and congestion
   - Utilization of parts not utilized by road users
   - Road space utilization
   - Road capacity
   - Use of roadside land
   - Traffic management
   - Traffic performance

(2) Indonesian Law No. 22 of 2009 on Road Transport and Traffic

Under this law, the institutions involved in road traffic safety are designated as follows.

a. Ministry of Public Works: Responsible for road-related problems.
b. Ministry of Transportation: Responsible for road transport and traffic facilities.
c. Ministry of Industry: Responsible for the development of industries related to road transport and traffic facilities.
d. Ministry of Research and Technology: Responsible for the development of technologies related to road transport and traffic facilities.
e. Indonesian National Police: Responsible for motor vehicle and driver registration/identification, law enforcement, traffic engineering and management operation, and traffic safety education.

(3) Indonesian Government Regulation No. 37 of 2011 on the Forum of Road Transport and Traffic.

This regulation designates the following institutions as organizations involved in road traffic safety.

a. Ministry of Public Works: Responsible for road-related problems.
b. Ministry of Transportation: Responsible for road transport and traffic facilities.
c. Ministry of Industry: Responsible for the development of industries related to road transport and traffic facilities.
d. Ministry of Research and Technology: Responsible for the development of technologies related to road transport and traffic facilities.

e. Indonesian National Police: Responsible for the motor vehicle and driver registration/identification, law enforcement, traffic engineering and management operation, and traffic safety education.

(4) National General Plan on Road Transport and Traffic Safety

According to this guideline, the following five institutions are involved in road traffic safety.

a. Ministry of Transportation: Responsible for coordinating the stakeholders involved in road safety management.
b. Ministry of Public Works: Responsible for providing safer roads.
c. Ministry of Industry: Responsible for providing safer vehicles, in which every vehicle on the road is compliant with high safety standards.
d. Indonesian National Police: Responsible for shaping road user behavior to create safer road users.
e. Ministry of Health: Responsible for providing adequate treatment of traffic accident injuries.

5. Laws, Regulations and Program

5.1 Traffic Safety-related Laws, Regulations and Program

The laws, regulations and a program related to traffic safety are presented in Table 2.

5.2 Description of Laws, Regulations and Program

This section describes laws and regulations that explicitly mention road traffic accidents rather than traffic safety as a general target of road and traffic management. Moreover, one program related to traffic safety is presented since it has become a milestone of traffic accident data collection in Indonesia.

In order to show the continuity of the description about the impacts of these normative issues on traffic accidents, the impacts of the regulations will be discussed in the next section.

Table 2 Laws, regulations and program related to traffic safety

No.	Year	Law / Regulation / Policy	Concerning	Remarks
1	1951	**Indonesian Law No. 7 of 1951**	Revision and addendum of Government Legislation No. 86 of 1933 on road traffic	No specific clauses concerning safety issues and no regulations derived from this law.
2	1965	**Indonesian Law No. 3 of 1965**	Road transport and traffic	This law enhances Indonesian Law No. 7 of 1951. No specific clauses concerning safety issues and no regulations derived from this law.
3	1980	**Indonesian Law No. 13 of 1980**	Roads	This law enhances Indonesian Law No. 3 of 1965. No specific clauses concerning safety issues.
4	1985	▪ Indonesian Government Regulation No. 26 of 1985 (derived from Indonesian Law No. 13 of 1980)	Roads	No specific clauses concerning safety issues.
5	1992	**Indonesian Law No. 14 of 1992**	Road transport and traffic	This law enhances Indonesian Law No. 13 of 1980. No specific clauses concerning safety issues.
6	1993	▪ Indonesian Government Regulation No. 41 of 1993 (derived from Indonesian Law No. 14 of 1992)	Road transport	No specific clauses concerning safety issues.
7	1993	▪ Indonesian Government Regulation No. 42 of 1993 (derived from Indonesian Law No. 14 of 1992)	Inspection of motorized vehicles on the road	No specific clauses concerning safety issues.
8	1993	▪ Indonesian Government Regulation No. 43 of 1993 (derived from Indonesian Law No. 14 of 1992)	Road traffic and infrastructure	This regulation endorses implementation of clauses of Indonesian Law No. 14 of 1992. Two clauses of this regulation define traffic accidents and the authority for traffic accident data reporting and investigation
9	1993	▪ Indonesian Government Regulation No. 44 of 1993 (derived from Indonesian Law No. 14 of 1992)	Vehicles and drivers	No specific clauses concerning safety issues.
10	1998	▪ Indonesian Government Regulation No. 71 of 1998 (derived from Indonesian Law No. 14 of 1992)	Postponement of implementation of regulation concerning the obligations of providing and using safety belts	As stated in Indonesian Law No. 14 of 1992, drivers and front-seat passengers must wear safety belts.
11	2009	**Indonesian Law No. 22 of 2009**	Road transport and traffic	This law enhances Indonesian Law No. 14 of 1992. There are specific chapters concerning: - Road transport and traffic safety and security (Chapter XI, clauses 200-208) - Traffic accidents (Chapter XIV, clauses 226-241)

12	2011	▪ Indonesian Government Regulation No. 32 of 2011 (derived from Indonesian Law No. 22 of 2009)	- Traffic engineering and management - Traffic impact analysis - Traffic demand management	This regulation endorses implementation of clauses of Indonesian Law No. 22 of 2009 concerning: - Traffic engineering and management , including data inventory and analysis on the number of traffic violations and accidents - Traffic impact analysis - Traffic demand management
13	2011	▪ Indonesian Government Regulation No. 37 of 2011 (derived from Indonesian Law No. 22 of 2009)	Road Transport and Traffic Forum	This regulation endorses implementation of a clause in Indonesian Law No. 22 of 2009 concerning the coordination among the stakeholders of road transport and traffic.
14	2011	▪ National General Plan on Road Transport and Traffic Safety 2011–2035 (derived from Indonesian Law No. 22, 2009)	Development of a national general plan concerning: - Development of national program on road transport and traffic safety - Provision and maintenance of facilities and instruments for road transport and traffic safety - Studies on road transport and traffic safety issues - Management of road transport and traffic safety	This plan is for implementing one clause of Indonesian Law No. 22 of 2009 , but it has not yet been legalized by government regulation.
15	2007 - 2011	Indonesia Integrated Road Safety Management Systems (IIRMSs)	Road safety improvement in some big cities and intercities on Java and Sumatra islands	This program deals with long-term strategies and the implementation framework for road safety, and with the database system for road traffic accident and road safety management .

Sources: [3], [4], [5]

5.2.1 Indonesian Government Regulation No. 43 of 1993

(1) Background

This regulation endorses implementation of Indonesian Law No. 14 of 1992 on road transport and traffic. It concerns traffic management and engineering, road networks, road facilities, pedestrians, and traffic accidents.

(2) Objective

Optimize network and traffic movement utilization in order to ensure the security, safety, orderliness and smoothness of road transport and traffic.

(3) Content and period of policy

This regulation concerns the following road traffic accident issues.

a. Definitions related to traffic accidents

Fatality: Traffic accident victim who dies within 30 days after the crash.

Seriously injured: Traffic accident victim who incurs permanent physical damage or is hospitalized for more than 30 days after the crash.

Slightly injured: Traffic accident victim other than the preceding two categories.

b. The authority for traffic accident recording and investigation

The Indonesian National Police has the authority to record traffic accident information and develop the traffic accident information system. Investigation of fatal accidents is carried out by the police, the Ministry of Transportation and the Ministry of Public Works.

This regulation went into effect in 1993.

(4) Organizations responsible for executing the policy

The Indonesian National Police, the Ministry of Transportation and the Ministry of Public Works are responsible for executing the provisions of this regulation that are related to the traffic accident issues.

(5) Scope of the policy and its sources of funding

This regulation covers the national level and is funded from national and local government budgets.

5.2.2 Indonesian Law No. 22 of 2009 on Road Transport and Traffic

(1) Background

Indonesian Law No. 22 of 2009 is an improvement of Indonesian Law No. 14 of 1992 concerning road transport and traffic problems. It is realized that the role and potency of road

transport as part of the national transportation system must be improved to ensure safety, security, smoothness and orderliness for the transportation system.

This law is the current supreme regulation concerning transportation issues, and deals with certain safety issues as well.

(2) Objectives

a. Establish road transport and traffic that provide safety, security, smoothness and orderliness, and are well connected to other modes of transportation.
b. Establish ethics for transportation.
c. Establish the law enforcement and certainty for the community.

(3) Content and period of policy

This regulation concerns the following road transport and traffic safety matters.

a. The Indonesian government is responsible for establishing safety in road transport and traffic through the national general plan on road transport and traffic safety, which includes:
   - Creating national programs on road transport and traffic safety.
   - Providing and maintaining facilities related to road transport and traffic safety.
   - Conducting research on road transport and traffic safety issues.
   - Implementing road transport and traffic safety management.
b. Supervision of the road transport and traffic safety programs includes:
   - Auditing by an independent auditor
   - Inspection by a mandatory (body) for road transport and traffic.
   - Observation and monitoring by a mandatory (body) for road transport and traffic
c. The mandatory (body) for road transport and traffic is responsible for building road transport and traffic safety culture through policies and programs that include:
   - Traffic safety education for young people
   - Internalization of and campaigns for traffic safety programs, culture and ethics
   - Appreciation to the traffic safety-related actions
   - Establishment of spaces that encourage people to use transportation in an orderly fashion
   - Sustainable and consistent law enforcement

This law went into effect in 2009.

(4) Organizations responsible for executing the policy

The organizations responsible for executing the road traffic safety programs under this law are as follows.

a. Ministry of Public Works: Responsible for road-related problems.
b. Ministry of Transportation: Responsible for the road transport and traffic facilities.
c. Ministry of Industry: Responsible for the development of industries related to road transport and traffic facilities.
d. Ministry of Research and Technology: Responsible for the development of technologies related to road transport and traffic facilities.
e. Indonesian National Police: Responsible for motor vehicle and driver registration/identification, law enforcement, traffic engineering and management operation, and traffic safety education.

(5) Scope of the law and its sources of funding

This law covers the national level, and there are some regulations derived from this law to endorse its implementation. It is funded from national and local government budgets.

5.2.3 Indonesian Government Regulation No. 32 of 2011 on Traffic Engineering and Management, Traffic Impact Analysis, and Traffic Demand Management

(1) Background

This regulation endorses implementation of Indonesian Law No. 22 of 2009, particularly with regard to issues related to traffic engineering and management, traffic impact analysis, and traffic demand management, including traffic safety issues.

(2) Objective

Optimize network and traffic movement utilization in order to ensure the security, safety, orderliness and smoothness of road transport and traffic.

(3) Content and period of policy

This regulation concerns the following road traffic accident issues.

a. Identification of potential traffic accident locations by the Ministry of Transportation, the Ministry of Public Works, the Indonesian National Police and locally by the governors, heads of regency and city mayors.
b. Data inventory and analysis of the traffic situation, including data on potential locations of traffic/security violations, traffic accidents and congestion. This is carried out by the Indonesian National Police.
c. Data inventory and analysis of the number of traffic violations and accidents on certain links or areas. This is carried out by the Indonesian National Police, and includes:
   - Data collection, data base development and analysis of existing traffic violations and accidents on all links.

- Data collection, database development and analysis of the causative factors of existing traffic violations and accidents on all links.
- Comparative analysis of the number of traffic violations and accidents between the current year and previous years, and among the causative factors of accidents.
- Analysis and evaluation of efforts to reduce and prevent traffic violations and accidents.

This regulation went into effect in 2011.

(4) Organizations responsible for executing the policy

The Indonesian National Police, the Ministry of Transportation, the Ministry of Public Works, governors, heads of regency, and mayors are responsible for executing the provisions of this regulation that are related to the traffic accident issues.

(5) Scope of the policy and its sources of funding

This regulation covers the national level and funded from national and local government budgets.

5.2.4 Indonesian Government Regulation No. 37 of 2011 on the Forum of Road Transport and Traffic

(1) Background

Under Indonesian Law No. 22 of 2009, the institutions involved in road traffic safety are: the Ministry of Public Works, which is responsible for road-related problems; the Ministry of Transportation, which is responsible for road transport and traffic facilities; the Ministry of Industry, which is responsible for the development of industries related to road transport and traffic facilities; the Ministry of Research and Technology, which is responsible for the development of technologies related to road transport and traffic facilities; the Indonesian National Police, which is responsible for motor vehicle and driver registration/identification, law enforcement, traffic engineering and management operation, and traffic safety education.

In order to coordinate these institutions, it is necessary to create a forum consisting of a mandatory (body), policy executors, scholars and community representatives.

(2) Objective

The Forum of Road Transport and Traffic is aimed at coordinating the institutions involved in the planning and execution of road transport and traffic matters at the local and national levels, including traffic safety issues.

(3) Content and period of policy

This regulation describes the membership, function and working mechanism of the forum.

The forum membership is separated into national, provincial and regency/city levels. In general, the membership consists of:

a. The Minister of Public Works, the Minister of Transportation, the Minister of Industry and the Minister of Research and Technology for the national level, or the Governor for the provincial level, or the Head of Regency/Mayor for the regency/city level.
b. The Head of the Indonesian National Police for the national level, or the Head of Provincial Police for the provincial level, or the Head of Resort/City Police for the regency/city level.
c. State-owned companies related to road transport and traffic matters
d. Associations of public transport companies
e. Representatives from higher education institutions
f. Road transport and traffic experts
g. Non-governmental organizations
h. Road transport and traffic observers

This forum was established in 2011.

(4) Organizations responsible for executing the policy

All the members represent the organizations involved in this forum.

(5) Scope of the policy and source of funding

This policy covers the national level and funded from national and local government budgets.

(6) Impact of policy

Since the forum was established in 2011, it is too early to identify its impacts.

5.2.5 National General Plan on Road Transport and Traffic Safety (RUNK)

(1) Background

In March 2011, the United Nations General Assembly designated the period 2011–2020 as the Decade of Action (DoA) for Road Safety, with the aim of controlling and reducing traffic accident fatalities globally by intensifying safety programs at the national, regional and global levels. This concept is in line with the message of Indonesian Law No. 22 of 2009 regarding road transport and traffic, particularly regarding the need to develop the National General Plan on Road Transport and Traffic Safety (RUNK). Having this momentum, the government of Indonesia established the RUNK and declared DoA to be part of it.[2]

(2) Objectives

RUNK is intended to be a guide for stakeholders of road safety in planning and implementing road safety programs in coordinated and integrated ways. Moreover, RUNK is also intended as a guide for local governments to incorporate the plan into the implementation as programs of their regions.

(3) Content and period of policy

RUNK involves not only the development of national programs on road transport and traffic safety, but also provision and maintenance of road safety facilities, studies on road safety, and road safety management.

In order to ensure its sustainability, RUNK encompasses a vision, missions, directions, targets, strategies, policies, programs and activities.

The development of RUNK is based on the following five pillars of road safety:

a. Road safety management
b. Safer roads
c. Safer vehicles
d. Safer road users
e. Post-crash action.

Programs and activities are formulated within each pillar, and the associated indicators, parameters and targets are set for five consecutive 5-year periods.

Policies established for the first 5-year period include the following objectives:

a. Redefine some terminologies related to traffic accidents and set a standard operational procedure for accident care.
b. Harmonize the information flow, communication, coordination and cooperation among stakeholders.
c. Synchronize the financial resources from the government, business world, communities and road users.
d. Encourage the stakeholders involved in research and education on traffic safety as well as data and traffic accident surveillances.

The programs are also provided by the leading and supporting sectors responsible for the action of the each program, namely, the National Development Planning Agency, the Ministry of Transportation, the Ministry of Public Works, the Ministry of Health, the Ministry of Communication and Information, the Ministry of Research and Technology, the Ministry of Education, the Ministry of Industry, the Ministry of Internal Affairs, the Ministry of Justice and Human Rights, the Ministry of Labor, the Ministry of Religious Affairs, the Ministry of Social Affairs, the Ministry of the Environment, insurance companies, local governments, the business world, the Road Transport Entrepreneur Organization, national/international partners,

higher education institutions, and communities.

RUNK was launched in 2011.

(4) Organizations for executing the policy

All the organizations involved in RUNK are assigned as executors of the programs.

(5) Scope of the policy and source of funding

RUNK covers the national level, but has not yet been legalized by government regulation.

(6) Impact of policy

Since RUNK was launched in 2011, it is too early to identify its impacts.

5.2.6 Indonesia Integrated Road Safety Management Systems (IIRMSs)

(1) Background

The Indonesian government recognizes that traffic congestion in the cities and intercities has adverse impacts on macroeconomic growth. In order to overcome such problems, the government of Indonesia, working through the Ministry of Public Works, created the Strategic Roads Infrastructure Project (SRIP) with the World Bank to improve the capacities of the national road networks of some big cities and intercities on Java and Sumatra islands. One of the objectives of SRIP was to improve the safety of road users through creation of the Indonesia Integrated Road Management Systems (IIRMSs). The Ministry of Transportation and the Indonesian National Police were assigned as Project Implementing Units.[4]

(2) Objectives

IIRSMSs was aimed at:

a. Developing the National Road Safety Strategy and the implementation framework of the institutions and policies involved in road safety.
b. Developing road safety management and a database system of road traffic accidents.

(3) Content and period of policy

This project consisted of the following elements:

a. Building a road safety “Results Focus” in Indonesia through capacity building; detailed planning for a multi-sectoral pilot project and preparation of an integrated road safety strategy, led by the Directorate General of Land Transport with involvement of key road safety agencies.
b. Creating a specification document that details the design of a road safety management information system, using accident data from the Indonesian National Police and other sources.

Period of project: September 2007–December 2011.

(4) Organizations responsible for executing the policy

IIRMSs was conducted by the two Project Implementing Units:

a. Directorate of Land Transport Safety of the Ministry of Transportation, which was responsible for the development of the long-term strategies and the implementation framework of the institutions and policies involved in road safety.
b. Directorate of Traffic of the Indonesian National Police, which was responsible for the development of the database system for road traffic accidents and road safety management.

(5) Scope of the policy and its sources of funding

IIRSMSs covered the road networks of some big cities and intercities on Java and Sumatra islands, and was financed with a World Bank loan.

(6) Impact of the program

As one focus of this project was to set up a database system for road traffic accidents, the program encouraged the Indonesian National Police to treat traffic accident data more intensively and professionally, leading to an increase in the amount of traffic accident data collected. This resulted in an extremely large jump in the number of accidents reported in 2010. As part of establishing the database system, the year 2009 was selected as the current reference point for the traffic accident analysis.

6. Review of Major Changes in Traffic Safety Policies and Regulations

In general, the laws and associated government regulations discussed herein were intended to optimize the utilization of network and traffic movement in order to ensure the security, safety, orderliness and smoothness of road transport and traffic. Most of the clauses of those laws and regulations did not explicitly mention about the issues of traffic safety, except for safety as a final target of road transport and traffic management.

The first government regulation concerning the road transport and traffic was Indonesian Government Regulation No.26 of 1985. It was derived to endorse implementation of Indonesian Law No.13 of 1980. Even though no clauses mentioned traffic safety explicitly, it was understood that this regulation was intended to make people safe in their utilization of transportation. It is believed that this regulation contributed to the decreasing trend in the number of accidents between 1985 and 1993.

Reflecting mounting concern about traffic safety, Indonesian Government Regulation No. 43 of 1993 highlighted the issue of traffic safety explicitly, albeit simply, in its two clauses on the definition of traffic accidents, and on the authority for traffic accident data reporting, recording and investigation.

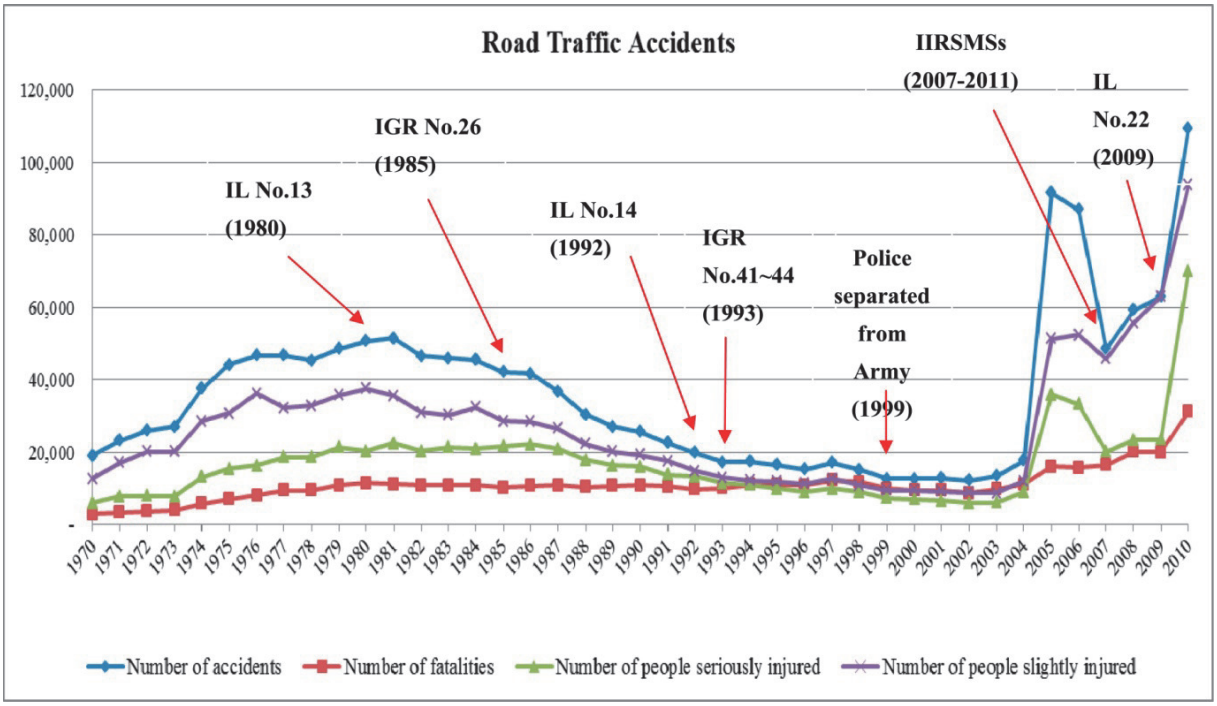
These clauses were produced to highlight the importance of traffic accident data reporting and recording.

This regulation defined fatalities as traffic accident victims who die within 30 days after the crash. However, in practice, the Indonesian National Police categorized as fatalities only victims who died at the scene, and categorized victims who died on the way to the hospital or within 30 days after the crash as seriously injured victims [12]. To date, the Indonesian National Police still use these definitions, while insurance companies and the Ministry of Health use different definitions. Consequently, there were still disparities between the data collected by different units of the Indonesian National Police (internally different) and also between the data of police units and other institutions related to traffic accidents (externally different) [12].

Moreover, the Indonesian National Police only took into account the road traffic accidents that were processed up to the courts. All the other road traffic accidents were not counted in the data base.

In addition to the problems of traffic accident definitions, and the way the traffic accidents were considered in the database, there was an important issue concerning the position of the Indonesian National Police within the government. Before 1999, the Indonesian National Police were organized under the Indonesian National Armed Forces. This position made the police more concerned about security issues than about safety ones. Due to this situation, police concern about traffic accident issues, including the issue of data reporting and recording, were likely diminished around 1980. It is understood that this may lead to a decrease in the traffic accident rate due to the problem of underreporting. However, as mentioned above, such a trend may also due to the existence of regulations related to traffic and road transport.

In 1999 the Indonesian National Police was separated from Indonesian National Army. This move was aimed at making the Indonesian National Police more professional in community services, including safety and security services. As a result, traffic accident data management started to be addressed more professionally, with the police working to recover the data recording system at the national level. These milestones are believed to have contributed to the increasing trend in traffic accidents after 2000, particularly the extreme rises in 2005 and 2006 (see figure 12). It is quite reasonable to presume that such increases were more affected by the intensive data collection, rather than the effect of certain serious technical problems in traffic safety management. The significant rise in 2005 and 2006 was presumed due to the individual-based data recording program rather than institutional-based one.



Source : Compiled using data from [1], [3], [4], [5], [6], [10]

Note: IGR : Indonesian Government Regulation

IL : Indonesian Law

Figure 12 Trends in road traffic accidents in association with traffic safety laws, regulations and program

In line with its policy concerning a data recording system, in 2007-2011 the Indonesian National Police conducted a project with a World Bank loan to develop IIRMSs (Indonesia Integrated Road Safety Management Systems). It focused on the issues of traffic accident database, including the improvement of accident data reporting, recording and auditing. Again, it was believed to have contributed to the increasing trend in traffic accidents.

Besides the problem of data collection, the increasing trend in traffic accidents after 2000 was believed to be due to the extremely rapidly increasing vehicle ownership, which was dominated by motorcycles. During the periods 1981-2002, 2002-2004, 2004-2007 and 2007-2009, ownership of motorcycles grew annually by about 600,000, 3 million, 6 million and 5 million units/year respectively. This is supported by the traffic accident figures for 2009, which show that motorcycles significantly dominated traffic accidents in all provinces. The total number of motorcycles involved in traffic accidents in 2009 was 72,815 (69.7% of the total number of motor vehicles involved in accidents). This figure was even larger in some provinces, such as 75% on Java Island (East Java Province), 73.3% on Kalimantan Island (East Kalimantan Province) and 78.9% on Sulawesi Island (Central Sulawesi Province).

Furthermore, as an improvement of the preceding law, Indonesian Law No. 22 of 2009 provides more clauses concerning road transport and traffic safety and security, as well as traffic accidents. These clauses were then endorsed in government regulations concerning:

- Data inventory and analysis on traffic violations and accidents (Indonesian Government Regulation No.32 of 2011)
- Coordination among the stakeholders of road transport and traffic (Indonesian Government Regulation No.37 of 2011)
- Development of the National General Plan on Road Transport and Traffic Safety 2011–2035

It is realized that those were critical issues that had been raised to reemphasize the importance of data inventory and analysis, coordination and planning on traffic safety programs.

Besides the issue of data inventory, the other important issue addressed in Indonesian Law No. 22 of 2009 was the coordination among the stakeholders involved in road transport and traffic problems. As described above, the organizations involved in road transport and traffic problems, including the road traffic safety issues, are the Ministry of Public Works, the Ministry of Transportation, the Ministry of Industry, the Ministry of Research and Technology and the Indonesian National Police (refer to Indonesian Government Regulation No. 37 of 2011). The Forum of Road Transport and Traffic was introduced to highlight the importance of collaboration and coordination among those institutions, and the Ministry of Transportation was assigned to take the lead of the forum. Furthermore, in order to focus on traffic safety issues, each of those institutions developed a special unit or division to be responsible for road safety matters.

Indonesian Law No. 22 of 2009 also addressed the establishment of National General Plan on Road Transport and Traffic Safety (RUNK) for the period 2011–2035. This plan was a comprehensive long-term plan on traffic safety that was in line with the spirit of the United Nations' Decade of Action (DoA) for Road Safety 2011-2020. RUNK was developed to be a guide for implementation of national safety programs, and encompasses strategies, policies, programs, indicators and targets to be implemented in five consecutive time periods. RUNK was launched in June 2011, together with the launching of the DoA of Indonesia, and it demonstrated that the Indonesian government was devoting serious attention to controlling and minimizing the number of traffic accidents and fatalities. However, it has not yet legalized by the implementation regulation.

Furthermore, some safety programs have been conducted in last decade by the central or local governments and communities, either in the form of international collaboration/partnership or self-conducted programs, at the local, national, regional or international level in order reduce the traffic accidents. Those programs are GRSP (Global Road Safety Partnerships, 2003-2007), ITSAP (Indonesia Transport Safety Assistance, 2010-2014), Police Goes to Campus, Safety Riding, Traffic Safety Campaign, School Security Patrol, Traffic Management Center, etc.

Again, as Indonesia is still dealing with the recovery of accident database, it is quite injudicious to investigate accurately the effect of those programs on the national trends in accident data.

7. Conclusions

Based on the analysis carried out on the time series data, as well as regulations related to traffic accidents in Indonesia during 1970–2010, the following points can be highlighted:

(1) The growth rate of motor vehicles in Indonesia continuously increased between 1980 and 2009, especially from 2000-2009, and was dominated by motorcycles. Moreover, motorcycles are suspected to have greatly contributed to the increasing trend of traffic accidents after 2000.

(2) The Indonesian government has devoted increasing attention to road traffic safety issues in last three decades, as evidenced by the laws and regulations produced by the government to support the safety programs. Some critical issues have been raised to underline the importance of the effort to reduce the number of traffic accidents. Those include accident data inventory and analysis, organization and coordination among the stakeholders of traffic safety and planning of traffic safety programs. In terms of organizations and coordination, some institutions having a major role in traffic safety have established special units/divisions to handle road safety issues, and a forum has been set up to coordinate the stakeholders of traffic safety. Moreover, the National General Plan on Road Transport and Traffic Safety has been also created to be a guide for stakeholders of road safety in planning and implementing road safety programs in coordinated and integrated ways.

(3) The recording and reporting of traffic accident data and analysis before 2009 was fairly poor, partly due to underreporting, resulting in the skewing of the traffic accident data collected. However, the government, particularly the Indonesian National Police, has intensively improved its database in last two decades. This may be a factor behind the increasing trend in traffic accidents for the last two decades. Moreover, this trend is also suspected to be due to the extremely rapidly increasing number of motor vehicles, during the last decade, particularly motorcycles.

(4) Since the Indonesian National Police is still dealing with the recovery of accident data base and the massive safety programs (RUNK) that are still to be implemented, it is quite injudicious to investigate accurately the impact of safety programs or regulations on the national trends in traffic accidents during the period 1970-2010.

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Changes in Traffic Safety Policies and Regulations in Taiwan (1950–2010)

1. Introduction

The evolution of traffic safety issues and practices in Taiwan had not been noted between the 1950s and 1960s. Some important facts such as numbers of accidents, road type classifications, registration numbers of vehicle types and driver's licenses were not well recorded until the 1970s. Taiwan has unique characteristics in its traffic system when compared with most developed countries, since the number of motorcycles accounts for two-thirds of total motor vehicles, and that has caused more difficult situations in traffic management. This paper organizes government facts, reports, and research literatures to offer some perceptions of the development of traffic safety practices in Taiwan. Firstly, a profile of changes in traffic related facts including the composition of population, road type, vehicle ownership and driver's licenses are illustrated. Secondly, fatalities and injuries by various road types, transport modes, victims' age and gender combinations are analyzed. Thirdly, we introduce organizations in charge of traffic safety work and their system structure. Finally, we describe some traffic safety measures that are discussed in Taiwan which may be considered effective in the developing process.

2. Basic Information

2.1 Population

Taiwan has a population of 23.2 million with a density of 645 persons per square kilometer in 2010. As shown in Figure 1, the yearly growth rate of the total population is about 0.9% on average during the last 40 years, and the population number between genders has been approaching since 1970s onward (detailed facts can be found in appendix 1). Per capita income GNP per year in Taiwan has increased to 19,155 US dollars in 2010, a rise of about 50 times in the past 40 years, which caused the rise in the use of motor vehicles. The composition of age distribution (see Table 1) has also changed in recent years. Taiwan entered an ageing society (65 years of age or older accounted for more than 7% in total population) in 1993. This ageing index reached 10.8% in 2010, and is forecasted to be 14% (i.e. aged society) in 2017 and 20% (i.e. super-aged society) in 2025 (Council for Economic Planning and Development, 2010). This implies we will face more serious challenges in elderly traffic safety issues.

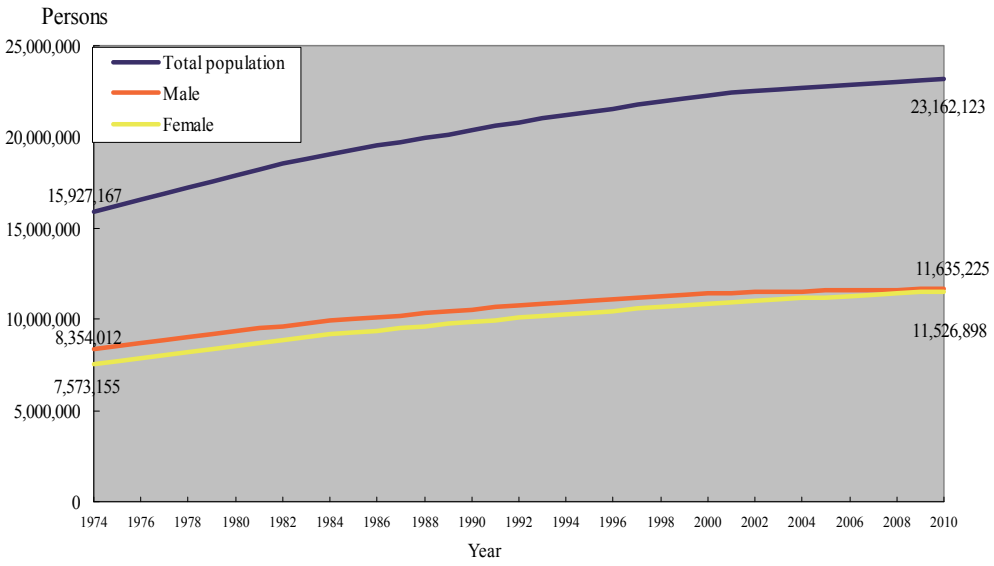


Figure 1 Population Growth Trend between 1974 and 2010

Source: Ministry of the Interior (2011)

Table 1 Age Composition of Population in Taiwan

Year	age 0-14	age 15-64	age 65+
2000	21.10%	70.30%	8.60%
2001	20.80%	70.40%	8.80%
2002	20.40%	70.60%	9.00%
2003	19.80%	71.00%	9.20%
2004	19.30%	71.20%	9.50%
2005	18.70%	71.60%	9.70%
2006	18.10%	71.90%	10.00%
2007	17.60%	72.20%	10.20%
2008	17.00%	72.60%	10.40%
2009	16.30%	73.10%	10.60%
2010	15.70%	73.50%	10.80%

Source: Ministry of the Interior (2011)

2.2 Road Types

Road types in Taiwan can be classified into five main categories: freeways, provincial roads, county roads, rural roads, and urban roads. In general, freeways and provincial roads are constructed and maintained by the central government, while county roads, rural roads, and urban roads are constructed and maintained by 23 local governments. Figure 2 shows that except from the length of urban roads which had an increasing growth rate, the other four types of roads have a slowing growth rate from 2000 to 2010. In general, freeways and provincial roads offering traffic function between cities have a faster travelling speed of around 100-110 km/h for freeways and 70-90 km/h for provincial roads (expressways are classified into provincial roads). On the other hand, county roads, rural roads, and urban roads are positioned as intra-city roads with a lower speed limit of 40-60 km/h.

In 2010, freeways accumulated to 993 km, provincial roads 4,984 km, county roads 3,544 km, rural roads 11,765 km, and urban roads 19,701 km, respectively. Detailed facts about road lengths can be found in appendix 2.

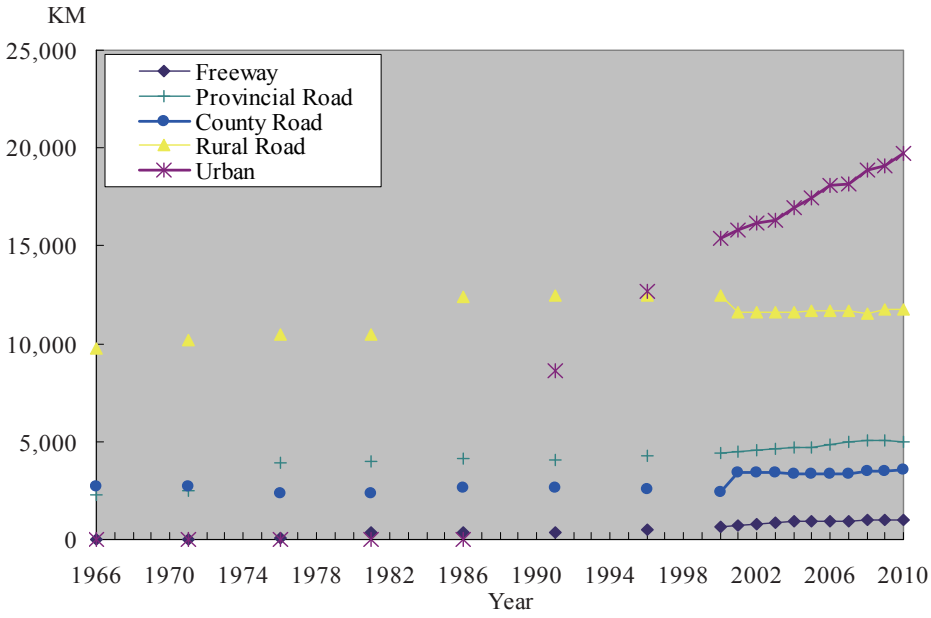


Figure 2 Road Type and Length between 1966 and 2010

Source: Ministry of Transportation and Communications (2011)

2.3 Vehicle Registration and Driver's License

2.3.1 Vehicle registration

Road traffic regulations define motor vehicles including buses, heavy trucks, passenger cars, light trucks and motorcycles. Excepting motorcycles, over four-wheeled vehicles are classified by private and business uses and only professional drivers are eligible to drive their corresponding business vehicles, endorsed by a professional license (Ministry of Transportation and Communications, 2008). Motorcycles accounted for about 20% of all registered motor vehicles in the early 1950s, followed by an increase to 60% in the early 1960s, and then rose to over 85% during the 1970s, accompanying economic booms in Taiwan. Since then on, motorcycles still comprise two-thirds of all registered motor vehicles (see Figure 2 and details in appendix 3). In 2010, the number of registered motorcycles is around 14,845 thousand, and passenger cars is 5,803 thousand, respectively. Over the last forty years, the number of motorcycles has risen 18 times, and even for a high ownership rate with 641 motorcycles per thousand people owned, it sill kept an annual growth rate of 2.6% on average after the year 2000. However, light-typed motorcycles (mopeds with engines sized under 50 cc.), which accounted for about 40% of total motorcycles in 2000 and dropped to 25% in 2010, decreased by 19% during 2003-2010, with an annual decrease rate of 2.7% on average. This might be that a stricter 2-stroke-engine motorcycles (mostly light-typed) emission standard has been implemented by the

Environmental Protection Administration (EPA) in recent years.

Different from motorcycles which had an early growth in the 1960s to 1970s, the amount of automobiles had a steady growth after the 1980s. Among four types of automobiles, passenger cars showed an increase rate of 10.5 times in the last 30 years, while light trucks 2.9 times, heavy trucks 1.4 times, and buses 0.5 times in the same period (see Figure 4).

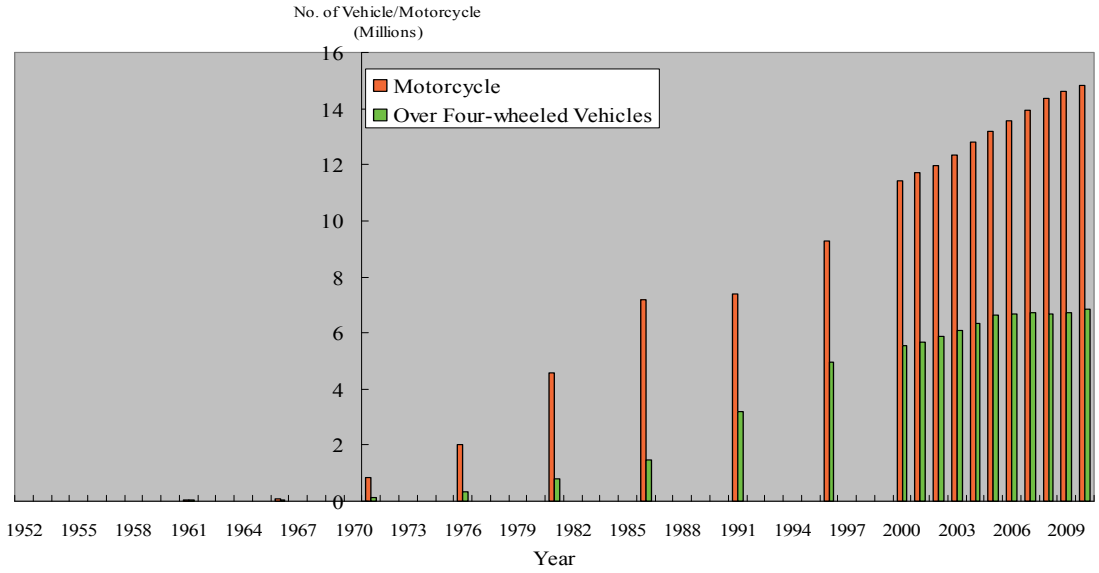


Figure 3 Compositions and Growth between Motorcycle and Automobile after 1970

Source: Ministry of Transportation and Communications (2011)

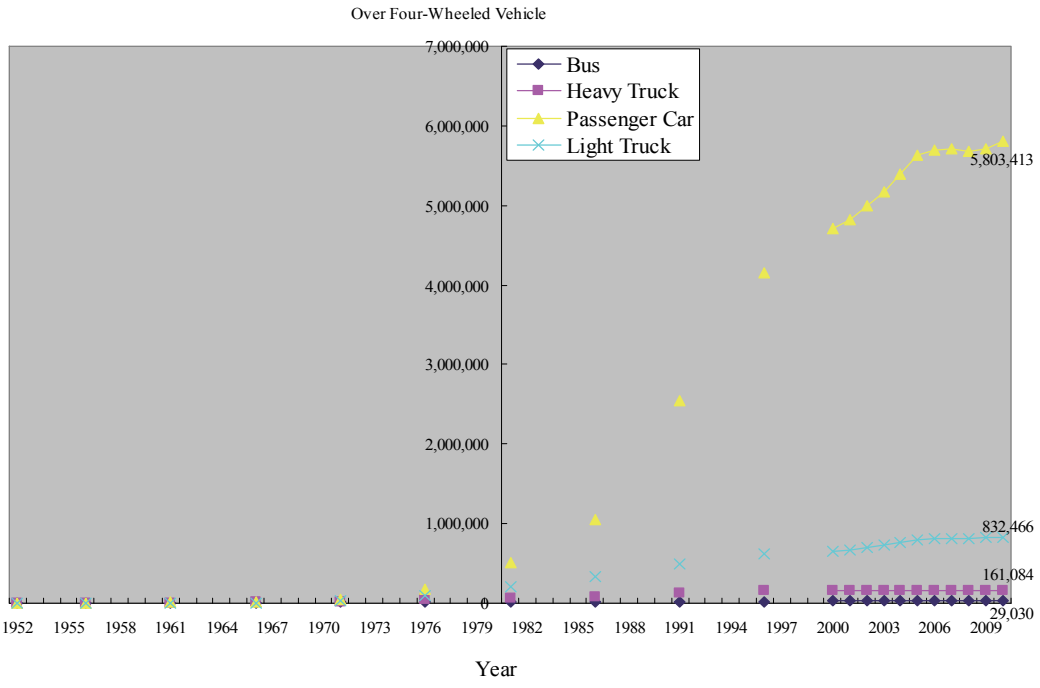


Figure 4 Compositions and Growth of Automobile after 1980

Source: Ministry of Transportation and Communications (2011)

2.3.2 Driver's license

Road traffic regulations define driver's licenses based on professional and private use. Professional drivers have a stricter training and test process, and higher medical standards to obtain their licenses. The maximum age limit for a professional driver is also set according to specifically authorized commercial vehicles. For example, professional licenses for a heavy commercial vehicle is restricted to 65 years old, whereas professional licenses for a taxi might be released to 68 years old. Figure 5 shows that the registered number of professional driver licenses kept steadily constant in the last 20 years, while private driver licenses and motorcycle licenses had a comparable increase rate of double the number of registered licenses during the same period (see detailed facts in appendix 4).

The motorcycle licensing system in Taiwan classifies motorcycles according to engine capacity: mopeds (engine capacity less than 50 cc), light motorcycles (50–250 cc), and heavy motorcycles (greater than 250 cc). Without additional speed or power limitations for vehicles, engine capacity is the only classification standard (Ministry of Transportation and Communications, 2008). The minimum licensing age for mopeds and light motorcycles is 18 years, whereas for heavy motorcycles, the minimum age is 20 years. Except for medical examinations, no prior experience or compulsory training is required for mopeds and light motorcycles before the license tests. An individual can obtain a moped license simply by passing the theoretical test, or obtain a light motorcycle license by passing the theoretical and practical tests. In contrast, heavy motorcycle licenses require an individual to have held a light motorcycle license for at least 1 year, and to have completed 32 hours of compulsory training at a driving school before completing the theoretical and the practical tests. Without compulsory education and training requirements for mopeds and light motorcycles, almost all riders gain experience and skills by a process of self-learning.

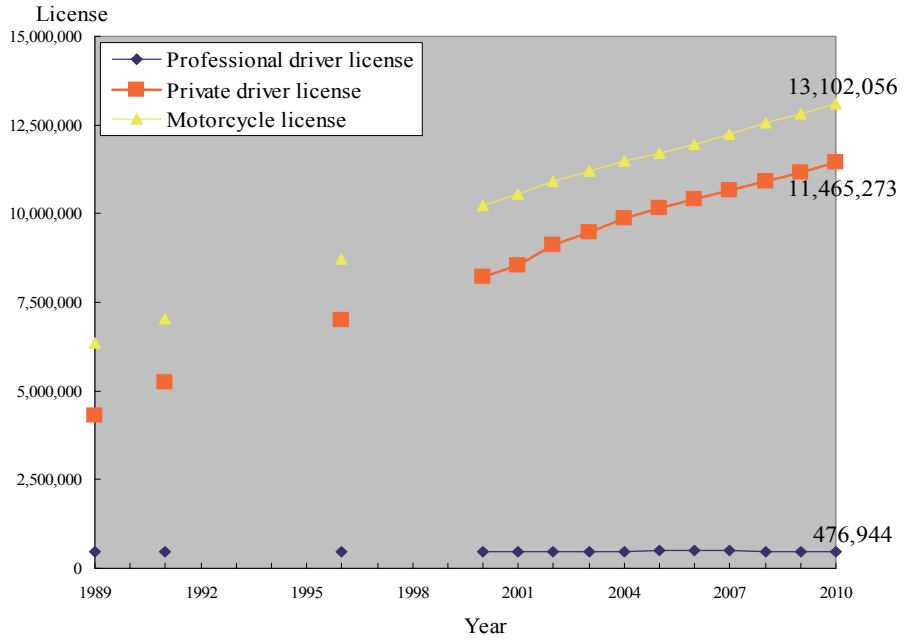


Figure 5 Compositions and Growth of Driver License after 1990

Source: Ministry of Transportation and Communications (2011)

3. The Profile of Traffic Accidents

The definition of road traffic accidents are divided into three categories: A1, A2, and A3. The latest definitions of A1, A2, and A3 accidents, revised in 2000, are whether at least one person died within 24 hours, at least one injury occurred, and only property damage occurred in the accident, respectively. The difference between the latest and its previous definition is that in the previous version, A1 data could represent either the death of at least one person within 24 hours of the accident, or at least one severe injury in the accident. However, only A1 and A2 crash data were recorded in the Taiwan police-reported accident database, Road Accident Investigation and Reporting System (RAIRS) data. RAIRS has been operating since 1985 but only A1 accident data have been fully recorded. A2 accident data were not formally recorded until 1998, and A3 data, had not yet been incorporated into RAIRS at the end of 2010.

In addition to A1 data which records fatalities within 24 hours, this paper also applied traffic fatality facts published by medical systems and estimated 30-days fatalities in Taiwan for the purpose of international comparison.

3.1 Fatality and Injury Accident Trends

Figure 6 shows A1 and A2 data spanning from 1966 to 2010. The number of traffic fatalities was around one thousand in mid-1960s, and then fatalities rose to three thousands in mid-1970s, and finally reached the peak of above four thousands in mid-1980s. Followed by the fluctuation between

2,500 and 3,500 in the next two decades, the fatalities approached nearly two thousands in 2010. This implies that the deaths caused by crashes have been decreased since the year 2000. On the contrary, both number of accident events and injuries soaked between 2001 and 2010. The reason why A2 data increased so rapidly needs to be studied. It might be caused by either well-recorded A2 data or the increase of accident likelihood. More detailed facts about accident data is listed in appendix 5.

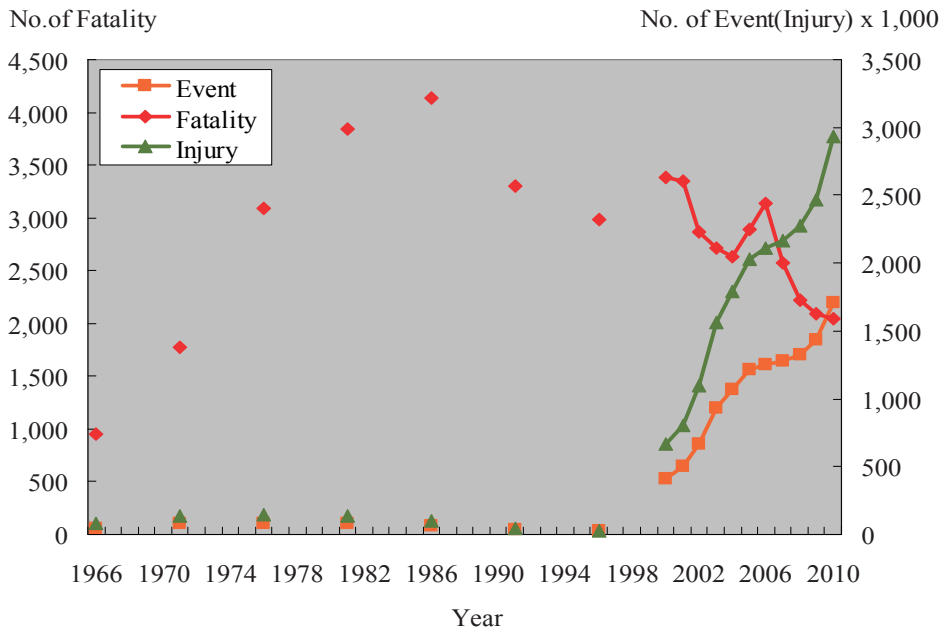


Figure 6 Fatality and Injury Accident Trend between 1966 and 2010

Source: Ministry of Transportation and Communications (2011)

According to UN/ECE (2003), the most commonly cited definition of a road traffic fatality is: "any person killed immediately or dying within 30 days as a result of an injury accident". For comparison, we use different data sources to demonstrate traffic fatalities in Taiwan. In addition to police-reported A1 fatalities within 24 hours, medical systems-reported estimated 30-days fatalities are also used in this report. The estimated 30-days fatalities have been produced by the Institute of Transportation (IOT) since the year 2003. IOT linked police-reported A1 and A2 data with death certificate data in medical systems to identify injury victims that finally died within 30 days.

Table 2 shows that medical system reported number of fatalities were about 1.6-1.8 times as much as police-reported fatalities within 24 hours, while the estimated 30-days fatalities had an adjustment factor of 1.4-1.6 times that of police-reported 24 hour fatalities in the same time span between 2003 and 2009. Based on the medical system reported data, the number of fatalities reached the peak of over 7,500 persons during 1988-1989 (also see Figure 7). The adjustment factor between medical system reported and police-reported fatalities were higher than 2 between 1991 and 1999, showing that

police-reported fatalities seem to have been seriously underestimated during that period. From a long term perspective, medical system reported fatalities had a decreasing trend from 1996 onward, while police-reported 24 hour fatalities had a fluctuating pattern during 1991-2006, followed by a greater decreasing rate after 2007. Over the last 20 years, even though the population and number of motor vehicles have been steadily increasing, medical reported accident deaths have reduced by half.

Table 2 Police-reported, Medical System Reported, and Estimated Fatalities

Year	Police-reported Fatality (within 24 hr) (1)	Medical System Reported Fatality (2)	Adjustment Factor (2)/(1)	Estimated Fatality (within 30 days) (3)	Adjustment Factor (3)/(1)
1966	948	—	—	—	—
1971	1,780	—	—	—	—
1976	3,087	—	—	—	—
1981	3,840	—	—	—	—
1986	4,139	6,270	—	—	—
1987	—	7,034	—	—	—
1988	—	7,524	—	—	—
1989	—	7,584	—	—	—
1990	—	7,333	—	—	—
1991	3,305	7,322	2.22	—	—
1992	2,717	7,216	2.66	—	—
1993	2,349	7,367	3.14	—	—
1994	3,094	7,250	2.34	—	—
1995	3,065	7,427	2.42	—	—
1996	2,991	7,077	2.37	—	—
1997	2,735	6,516	2.38	—	—
1998	2,507	5,903	2.35	—	—
1999	2,392	5,526	2.31	—	—
2000	3,388	5,420	1.60	—	—
2001	3,344	4,787	1.43	—	—
2002	2,861	4,322	1.51	—	—
2003	2,718	4,389	1.61	3,714	1.37
2004	2,634	4,735	1.80	3,948	1.50
2005	2,894	4,735	1.64	4,358	1.51
2006	3,140	4,637	1.48	4,411	1.40
2007	2,573	4,007	1.56	3,756	1.46
2008	2,224	3,646	1.64	3,459	1.56
2009	2,092	3,464	1.66	3,219	1.54
2010	2,047	3,515	1.72	—	—

Source: Institute of Transportation (2011a) and Department of Health (2011)

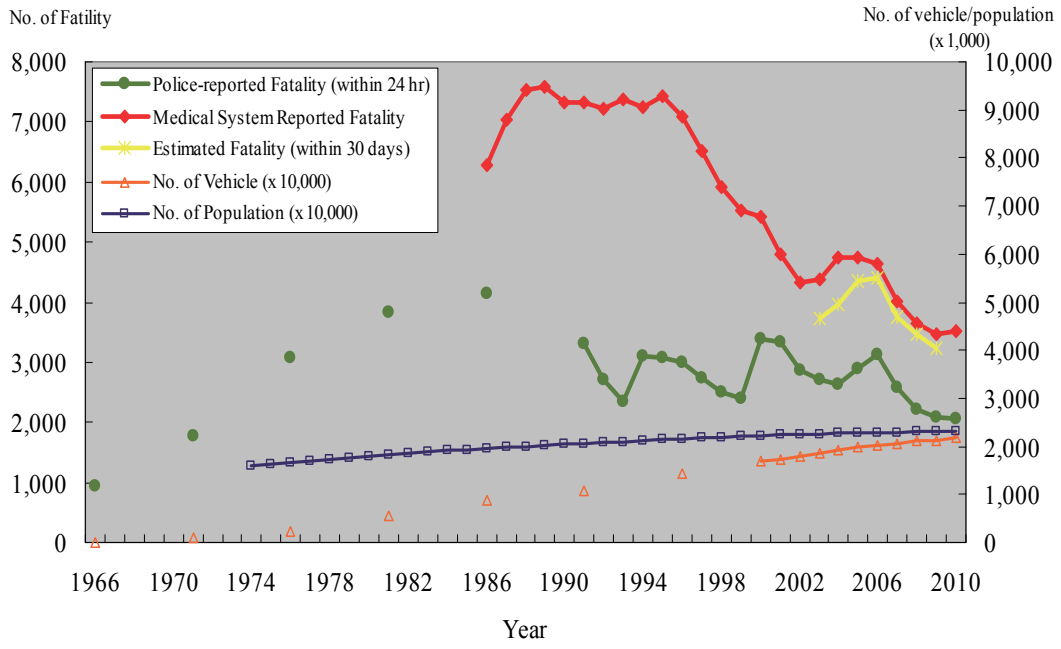


Figure 7 Comparison between Police-reported, Estimated, and Medical System Reported Fatalities

Source: Ministry of the Interior (2011), Department of Health (2011), Institute of Transportation (2011a) and Ministry of Transportation and Communications (2011)

3.2 Fatality and Injury Accident by Road Type, Transport Mode, and Victim's Age

3.2.1 Fatality and injury proportion by transport mode

Based on police-reported fatalities, the number of fatalities and injuries by different transport modes were analyzed between 1999 and 2009. Traffic accidents have caused over 1,186 motorcycle rider fatalities (57% of all deaths) and over 179,000 injuries (73% of all injuries) in 2009 (detailed facts demonstrated in Appendix 6). Figure 8 and Figure 9 shows that motorcycle rider fatalities and injuries have the biggest portion in all fatalities and injuries respectively. Motorcycle rider fatalities comprised 50% of all fatalities in average between 1999 and 2009, and the rider death percentage was 39% in 1999 and reached to 57% in 2009. Motorcycle rider injuries also had a high proportion in all injuries, comprising 70% on average between 1999 and 2009, and increased from 60% in 1999 to 73% in 2009. Thus, improving motorcycle safety is a pressing issue in Taiwan.

Over the past 10 years, pedestrians took the second highest portion in fatalities, around 14% on average, passengers of all modes the third (around 13%), and then passenger car drivers (around 11%) and bicycle riders (around 6%). In terms of injuries, passengers of all modes had the second highest portion (around 14%), passenger car drivers the third (around 6%) and then pedestrians (around 5%) and bicycle riders (around 4%) spanning from 1999 to 2009.

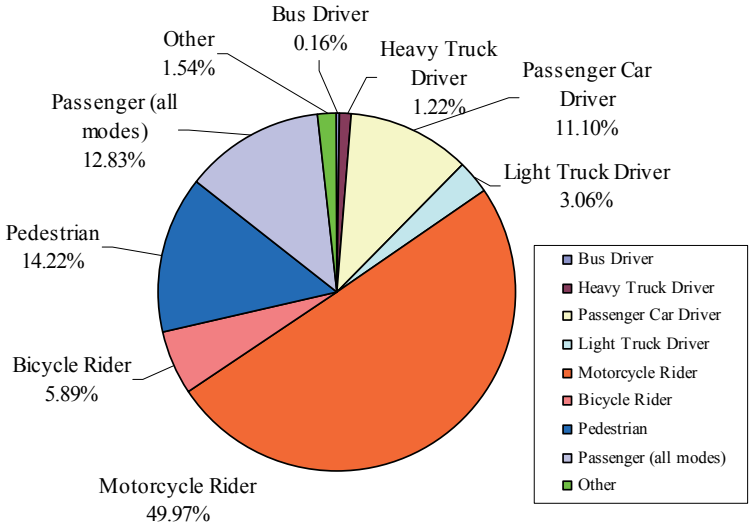


Figure 8 Fatality Compositions by Transport Mode between 1999 and 2009

Source: Institute of Transportation (2011b)

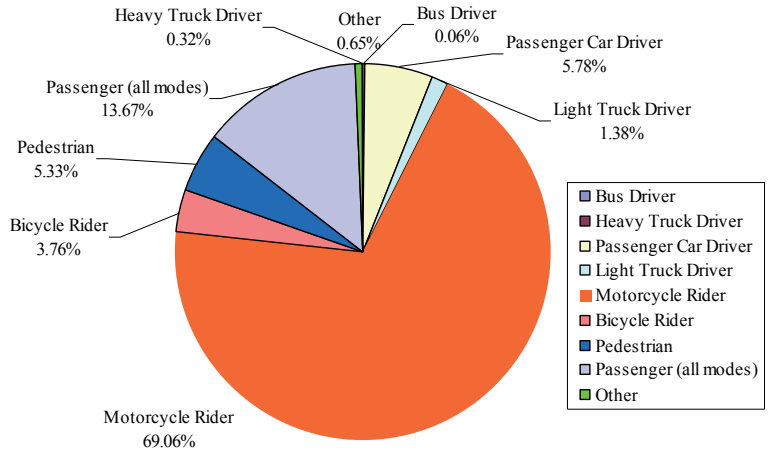


Figure 9 Injuries Composition by Transport Mode between 1999 and 2009

Source: Institute of Transportation (2011b)

3.2.2 Fatality rate by road type, transport mode, and victim's age

As mentioned earlier, the number of fatalities tends to be decreasing in recent years. To further explore the composition of fatality changes, we use the corresponding road length, vehicle registration number, and number of populations to calculate the fatality rate among different types of roads, modes of transport, and age group of victims. Only the 24-hour police-reported data is able to be reached, and the corresponding fatality rate spanning from 1999 to 2009 are demonstrated in Figure 10 through Figure 17.

Figure 10 shows that freeways, provincial roads, and county roads had a higher but similar

significantly decreasing trend on fatality rates of about 200 to 80 fatalities per thousand km over the last ten years. Urban roads had a slightly downward pattern of about 70 to 30 fatalities per thousand km, while rural roads had a rather stable rate about 20 fatalities per thousand km between 1999 and 2009. Freeways, provincial roads and county roads revealed a higher fatality rate, which may be caused by the higher running speed on these types of roads.

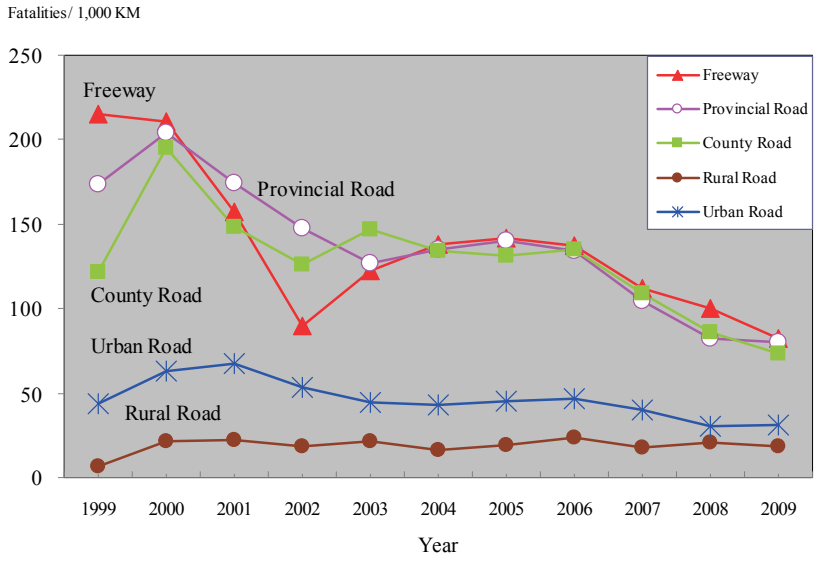


Figure 10 Fatality Rate by Road Type between 1999 and 2009

Source: Institute of Transportation (2011b)

In terms of different transport modes (see Figure 11) passenger car drivers had the lowest fatality rate during the ten-year period, while heavy truck, light truck drivers, and motorcycle riders had a higher fatality rate as compared with passenger car drivers. Bus drivers, on the other hand, showed an unstable pattern of fatality rates because of a relatively fewer of vehicle. All transport modes revealed a slightly decreasing trend on fatality rates with 3.26 fatalities of passenger car drivers, 5.19 fatalities of light truck drivers, 5.67 fatalities of heavy truck drivers, 7.23 fatalities of bus drivers and 8.12 fatalities of motorcycle riders per one hundred thousand registered vehicles in the year 2009.

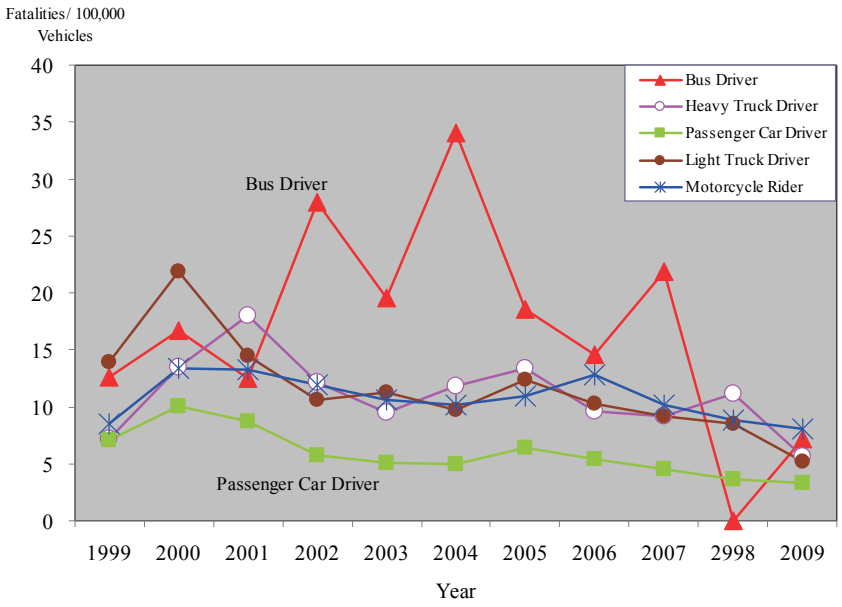


Figure 11 Fatality Rate by Motor Vehicle Type between 1999 and 2009

Source: Institute of Transportation (2011b)

We further examined the fatality rate of drivers and passengers for different transport modes based on various age and gender groups, shown in Figure 12 through Figure 17. Figure 12 shows that male passenger car drivers, especially aged between 18 and 64, had a comparatively higher fatality rate compared with their female counterparts. Male car drivers aged between 18 and 64 also had an obviously decreasing trend of fatality rates over the past ten years. Moreover, male car drivers aged 18-24 had a dominantly high fatality rate between the year 1999 and 2006, but male drivers aged 25-64 ranked top since 2007.

The population-based motorcycle fatalities per one hundred thousand persons (Figure 13) is higher than any other kind of their same age and gender counterparts of drivers or passengers shown in Figure 12, Figure 14 through 17. For example, male motorcycle riders aged 18-24 had 14.5 fatalities as compared with male passenger car drivers of the same age which had only 1.6 fatalities per one hundred thousand persons. Similarly, male motorcycle riders also showed a higher fatality rate as compared with female riders. Male riders aged 65 or above had the highest death risk in traffic accidents, possibly because their frailty and lower resistance capacity to trauma. In addition to the problem of older riders, male motorcycle riders aged 13-17 also had the risk even higher than any age groups of female riders. Riders aged under 18 in Taiwan experiencing unlicensed motorcycling has been an important issue. According to the ten years' data, the fatality rate among different age and gender combinations for motorcycle riders revealed a rather stable pattern.

Elderly bicycle riders had a higher fatality risk as compared with their young counterparts (as demonstrated in Figure 14). Older male bicycle rider aged 65 or above had the highest rate, and then older female aged 65 or above had the second highest rate. However, the difference between the two

elderly gender groups seemed to be close in recent years. For the pedestrian part in Figure 15, similarly with bicycle riders, both elderly genders as pedestrians show a higher fatality rate than their younger counterparts. The population-based death rate of older pedestrians were higher than older bicycle riders, and the rate for female pedestrians aged 65 or above was slightly higher than male pedestrians aged 65 or above. However, in both genders, elderly pedestrians had a diminishing trend in death rates since 2003.

As for passengers seated in passenger cars and motorcycles, it is difficult to find a consistent trend for both kinds of passengers in Figure 16 and Figure 17. Passengers aged 18-24 seated in cars seemed to have a higher death rate between 2003 and 2008; however, male passengers aged 18-24 seated in motorcycles also seemed to have a higher death rate between 1999 and 2003 and it turned out that female passengers aged 18-24 seated in motorcycles have a higher rate of fatalities after 2005. It should be noted that passengers aged 13-17 seated in motorcycles also contribute to a significant part of passenger deaths.

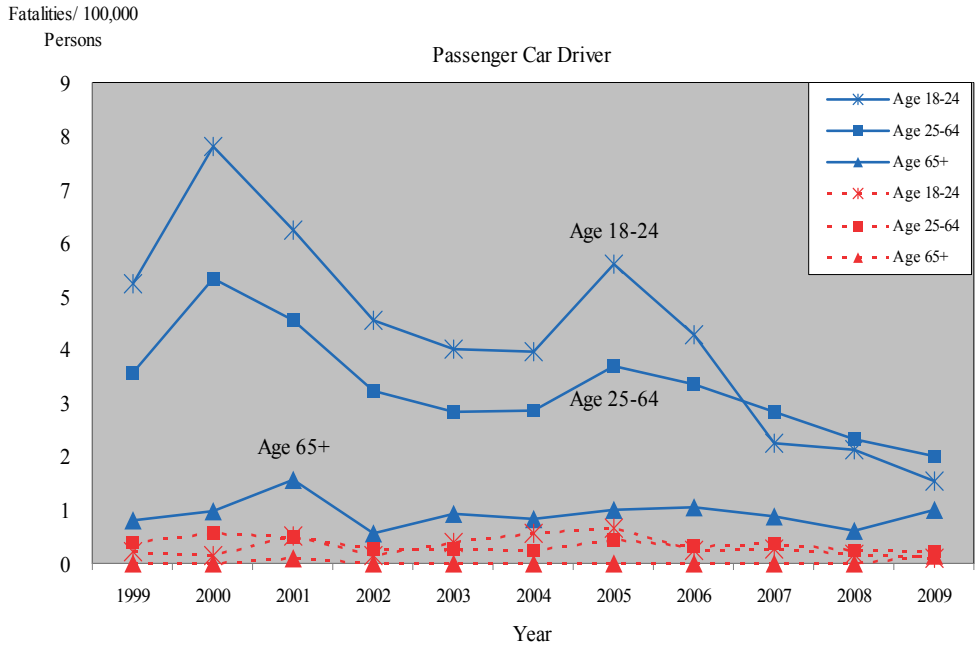


Figure 12 Fatality Rate by Age of Passenger Car Driver between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

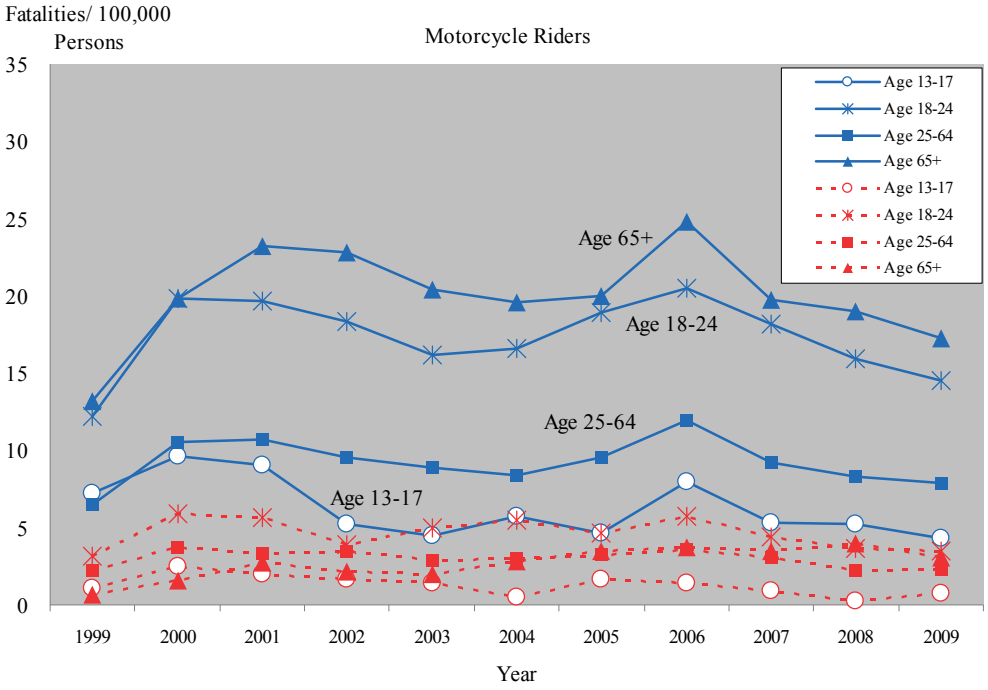


Figure 13 Fatality Rate by Age of Motorcycle Rider between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

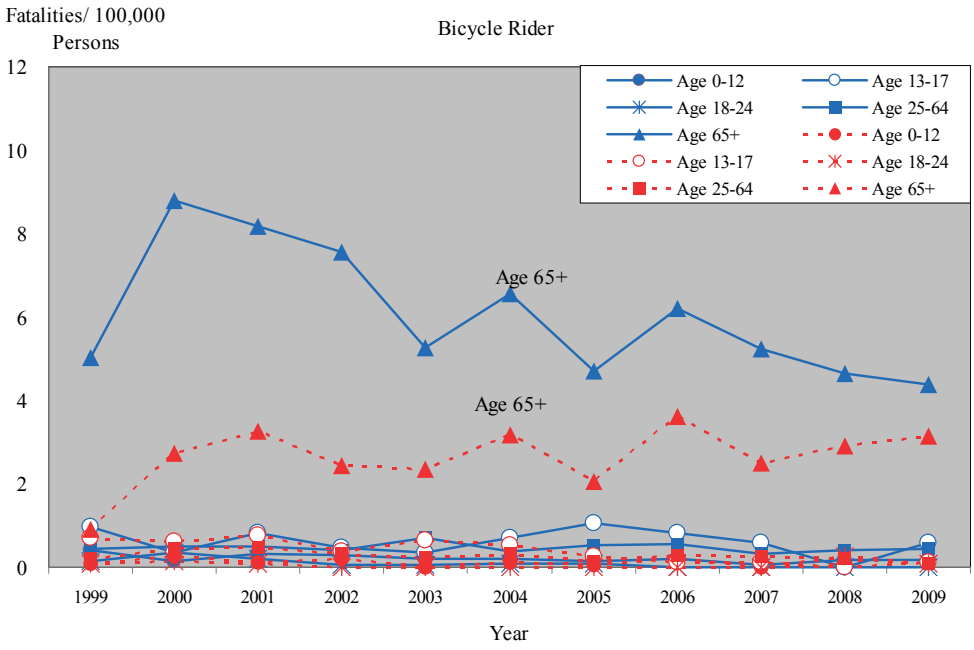


Figure 14 Fatality Rate by Age of Bicycle Rider between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

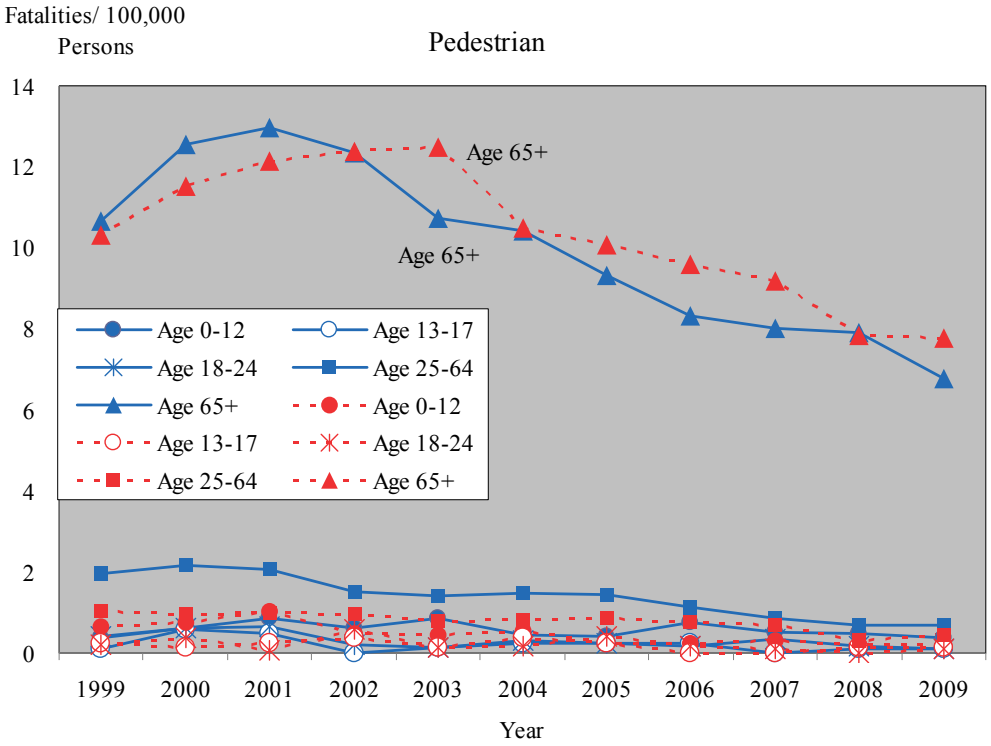


Figure 15 Fatality Rate by Age of Pedestrian between 1999 and 2009
(Blue: Male, Red: Female)
Source: Institute of Transportation (2011b)

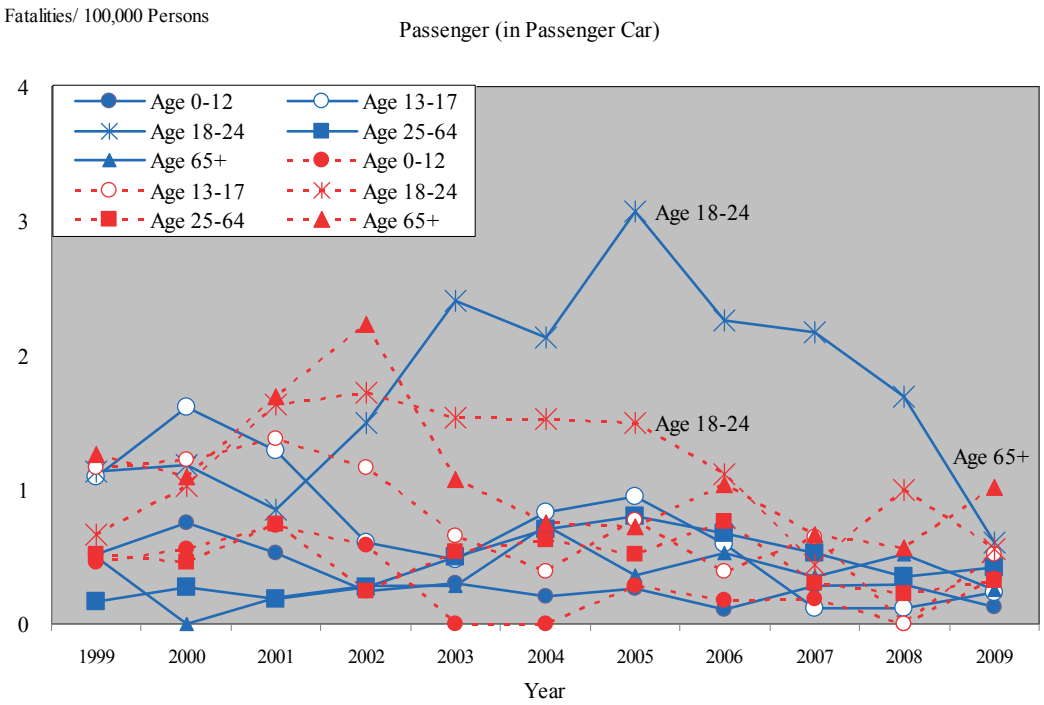


Figure 16 Fatality Rate by Age of Passenger Seated in Passenger Car
between 1999 and 2009 (Blue: Male, Red: Female)
Source: Institute of Transportation (2011b)

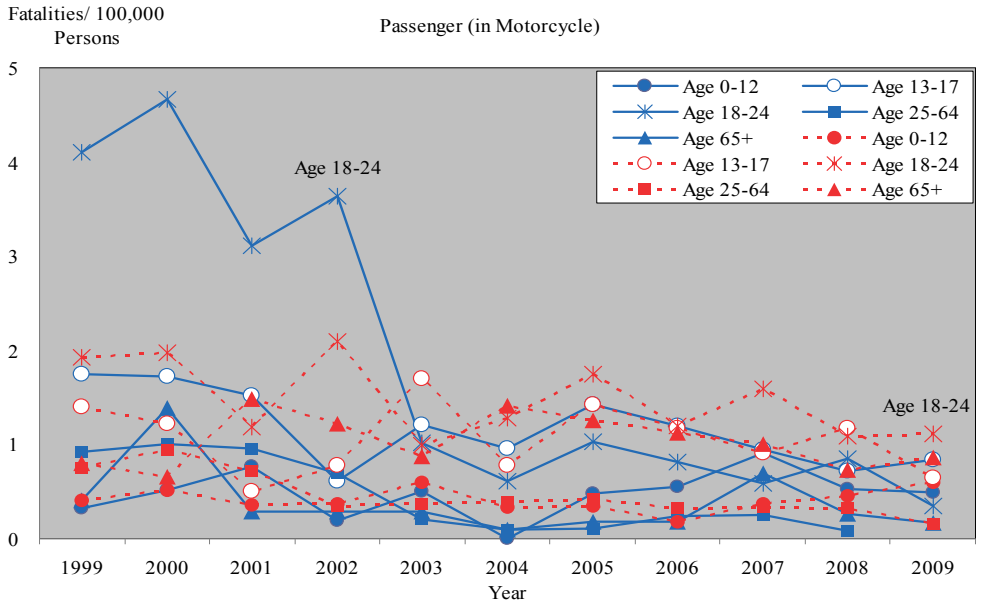


Figure 17 Fatality Rate by Age of Passenger Seated in Motorcycle between 1999 and 2009 (Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

3.2.3 Injury rate by road type, transport mode, and victim's age

Different from fatality rates, the number of injuries appears to be increasing in recent years. Consistent with fatality rates between 1999 and 2009, we applied 24-hour police-reported data to analyze the corresponding injury rate by road type, transport mode and age and gender groups of victims. The related figures are demonstrated in Figure 18 through Figure 25.

In Figure 18, we can find that only freeways had a slightly decreasing tendency over the past ten years. Both urban and county roads had a similar increasing rate on road length based injury rates from the year 1999 to 2008. Provincial roads and rural roads also had a comparable increasing rate. Up until 2009, urban roads had the highest injury rate with 7,342 injuries per thousand km, and county roads had the second highest rate with 4,771 injuries per thousand km. However, provincial roads, rural roads, and freeways had a lower injury rate of about 3,515, 1,742 and 1,376 injuries per thousand km respectively.

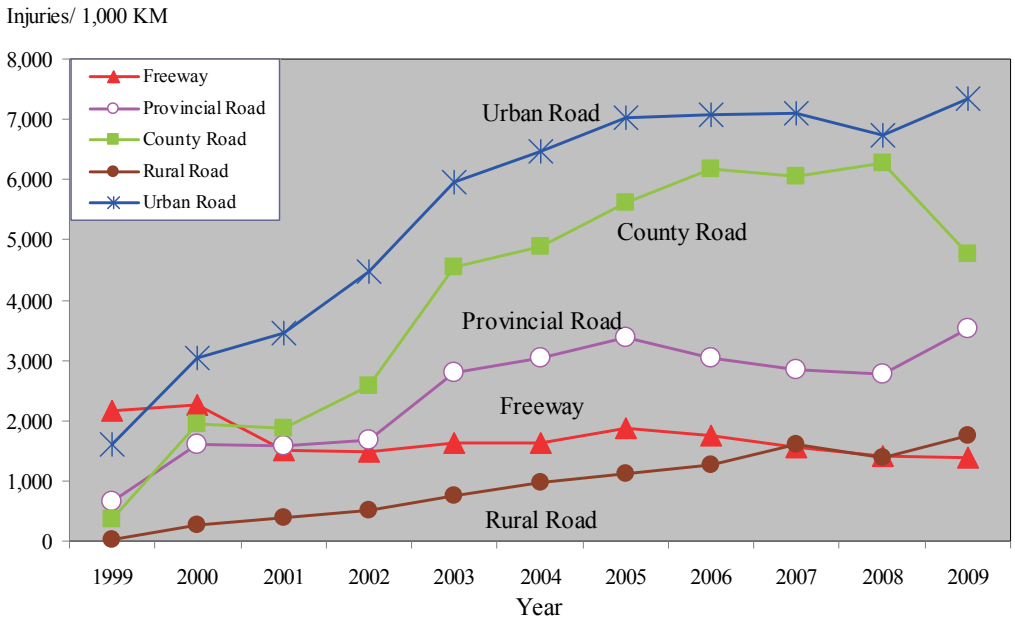


Figure 18 Injury Rate by Road Type between 1999 and 2009

Source: Institute of Transportation (2011b)

To analyze injury rates by transport mode, Figure 19 shows that over the past ten years, only motorcycle riders have revealed a sharply increasing rate with over 60% growth in injury rates per year. However, bus drivers showed a sharply decreasing trend since 2004, and heavy truck drivers a slightly decreasing rate in 2008 and 2009. Both bus drivers and heavy truck drivers had a comparable injury rate with passenger car drivers for the last two years. Light truck drivers had a little higher rate of injuries than passenger cars over the ten-year period. Based on the vehicle based injury rate in the year 2009, motorcycle riders revealed a high rate of 1,234 injuries per one hundred thousand registered vehicles, and in addition, light truck drivers had a rate of 302 injuries, passenger car drivers 180 injuries, heavy truck drivers 145 injuries, and bus drivers with 137 injuries on the basis of per one hundred thousand registered vehicles.

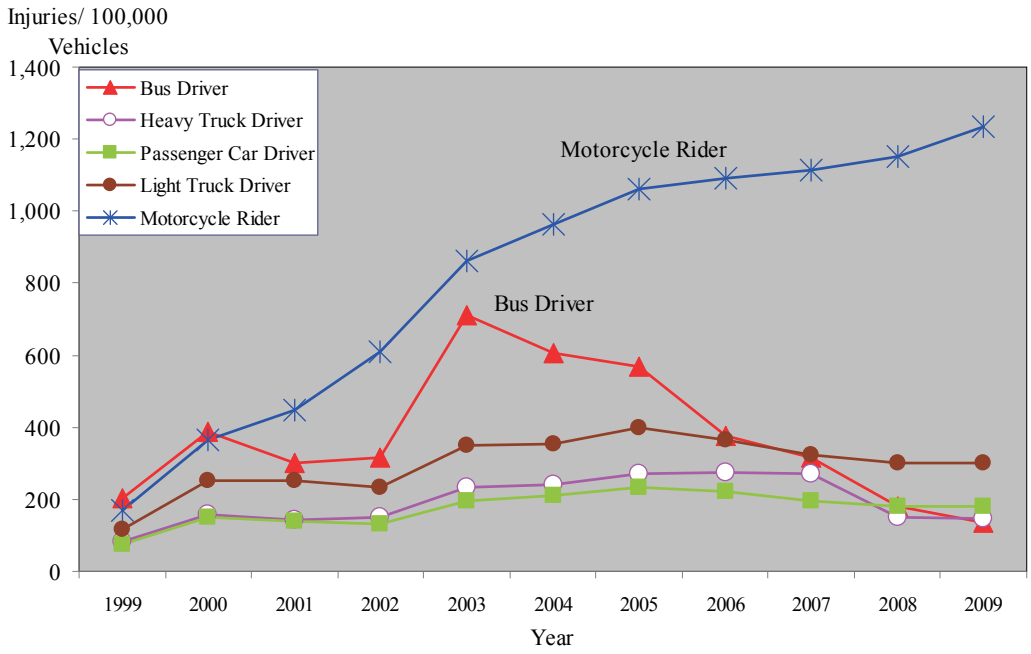


Figure 19 Injury Rate by Motor Vehicle Type between 1999 and 2009

Source: Institute of Transportation (2011b)

The population-based injury rate of drivers and passengers for different transport modes based on different age and gender groups are demonstrated in Figure 20 through Figure 25. Figure 20 shows that male car drivers aged between 18 and 64 had a relatively higher injury rate compared with their female counterpart drivers. Male car drivers aged 65 or above also had a higher injury rate than female drivers of the same age, and the injury rate of these elderly male drivers were just a little lower than female drivers aged 25-64. The changes of injury rates over the past ten years revealed that male car drivers aged 18-24 and 25-64 both demonstrated a sharp rise between 1999 and 2005, which is then followed by an obviously downward trend since 2006, and male car drivers aged 25-64 took the highest rate of injury in the recent two years. Moreover, male car drivers aged 65 or above and female drivers aged 18-24 also increased slowly but steadily over the ten-year period.

Motorcycle rider injuries per one hundred thousand persons, as shown in Figure 21, is extraordinarily higher than any other kind of drivers or passengers of the same age and gender combinations as shown in Figure 20, and Figure 22 through 25. Over the last ten years, except for unlicensed male and female riders aged 13-17 having a stable pattern, all the other age and gender combinations revealed an obviously increasing trend in injury rates, and the increasing trend was relatively significant for young rider aged 18-24 for both genders (see Figure 21). In 2009, motorcycle riders aged 18-24 experienced 3,087 injuries for male and 1,890 injuries for female riders per one hundred thousand persons respectively.

Bicycle riders also experienced an increasing injury rate over the last ten years. It should be noted that bicycle riders aged 13-17 and aged 65 or over had a relatively higher injury rate, especially for male

bicycle riders.

For the pedestrian part in Figure 23, both elderly genders aged 65 or greater as pedestrians show a higher injury rate than their young counterparts. The population-based injury rate of older pedestrians were a little higher than older bicycle riders, but different from older bicycle riders, elderly female pedestrians experienced a higher injury rate as compared to their elderly male counterparts. The reverse results in bicycle riding and walking injury risk between elderly genders may be caused by the difference in exposure to these two means of traffic.

As for passengers seated in passenger cars in Figure 24, young passengers aged 18-24 for both genders seemed to have a higher injury rate. The injury rate for young female passengers was even higher than their young male counterparts. Figure 25 shows that besides the age 18-24, younger motorcycle passengers with relatively high injury rates also extended to passengers aged 13-17. Both young female motorcycle passengers aged 13-17 and aged 18-24 had a higher injury rate than their male counterparts of the same age since 2003. Female motorcycle passengers aged 18-24 experienced an extraordinarily high rate of accident injuries. In addition, it should also be noted that children aged under 12 as a passenger for both genders underwent a slow but steady increasing trend of injury rates since 2003.

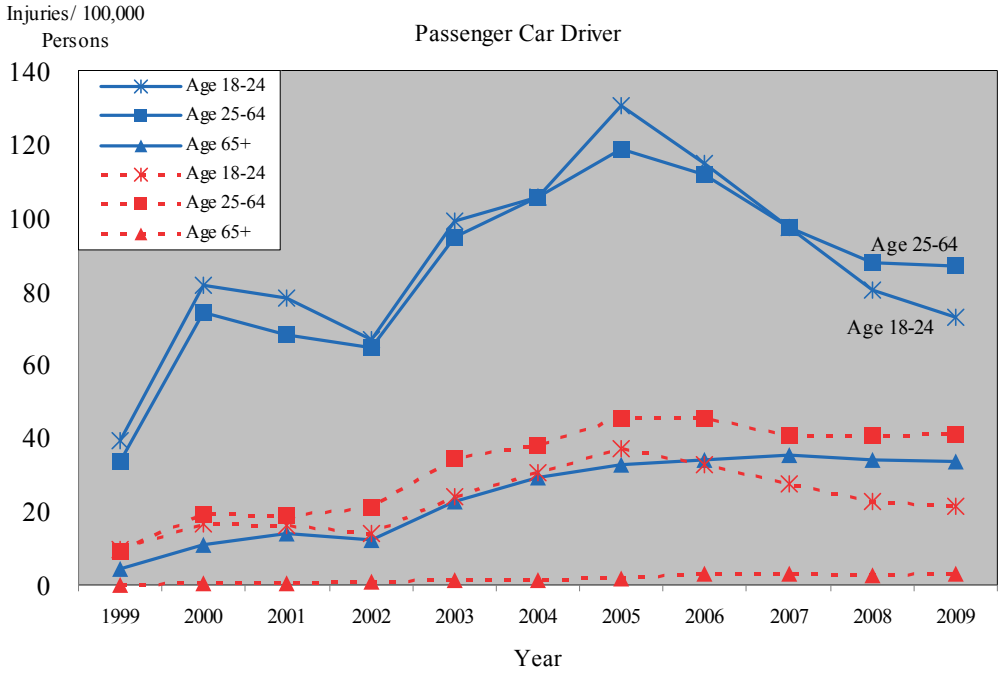


Figure 20 Injury Rate by Age of Passenger Car Driver between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

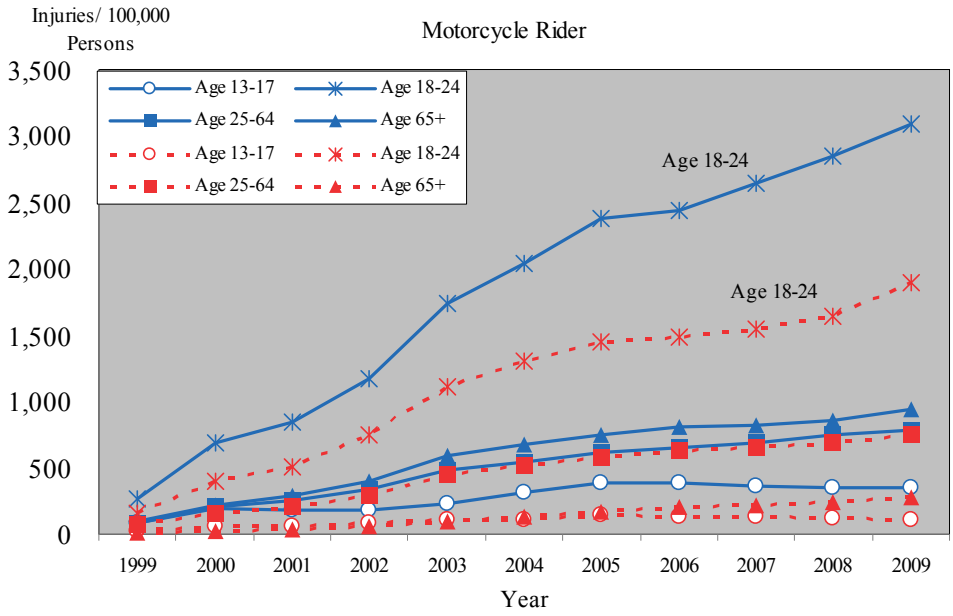


Figure 21 Injury Rate by Age of Motorcycle Rider between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

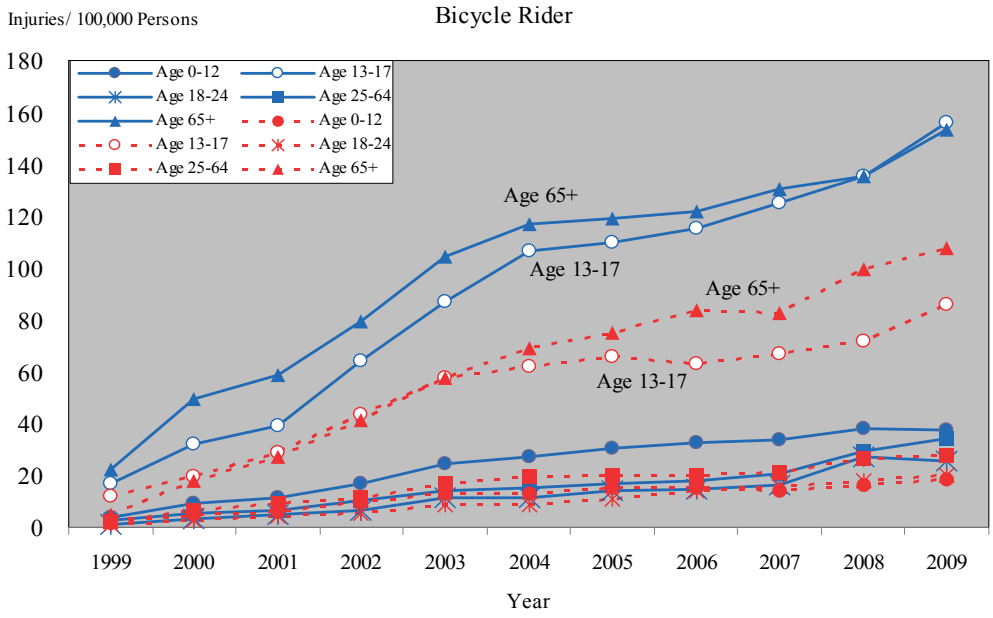


Figure 22 Injury Rate by Age of Bicycle Rider between 1999 and 2009

(Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

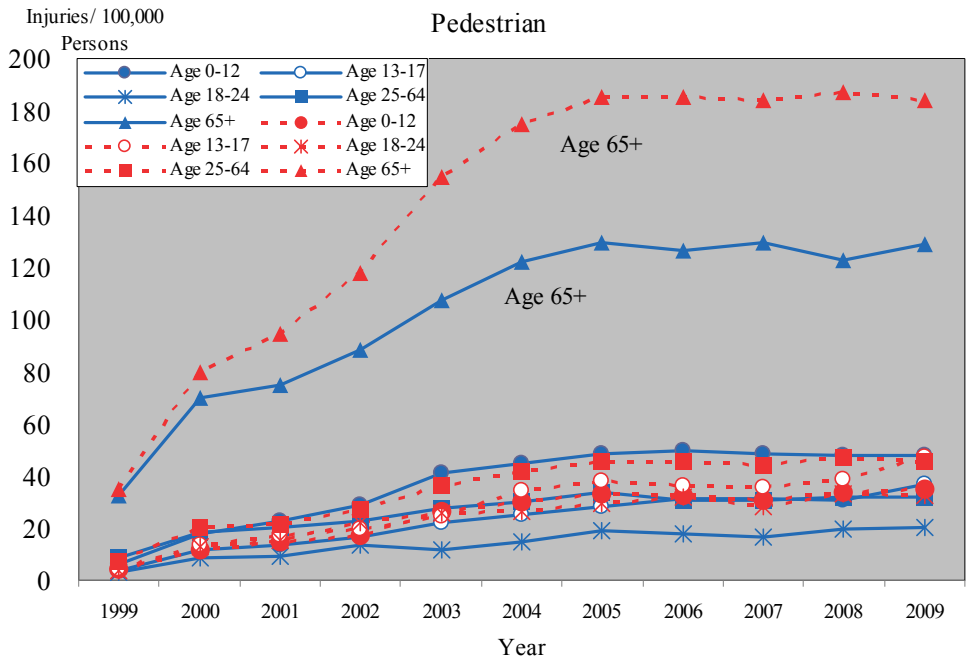


Figure 23 Injury Rate by Age of Pedestrian between 1999 and 2009 (Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

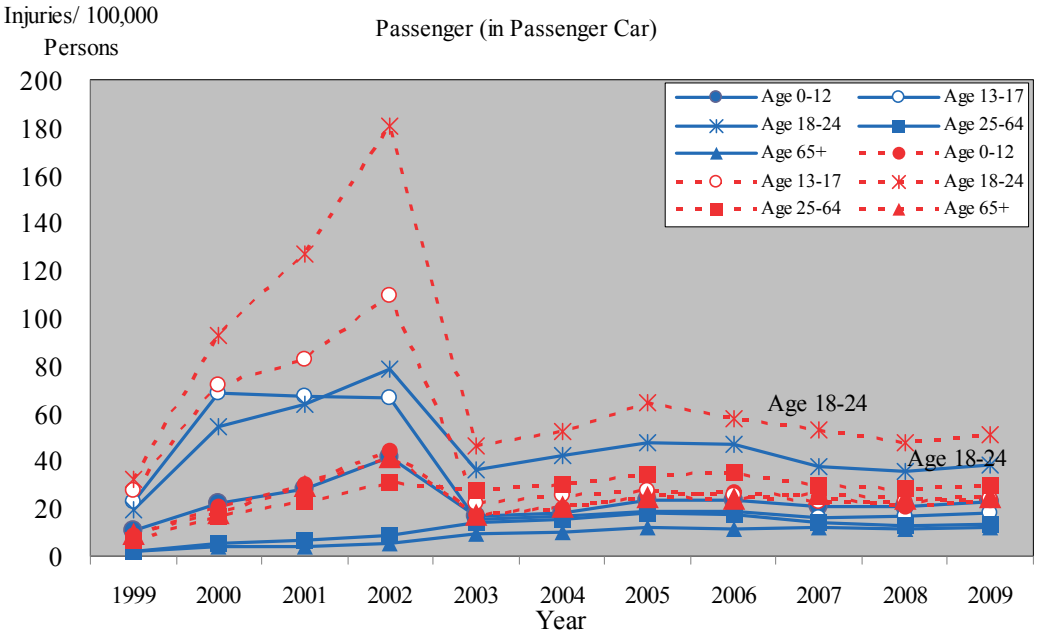


Figure 24 Injury Rate by Age of Passenger Seated in Passenger Car between 1999 and 2009 (Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

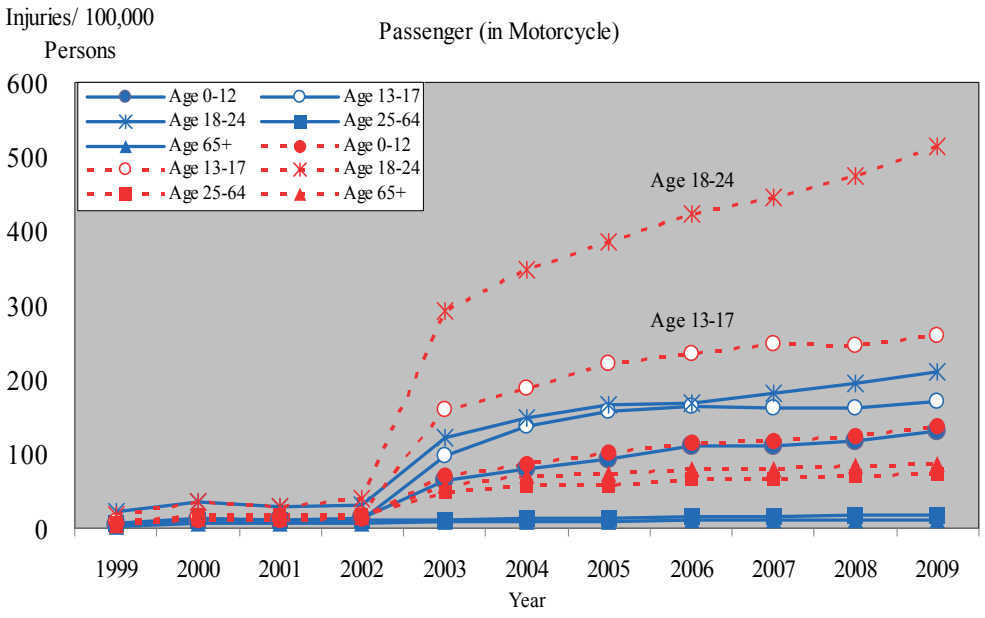


Figure 25 Injury Rate by Age of Passenger Seated in Motorcycle between 1999 and 2009 (Blue: Male, Red: Female)

Source: Institute of Transportation (2011b)

3.3 International Comparisons

As mentioned earlier, the trend of accident fatalities in Taiwan diminished over the past ten years, while accident injuries increased in the same period. Fatality rates have been one of the most common indicators for international comparisons, even though some advanced countries are extending their focus on accident injury prevention, such as the European Union (EU) (European Commission, 2010). To compare traffic safety performance with other developed countries, we use the estimated 30-days fatality data to demonstrate population-based fatality rates from 1998 to 2008 (i.e. Taiwan with data from 2003 to 2008) in Figure 26 (detailed facts can be found in Appendix 7). Figure 26 indicates that Taiwan had 191 fatalities per million persons in 2006 and reduced to 150 in 2008. Compared with the countries with the best performance such as Sweden, United Kingdom, Japan, and Norway with 50 or fewer fatalities per million persons in 2008, the traffic fatality rate in Taiwan was three times greater. The traffic fatality rate in Taiwan also had 1.8-1.9 times more than the average of Organization for Economic Cooperation and Development (OECD) countries and EU. Thus, even with the reduction of fatality rates in recent years, Taiwan still appears to have much to improve, especially concerning the specific issues relating to motorcycle use, elderly road users, and the leading accident cause produced by drunk driving.

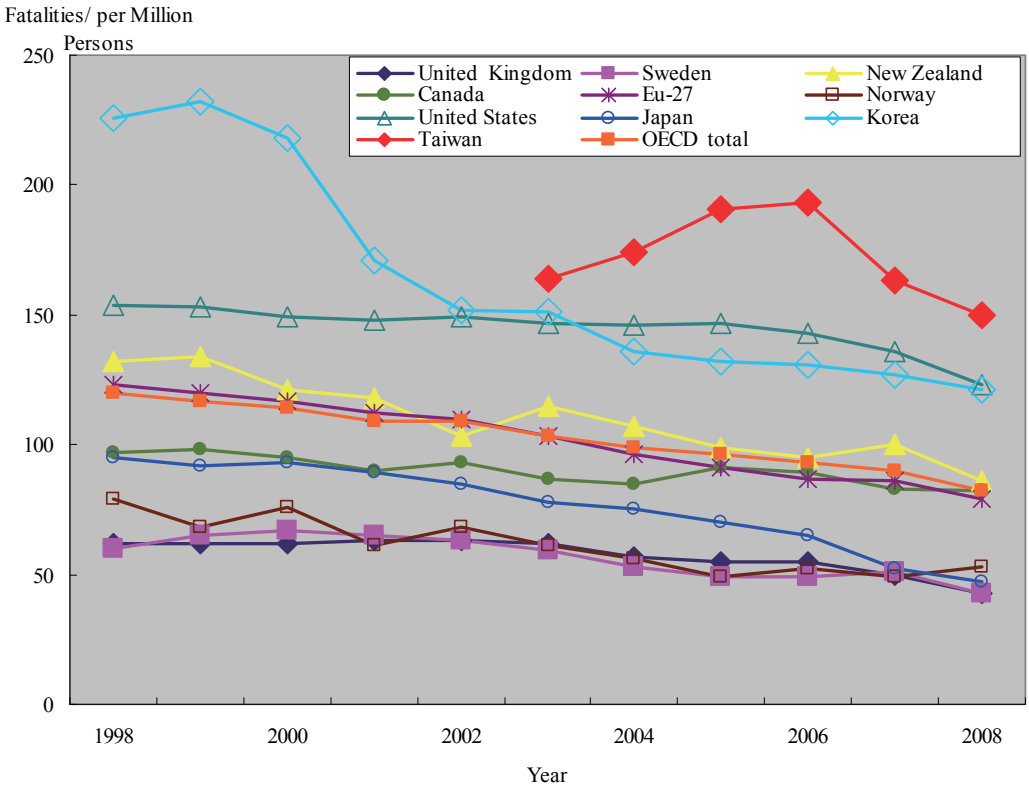


Figure 26 International Comparison of 30-days Fatality Rate between 1998 and 2008

Source: Institute of Transportation (2011b)

4. Organizations for Traffic Safety

For promoting road traffic safety activities, Taiwan has established the National Road Traffic Safety Committee (NRTSC) under the Ministry of Transportation & Communications (MOTC) in 1983. It assumes the responsibility of planning and supervision of nationwide road traffic safety administrative agencies, and also invites the representatives of central administrative agencies to form the Committee, which meets regularly once a month. These representatives include the Ministry of Education, Ministry of the Interior, Administration of Police (under the Ministry of the Interior), Government Information Office (under Executive Yuan), Department of Health (under Executive Yuan), Taiwan Area National Freeway Bureau (under MOTC), Directorate General of Highways (under MOTC), Institute of Transportation (under MOTC) and 25 local governments concerned, as well as academic and professional specialists. The Meeting of the Committee examines traffic safety problems and supervises nationwide and city authorities in the implementation of their corresponding safety programs. There are three functions of the Committee as follows:

(1) To strengthen the planning of special programs for road traffic safety and the coordination and supervision of its implementation;
(2) To examine, supervise and monitor the planning, expenditures and implementation status of subsidized traffic safety programs for central and local administrative; and
(3) To recommend the revision of road traffic safety regulations.

All the local governments have established their corresponding Task Forces in connection with the operation of NRTSC. The freeways, provincial roads and some county roads are maintained and managed by the central agencies, while urban roads, most of county roads, and rural roads are maintained and managed by the local agencies. The annual budget of NRTSC is based on 1.76% of the nationwide fuel tax revenue, approximating NT$0.3 billion (US$10 million) annually in recent years.

To support the mission of road safety improvements, in addition to the dedicated organization established, MOTC has also set up and promoted "Improving Highway Traffic Order and Safety Projects" triennially since 1982. The Projects, conducted by NRTSC, aims to enhance traffic order and safety but also to reduce deaths, injuries and economic losses resulting from motor vehicle crashes. To achieve their aims, NRTSC coordinates with central and local governments' plans and annual implementation programs through the connected links of traffic engineering, enforcement, education, propaganda, and motor vehicles supervision, etc.

The ongoing 2011 Project belongs to the second year of the 10th triennial Project (from 2010 to 2012). Three major issues are focused in recent years: reducing the accidents of the motorcyclists, senior citizens and drunk drivers. As a recent task, NRTSC has advocated the project "Pedestrian Right of Way" since July 2010. This project promotes the concept of priority for pedestrians when motor vehicles approach intersections. Other important programs that NRTSC continues focusing on are engineering based improvements such as "Implementing the Projects of Accident-prone Locations Improvement in Taiwan Area" and "Riding a motorcycle in order," and enforcement based improvements such as "Deterring Drunk from Driving", "Promoting Motorcycle Helmets Use by Enforcement and Education" and "Promoting the Concept of right of way Projects". In addition to engineering based and enforcement based improvements, NRTSC has promoted through measures of traffic propagandas to raise people's awareness about road accident risks.

5. Changes in Traffic Safety Measures

5.1 Main Accident Causes

To further discuss changes in traffic safety measures in Taiwan, it is helpful to observe the trend of main traffic causes in recent years. Figure 27 shows the changes of six main A1 accident causes including drunk driving, careless driving, failing to yield, violating signals or signage regulations, inappropriate turning, and losing control out of speeding, over the past ten years. The number of the

six main causes comprised about 60-70% of the total sum of main causes. Drunk driving has risen to the peak in the year 2006, and though followed by a three-year decline, it remains to be the highest cause since 2006. On the other hand, careless driving appears to have a decreasing trend. Failing to yield and violating signal or signage regulations slightly increased, while inappropriate turning slightly decreased during the same period. The most dramatic change in main accident causes was losing control out of speeding. Speeding was the second highest cause of accidents in 2000 and then dropped to the fewest among the six main causes in 2009. However, since only one main cause was requested to be recorded by the police, it is believed that speeding was usually underestimated and has remained to be a serious problem in Taiwan.

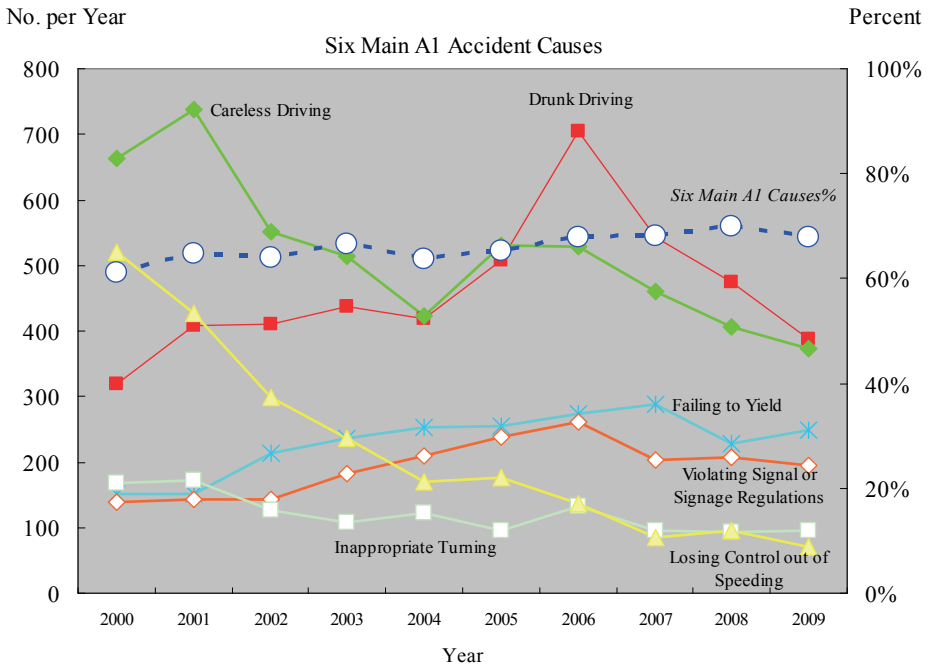


Figure 27 Six Main Accident Causes between 2000 and 2009

Source: National Road Traffic Safety Committee (2010)

5.2 Traffic Safety Measures

As mentioned earlier, triennially issued "Improving Highway Traffic Order and Safety Projects" has been the principal guideline for traffic safety improvements followed by central and local governments since 1982. The Projects basically emphasize the measures of the three Es (Engineering, Enforcement, and Education), which are commonly applied to tackle traffic safety problems in international safety communities. Enforcement, however, appears to be the most effective measure in Taiwan. The inverse relationship between accident event rates and traffic violations cited or fined might strengthen the image of the effectiveness of enforcement. In Figure 28, we can find the negative association between event rates and traffic violations cited or fined during the period 2002-2010. From this, we can say the principal changes in traffic safety policies in Taiwan may be regarded as waves of amendments on

traffic laws and regulations. In addition, the comparably large number of motorcycles and their high proportion of accident composition in Taiwan, which has resulted in special engineering design for motorcycle riders, may have unique safety implications.

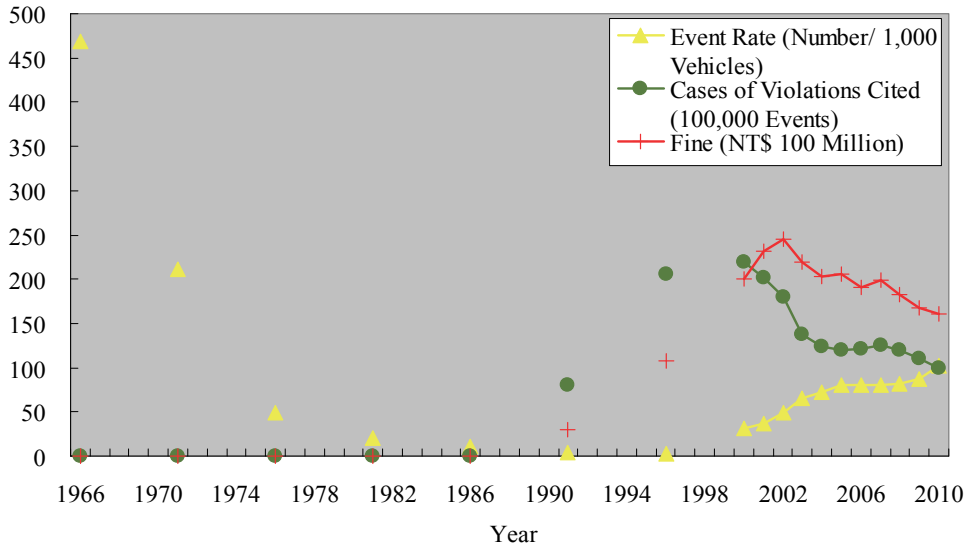


Figure 28 The Relationships between Accident Event Rate, Traffic Violation Cited and Fined between 1966 and 2010

Source: Ministry of Transportation and Communications (2011)

5.2.1 Law amendments

Several waves of law amendments in Taiwan for accident prevention has been thought effective, including mandatory helmets for motorcyclists, mandatory seatbelts for front seat occupants of cars, and stricter punishments for drunk driving.

Mandatory restrain use laws for motorcycle riding and automobile driving was not enacted until the year 1996 and 1985 respectively (see Table 3). Motorcycle helmet wearing was encouraged through promotions and campaigns in 1981, but there were no punishments for violators at that time. Mandatory helmet wearing law with a fine for motorcyclists took effect in 1996. Car seatbelt fastening law was enacted only for front seat occupants travelling on freeways in 1985, and was expanded to include front seat occupants travelling on expressways in 1996, and general roads in 2001 respectively. The fine for not fastening seatbelts on freeways is higher than any other types of roads. Together with mandatory seatbelt fastening for front seat occupants on general roads, mandatory law for baby car seats also took effect in 2001, and the fine was raised for violating car drivers in 2005. Following the successful examples of international practices, mandatory seatbelt fastening will expand to include back seat occupants in the upcoming 2012.

Although mandatory helmets and seatbelts were conducted over 15 years, the helmet wearing rates and seatbelt fastening rates have never been investigated through a large scale sampling survey. A

recent convenient sampling survey (Institute of Transportation, 2012) showed that restraint use measures should be even more emphasized, since even with a low not-wearing rate(<5%), the unsuitably fastening rate is still high(>15%) for motorcyclists, and in addition, a high not-fastening rate for front seat occupants(ranging from 5% to over 60%) and a extremely high not-fastening rate for back seat occupants(>95%) reveals that there is much room for improvement in various cities in Taiwan.

Table 3 Law Amendments for Mandatory Helmet and Seatbelt Wearing

Target	Time	Amendment Contents
Motorcycle Helmet Wearing	July 17th, 1981	◆Specific regulations for encouraging helmet wearing were enacted, but there were no punishments for violators.
	December 31th, 1996	◆ Mandatory helmets for both riders and passengers took effect, and violators were fined 500 NT dollars.
Car Seatbelt Fastening	March 1st, 1985	◆ Mandatory seatbelts for front seat occupants running on freeways took effect (defined by traffic regulations on freeways), and violators were fined 500 NT dollars. (The amount of fine was raised to 1,000 NT dollars on May 13th, 1986, and to 3,000 NT dollars on December 31th, 1996).
	December 31th, 1996	◆ Mandatory seatbelts for front seat occupants running on expressways took effect and violators were fined 1,500 NT dollars.
	January 2nd, 2001	◆ Mandatory seatbelts for front seat occupants expanded to general roads and violators were fined 1,500 NT dollars. ◆ Car drivers violating the mandatory rule for baby car seats were fined 500 NT dollars. ◆ Violating mandatory seatbelts for front seat occupants running on freeways was formally defined by traffic law but no further adjustment was made to the amount of fine (3,000 NT dollars).
	December 9th, 2005	◆ The fine of violating the mandatory rule for baby car seats was raised to 1,500-3,000 NT dollars. ◆ The baby car seats applying for children aged under 4 or weight under 18 kg was clearly defined.
	April 22th, 2011 (taking effect in 2012)	◆ Mandatory seatbelts expanded to back seat car occupants. ◆The fine of violating the mandatory seatbelt wearing on expressway was raised to 3,000 NT dollars, comparable with freeways.

Source: The Legislative Yuan: Legal System Database (2012)

Law amendments for drunk driving has always been the main focus, since drunk driving has been the first two main causes of traffic crashes since 2002. Two types of laws were amended against drunk drivers in Taiwan: Administrative and Penalty Law respectively. The BAC standard for drunk drivers in administrative law is 0.05% (defined by the traffic regulations), and BAC standard for drivers that "cannot safely drive" while intoxicated is not rigidly defined in penalty law but 0.11% is the practically accepted number by most of the judges.

Administrative law against drunk driving has been extensively amended since 1996. The scope of the law was expanded to drugged drivers and suspected drivers refusing to take the alcohol breath test. The license suspension and revocation measures were used, and the fines for violators were largely increased (see Table 4). The life-time license revocation was adopted in the Administrative Law in 1996 under the conditions that the accident caused a victim severe injury or death, but was abandoned in 2005 because it was against the authorization by the Constitutional Law. However, a longer period for license revocation was still applied. Penalty law for punishing drunk driving took effect in 1999 and the recent amendment in 2011 has increased the fines and imprisonment durations for serious drunk drivers (see Table 5).

Table 4 Administrative Law Amendments for Drunk Driving

Law Type	Time	Amendment Contents
Administrative Law for Drunk Driving	July 11th, 1975	◆ Drunk drivers were fined 300-600 NT dollars and restricted driving on the scene. ◆ The license for drunk drivers were also revoked for 3 years on conditions that the accident caused a victim severe injury or death. (i.e. The definition of drunk driving is defined as BAC over 0.05%.)
	May 13th, 1986	◆ The fines for drunk drivers were raised to 900-1,800 NT dollars.
	December 31th, 1996	◆ The fines for drunk drivers were raised to 6,000-12,000 NT dollars. ◆ Drugged drivers and suspected drivers refusing to take the alcohol breath test were also be fined 6,000-12,000 NT dollars.. ◆ The license for the above violators were suspended for 6 months without causing any other injuries and one year when causing injuries. ◆ The licenses for the above violators were revoked for life-time on conditions that the accidents caused a victim severe injury or death. ◆ The sentence for imprisonment duration were extended by half on conditions that an unlicensed or drunk driver should receive a penalty law when they caused a victim severe injury or death.
	January 2nd, 2001	◆ The fines for drunk drivers, drugged drivers and suspected drivers refusing to take the alcohol breath tests were raised to 16,000-60,000 NT dollars. ◆ The suspension duration for the above violators' licenses were extended from 6 months to one year without causing any other injuries and from one year to two years with causing injuries.
	December 9th, 2005	◆ Regardless of causing injuries, the licenses for commercial heavy vehicle drivers were revoked for 4 years on conditions that they drove while intoxicated. ◆ The life-time license revocation for drunk drivers, drugged drivers and suspected drivers refusing to take the alcohol breath test were lifted because life-time revocation had been declared against the Constitutional Law and were revoked for 8 years, 10 years, and 12 years on conditions that the accidents caused a victim injuries, severe injuries and death, respectively.

Source: The Legislative Yuan: Legal System Database (2012)

Table 5 Penalty Law Amendments for Drunk Driving

Law Type	Time	Amendment Contents
Penalty Law for Drunk Driving	March 30th, 1999	◆ A driver taking drug, alcohol or similar substance and cannot safely drive would receive at most one-year imprison sentence, custody or at most 30,000 NT dollars. (i.e. The definition of "cannot safely drive" is practically regarded as BAC over 0.11% or over and is through the verdict by the judge.)
	December 18th, 2007	◆ The fine was extended to at most 150,000 NT dollars.
	November 9th, 2011	◆ At most one-year imprisonment sentence was extended to two years and would be extended to 6 months to 5 years and one to 7 years on conditions that the accident caused a victim severe injury or death respectively. ◆ The fine rose to at most 200,000 NT dollars.

Source: The Legislative Yuan: Legal System Database (2012)

From a chronological perspective (see Figure 29), mandatory law for helmet wearing in 1996 appeared to have a significant effect on reducing crash deaths. Followed by the amendments of Penalty Law in 1999 and fine rises in 2001 for drunk driving, and together with mandatory law for seatbelt fastening in 2001, the fatalities steadily went downward. However, traffic accident fatalities increased with a reversing trend since 2003 till 2006.

In 2005, law amendments on speeding higher than 60 km/h of the speed limit was attributed to dangerous driving and violators would be fined 6,000-24,000 NT dollars, but it seemed no evidence that the second wave of fatality reduction between 2006 and 2010 was contributed by an effective speed management. On the contrary, the 2005 law amendments for general speeding enforcement also limited the enforcement flexibility of the police since the position of the fixed speed cameras should be informed in advance ahead of the cameras. Though without scientific evidence, it is believed that the fatality reduction between 2007 and 2010 was due to the heavier enforcement by the police on drunk driving, red-light running, and several violation behaviors since the beginning of 2007.

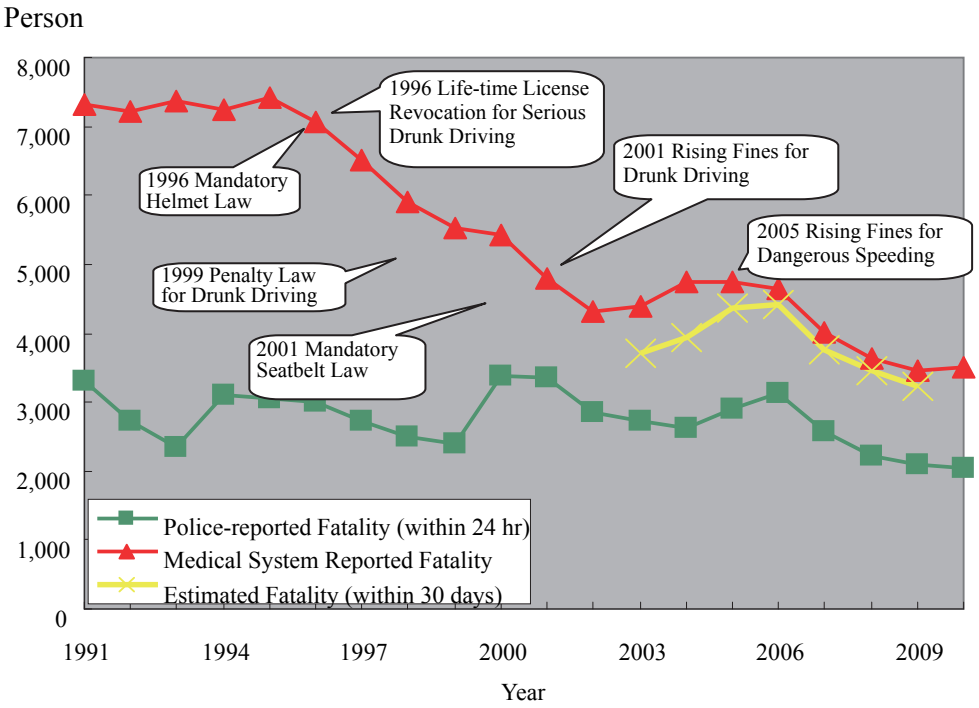


Figure 29 Major Traffic Law Amendments between 1991 and 2010

Source: Department of Health (2011), Institute of Transportation (2011a), Ministry of Transportation and Communications (2011) and The Legislative Yuan: Legal System Database (2012)

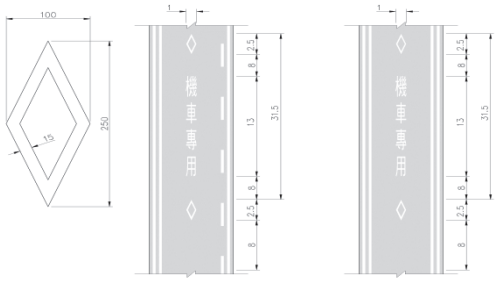
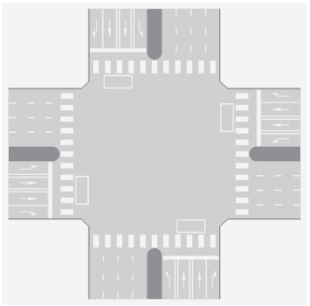
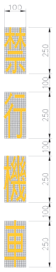
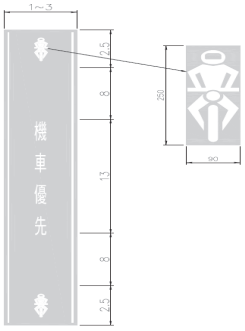
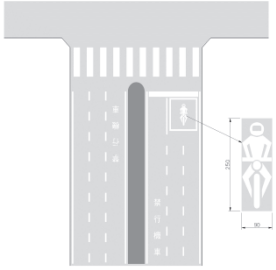
5.2.2 Special engineering design for motorcycle running

As mentioned before, motorcycle riders have comprised a big portion of all injured accidents, and also sustained severe accident outcomes. Densely mixed with cars, motorcycle riders may experience a higher accident risk. Thus, some special designs for segregating the running of motorcycles with engines sized under 250 cc and cars have been applied in Taiwan (see Table 6). For intersectional segregation measures, a two-phased left-turning, together with applying the inner prohibited lanes for motorcycle riders requires the left-turning riders to wait temporarily in front of the stop line of the transverse direction, and to start when the green light of that direction turns on. It is usually installed in a running direction with over two lanes. In addition, a motorcycle exclusive stopping area behind the stop line offers motorcycle riders an isolated space in front of cars when waiting for a green light. Motorcycle exclusive lane offers a separate lane space dedicated to motorcycle riders and a priority lane also offers a separate lane space mostly for motorcycle riders unless cars have to pass through for the purpose of parking along the curbs or turning right in the approaching intersection. Limited by road space, a two-phased left turning, inner prohibited lanes and exclusive stopping areas behind the stop line are more likely to be installed than motorcycle exclusive or priority lanes.

According to Yeh's (2011) study on motorcycle injury likelihood on different positions of the roads using the 2009 A1 and A2 accident data, inner fast moving lanes for cars (i.e. usually motorcycle running prohibited) had 51% higher and motorcycle priority lane had 28% higher injury likelihood as

compared with a slow moving lane (i.e. the rightmost lane with mixed traffic and 40 km/h speed limit if installed), while motorcycle exclusive lanes had 14% lower injury likelihood compared to a slow moving lane. In addition, compared with right turning movements at intersections, motorcycle direct left turning also had 93% higher and straight running had 3 times higher injury risk. The results showed that two-phased left turning and motorcycle exclusive lanes might provide a protective function for motorcycle riders.

Table 6 Special Traffic Engineering Design for Motorcycles

Special Type	Time	Road Markings
Motorcycle Exclusive Lane	November 30th, 1978	
Motorcycle Two-Phased Left Turning	December 15th, 1989	 
Motorcycle Prohibited Lane	December 15th, 1989	
Motorcycle Priority Lane	July 13th, 2000	
Motorcycle Exclusive Stopping Area	September 24th, 2003	

Source: Ministry of Transportation and Communications: Administrative Traffic Law and Regulation Database (2012)

6. Conclusions

The evolution of traffic safety performance in Taiwan has made a significant progress in reducing crash deaths over the past two decades. It might be mainly contributed by several waves of law amendments including mandatory helmet and seatbelt wearing as well as stricter punishments for drunk driving. Stricter enforcements also played a crucial role for implementing these revised regulations.

The effectiveness of a new revision of Penalty Law on stricter sentence of imprisonment and higher fines for serious drunk driving requires more detailed observations. In addition, motorcycle involved accidents, which still covers a big portion and with severe outcomes, has become the principal target for promoting traffic safety in Taiwan. However, some structural barriers such as the riders' training system and traffic engineering design still need to change to enhance the safety performance of motorcycle riding. Along with the coming of aging society, the safety of elderly road users has been inevitably becoming a high priority issue in Taiwan. More research, evaluations, and institutional changes on these safety issues need to done to face the upcoming challenges.

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Appendix 1 Number of Population in Taiwan

Year	Total	Male	Female
1974	15,927,167	8,354,012	7,573,155
1975	16,223,089	8,501,391	7,721,698
1976	16,579,737	8,678,165	7,901,572
1977	16,882,053	8,829,635	8,052,418
1978	17,202,491	8,991,263	8,211,228
1979	17,543,067	9,160,239	8,382,828
1980	17,866,008	9,320,105	8,545,903
1981	18,193,955	9,479,508	8,714,447
1982	18,515,754	9,636,285	8,879,469
1983	18,790,538	9,769,572	9,020,966
1984	19,069,194	9,904,853	9,164,341
1985	19,313,825	10,023,344	9,290,481
1986	19,509,082	10,114,710	9,394,372
1987	19,725,010	10,217,434	9,507,576
1988	19,954,397	10,328,081	9,626,316
1989	20,156,587	10,424,102	9,732,485
1990	20,401,305	10,540,635	9,860,670
1991	20,605,831	10,640,276	9,965,555
1992	20,802,622	10,734,609	10,068,013
1993	20,995,416	10,824,161	10,171,255
1994	21,177,874	10,907,032	10,270,842
1995	21,357,431	10,990,657	10,366,774
1996	21,525,433	11,065,798	10,459,635
1997	21,742,815	11,163,764	10,579,051
1998	21,928,591	11,243,408	10,685,183
1999	22,092,387	11,312,728	10,779,659
2000	22,276,672	11,392,050	10,884,622
2001	22,405,568	11,441,651	10,963,917
2002	22,520,776	11,485,409	11,035,367
2003	22,604,550	11,515,062	11,089,488
2004	22,689,122	11,541,585	11,147,537
2005	22,770,383	11,562,440	11,207,943
2006	22,876,527	11,591,707	11,284,820
2007	22,958,360	11,608,767	11,349,593
2008	23,037,031	11,626,351	11,410,680
2009	23,119,772	11,636,734	11,483,038
2010	23,162,123	11,635,225	11,526,898

Source: Ministry of the Interior (2011).

Appendix 2 Road Length and Road Density in Taiwan

Year	Total (KM)	Freeway (KM)	Provincial Road(KM)	County Road(KM)	Rural Road(KM)	Exclusive Road(KM)	Urban Road (KM)	Road Density (M/KM^2)
1966	15,040	—	2,264	2,733	9,762	281	—	—
1971	15,747	—	2,471	2,725	10,216	335	—	—
1976	17,100	44	3,892	2,332	10,459	373	—	—
1981	17,522	373	3,981	2,330	10,451	386	—	—
1986	19,885	382	4,107	2,612	12,396	388	—	—
1991	28,472	382	4,062	2,613	12,429	387	8,600	791
1996	32,778	484	4,246	2,533	12,465	390	12,660	910
2000	35,750	608	4,447	2,455	12,475	390	15,375	993
2001	36,445	718	4,515	3,401	11,630	390	15,791	1,012
2002	37,016	789	4,573	3,426	11,613	414	16,201	1,028
2003	37,289	872	4,621	3,426	11,613	414	16,343	1,036
2004	37,918	901	4,680	3,359	11,639	414	16,925	1,053
2005	38,517	912	4,721	3,360	11,653	414	17,457	1,070
2006	39,285	954	4,843	3,358	11,654	414	18,062	1,091
2007	39,521	954	5,000	3,360	11,654	414	18,139	1,098
2008	40,306	993	5,024	3,484	11,560	396	18,849	1,119
2009	40,860	993	5,092	3,518	11,765	396	19,096	1,135
2010	41,383	993	4,984	3,544	11,765	396	19,701	1,149

Source: Ministry of Transportation and Communications (2011).

Appendix 3 Composition of Motor Vehicle in Taiwan

Year	Grand Total	Bus		Heavy Truck		Passenger Car			Light Truck		Motorcycle	
		Private	Business	Private	Business	Private	Business	Business (Taxi Only)	Private	Business	Heavy-type	Light-type
1952	10,710	244	1,379	1,511	2,188	2,089	490	490	316	9	—	—
1956	16,753	423	2,176	1,919	2,480	4,760	834	834	262	10	—	—
1961	56,774	498	3,102	2,880	3,675	6,671	2,297	2,297	1,280	34	—	—
1966	152,636	963	4,576	3,291	7,852	11,038	8,171	8,171	3,816	781	—	—
1971	957,295	1,732	7,168	8,028	13,964	32,824	22,287	22,287	24,686	907	517,684	308,808
1976	2,347,298	2,661	11,063	19,145	22,619	127,416	43,568	43,568	85,514	2,575	1,710,500	299,198
1981	5,413,409	4,726	14,064	34,782	31,782	438,052	68,239	68,239	206,748	4,556	3,833,293	758,254
1986	8,696,045	5,976	15,722	46,350	39,771	956,625	90,035	90,035	327,427	4,664	5,419,023	1,775,179
1991	10,611,036	5,381	14,739	66,184	54,977	2,440,685	100,679	100,679	489,381	5,786	4,798,804	2,610,371
1996	14,273,465	3,487	18,285	81,964	73,776	4,039,649	106,826	106,826	615,966	6,178	5,455,570	3,828,344
2000	17,022,689	2,748	21,175	81,003	74,620	4,608,960	107,257	107,257	643,796	9,167	6,848,116	4,575,056
2001	17,465,037	2,580	21,473	81,813	73,327	4,720,641	104,940	104,940	665,718	9,815	7,131,438	4,601,764
2002	17,906,957	2,326	22,753	82,649	73,156	4,888,050	101,286	101,286	690,750	10,228	7,386,784	4,596,973
2003	18,500,658	2,196	23,432	83,912	73,244	5,071,981	97,752	97,752	717,915	10,709	7,759,650	4,607,214
2004	19,183,136	2,042	24,411	85,662	74,798	5,262,693	128,155	95,665	743,939	14,870	8,239,700	4,554,250
2005	19,862,807	1,883	25,084	88,049	76,199	5,495,693	138,669	94,278	770,659	18,563	8,746,286	4,448,979
2006	20,307,197	1,812	25,710	90,142	76,069	5,555,507	142,817	92,418	783,979	21,611	9,225,155	4,331,873
2007	20,711,754	1,793	25,568	91,050	72,954	5,567,687	145,155	89,738	787,361	24,285	9,762,555	4,180,918
2008	21,092,358	1,723	25,616	91,215	70,016	5,530,314	144,112	88,779	786,782	25,658	10,349,865	4,015,577
2009	21,374,175	1,909	25,758	91,543	67,269	5,559,247	145,065	88,589	792,288	35,667	10,749,348	3,854,982
2010	21,721,447	1,856	27,174	93,304	67,780	5,642,969	160,444	87,449	803,493	28,973	11,112,224	3,732,708

Source: Ministry of Transportation and Communications (2011).

Appendix 4 Composition of Driver License in Taiwan

Year	Grand Total	Automobile Total	Automobile Driver										Motorcycle Total	Motorcycle Rider	
			Professional Driver					Private Vehicle Driver							
			Subtotal	TractorTrailer	Bus	HeavyTruck	SmallVehicle	Subtotal	TractorTrailer	Bus	HeavyTruck	SmallVehicle		Heavy-type	Light-type
1989	11,119,592	4,766,627	463,529	38,200	95,543	133,635	196,151	4,303,098	2,589	33,901	187,688	4,078,920	6,352,965	5,781,691	571,274
1991	12,743,375	5,717,706	479,595	45,931	91,779	138,387	203,498	5,238,111	4,259	41,961	225,769	4,966,122	7,025,669	6,372,518	653,151
1996	16,194,060	7,465,839	462,832	63,529	72,163	139,421	187,719	7,003,007	11,750	57,444	323,294	6,610,519	8,728,221	7,835,157	893,064
2000	18,934,549	8,692,270	465,117	82,460	67,826	136,709	178,122	8,227,153	18,157	67,773	400,630	7,740,593	10,242,279	9,185,365	1,056,914
2001	19,583,958	9,023,240	473,474	85,008	67,905	138,117	182,444	8,549,766	19,250	70,436	414,289	8,045,791	10,560,718	9,487,453	1,073,265
2002	20,509,658	9,611,677	479,541	88,790	70,945	138,486	181,320	9,132,136	21,305	77,742	446,380	8,586,709	10,897,981	9,802,092	1,095,889
2003	21,165,753	9,969,719	482,090	92,593	72,832	137,938	178,727	9,487,629	23,093	83,297	463,279	8,917,960	11,196,034	10,078,034	1,118,000
2004	21,803,355	10,334,755	482,931	96,201	74,218	136,974	175,538	9,851,824	25,185	89,207	478,777	9,258,655	11,468,600	10,345,748	1,122,852
2005	22,362,540	10,649,187	485,169	99,482	75,682	136,980	173,025	10,164,018	26,788	93,291	489,748	9,554,191	11,713,353	10,594,164	1,119,189
2006	22,846,348	10,885,591	486,501	108,170	79,180	136,850	162,301	10,399,090	28,192	96,585	493,249	9,781,064	11,960,757	10,849,663	1,111,094
2007	23,403,464	11,149,212	485,604	110,046	80,447	136,109	159,002	10,663,608	29,711	100,371	502,364	10,031,162	12,254,252	11,161,299	1,092,953
2008	23,939,606	11,390,746	483,240	111,291	82,045	134,124	155,780	10,907,506	31,478	103,697	509,645	10,262,686	12,548,860	11,480,318	1,068,542
2009	24,484,174	11,656,279	480,982	111,262	84,724	131,847	153,149	11,175,297	33,808	108,196	516,517	10,516,776	12,827,895	11,785,932	1,041,963
2010	25,044,273	11,942,217	476,944	111,371	85,828	129,271	150,474	11,465,273	36,477	112,703	524,715	10,791,378	13,102,056	12,083,127	1,018,929

Source: Ministry of Transportation and Communications (2011).

Appendix 5 Accident Frequency, Rate and Traffic Violations in Taiwan

Year	Total			A1 Accidents			A2 Accidents		Accident Rate per Ten Thousand Vehicles			Road Traffic Violations	
	Number (Event)	Fatality (Person)	Injury (Person)	Event (Number)	Fatality (Person)	Injury (Person)	Number (Event)	Injury (Person)	Event Rate (Number/ 1,000 Vehicles)	Fatality Rate (Number/ 1,000 Vehicles)	Injury Rate (Number/ 1,000 Vehicles)	Cases of Violations Cited (1,000 Events)	Fine(NT$ Million)
1966	6,045	948	7,793	6,045	948	7,793	—	—	468.19	73.42	603.58	—	—
1971	10,088	1,780	13,412	10,088	1,780	13,412	—	—	210.76	37.19	280.21	—	—
1976	10,517	3,087	14,792	10,517	3,087	14,792	—	—	48.53	14.24	68.26	—	—
1981	10,072	3,840	13,377	10,072	3,840	13,377	—	—	19.99	7.62	26.54	—	—
1986	8,630	4,139	9,983	8,630	4,139	9,983	—	—	10.37	4.97	11.99	—	—
1991	4,729	3,305	4,308	4,729	3,305	4,308	—	—	4.58	3.20	4.17	8,083	3,009
1996	3,619	2,990	2,939	3,619	2,990	2,939	—	—	2.63	2.18	2.14	20,538	10,713
2000	52,952	3,388	66,895	3,207	3,388	1,541	49,745	65,354	31.76	2.03	40.13	21,987	20,003
2001	64,264	3,344	80,612	3,142	3,344	1,490	61,122	79,122	37.27	1.94	46.75	20,192	23,096
2002	86,259	2,861	109,594	2,725	2,861	1,284	83,534	108,310	48.77	1.62	61.97	17,931	24,504
2003	120,223	2,718	156,303	2,572	2,718	1,262	117,651	155,041	66.04	1.49	85.86	13,781	21,932
2004	137,221	2,634	179,108	2,502	2,634	1,248	134,719	177,860	72.83	1.40	95.06	12,336	20,344
2005	155,814	2,894	203,087	2,767	2,894	1,383	153,047	201,704	79.81	1.48	104.02	11,966	20,547
2006	160,897	3,140	211,176	2,999	3,140	1,301	157,898	209,875	80.11	1.56	105.14	12,067	19,064
2007	163,971	2,573	216,927	2,463	2,573	1,006	161,508	215,921	79.95	1.25	105.77	12,493	19,908
2008	170,127	2,224	227,423	2,150	2,224	983	167,977	226,440	81.39	1.06	108.80	11,957	18,324
2009	184,749	2,092	246,994	2,016	2,092	893	182,733	246,101	87.01	0.99	116.32	11,027	16,738
2010	219,646	2,047	293,793	1,973	2,047	774	217,673	293,019	101.93	0.95	136.34	9,918	16,104

Source: Ministry of Transportation and Communications (2011).

Appendix 6 Numbers of Fatalities and Injuries by Transport Mode between 1999-2009

Year	Passenger Car Driver		Light Truck Driver		Heavy Truck Driver		Bus Driver		Motorcycle Rider		Pedestrian		Bicycle Rider		Passenger (all modes)		Other	
	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury	Fatality	Injury
1999	320	3,107	87	650	29	236	3	45	933	17,579	421	1,821	134	938	444	4,742	21	149
2000	476	6,646	143	1,502	39	390	4	89	1,526	40,383	477	4,488	200	2,123	493	10,946	31	297
2001	421	6,370	98	1,600	51	335	3	69	1,556	51,015	491	5,173	205	2,778	472	12,341	46	374
2002	287	6,256	74	1,560	30	371	7	72	1,429	71,537	443	6,447	168	4,044	384	15,319	39	426
2003	265	9,853	82	2,480	28	576	5	177	1,314	105,352	421	8,570	160	5,754	350	21,813	81	1,711
2004	267	11,001	74	2,618	34	607	9	151	1,304	121,960	409	9,867	170	6,473	315	24,983	52	1,440
2005	362	12,838	98	3,054	40	731	5	148	1,442	138,808	398	10,889	142	7,093	337	27,940	69	1,576
2006	309	12,353	83	2,858	37	716	4	100	1,742	146,372	361	10,926	183	7,356	367	29,214	49	1,387
2007	256	10,922	74	2,539	31	676	6	80	1,415	153,834	330	10,814	141	7,985	282	28,518	35	1,272
2008	209	10,124	69	2,389	27	437	0	49	1,263	164,415	278	11,369	139	9,593	218	29,053	21	1,239
2009	186	10,102	43	2,454	22	394	2	36	1,186	179,096	271	11,515	140	10,686	219	30,725	23	1,339
Total	3,358	99,572	925	23,704	368	5,469	48	1,016	15,110	1,190,351	4,300	91,879	1,782	64,823	3,881	235,594	467	11,210

Source: Institute of Transportation (2011b).

Appendix 7 Fatality Rate (per million population) among Developed Countries

Year / Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Taiwan	—	—	—	—	—	164	174	191	193	163	150
United States	154	153	149	148	149	147	146	147	143	136	123
Korea	226	232	218	171	152	151	136	132	131	127	121
New Zealand	132	134	121	118	103	115	107	99	95	100	86
Canada	97	98	95	90	93	87	85	91	89	83	82
OECD total	120	117	114	109	109	103	99	96	93	90	82
Eu-27	123	120	117	112	110	103	96	91	87	86	79
Norway	79	68	76	61	68	61	56	49	52	49	53
Japan	95	92	93	89	85	78	75	70	65	52	47
United Kingdom	62	62	62	63	63	62	57	55	55	50	43
Sweden	60	65	67	65	63	59	53	49	49	51	43

Note: No. of fatalities is based on (or estimated) 30-days.

Source: Institute of Transportation (2011b).

Changes in Traffic Safety Policies and Regulations in Turkey (1950–2010)

Changes in Traffic Safety Policies and Regulations in 7 Countries (1950-2010)

1. Introduction

In this report Turkey's policies on traffic safety and the general aspects are examined. First, we provide an overview of the main aspects of the problem of traffic accidents in Turkey. We began with a brief summary of the traffic regulations and transportation policies prior to year 1950. This information will help to clarify the background of the policies after 1950. We consider the issue of traffic accidents after 1950 to be a direct consequence of transportation policies, economic development, educational level, etc., as well as a consequence of various new laws and regulations on traffic. We then provide an overview of all the traffic laws that were in effect from the beginning of the republic period (1923) to the year 2010, highlighting their basic principles and newly adopted ideas. Next we provided important background information related to these laws and regulations, their objectives and goals, and the period in which these laws and policies were in effect. Finally, we explain the development of institutions on traffic safety and road transportation, and clarify their respective aims.

2. Overview of Traffic Accidents in Turkey

Road traffic accidents are a worldwide problem resulting in more than 1.2 million fatalities and between 20 and 50 million injuries every year [1]. Road traffic accidents are currently the ninth leading cause of death around the world. The World Health Organization (WHO) predicts that this figure will rise to become the fifth leading cause of death by the year 2030 (see Figure 1).

TOTAL 2004

RANK	LEADING CAUSE	%
1	Ischaemic heart disease	12.2
2	Cerebrovascular disease	9.7
3	Lower respiratory infections	7.0
4	Chronic obstructive pulmonary disease	5.1
5	Diarrhoeal diseases	3.6
6	HIV/AIDS	3.5
7	Tuberculosis	2.5
8	Trachea, bronchus, lung cancers	2.3
9	Road traffic injuries	2.2
10	Prematurity and low birth weight	2.0
11	Neonatal infections and other	1.9
12	Diabetes mellitus	1.9
13	Malaria	1.7
14	Hypertensive heart disease	1.7
15	Birth asphyxia and birth trauma	1.5
16	Self-inflicted injuries	1.4
17	Stomach cancer	1.4
18	Cirrhosis of the liver	1.3
19	Nephritis and nephrosis	1.3
20	Colon and rectum cancers	1.1

TOTAL 2030

RANK	LEADING CAUSE	%
1	Ischaemic heart disease	12.2
2	Cerebrovascular disease	9.7
3	Chronic obstructive pulmonary disease	7.0
4	Lower respiratory infections	5.1
5	Road traffic injuries	3.6
6	Trachea, bronchus, lung cancers	3.5
7	Diabetes mellitus	2.5
8	Hypertensive heart disease	2.3
9	Stomach cancer	2.2
10	HIV/AIDS	2.0
11	Nephritis and nephrosis	1.9
12	Self-inflicted injuries	1.9
13	Liver cancer	1.7
14	Colon and rectum cancers	1.7
15	Oesophagus cancer	1.5
16	Violence	1.4
17	Alzheimer and other dementias	1.4
18	Cirrhosis of the liver	1.3
19	Breast cancer	1.3
20	Tuberculosis	1.1

Figure 1 Leading cause of death, 2004 and 2030 compared [1]

The situation is even more severe for the developing countries. Over 90% of the world's traffic fatalities occur in low-income and middle-income countries, despite the fact that these countries have only 48% of the world's vehicles. Low-income and middle-income countries have higher road traffic fatality rates (21.5 and 19.5 deaths for every 100,000 people, respectively) than high-income countries (10.3 deaths per 100,000) [1]. Table 1 presents the accident data from various countries.

Table 1 Comparison of 2009 Traffic Accident Data from Various Countries [2] [3]

Country	Number of Fatal and Injury Accidents	Number of Fatalities	Number of Vehicles (x1,000)	Population (x1,000)	Vehicles per 1,000 population	Fatalities per 100,000 Vehicles	Fatalities per 100,000 People	Fatalities per billion veh-km
Austria	39,468	633	5,972	8,373	713	10.6	7.6	9.0
Canada	151,321	2,130	21,300	34,076	625	10.0	6.3	6.3
C. Republic	16,415	901	8,500	10,512	809	10.6	8.6	19.4
Finland	7,052	279	3,100	5,358	579	9.0	5.2	5.2
France	58,215	4,273	31,951	65,447	488	13.4	6.5	7.8
Germany	320,314	4,152	39,170	81,758	479	10.6	5.1	6.0
Japan	886,864	5,772	90,188	127,380	708	6.4	4.5	7.7
Netherlands	25,308	644	9,200	16,605	554	7.0	3.9	5.6
New Zealand	7,425	384	3,200	4,365	733	12.0	8.8	9.6
Norway	6,733	212	3,029	4,877	621	7.0	4.3	5.4
Poland	46,876	4,572	20,782	38,164	545	22.0	12.0	9.1
Portugal	35,680	840	5,600	10,637	526	15.0	7.9	
Slovenia	11,731	171	1,315	2,057	639	13.0	8.3	9.6
South Korea	209,524	5,838	20,850	49,773	419	28.0	11.7	20.0
Spain	99,797	2,714	30,156	45,989	656	9.0	5.9	
Sweden	16,344	358	5,114	9,349	547	7.0	3.8	4.4
Switzerland	27,088	349	4,986	7,783	641	7.0	4.5	5.7
Turkey	**110,906**	**4,324**	**14,317**	**72,561**	**197**	**30.0**	**5.9**	**43.4***
UK	258,404	2,337	35,409	62,042	571	6.6	3.8	4.6

*Due to the limited resources in travelling data, the figures include only accidents that occurred on freeways, state roads, and province roads.

Turkey, with 5.9 fatalities per every 100,000 people, may at first glance look like one of the safest countries. Yet because Turkey has the lowest vehicle ownership among the given countries, this statistic is misleading. A more meaningful formulation of the data would show that Turkey has a ratio of 30 fatalities per every 100,000 vehicles—which is the highest of all the countries cited above. For the better comparison, we might instead use the exposure data, i.e. the total vehicle-kilometers. When formulated this way, Turkey—with 43.4 fatalities per every billion vehicle kilometers—has by far the highest death ratio.

Moreover, it becomes clear that the situation in Turkey is even worse when traffic data only includes the fatalities that occurred within the day of accident. (Data in most of the other countries include the fatalities that occurred within 30 succeeding days of the accident.)

Accordingly, WHO estimates that these unreported fatalities are added, the number of fatalities in Turkey in 2009 rises from 4,324 to 6,022 [1].

3. Transportation Policies at the Beginning (1923-1950)

Since the founding of the Republic of Turkey, investments in transportation infrastructure have served as the backbone of the country's development policy. In the beginning, there were only 13,900km stabilized road and only 4,000 km of the total road network were in good condition. During the first 30 years of the new state, railroad constructions constituted the biggest government investments, and nearly no motorways were constructed. The natural difficulties in transportation that arose from the geography of the land had a huge role in shaping the social and economic structure of Turkey. The land's mountainous formation and lack of rivers suitable for travel made the transportation very costly and prevented the integration of social and economic life in Anatolia. In the 1920s, the prioritization of railroads was a response to the necessity of an integrated national market and to an increase in the export capacity of the country [4]. Railroad constructions began in 1924, and led to 3,360 km of new network in 20 years. Considering the simple construction technology and scarce resources of that time, construction of railroads was very fast.

Construction of motorways was very slow until the Second World War. Between 1923 and 1929, the length of the road network increased only from 13,900 km to 14,400 km. Yet the majority of these roads were not in good condition—in fact, by today's standards they would not even be regarded as "roads." Between 1923 and 1933, Turkey constructed 2,600 km of new stabilized road, and repaired 6,170 km of road. Between 1939 and 1945, the war economy brought transportation investments to a halt. In 1947, there was 825 km of asphalt road and 43,743 km of stabilized road [4]. Road infrastructure was not suitible for transportation at all.

4. Traffic Regulations (1923-1950)

The 564th and 565th clauses of Turkish Panel Code (Act No: 765), which came into effect on March 13, 1926, authorized the city police to control drivers who endanger the safety of life and property. These clauses were very effective in preventing traffic accidents. The clause the 565th in particular states that any person endangers another person or property on the street or in any open public space while driving automobile or riding an animal is subject to a jail term of 20 days and a nominal fine. Moreover, if this person is a professional driver or a coachman, he is subject to a one-month suspension of his driver's license. These statements were in effect the first traffic regulations in Turkey. At that time, there were only 1,000 automobiles in all of Turkey, 800 of which were in Istanbul [4].

Municipality Law (Act no: 1580), that came into effect on April 14, 1930, authorized the municipalities to control the maximum cargo limits of vehicles and to determine the classes and numbers of automobiles, trucks, buses and horse cars that travelled on the roads between municipal areas and villages. Moreover, the district municipalities began at this time to monitor driving skills and the health of the drivers. The same clause states that, for borders between towns, the municipalities are

responsible for determining the maximum and minimum speed limits and cruising price lists of carriage vehicles. The law also put municipalities in charge of maintaining traffic order. A traffic guideline was prepared and put into effect in order to accomplish these tasks. The guideline mainly concerns vehicle registrations and the administering of driver's license by conducting traffic tests and controlling the traffic order in big cities. However, by making the municipalities responsible for traffic services, the law resulted in different applications of rules in every municipality. In addition, other consequences of the law included difficulties in vehicle inspections, corruption in driver tests, and difficulties in traffic checks on the intercity roads and rural roads.

In 1934, the law passed regarding police duties gave the police officers the authorization to control drunk driving and other traffic offences that endanger the public safety.

As technology developed, the number of motor vehicles increased rapidly and traffic accidents became a big problem. For this reason, lawmakers and developers began to reconsider the road traffic law that was passed in 1930. As a result, General Directorate of Safety, the Ministry of Internal Affairs, and Ankara, Istanbul, Izmir Municipalities together prepared a new law draft. In 1938, this bill was submitted to the Grand National Assembly of Turkey (TBMM), but it did not pass.

During the Second World War, economic shortage had a negative effect on vehicle supply. After the war, the social and economic developments increased the demand on transportation services. In addition to this, technological advances made high-speed vehicles a real possibility, and countries all around the world began to construct new road systems. Within this global context, the road transportation in Turkey also developed rapidly. Due to all these developments, the number of traffic accidents, fatalities and injuries rapidly increased.

5. Transportation Policies and Traffic Regulations (1950-1980)

5.1 Transportation Policies

In the 1950s, particulary after the start of the U.S. Marshall Plan, construction of strategical roads became very important. Within the framework of Marshall aid, national govenment abandoned railroad transportation policies and ceased investments in railroads. The construction of motorways took up nearly 95% of all state investments on transportation [6]. Automotive firms that grew tremendously during the Second World War (e.g., American Ford, General Motors and petrolleum companies) strongly asserted that they were on the side of road transportation all around the world. Until 1950, Turkey's transportation infrastructure was largely based on rail transport. During the preliminary arrangements to Marshall Aid, the Vice Director of Federal Bureau of Public Roads, Mr. Hilts visited Turkey and prepared a report in 1947 suggesting improvements to the highway system. His suggestions were accepted by Turkish Ministry of Transportation in February 1948. Mr. Hilts´ suggestion appears to have been based on the premise of the necessity to distribute the increased

agricultural production nationwide. As a matter of fact, the highway systems of Turkey developed using machinery, asphalt and technical assistance all provided by the U.S. Many Turkish civil engineers were sent to the U.S. for education. On March 1, 1950, Turkey established The General Directorate of Highways (KGM), a beurocratic division not connected to Ministry of Transportation. KGM began to implement the construction of roads, and the Turkish Government increasingly put more effort into road constructions in the 1950s. Between 1952 and 1962, KGM's budget reached to 10% of the total state budget [4].

The period between 1950 and 1970 witnessed the rapid development of the road network system. In 1950, the total length of repaired and heavy-machinery-constructed roads was 8,024 km; this number increased to 33,000km in 1960. Moreover, the length of roads suitable for transport in any season was 9,624 km in 1950, and 22,000km in 1960 [7]. Between 1960 and 1970, the main policy for road construction was to build roads of low physical and geometrical proportions that were suitable for transport in both summer and winter. The paving of the roads became increasingly important during this period. By the end of 1970, the government initiated the construction of expressways. They had built superstructures for 48,125 km of the total 59,469 km of state and city roads, and asphalted 19,000 km of these roads. In the 1970s, they focused on improving the physical standards of roads, paving with asphalt 32% of the total road network. Road construction investments had the biggest portion of state's transportation budgets at that time. After 1980, despite a decrease in road investments in terms of the total state budget, freight and passenger transport on the roads did not slow down. In the 1980s, Turkey had 62,500 km of long road network, 34,000 km of which were paved with asphalt [7].

After 1960, Turkey's economic progress was promoted with development plans. The State Planning Organization played a major role during this period. Turkey announced that they would enact a series of four five-year development plans between 1960 and 1980. These plans included major development paths for critical economic sectors such as transportation, energy, housing, and finance. At the beginning of the planned period (1963), the portion of passenger transport by roads was 73%, railroads had 24%, maritime transportation had nearly 3%, and air transport had 1%. The portion of railroads in freight transport (43%) was nearly the same as road transportation (40%).

In the first five-year development plan, Turkey determined that the geometric standards of the roads were above the national need, but in the second plan, however, they stated that the standards were not sufficient. For that reason, Turkey began to generate new budgets for improving the geometrical standards as well as the physical standards of the roads.

During the first three plans (1963-1978), the growth of transportation sector was bigger than other sectors, and the portion of this sector in the gross national product increased from 7% in 1960 to 8.6% in 1978. Each plans' emphasis on the construction and repair of roads was not the result of a general concern for traffic safety. In fact, in the first three plans traffic safety precautions were insufficient in several regards. It was not until the second five-year plan (1968) that an emphasis on traffic accident was made, and this emphasis remained in place through the third plan (1973) [5]. Yet these plans stressed only the improvement of road standards. There were no budget plans for improving the traffic

signal system, for increasing awareness on traffic accidents, or for traffic education. In the fourth plan, they stressed the need to improve alternative transportation systems. However, the reason behind this emphasis was not the traffic safety considerations but rather the oil shortages and the recession of automotive sector of that time.

5.2 Traffic Safety Policies and Regulations

The General Directorate of Highways (KGM) was established on March 1, 1950 (Act no: 5539). The main duties of the KGM were improving the infrastructure of road network system and constructing new roads. These projects began to gather pace with the establishment of the KGM. The construction of new roads led to a more frequent use of motorways. As a result, the number of traffic accidents and the number of people killed and injured in traffic accidents rapidly increased. Before the 1950s, authorities did not sufficiently deal with the problem of traffic accident because railroads were still the dominant mode of freight and passenger transportation. Yet eventually, traffic accidents became a life and property threatening problem that had to be dealt with. For this reason, the govenment began to exert more effort in writing traffic laws, eventually resulting in the Road Traffic Act (Act number: 6085), which was passed by the Grand National Assembly of Turkey and came into force on May 11, 1953. This act was the first general law to deal specifically with road traffic. There has been a previous general law drafted in 1938, but this law did not pass through the parliement due to the general elections. This demonstrates that traffic safety problem had, by 1953, become a national security problem, and that previous laws were not sufficient in handling the problem.

Road Traffic Act (1953) states in its third clause that the "duty of arrangement and inspection of traffic is implemented by city and provincial traffic police who are directly connected to General Directorate of Security. Furthermore, City Security Directorates shall establish traffic bureaues in all city centers and towns where they have organizations." Through these means the law—passed 30 years after the decleration of the Turkish Republic—made possible the creation of a police organization that deals exclusively in traffic. The law assigned all additional duties to General Directorate of Highways and General Directorate of Security. It also established the City Traffic Commissions for making decisions about traffic order in cities. Furthermore, it gave extra obligations to municipalities in order to arrange traffic and construct infrastructure of roads in municipal borders. Before the Road Traffic Act of 1953, only the municipal police was responsible for the arrangement of traffic, and there was no central organization for traffic control. The new act, however, cancelled the clauses that were relevant to road traffic in the Municipalities Act (Act number: 1580) and assigned the main responsibility of controlling the traffic order was given to the General Directorate of Security.

The Road Traffic Act of 1953 stressed the following three main points:

- Penalties related to traffic offences will be given by the courts of justice,

- The arrangement and control of traffic will be implemented by the traffic police officers who have motorized vehicles,
- Making vehicle inspections and controls, and ensuring traffic safety equipments are the resposibilities of General Directorate of Highways.

With the act number 6547, dated May 2, 1955—Turkey became member of the Road Traffic Agreement that was signed in Geneva, Switzerland on September 19, 1949.

The General Directorate of Security Traffic Organization was established with the passing of Act 6376 on March 20, 1954. The Technical Commitee of Roads was founded with the passing of Act 6387 on March 21, 1954. And the Traffic Courts were established with the passing of Act 6406.

Subsequently, due to budget problems the Turkish government was not able to apply the Road Traffic Act throughout the whole of the country. The government had been commissioned to enforce the law gradually over a period of 4 years, with the goal of eventually assuming full enforcement responsibility. In the first year, the act applied only to Istanbul and Ankara. Some of other big cities joined in 1955, such as Bursa, Adana, Izmir and Aydın. In 1956, the act was expanded to apply to thirteen other cities. The remaining 48 cities were included in 1957. Finally, in March, 1958 the government completed the establishment of traffic organizations and applied the Road Traffic Act to all regions of Turkey.

Table 2 Number of Road Motor Vehicles by Type (1950-1980) [8]

Year	Car	Bus	Truck	Light Commercial vehicle*	Minibus, Van*	Motorcycle
1950	13,405	3,755	15,404	-	-	2,661
1951	16,427	4,569	18,356	-	-	3,464
1952	23,938	5,510	24,722	-	-	4,528
1953	27,692	5,933	27,549	-	-	6,587
1954	28,599	6,671	30,250	-	-	8,345
1955	29,970	6,848	34,429	-	-	9,510
1956	33,377	7,914	35,070	-	-	1,135
1957	36,755	8,291	36,919	-	-	9,743
1958	34,244	8,065	39,721	-	-	7,329
1959	37,616	8,881	48,094	-	-	8,215
1960	45,767	1,981	57,460	-	-	9,380
1961	52,381	1,956	64,706	-	-	11,076
1962	60,731	1,437	73,323	-	-	12,816
1963	72,034	1,269	80,695	-	-	15,055
1964	79,449	20,412	75,379	-	-	20,575
1965	87,584	22,169	79,121	-	-	26,094
1966	91,469	12,041	47,931	31,462	10,913	32,099
1967	11,367	13,332	56,889	39,927	16,008	39,647
1968	12,375	13,948	62,616	43,441	18,967	47,062
1969	13,345	15,529	69,478	48,655	20,540	52,959
1970	13,771	15,980	70,730	52,152	20,916	60,994
1971	15,676	17,140	73,433	57,011	22,380	68,417
1972	18,272	18,504	78,920	62,796	25,559	74,402
1973	24,360	20,011	86,780	71,043	30,055	80,860
1974	31,160	21,404	95,309	81,025	34,122	86,028
1975	40,546	23,763	108,381	98,579	40,623	91,421
1976	48,894	25,388	122,176	116,861	46,066	96,984
1977	560,424	27,096	138,093	134,213	51,999	102,127
1978	624,438	28,559	146,551	144,695	56,836	109,890
1979	688,687	30,634	157,095	155,278	61,596	120,378
1980	742,252	32,783	164,893	165,821	64,707	137,931

*Since the number of small trucks, vans and minibuses (Light Commercial Vehicles) are treated together with those of trucks and buses until the year 1966, these items could not be given separetely in the table.

Table 3 National Population (1950-1980)[8]

Year	Population In Census Years	Mid-Year Population Estimate
1950	20,947,188	20,807,000
1951		21,351,000
1952		21,951,000
1953		22,569,000
1954		23,204,000
1955	24,064,763	23,857,000
1956		24,540,000
1957		25,250,000
1958		25,981,000
1959		26,733,000
1960	27,754,820	27,506,000
1961		28,227,000
1962		28,931,000
1963		29,652,000
1964		30,391,000
1965	31,391,421	31,149,000
1966		31,936,000
1967		32,750,000
1968		33,586,000
1969		34,443,000
1970	35,605,176	35,321,000
1971		36,215,000
1972		37,132,000
1973		38,073,000
1974		39,037,000
1975	40,347,719	40,026,000
1976		40,916,000
1977		41,769,000
1978		42,641,000
1979		43,531,000
1980	44,736,957	44,439,000

*Annual intercental increase between two concecutive cencuses are calculated by formula $P^n=P_o\ e^{r.n}$

**Mid-year population is calculated by the annual population increase rate as of 1st of July

Where;

Pn : Population at n date (at the initial period),

Pn+t : Population at n+t date (t years later),

e : Logarithm,

r : Annual growth rate of population,

t : The time period between two dates (in years).

Table 4 Number of Accidents, Fatalities and Injuries on Roads in Turkey from 1955-1980 [8]

Year	Accidents	Fatalities	Injuries
1955	7,493	1,247	8,673
1956	7,397	1,083	7,370
1957	7,816	1,329	8,157
1958	6,856	1,206	6,636
1959	7,542	1,320	7,441
1960	8,136	1,590	7,729
1961	10,309	1,861	10,325
1962	11,770	2,086	11,691
1963	12,619	2,422	12,001
1964	14,043	2,526	13,273
1965	14,805	2,564	13,654
1966	16,218	3,134	15,138
1967	16,763	3,364	15,211
1968	19,973	3,747	16,896
1969	20,009	3,772	17,233
1970	19,207	3,978	16,838
1971	26,783	4,149	19,271
1972	29,891	4,282	21,423
1973	35,254	5,116	24,392
1974	40,674	4,699	25,065
1975	46,643	6,054	30,864
1976	50,475	5,389	30,207
1977	56,467	6,983	33,144
1978	51,853	5,417	30,407
1979	41,481	4,368	25,332
1980	36,960	4,100	23,816

Table 5 Annual Traffic Accident Injuries and Fatalities by Mode of Transport (1955-1960) [9]

	1955		1956		1957	
Type of Vehicle	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
Motorcycle	26	381	17	338	20	282
Automobile	144	2,035	141	1,976	113	1,902
Bus	155	1,416	128	1,268	172	1,142
Minumus						
Truck	655	3,214	565	2,565	722	2,860
Small Truck	68	609	40	389	61	507

	1958		1959		1960	
Type of Vehicle	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
Motorcycle	23	255	19	298	14	274
Automobile	141	1,601	157	1,908	188	1,794
Bus	137	1,147	175	1,390	239	1,383
Minibus						
Truck	656	2,233	713	2,714	800	2,888
Small Truck	72	554	69	542	119	886

As seen in Table 2, vehicle ownership numbers increased four times between 1950 and 1960. This was a result of (1) newly added motorways and (2) changes in transportation policies that caused a decrease in railroad use. Because the road network was used primarily for freight transport, trucks numbered more than any other vehicle type. However, Table 4 shows that there was nearly no changes in the number of road accidents, fatalities and injuries during these years. This indicates that newly adopted traffic regulations and traffic police were efficient in keeping accident numbers approximately the same. Considering vehicle properties and safety criteria in the automotive sector at that time, the increase in the length of asphalt roads can be another reason for the similar numbers.

At first, Turkey experienced many problems in implementation the Road Traffic Act of 1953. After the start of its country-wide implementation in 1958, each traffic organization sustained its own development. The traffic system was improved in terms of vehicle registrations, driver's licenses, traffic signals, vehicle inspection stations, traffic police, tickets, insurances and vehicle taxes. The new traffic system was first becoming similar to the system of develped countries in terms of both organizational and regulational aspects. However, the coordination between different traffic organizations was not developing as expected, and this led to many problems. Hence, the issue of traffic safety remained inefficient.

In 1961, Road Traffic Act was replaced by a new act—Act 232 which was designed to handle the difficulties in applying the traffic law. With this change, police became authorized to issue tickets for certain traffic violations. Furthermore, judicial responsibility for traffic offences was taken form

drivers and given to the vehicle owners. Tractors now had to be registered, and the tractor drivers were obliged to acquire a driver's license.

In 1964 and 1967, two changes were added to the Road Traffic Act based on Acts 471 and 866. Despite all these improvements, however, the problems related to the application of the act continued to persist. The act was not sufficient to handle the expansion of road network, or to respond to the increasing number of vehicle and road accidents. The act also proved ineffective in improving coodination between the various traffic organizations. Between 1960 and 1980, the number of automobiles increased from 46,000 to 742,000. And the rate of increase in the number of motocycles was even greater. The number of fatalities was nearly 1,900 in the year 1960, and this number gradually increased up to 7,000 in 1977.

The lack of a comprehensive traffic safety plan and proper consideration of traffic safety resulted in a large increase in the number of road accidents. Improvements in geometrical and technical standards of roads in 1970s could not compensate the rapid increase in the number of vehicle ownership. In addition, speed limits were the same as the European countries but the geometry and superstructure of roads were not suitable for those limits.

6. Transportation Policies (1980-2010)

The share of transportation investments in the total public investments was 20.5% in 1983 and it gradually increased to 32.3% in 1988. This made up the largest portion of public investments. In 1988, the transportation sector made up 9.1% of gross domestic product. At the 2nd Izmir Economy Congress, representative of State Planning Organization M. Barutçu, summarized the state's transportation policy as follows:

"…In the field of transportation sector we must aim for ***(1)*** *the lowest-cost transportation services,* ***(2)*** *fast transportation services,****(3)*** *safe transportation services,****(4)*** *the permenant improvement and cutting edge technology compatible with transportation services,* ***(5)*** *efficient, comfortable and suitable transportation services. To reach these objectives, we will prepare the "Master Plan of Transportation." The way to have a consistent and progressive transportation policy is to have comprehensive and reliable data and policies. We can only do this by preparing master plans for every economic sector"* [6].

During this period, Turkey put together the "1983-1993 Transportation Master Plan," the goal of which was obtaining a healty transportation structure. With regard to the question of how to enhance the road system, they placed their main emphasis on "the improvement of life- and property-safety in areas of transportation." The plan targeted a decrease in freight- and passanger-transportation ratio on roads in order to effect a structural change in the transportation system. The table below illustrates the

targeted distributions of passenger and freight transport with respect to transportation types in 1980 and 1993.

Table 6 Distribution Targets of Passenger and Freight Transport by Type of Transportation (1980-1993) [4]

Type of Transportation	Passenger Transport		Freight Transport	
	% 1980	% 1993	% 1980	% 1993
Maritime	1.18	1.08	15.87	32.16
Rail	4.12	4.08	10.41	27.45
Road	93.96	94.06	72.26	36.06
Air	0.74	0.82	0.1	0.2

As seen from Table 6, they envisaged no major change in passenger transport, and instead attempted to transfer the freight transport load to maritime and rail transportation in order to achieve a balance between the transportation types. They intended to revise the plan every three years. However, looking at the final distribution figures, they were ultimately unable to meet their targets. This might show that the master plan was not implemented successfully.

The total length of railroads was 8,397 km in 1980, and it was only increased by 210 km when it reached 8,607 km in 1997. The present railroad network is still not convenient for fast transportation, and the network is at the end of its economic life. Due to these facts, it is clear that the railroad transportation is far behind the road transportation.

Table 7 The Distribution of Passenger and Freight Transport by Transportation Types [4]

	Road		Rail	
Year	Passenger	Freight	Passenger	Freight
1960	37.8	72.9	47.7	24.3
1970	60.9	91.4	21.2	7.6
1980	73.5	94.8	10.1	4.5
1990	81	94.6	10	4.5
1997	92.6	94.8	7.2	3.6

With regard to city roads, subway projects were implemented in big cities such as Ankara and Istanbul for the purpose of decreasing the traffic loads on roads. However, public transportation projects such as the Kızılay-Batıkent Subway in Ankara and the Aksaray-Yeniköy Subway in İstanbul were not effectively meeting the needs of the population growth and, therefore, only the number of subway users increased to problematic levels. The consequences of having an insufficient public transportation system pushed people to buy private vehicles. This resulted in a rapid increase in the number of car ownership and in traffic volumes on the city roads. Traffic congestion and increasing travel times also brougth about considerable energy losts [4].

Significantly, in 1980s and 1990s authorities began to acknowledge the importance to freeway constructions. In 1999, the General Directorate of Highways owned 62,611 km of state roads and province roads, and 1,726 km of long freeways. Freeways in Ankara-Istanbul-Edirne, Aydın-Izmir, and Adana-Gaziantep were completed during this period [4].

7. Traffic Safety Policies and Traffic Regulations (1980-2010)

In 1981, Ministry of Internal Affairs started preparing a law draft of a new Road Traffic Act that would respond to the necessities of Turkey and be in accordance with other international laws. In preparation of this law, the ministry made use of the regulations of foreign countries regarding technical topics and common provisions. After a substantial study of the draft, it was passed into law on October 13, 1983 under the name Road Traffic Act 2918. The authorities decided that some of the clauses would be activated after 20 months, so the full effectuation of policies of the law was on June 18, 1985.

With the passing of this law, a new organizing period was initiated in order to begin its implementation. According to the 5th clause of the law, traffic organizations was established in centers, regions, cities and counties. Furthermore, the law authorised traffic police the use of scientific methods for evaluating traffic accidents. Another feature of this law was that it sent a message that anyone who commits a traffic crime risks getting caught, thus increasing the perceived presence of state authority over the roads.

In addition, the law also gave the various ministries of public works, health, national education, transportation, agriculture and forestry the authorizations, duties and responsibilities of making roads safer and improving technical services such as infrastructure services.

The main subjects that the Road Traffic Act (1983) stressed were listed as follows:

- The redetermination of authorities, duties and responsibilities of relevant organizations related to the evaluation of traffic rules, human errors, vehicles and roads.
- The establishment of traffic schools to educate driver candidates.
- Embedding mandatory traffic courses in the curriculum of the primary schools and high schools.
- Putting emphasis on the safety of students in traffic.
- Authorization of traffic police to take the minutes according to the license plates of the vehicles when the driver of the vehicle cannot be identified.
- Improving the standards of vehicle inspections with more scientific methods.
- Determining penalty points for every traffic crime. (It was decided that when a driver exceeds 100 penalty points, his driver's license would be suspended for two months.)

7.1 Main Arrangements in the Road Traffic Act (1983)

(1) Alcohol Levels

It is stated both in the Road Traffic Act and the Road Traffic Regulation that drunk driving is to be regarded as a traffic offence.

The prohibition of driving while under the influence of alcohol (measured by the amount in the blood) falls under two cases:

- Public servants, taxi and jitney drivers, as well as drivers of minibuses, busses, trucks, carriers that transport passengers and cargo are not allowed to drive with any quantity of alcohol in the blood.
- All drivers other than those stated above cannot drive if the alcohol quantity in their blood exceeds 0.5 promils.

If a drunk driver is involved in a traffic accident, the alcohol quantity in his blood is determined and recorded in the accident minutes by the police. If it is the driver's first drunk driving offence, his driver's license will be confiscated for six months. If it is his/her second offence, it will be confiscated for two years. For third-time offenders, the period of suspension is five years. In addition, the driver has to comply with the requirements such as tickets and mandatory traffic trainings. Psychiatric treatment is required if it is the third traffic accident caused by drunk driving. In the cases of accidents involving fatalities and injuries, they will be recorded as serious faults in their accident minutes.

The use of drugs or other pleasure-inducing substances is illegal in Turkey [5]. In addition to the penalties given for the drug usage, if the police detect that a driver used drugs, the driver will be subject to a minimum penalty of a six-months prison sentence, a nominal fine, and an indefinite confiscation of the driver's license.

(2) Speed Limits

The Road Traffic Act contains three clauses that concern speed limits on roads. Unless special arrangements are stated, the speed limit on state roads and province roads is 90 km/h. On freeways and in residential areas, the speed limits are 120 km/h and 50 km/h, respectively.

Table 8 Speed Limits on Turkish Roads [10]

Type of Vehicle	Residential areas	Outside residential areas	Freeways
Automobile	50	90	120
Bus	50	80	100
Minibus, Truck, Small Truck	50	80	90
Motorcycle and Jeep	50	70	80
Vehicle Carrying Hazardous Substances	30	50	60
Bicycle	30	50	-
Tractor and Heavy Equipment	20	20	-

Special Cases on Speed Limits:

- If there is no force majeure, minimum speed limits are 15 km/h on intercity roads and 40 km/h on freeways.
- Vehicles carrying hazardous substances can move between the speed limits of their vehicle types if they are unloaded.
- The speed limit of truck trailers and wreckers is 15 km/h when they are pulling vehicles that have brake failures.
- Ministry of Internal Affairs can increase the speed limits of automobiles on freeways by 20 km/h by taking the view of Ministry of Public Works.
- The penalty of exceeding the speed limits by an excess of between 10% and 30% was $74 (140 Turkish Liras); for exceeding the speed limits by more than 30%, the fine was $153 (290 TL) in 2010. If a driver exceeds the speed limits by 30% five times within a year, his/her driver's license will be suspended for one year.

(3) Seat Belt Usage and Security Systems

According to the Road Traffic Act, "certain drivers and passengers must use security systems on the roads." The arrangements on the security systems are set out in the Road Traffic Regulation.

- The drivers and passengers of motorcycles and motorized bicycles are required to wear helmets; and the drivers of these vehicles are required to wear safety glasses.
- Drivers and front-seat passengers of automobiles, buses, minibuses, trucks and small trucks are required to wear seat belts. In 1995, a change in traffic regulation made it obligatory to install back-seat passenger seat belts for vehicles imported or produced in Turkey.
- Sitting on the front seats of vehicles is forbidden for children under ten years old.

(4) Space Cushions

The Road Traffic Regulation determined "space cushions" as follows:

- Drivers must not drive too close to the vehicle immediately in front of them. The distance should be at least half of their vehicle speed in km/h in terms of meters.
- The “space cushion” should be equal to the distance that the trailing vehicle moves in two seconds.
- The vehicles carrying hazardous substances have to maintain at least a 50m distance when following another vehicle.
- The drivers of the vehicles moving in a convoy should remain far enough away from the next car to allow for passing vehicle to enter.

8. Road Traffic Accidents in Turkey (1980-2010)

Although the transportation sector offers alternative modes such as maritime, railway and airline, the chief mode of transportation in Turkey is road transportation (Table 6). The dominant role of road transport in passenger and cargo transportation and the low safety level of traffic environment (which is not adequate to the road-dominated transportation system) cause a high frequency of traffic accidents. Some of the main reasons behind these traffic accidents can be listed as following: the rapid increase in the number of motorized vehicles, an insufficient road system, inadequate road safety policies, reckless driving, and inadequate emergency services. Traffic accidents result in deaths, injuries,disabled persons and enormous economical losses.

Table 9 Number of Vehicles by Type (1980-2010) [8]

Year	Car	Bus	Truck	Light Commercial vehicle	Minibus, Van	Motorcycle
1981	776,432	33,839	172,372	172,269	66,514	160,557
1982	811,465	35,432	180,772	178,762	69,598	182,795
1983	856,350	38,478	190,277	186,427	73,585	217,327
1984	919,577	43,638	197,721	198,106	80,697	256,338
1985	983,444	47,119	205,496	212,505	87,951	289,052
1986	1,087,234	50,798	217,111	224,755	97,917	327,326
1987	1,193,021	53,554	225,872	233,480	106,314	369,894
1988	1,310,257	56,172	234,166	240,718	112,885	420,889
1989	1,434,830	58,859	241,392	248,567	118,026	472,853
1990	1,649,879	63,700	257,353	263,407	125,399	531,941
1991	1,864,344	68,973	273,409	280,891	133,632	590,488
1992	2,181,388	75,592	287,160	308,180	145,312	655,347
1993	2,619,852	84,254	305,511	354,290	159,900	743,320
1994	2,861,640	87,545	313,771	374,473	166,424	788,786
1995	3,058,511	90,197	321,421	397,743	173,051	819,922
1996	3,274,156	94,978	333,269	442,788	182,694	854,150
1997	3,570,105	101,896	353,586	529,838	197,057	905,121
1998	3,838,288	108,361	371,163	626,004	211,495	940,935
1999	4,072,326	112,186	378,967	692,935	221,683	975,746
2000	4,422,180	118,454	394,283	794,459	235,885	1,011,284
2001	4,534,803	119,306	396,493	833,175	239,381	1,031,221
2002	4,600,140	120,097	399,025	875,381	241,700	1,046,907
2003	4,700,343	123,500	405,034	973,457	245,394	1,073,415
2004	5,400,440	152,712	647,420	1,259,867	318,954	1,218,677
2005	5,772,745	163,390	676,929	1,475,057	338,539	1,441,066
2006	6,140,992	175,949	709,535	1,695,624	357,523	1,822,831
2007	6,472,156	198,128	729,202	1,890,459	372,601	2,003,492
2008	6,796,629	199,934	744,217	2,066,007	383,548	2,181,383
2009	7,093,964	201,033	727,302	2,204,951	384,053	2,303,261

Table 10 Road Accidents, Fatalities and Injuries (1980-2010) [8]

Year	Population	Number of Driver's Licenses	Number of Accidents	Fatalities	Injuries
1981	45,540,000		40,023	4,327	27,711
1982	46,688,000		46,264	4,832	35,489
1983	47,864,000		55,256	5,200	43,888
1984	49,070,000		60,705	5,684	49,234
1985	50,306,000		63,473	5,477	49,058
1986	51,433,000		92,468	7,278	71,445
1987	52,561,000		110,207	7,661	80,456
1988	53,715,000		107,651	6,848	79,243
1989	54,893,000		103,758	6,352	79,928
1990	56,098,000		115,295	6,317	87,668
1991	57,064,000		142,145	6,231	90,520
1992	57,931,000		171,741	6,214	94,824
1993	58,812,000		208,823	6,457	104,330
1994	59,706,000		233,803	5,942	104,717
1995	60,614,000		279,663	6,004	114,319
1996	61,536,000		344,643	5,428	104,599
1997	62,510,000		387,533	5,125	106,246
1998	63,451,000		440,149	4,935	114,552
1999	64,385,000		465,915	5,713	125,158
2000	65,311,000		500,664	5,510	136,751
2001	66,229,000	14,491,332	442,960	4,386	116,203
2002	67,140,000	14,994,960	439,777	4,093	116,412
2003	68,043,000	15,488,493	455,637	3,946	118,214
2004	68,938,000	16,151,623	537,352	4,427	136,437
2005	69,825,000	16,958,895	620,789	4,505	154,086
2006	70,703,000	17,586,179	728,755	4,633	169,080
2007	70,586,256	18,422,958	528,561	5,007	189,057
2008	71,517,100	19,377,790	950,120	4,236	184,468
2009	72,561,312	20,460,739	1,053,346	4,324	201,380
2010	73,722,988	21,548,381	1,106,201	4,045	211,496

Table 10 shows the trends in the number of accidents, fatalities and injuries that occurred on roads in Turkey between 1981 and 2010. The number of accidents has continued to increase each year, culminating in 1,000,000 accidents in 2009. This increasing trend can be attributed to the rapid increase in population and the high number of vehicles on the road in the last decade. Table 10 shows that the number of persons killed in road accidents have been decreasing since 1988 and 1989, even though the numbers of accidents and persons injured have been increasing after a local decrease in 1988 and 1989. This trend deviation is attributable to the construction of freeways and safer road infrastructures.

Table 11 Annual Traffic Accident Injuries and Fatalities by Mode of Transport (1990-1999) [11]

Type of Vehicle	1990		1991		1992	
	Fatalities	Injuries	Fatalities	Injuries.	Fatalities	Injuries
Motorcycle	436	8,747	468	9,525	507	11,291
Automobile	2,020	33,034	2,184	35,327	2,115	37,671
Bus	337	5,357	324	5,600	529	5,986
Minibus	187	5,455	230	5,728	241	5,969
Truck	420	4,758	368	5,326	445	5,538
Small Truck	104	2,960	144	3,080	104	3,177

Type of Vehicle	1993		1994		1995	
	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
Motorcycle	556	12,697	405	10,406	356	10,702
Automobile	2,398	44,570	2,379	47,854	2,505	52,609
Bus	447	6,024	316	5,318	293	5,715
Minibus	272	6,278	205	5,760	232	5,812
Truck	386	5,559	430	5,776	530	6,959
Small Truck	146	3,906	152	4,139	149	4,787

Type of Vehicle	1996		1997		1998	
	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
Motorcycle	139	4,074	172	5,867	327	12,191
Automobile	1,568	22,785	2,520	58,880	3,342	9,3414
Bus	389	2,996	544	7,381	720	12,277
Minibus	113	2,725	270	7,457	414	12,423
Truck	302	4,424	921	1,110	1,908	21,549
Small Truck	127	2,474	316	9,265	602	17,585

Type of Vehicle	1999	
	Fatalities	Injuries
Motorcycle	141	7,778
Automobile	1,208	40,876
Bus	191	3,168
Minibus	135	3,810
Truck	514	5,995
Small Truck	272	8,952

In order to provide a safe traffic environment, various organizations responsible for traffic issues have made considerable effort, and the media has offered its support in raising safety awareness among drivers, pedestrians, passengers and institutions.

In December 2001, the Turkish government established the “National Traffic Safety Program for Turkey“ to diminish the magnitude of the problem caused by traffic accidents. The objectives of this program were as follows

- To increase enforcement on traffic safety with rules, legislations and regulations.

- To minimize losses and damages caused by traffic accidents.
- To improve efficiency of transport infrastructure safety.
- To raise road users' awareness of and willingness to comply with the law.
- To decrease traffic volume on roads by improving other alternative transportation systems.

This safety program covered the period from 2002 to 2011, and established several mid-term and long-term strategies. The objectives of the mid-term strategies (2002-2006) were to reduce the number of road traffic fatalities by 20%, the number of accidents involving unprotected road users by 20% (passengers and cyclists), and the number of accidents involving children aged between 0-14 years by 25%. The long-term strategy has aimed to reduce road traffic fatalities by 40%, the number of accidents involving unprotected road users by 40%, and the number of accidents involving children aged between 0-14 years by 50% [13].

Consequently, in recent years there has been a marked decline in traffic acciden; however, traffic accidents still remain one of the most serious problems in Turkey.While the number of fatalities has decreased, the number of injuries has continued to rise in past years. The above-mentioned improvements have helped to decrease the severity of accidents, yet they have not yet eliminated injury risk. It seems that there is still a large potential for improving road safety in Turkey. To achieve this, it is necessary to understand the causes of the accidents and to adopt a methodical approach to find remedial actions.

There are three categories of factors affecting accident occurrences: road environment, vehicles, and road users. These factors have a combined role in causing accidents, and it is necessary to evaluate all three to understand the nature of accidents.

Table 12 Fault Distribution in Police Reports for the Road Traffic Accidents in Turkey [12]

Year	**Accident Fault Distribution (%)**				
	Driver	**Road**	**Vehicle**	**Pedestrian**	**Passenger**
2000	96.06	0.77	0.52	2.40	0.25
2001	96.56	0.43	0.38	2.32	0.31
2002	96.82	0.25	0.31	2.39	0.23
2003	97.03	0.22	0.27	2.32	0.16
2004	97.30	0.19	0.22	2.18	0.11
2005	97.39	0.22	0.25	2.03	0.11
2006	98.07	0.13	0.10	1.61	0.09
2007	98.03	0.11	0.14	1.63	0.09
2008*	90.53	0.42	0.26	8.36	0.43
2009*	89.60	0.61	0.29	9.09	0.41
Average	**95.74**	**0.34**	**0.27**	**3.43**	**0.22**

* For fatal and injury accidents only

Table 12 shows the fault distributions (according to the police reports) for traffic accidents that occurred between 2000 and 2009 in Turkey. According to this data, drivers are responsible for

95.74% of all accidents, while the road environment and the vehicles are only responsible for 0.34% and 0.27%, respectively. However, the problem is that the majority of the police officers do not have the necessary education about highway design to come up with a sound judgment about the road deficiencies that lead to an accident. Moreover, current accident data forms include a detailed list of driver faults to help the officer decide, while there is little space on the form for road deficiencies. (This is partly because the possible design problems that can cause an accident are innumerable.) Given the current state of the forms, it is much easier to blame drivers rather than conduct a thorough investigation of road deficiencies. Hence, it is understandable that the police officers cite drivers as the sole cause for the majority of the accidents.

Unfortunately, however, merely faulting drivers as the primary cause of accidents will not lead to a reduction in accidents. It should be taken into account that faulty road design is often the cause of human error. The road environment and the vehicles must be designed, built and maintained to inform the road users in a way that minimize the possibility of human error. A well-designed road should allow road users to accurately perceive the demands of the road environment and prevent crashes from occurring in the first place. If there is a failure in the road user's ability to accurately perceive this demand, then the roadway should be "forgiving," i.e. it should enable the road user to recover and continue, thereby changing the outcome of the event or minimizing the severity of the accident. Roadsides designed according to these principles are called "forgiving roadsides" [14].

"Roadside design" is the design of the area between the outside shoulder edge and the right-of-way limits. Considering the limited amount of infrastructure funds, one may question whether spending resources on materials other than pavement is beneficial. Yet statistics show how important roadside safety in the reduction of accident severity [15].

Table 13 shows the number of accidents involving fatality and injuries by the accident types, as occurred in 2009.

Table 13 Number of Accidents in Turkey Involving Fatalities and Injuries by Accident Type (2009) [12]

Type of Accident	Accidents Involving Fatality		Accidents Involving Injury		Total	
	Number of Accidents	%	Number of Accidents	%	Number of Accidents	%
1) Front collision	333	14.33	5,556	6.21	5,889	6.42
2) Rear-end collision	210	9.04	9,564	10.70	9,774	10.66
3) Side collision	316	13.60	28,540	31.92	28,856	31.46
4) Collision with stationary vehicle	61	2.63	2,350	2.63	2,411	2.63
5) Collision with fixed object	207	8.91	8,684	9.71	8,891	9.69
6) Hitting pedestrian	530	22.82	16,148	18.06	16,678	18.18
7) Hitting animal	5	0.22	312	0.35	317	0.35
8) Overturning	217	9.34	6,798	7.60	7,015	7.65
9) Running off the road	427	18.38	11,090	12.40	11,517	12.56
10) Passengers dropped from the vehicle	16	0.69	316	0.35	332	0.36
11) Supplies dropped from the vehicle	1	0.04	48	0.05	49	0.05
Total	**2,323**	**100**	**89,406**	**100**	**91,729**	**100**
(5+8+9) Roadside Accidents	**851**	**36.63**	**26,572**	**29.72**	**27,423**	**29.90**

Among the given eleven types of accidents in Table 13, three are associated with roadside safety. The majority of accidents involving fixed object collisions, overturning and running off the road occur at the roadside. According to the table, 29.9% of accidents involving fatlity and injury happen at the roadside. In other words, one in every three serious accidents ends up at the roadside. The table also shows that 36.63% and 29.72% of the roadside accidents end up with fatality and injury, respectively.

These figures become even more striking when the data is categorized by the accident location, as it is done in Table 14. The table shows that, in rural areas 60.57% of all the fatal and injury accidents are roadside accidents. Hence, for the rural roads, designing a safe roadside becomes much more important than designing the road itself.

Table 14 Number of Accidents in Turkey Involving Fatalities and Injuries by Accident Location and the Accident Type (2009) [12]

Type of Accident	Rural		Urban		Total	
	Number of Accidents	%	Number of Accidents	%	Number of Accidents	%
1) Front collision	1,192	5.49	4,697	6.71	5,889	6.42
2) Rear-end collision	2,789	12.84	6,985	9.98	9,774	10.66
3) Side collision	3,194	14.71	25,662	36.65	28,856	31.46
4) Collision with stationary vehicle	330	1.52	2,081	2.97	2,411	2.63
5) Collision with fixed object	2,246	10.34	6,645	9.49	8,891	9.69
6) Hitting pedestrian	813	3.74	15,865	22.66	16,678	18.18
7) Hitting animal	180	0.83	137	0.20	317	0.35
8) Overturning	3,402	15.66	3,613	5.16	7,015	7.65
9) Running off the road	7,508	34.57	4,009	5.73	11,517	12.56
10) Passengers dropped from the vehicle	41	0.19	291	0.42	332	0.36
11) Supplies dropped from the vehicle	24	0,.11	25	0.04	49	0.05
Total	**21,719**	**100**	**70,010**	**100**	**91,729**	**100**
(5+8+9) Roadside Accidents	**13,156**	**60.57**	**14,267**	**20.38**	**27,423**	**29.90**

In Table 15, serious accidents in Turkey (2009) by the number of vehicles involved are presented. The table shows that 47.55% of all serious accidents are single vehicle only. This value supports the previously stated assumption that the majority of fixed object collisions, overturning and running off the road accidents happen at the roadside. Due to the nature of them, single vehicle accidents can only end up with a roadside, pedestrian or animal collision. Subtracting the hitting pedestrian (18.18%) and hitting animal (0.35%) accident ratios from the single vehicle only (47.55%) accident ratio gives 29,02% which is very close to the assumed roadside accident ratio of 29.9%. Therefore, it can be said that that approximately 30% of all the serious accidents are single vehicle, running off the road type accidents. Roadside areas are often unsafe, with steep and high side slopes, stone or concrete lined ditches, rock cuttings and hazardous objects (e.g., poles and trees) close to the roadway. Guardrails are often missing. In many medians there are dangerous columns and no guardrails. Deformable and energy absorbing supports are not used.

Table 15 Serious Accidents in Turkey by the Number of Vehicles Involved (2009) [12]

Number of Vehicles Involved	Accidents Involving Death		Accidents Involving Injury		Total	
	Number of Accidents	%	Number of Accidents	%	Number of Accidents	%
Single Vehicle	1,347	57.99	42,266	47.27	43,613	47.55
Two Vehicles	837	36.03	41,839	46.80	42,676	46.52
Multiple Vehicles	139	5.98	5,301	5.93	5,440	5.93
Total	**2,323**	**100**	**89,406**	**100**	**91,729**	**100**

It was suggested in the *Road Improvement and Traffic Safety Project* (Sweroad 2001) that roadside design principles should be reconsidered and a new design code should be prepared. General Directorate of Highways (KGM) prepared a new road design code that was mainly based on AASHTO (American Association of State Highway and Transportation Officials) manual of the US. Before the new code, roadsides were designed and constructed according to the road design regulation prepared in 1965 and revised in 1997 [13]. The old code had insufficient emphasis on the roadside safety. Since 2002, Turkish roads have been designed according to the new code, and roadside improvements have been carried out by KGM.

9. Organizations Relevant to Traffic Safety in Turkey

Although different ministries and organizations share the responsibilities, in the present situation the main actors on the national level are:

- The General Directorate of Security, under the Ministry of Internal Affairs,
- The General Directorate of Highways under the Ministry of Public Works,
- 81 Municipilities. Although there are some unions of municipilities, they are not acting as representative bodies in the traffic safety area.

There are several voluntary organizations, but they are not represented by one single organization. Some of them have the right to attend coordination councils.

The Ministry of Transportation has a very minor role in highway transportation and traffic safety. Railway transportation is governed by the Ministry of Transportation, and it is also responsible for regulation of the transportation sector.

Turley has attempted to establish cooperation on a national scale through two safety councils described below. On a provincial base, the province and town (sub-province) traffic commissions

obtain coordination with one another. These councils and commissions have the rights to make traffic regulation decisions.

The State Planning Organization, which is directly subordinated to the Prime Ministry, evaluates plan and budget proposals. There are no mid- and long-term plans. There are short-term plans for transportaion sectors. There is also a lack of plans for traffic safety.

The main roles and responsibilities of different ministries/organizations are summarized as follows.

(1) Ministry of Internal Affairs - General Directorate of Security and General Commandership of Gendarmerie

- Law enforcement (traffic control and monitoring),
- Registration of the vehicles and issuing driving licenses,
- Taking necessary actions after traffic accidents in order to secure a safe area for other road users, as well as reporting accidents,
- Reporting statistics about vehicle registrations, driving licenses and accidents,
- Public information.

(2) Ministry of Public Works - General Directorate of Highways

- Physical arrangements and signing for a safe road transportation,
- Decisions on the standards of signs ,
- Roadside facilities (gasoline stations, accesses, lighting, etc.),
- Periodic vehicle inspections,
- Stationary and mobile weight controls.

(3) Ministry of National Education

- Regulation of driving license schools and performing tests (including issuing certificates).
- Pre-school, primary school and high school as well as public traffic education and training (including coordination with other agencies).
- Public information.

(4) Ministry of Health

- Regulation and implementation and follow-up of first aid and emergency services, as well as medical care and rehabilitation.

(5) Ministry of Industry and Commerce

- Vehicle type approvals.

(6) Ministry of Transportation

- Coordination of transportation by issuing regulations in the transportation sector.

(7) Ministry of Forestry

- Traffic regulation for forest roads.

(8) Ministry of State - General Directorate of Village Affairs

- Traffic regulations for village roads.

(9) Ministry of Justice

- Giving necessary help in revising the law.

(10) Municipalities

- Physical implementation and regulation of traffic safety measures on municipality roads.

10. Coordination

(1) Supreme Highway Traffic Safety Council

Head: The Prime Minister.

Participants: Ministers of the following Ministries: Justice, Interior, Finance, National Education, Public Works, Health, Transportation, Forestry, State (which holds General Directorate of Village Affairs). Head Commander of Gendarmerie, Under Secretary of State Planning Organization, General Directors of General Directorate of Security and General Directorate of Highways.

Meetings: Twice a year

Tasks and responsibilities: The issues are prepared by Traffic Services Department (General Directorate of Security), approved by the Highway Traffic Safety Council, and later discussed in the High Council. The decisions (proposals) are followed and precautions for the coordination are taken by the Council in its implementation areas. Secretarial work of the Council is given by General

Directorate of Security. Guidelines related to Council´s work are arranged by regulations prepared by the Cabinet.

(2) Highway Traffic Safety Council

Head: The Director of the Traffic Services Department in General Directorate of Security.

Participants: Related Heads of Departments of the Ministries and Organizations stated above.

Representatives from:

Commandership of Gendarmerie, State Standardization Institution, Turkish Drivers and Automobiles Association, Universities, Chamber of Engineers and Architects, Prevention of Traffic Accidents Foundation, Aid for Traffic Accidents Foundation, Metropolitan Municipality of Ankara.

Meetings: Every month

Tasks and responsibilities: Giving proposals to achieve coordination and to reduce accidents. Finding deficiencies in the applications and the legislative deficiencies in traffic safety area.

(3) Municipal traffic units

UKOME (Transportation Coordination Centre)

Head: Mayor (Head of greater municipality).

Participants: General Directors or Directors of Municipal transportation/traffic units. General Directors or Regional Directors of Organizations related with transportation/traffic.

Mayors of towns within the province border. The number of municipal representatives must not exceed the number of participants from other organizations.

Tasks and responsibilities:

- Follow and monitor fulfilment of the tasks given tomunicipalities by the traffic law and other tasks related to urban transportation by the municipality law.
- Monitor competition and balance among different urban transportation modes by arranging tariffs, ticket prices, and so on.
- Making decisions about the working conditions of the commercial vehicles in the province has to be approved by Province Traffic Commissions.

(4) Province and Town (sub-provincial) Traffic Commissions

Head: Governor/Deputy governor/Head offcial of a district.

Participants: Representatives from Municipility, Security (police), KGM, Gendarmerie, Automobile and Drivers Association, Other representatives from universities, etc., approved by the governor (maximum three persons).

Tasks and responsibilities:

- To take necessary precautions for achieving traffic regulation and safety in the district.
- To make necessary decisions about upgrading of the infrastructure, and give proposals to the Ministry of Internal Affairs.
- To make decisions about the working conditions of the commercial vehicles in the province, regardless of the regulations issued by the Ministry of Transportation.
- To make decisions about parking areas.

(5) Foundations and Associations (Voluntary Organizations)

- Turkish Automobiles and Drivers Association
- Automotive Industry Association
- Prevention of Traffic Accidents Foundation
- Aid for Traffic Accidents Foundation

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16. Road Traffic Act, 1953.

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18. Road Traffic Regulation, 1997.

19. SweRoad, 2001, National Traffic Safety Program for Turkey, Ankara.

http://www.kgm.gov.tr/SiteCollectionDocuments/KGMdocuments/Eng/Traffic/Executive.pdf

Websites of state organizations about Traffic and Traffic Safety

- Head of Traffic Services www.trafik.gov.tr
- General Directorate of Highways www.kgm.gov.tr
- General Directorate of Road Transportation www.kugm.gov.tr
- Head of Revenue Administration http://www.gib.gov.tr/
- General Directorate of Meteorology http://www.dmi.gov.tr/
- Ankara Security Directorate http://www.ankara.pol.tr/2011_v1/
- Bayburt Security Directorate http://www.bayburt.pol.tr/

Some of semiofficial websites

- Foundation of Turkish Drivers-Ankara http://www.tsof.org.tr/
- Turkish National Committee of Roads http://www.ytmk.org.tr/
- Traffic Insurance Information Center http://www.tramer.org.tr/
- Vehicle Inspection Stations, Istanbul http://www.tuvturk.com.tr/
- Chamber of drivers, Antalya http://www.antalyasoforlerodasi.com.tr/

Websites of Some Turkish Universities

- Bogazici University: www.boun.edu.tr
- Istanbul Technical University: www.itu.edu.tr
- Middle East Technical University: www.metu.edu.tr
- Koç University: www.ku.edu.tr

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Changes in Traffic Safety Policies and Regulations in UK (1950-2010)

1. Review of the Traffic Accident Situation in the UK

1.1 National Population

The population of the UK has grown throughout the century but at a declining rate. For example, between 1901 and 1911 the growth rate of the UK population averaged 1% per annum. Between 1981 and 1991, however, the average growth rate of the population had fallen to about 0.26% per annum. The following graphs in Figure 1 shows how the population has changed over the period 1951-2010.

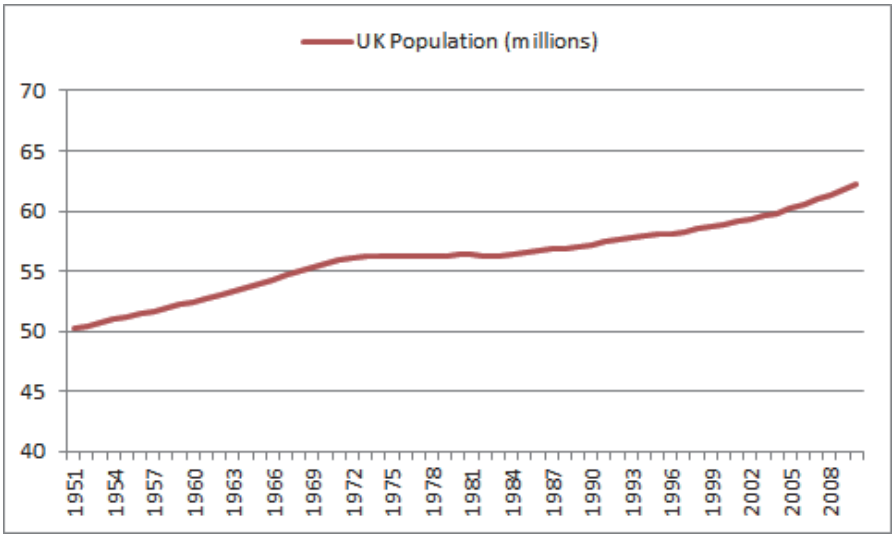

Figure 1 UK population statistics 1951-2010[1]

[1] source: http://www.guardian.co.uk/news/datablog/2009/oct/21/uk-population-data-ons
Extrapolated between 1951 and 1961 and again between 1961 & 1971

The proportion spilt between gender and age groups over the same period are shown in Figure 2 and Figure 3.

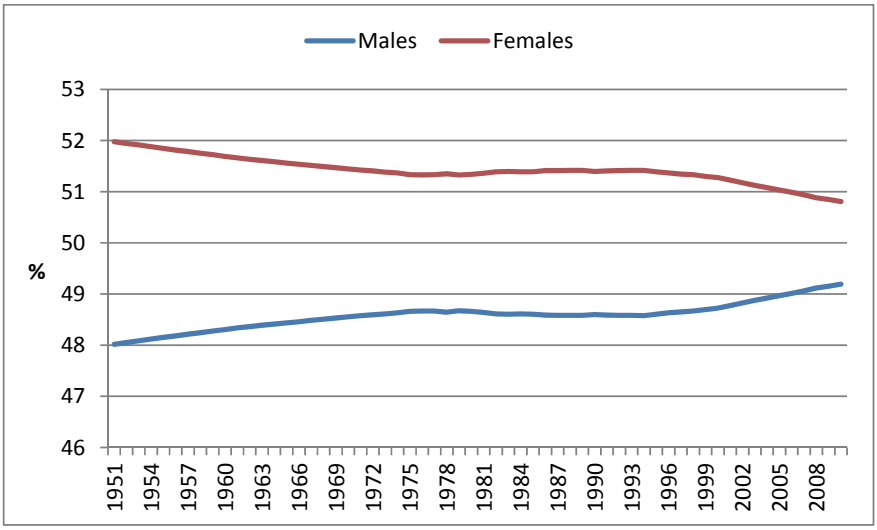

Figure 2 UK population split by gender[1]

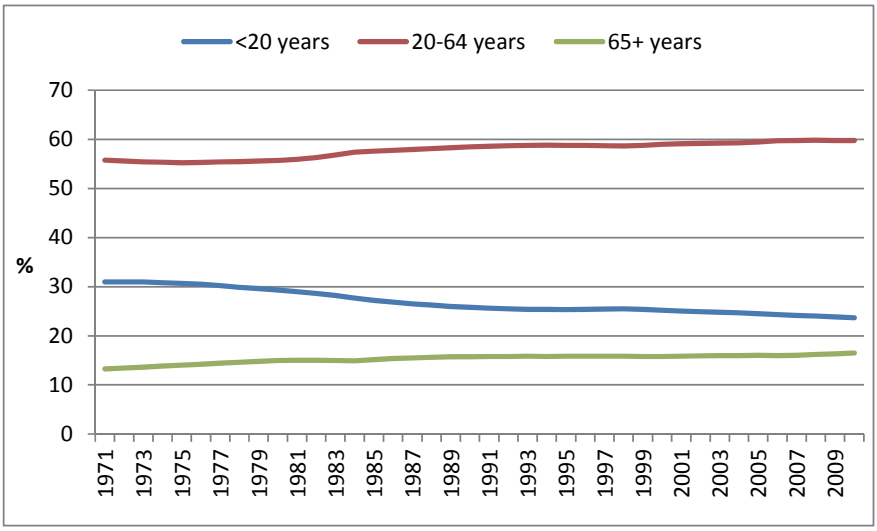

Figure 3 UK population split by age[1]

The projection of the UK population statistics is shown in Figure 4.

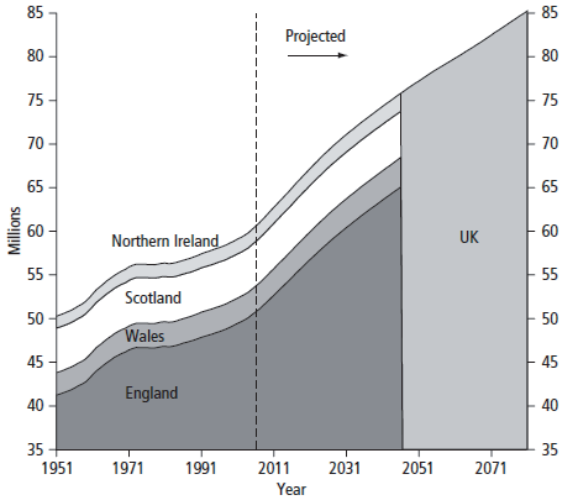

Figure 4 Actual and projected population of the United Kingdom and constituent countries, 1951–2081[2]

1.2 Vehicle Ownership Numbers

Licensed stock in the UK has been steadily increasing since 1950, with a noticeable increase in motorcycle numbers in 2000 onwards, Figure 5.

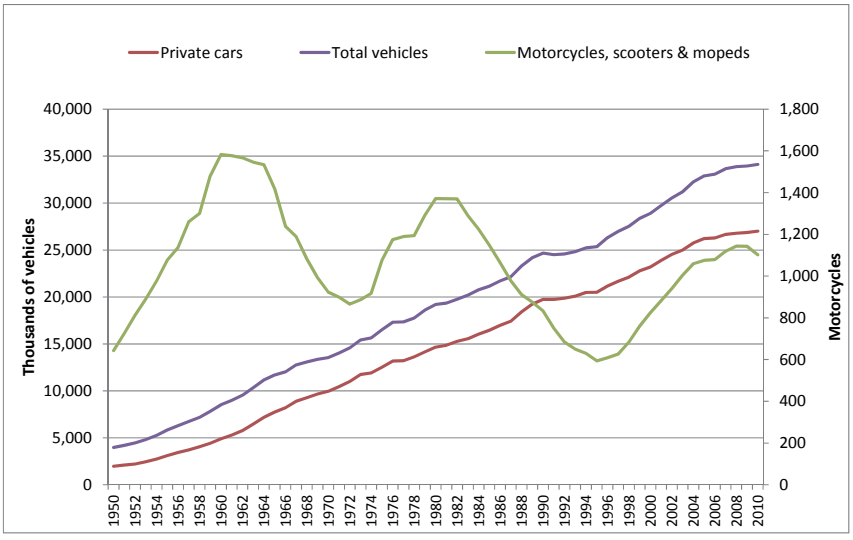

Figure 5 Vehicle ownership (licensed stock 1950-2010)[3]

[2]Source: http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2010-based-projections/rep-2010-based-npp-results-summary.html

[3] Department for Transport statistics Vehicle Licensing Statistics Table VEH0103

1.3 Annual Traffic Accident Fatalities

Fatalities for each mode are shown in Figure 6. All modes show a decline, which is particularly noticeable for 2005 onwards overall. Motorcycle fatalities have remained relatively stable, but have seen large increases in vehicle stock.

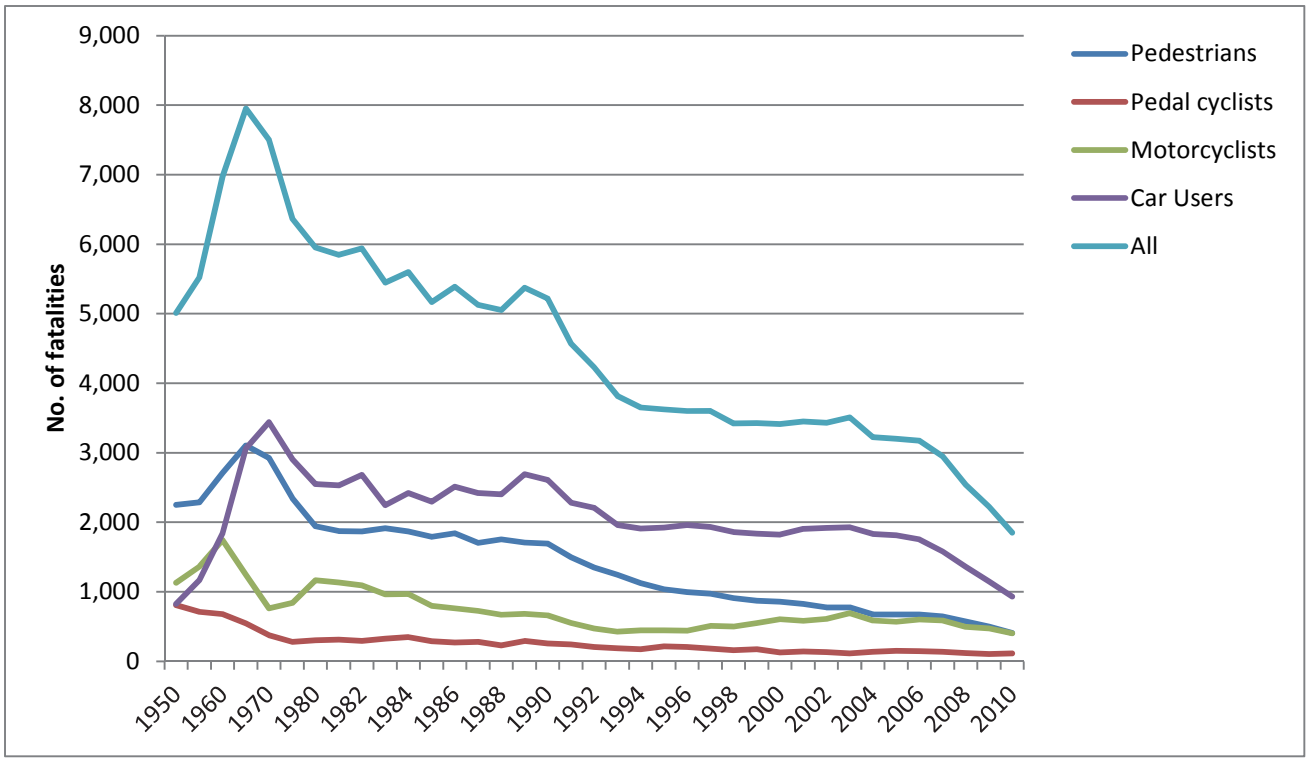

Figure 6 Road fatalities (1950-2010)[4]

There has been a rise in cyclist deaths however over the past three years, with serious injuries being 2,428 in 2007 and 2,660 in 2010.

1.4 Annual Traffic Accident Injuries

Injuries sustained on UK roads are shown in Figure 7. Sharp decreases in overall numbers can be seen from 2000 onwards.

[4] http://www.dft.gov.uk/statistics/releases/road-accidents-and-safety-annual-report-2010

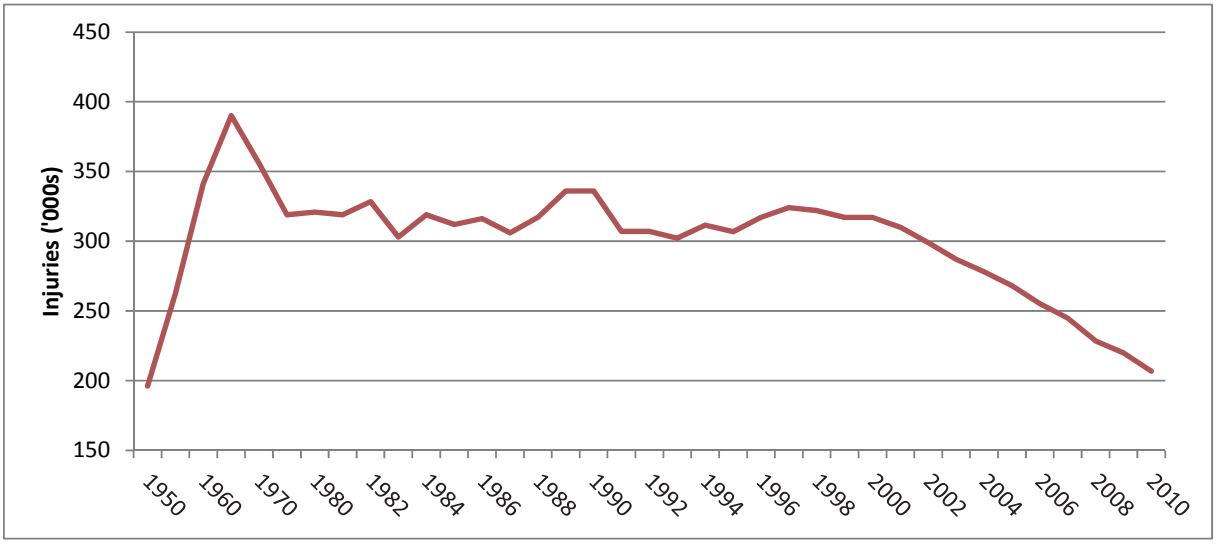

Figure 7 Injuries (1950-2010)[5]

2. National Organizations with Jurisdiction for Traffic Safety

In the United Kingdom, the Department for Transport (DfT) is the government department which is responsible for the English transport network along with a limited number of transport matters in Scotland, Wales and Northern Ireland (those which have not been devolved to local control). The department is run by the Secretary of State for Transport, currently Justine Greening (since 14 October 2011). The Secretary of State is supported by a small team (around 3) of junior Ministers.

2.1 Organisation

The DfT also has a number of executive agencies, considered central to delivering the Government's transport priorities and services:

(1) Vehicle Certification Agency (VCA)

VCA tests and certifies new models of vehicles and components against European and United Nations safety and environmental performance standards. It also provides a service to manufacturers who wish to be certified as meeting international quality, environmental and safety management system standards. VCA publishes the definitive data on emissions, fuel consumption and noise. This helps people decide what vehicle to buy and enables in-service testing of car emissions. This information also supports the Department and the Inland Revenue in applying Vehicle Excise Duty schemes linked to vehicle fuel consumption.

(2) Highways Agency (HA)

HA is responsible for operating, maintaining and improving the strategic road network, on behalf of the Secretary of State for Transport. This comprises 9,380 km/5,863 miles of

[5] Department for Transport statistics http://www.dft.gov.uk/statistics/releases/road-accidents-and-safety-annual-report-2010

motorways and trunk roads in England, on which over 170 billion vehicle/km journeys are made each year. HA's aim is 'Safe roads, reliable journeys, informed travellers' which supports the DfT objective of a transport system that works for everyone. The agency:

- improves road safety;
- makes journeys more reliable through better network management and information; and
- respects the environment.

HA also has an international role, building good working relationships and sharing expertise with other overseas road administrations. This helps promote the value of UK knowledge and best practice across the world to support UK industry.

(3) Maritime and Coastguard Agency (MCA)

MCA delivers and implements the Government's maritime safety strategy. The agency co-ordinates search and rescue at sea through Her Majesty's Coastguard, and checks that ships meet UK and international safety rules. It works to prevent loss of life at the coast and at sea, to ensure that ships are safe, and to prevent coastal pollution.

(4) Government Car and Despatch Agency (GCDA)

The GCDA is a non-profit making executive agency which aims to be the first choice supplier of secure transport, distribution and mail related services to Government, the wider public sector and other approved customers.

(5) Driver and Vehicle Licensing Agency (DVLA)

DVLA maintains an up-to-date record of all those who are entitled to drive various types of vehicles, together with a register of all vehicles entitled to travel on public roads. It is responsible for driver licensing, the collection of vehicle excise duty and vehicle registration policy for Great Britain. DVLA also contributes to Government policies and to broader objectives, such as an improved environment and modernised, customer-focussed services.

(6) Vehicle and Operator Services Agency (VOSA)

VOSA works with Traffic Commissioners to improve road safety and the environment and to safeguard fair competition by promoting and enforcing compliance with commercial operator licensing requirements.

(7) Driving Standards Agency (DSA)

DSA promotes road safety in Great Britain by improving driving standards, through testing drivers and driving instructors. The DSA has continued to contribute to the target for reducing road casualties set in the Government's road safety strategy, Tomorrow's Roads - Safer for Everyone.

2.2 Brief History

Over the years the name of the department has changed numerous times:
1919–1941: Ministry of Transport
1941–1945: Ministry of War Transport - after absorption of Ministry of Shipping
1945–1953: Ministry of Transport
1953–1959: Ministry of Transport and Civil Aviation
1959–1970: Ministry of Transport
1970–1976: Department for the Environment
1976–1979: Department of Transport
1979–1981: Ministry of Transport
1981–1997: Department of Transport
1997–2001: Department for the Environment, Transport and the Regions
2001–2002: Department for Transport, Local Government and the Regions
2002– Department for Transport

In 1910, the Road Board was set up to administer grants paid to local authorities for road improvements. Its functions were taken over by the new Ministry of Transport in 1918. In 1936 Trunk Roads Act transferred responsibility for main roads from local authorities to Ministry of Transport. In 1967 the Ministry of Transport issued "Road Safety - A Fresh Approach", a Paper proposing a wide range of measures to reduce the number of injuries and the Road Traffic Act 1974 was published. In 1980, the Parliamentary Advisory Committee on Transport Safety (PACTS) was set up followed by the Driving Standards Agency in 1990.

The role of the Department is to determine overall transport strategy and to manage relationships with the Agencies responsible for the delivery of that vision.

The Department was set up to provide a stronger focus on delivering the Government's transport strategy. The role of the centre of the Department is to set strategy and policy context, and to establish and manage relationships with the organisations that are responsible for delivery. The centre of the Department has been structured to reflect this role with a strong central strategy, delivery, communications and finance group.

The Transport Committee is charged by the House of Commons with scrutiny of the Department for Transport. Its formal remit is to examine the expenditure, administration and policy of the Department for Transport and its associated public bodies. Recently, The Transport Committee has decided to undertake an inquiry into the Government's strategic framework for road safety, which was published in May 2011. The Government's vision for road safety is to ensure that Britain remains a world leader on road safety and that the relatively high risk of accidents amongst some groups, such as cyclists and children from deprived areas, is quickly reduced. The Committee will examine whether the strategic framework will fulfil this vision.

2.3 The Road Safety Bill – a Case Study

DFT published its strategy for reducing road accident casualties over the next ten years in its report "Tomorrow's Roads - Safer for Everyone" in March 2000. The Road Safety Bill emanated from that strategy and aimed to improve road safety measures to reduce casualties on the roads. Bills and Legislation sets out the proposals for new laws, and plans to change existing laws, that are presented for debate before Parliament. A Bill is a draft law; it becomes an Act if it is approved by a majority in the House of Commons and House of Lords, and formally agreed to by the reigning monarch (known as Royal Assent). An Act of Parliament is a law, enforced in all areas of the UK where it is applicable. The passage of a Bill is shown in Figure 8.

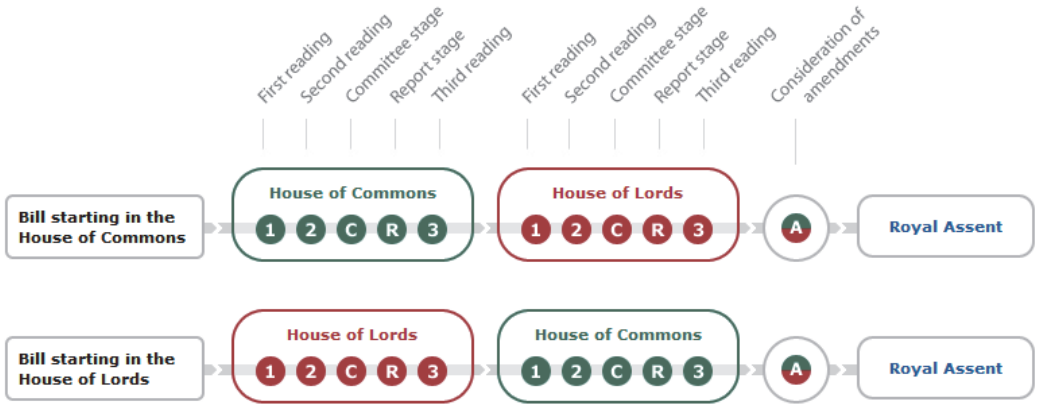

Figure 8 Passage of a Bill in the UK

The main provisions of the Road Safety Bill were:

(1) Police given power to use roadside breath testing as evidence

(2) Offenders disqualified for two years or more to re-take the driving test, closing a loophole allowing those at highest risk of re-offending to drive pending medical enquiries and encouraging take-up of the Drink Drive Rehabilitation Scheme and introducing an experimental scheme for alcohol ignition interlocks

(3) Variable fixed penalties for speeding, increasing the range of penalty points from 3-6 to 2-6 and maximum penalties increased for other road traffic offenses

(4) Bans the carriage or use of speed camera detectors and jammers

(5) Exemptions from speed limits and other traffic restrictions allowed in certain cases, such as donor vehicles

(6) Provision is made to prevent foreign drivers escaping punishment in the UK by requiring them to pay a deposit where an offence is committed

(7) Gives police the power to detect uninsured driving through the use of Automatic Number Plate Reading technology

(8) Gives police access to insurance data and confers new enforcement powers on vehicle examiners

Timeline:

Origin: House of Commons
Introduced: 30 November 2004
Second reading: 11 January 2005
Programme motion: 11 January 2005
Money resolution: 11 January 2005
Committee stage: From 20 January 2005 to 3 February 2005
Remaining stages: 8 March 2005

Responsible department: Department of Transport
Origin: House of Lords
Introduced: 24 May 2005
Second reading: 8 June 2005
Committee stage: 27 June, 4 July, 17, 26 October 2005
Report stage: 22 & 29 November 2005
Third reading: 10 January 2006

COMMONS:
First reading: 11 January 2006
Second reading: 8 March 2006
Committee stage: 16, 21 & 22 March, 18 & 20 April, 19, 24 & 25 July, 4 & 5 October 2006
Report stage: 9 October 2006
Third reading: 9 October 2006
ROYAL ASSENT: 8 November 2006

3. Major Changes in Traffic Safety Policies and Regulations

3.1 Government Target Setting

One of the most recent strategic implementations in terms of traffic safety policy is that of target-setting. Having clear goals and identifiable measures of success provide direction and cooperation. By way of example the road safety strategy "Tomorrow's Roads - Safer for Everyone" was published by the UK government on 1 March 2000[6].

[6] Prior to this the 1987 target to reduce road casualties by one-third by 2000 was more than achieved for deaths and serious injuries, cutting deaths by 39 per cent and serious injuries by 45 per cent.

Even though the UK has a comparatively good road safety record and the casualty reduction targets for deaths and serious injuries, set in 1987, were achieved, by the late 1990s the decline was lessening. Therefore the new strategy was formulated.

By 2010, the Government wished to achieve, compared with the average for 1994-98:

- a 40% reduction in the numbers of people killed or seriously injured in road accidents;
- a 50% reduction in the numbers of children killed or seriously injured; and
- a 10% reduction in the slight casualty rate, expressed as the number of people slightly injured per 100 million vehicle kilometres.

The strategy and targets were reviewed every three years and a Road Safety Advisory Panel was established to assist in that review process. The keys areas identified were:

(1) Safer for children

- babies and very young children - through advising their parents and first teachers on protection in cars and teaching safe behaviour on the road;
- primary age children - through child pedestrian training schemes and, later, cycle training, alerting parents to the risks of cycling in particular traffic conditions;
- older children - by providing road safety information as they change schools and go on longer journeys on their own; and
- older teenagers - providing advice as they contemplate much more independent mobility.

(2) Safer drivers - training and testing

- instil in young people the right attitudes towards road safety and safe driving;
- guide learner drivers to take a more structured approach to learning, to prepare them for their driving career, not just to pass a test;
- raise the standard of tuition offered by driving instructors;
- improve the driving test in the light of better understanding about what needs to be examined and effective ways to do it;
- focus on the immediate post-test period for novice drivers;
- enhance the status of advanced motoring qualifications;
- address the needs of professional drivers; and
- bring safety benefits for all categories of motor vehicle.

(3) Safer drivers - drink, drugs and drowsiness

- introduce new measures to reduce drink-driving further;
- develop more effective ways to tackle drug-driving;
- carry out research to improve understanding of drug-driving;
- strengthen and enforce laws on driving time for lorry, bus and coach drivers; and
- make people aware how much tiredness contributes to road accidents and advise drivers and employers how to cut the risks.

(4) Safer infrastructure

- ensure safety continues to be a main objective in designing, building, operating and maintaining trunk and local roads;
- ensure safety continues to be part of the planning framework for main and local routes;
- publish guidance about engineering for safer roads based on sound research and experiment;
- use local transport plans to promote safer neighbourhoods; and
- monitor progress on local efforts to reduce casualties.

(5) Safer speeds

- publicise widely the risks of speed and reasons for limits:
- develop a national framework for determining appropriate vehicle speeds on all roads, and ensure that measures are available to achieve them;
- research a number of speed management problems to gain the necessary information to develop and test new policies; and
- take into account environmental, economic and social effects of policies when assessing their ability to reduce accidents.

(6) Safer vehicles

- improvements which prevent accidents happening in the first place;
- improvements which protect car occupants in the event of an accident;
- improvements which protect other road users;
- better information for consumers, helping them to choose safer vehicles;
- better standards of vehicle maintenance; and
- renewed emphasis on new vehicle safety inspections by manufacturers and dealers.

(7) Safer motorcycling

- to improve training and testing for all learner riders;
- to publish advice for people returning to motorcycling after a break, and people riding as part of their work;
- to ensure the quality of instruction;
- through training and testing, to help drivers become more aware of how vulnerable motorcyclists are;
- to promote improvements in engineering and technical standards which could protect motorcyclists better; and
- to work with representatives of interested organisations, in an advisory group, to look at issues of concern.

(8) Safety for pedestrians, cyclists and horse riders

- helping drivers become more aware of their responsibilities towards all vulnerable road users through better training and testing.
- working with the CTC to develop cycle training courses for adults:

- schemes to promote cycle helmets;
- supporting training schemes for horse riders through the British Horse Society; and improving victim support systems.

(9) Better enforcement

- more effective road traffic law enforcement;
- better public understanding of and respect for road traffic law;
- penalties more appropriate and proportionate to the seriousness of offences;
- more emphasis on education and retraining; and
- maximum use of new technology.

In 2010, the targets were met or exceeded with:

- 24510 people killed or seriously injured – down 41% from 41564 in 2000 (against a target of 40%)
- 184,138 slight injuries – down 34% from278,719 in 2000 (against a target of 10%)
- 2502 children killed or seriously injured in the 0–15 age group – down 52% from 5202 in 2000 (against a target of 50%)

In parallel, a post-2010 strategy was considered, with a scoping study taking place in 2009 along with a consultation (Department for Transport, 2009). It provided a number of recommendations to inform the development of a road safety strategy beyond 2010. Consequently, the Strategic Framework for Road Safety was published in May 2011 highlighting the following areas for further improvement:

(1) Make it easier for road users to "do the right thing"

(2) Better education and training for children and learner and inexperienced drivers

(3) Remedial education for those who make mistakes and for low level offences

(4) Tougher enforcement for a small minority of drivers who deliberately choose to drive dangerously

The Road Safety Action Plan was developed as a result and more sophisticated methods of monitoring progress are under development with the Road Safety Outcomes Framework, to help local authorities assess and prioritise their actions.

3.2 Changes to the Driver Training Regime

Prior to July 1996, drivers in the UK were required only to pass a practical driving test, taken in a test centre local to the candidate and lasting for approximately forty minutes. The driving skills of the candidates are evaluated by driving examiners employed by the Driving Standards Agency (DSA), an agency of the Department for Transport. The tests are conducted on public roads, on one of several test routes selected for that particular test centre. The UK driving test covers a range of different types of road and driving conditions, as well as being required to pass an eyesight check, answer vehicle

safety questions and demonstrate a range of driving skills including a reversing manoeuvre and an emergency stop.

The Environment, Transport and Rural Affairs Committee (ETRAC) conducted an inquiry on Young and Newly-Qualified Drivers: Standards and Training in 1999 and made a number of specific recommendations, including the introduction of a Hazard Perception Test as part of the computerised theory test. ETRAC rejected suggestions for a probationary driver scheme and a proposal that the Pass Plus scheme be made mandatory.

Thus the Theory Test for Car Drivers (and Motorcyclists) was introduced in July 1996 and aimed to improve the safety of newly qualified drivers and includes assessment of:

- alertness
- attitude and safety margins
- hazard awareness
- vulnerable road users
- vehicle handling
- rules of the road
- road & traffic signs

The test is separated into two parts with the first consisting of multiple choice questions and the second part being the hazard perception test. Candidates must pass both parts of the test. Some of the multiple choice questions are presented in the form of a case study which shows a scenario followed by five questions. The subject of the scenario focusses on real life examples and experiences that may be encountered when driving.

With regards to effectiveness, the 'Cohort II' study was commissioned by the Department for Transport, in order to evaluate how different cohorts of learner drivers in Great Britain are trained. One of the aims of the study was to assess the impact of changes to the testing procedures, specifically the hazard perception test which was introduced during the period of study. The findings (Wels et al. 2008) indicate that the introduction of the hazard perception component in the theory test is associated with a small reduction in the likelihood of having accident:

> "For reported non-low-speed accidents on a public road where the driver accepted some blame, the size of the accident reduction in the first year of driving for those who had taken the hazard perception test (controlling for age, sex, experience and exposure) compared with those who had not was at least 3%".

There was also found to be a relationship between scores on the hazard perception test and levels of reported accidents in the first year of driving:

> "For non-low-speed public road accidents, in which the driver accepted some blame, those in the highest scoring group in the hazard perception test had an accident liability estimated to be at least 4.5% lower than that of the lowest scoring group".

3.3 Changes to Motorcycle Policy

Over the last sixty years there has been more substantial changes to motorcycle training than there has been for passenger car drivers. In 1960 law was introduced which limited all new riders to riding machines of less than 250cc with L-plates. In the early 1970's whilst 16 year olds were still allowed to ride mopeds (less than 50cc and restricted to 30 mph), the new learner age was raised to 17. In the 1980's a two part test was introduced with Part 1 requiring riders to complete a figure of eight, a slow ride and a junction crossing. Part 2 still required a test being conducted by an examiner watching from the side of the road. In addition, learners can no longer take a passenger on their motorcycle.
In 1990 the Part 1 test abolished and replaced by Compulsory Basic Training; meanwhile the Part 2 test is updated with a "pursuit" test whereby the examiner follows the learner in a car or on a motorcycle and communications via a radio headset. The road ride is approximately two hours in length.

In 2001, all new riders had to complete a theory test and in 2002, a hazard perception test was introduced as part of this test. More recently there have been moves to bring the UK motorcycle test in line with those in the rest of Europe.

With regards to the efficacy of these changes in training, there has been little longitudinal research completed in the UK. A scoping study (Sudlow, 2003) concluded that the UK motorcycle training industry

> "is very fragmented, with many one-man or small businesses, a wide range of qualifications held by instructors, many agencies providing training and a wide variation in courses offered".

In 2010 (compared with the 1994-98 average), there were reductions in the number of reported KSI casualties (of between 25 and 64%) for all of the main road user types, with the exception of motorcyclists where the number fell by 20%. However, over this period motorcycle traffic increased by 21 % in total (more than any other road user type), so that the KSI casualty rate for motorcyclists actually fell by 34%. Motorcycle traffic increased from the 1994-98 average until 2003. Since 2003, the traffic has been fairly volatile, with the 2010 traffic figure 10% lower than the 2008 figure; this volatility makes it quite difficult to assess any effects of training, without investment in experimental or longitudinal studies. The move to introduce compulsory helmet wearing in 1973 has undoubtedly decreased the likelihood of serious head injury. Hurt et al. (1981) concluded that the risk of death is more than halved if a helmet is worn.

Talking about improvement of helmet protection, Hopes and Chinn (1989) investigated the effect of helmet shell and liner stiffness on the ability of a helmet to protect the head. Research found that present helmets are too stiff and resilient, with the maximum energy absorption of the liner occurring at high impact velocities where the probability of death is high. Helmet shells and liners should be less stiff in order to provide maximum energy absorption at lower, more prevalent, impact velocities where the benefit of wearing a helmet can be more effectively realised.

3.4 Introduction of Mobile Phone Legislation

Following the rapid increase in mobile phone sales at the turn of the century, the government introduced a law banning the use of hand-held phones while driving. Following numerous roadside surveys that indicated wide-spread flouting of the law, the legislation was updated in 2007 whereby the maximum fixed penalty fine was doubled to £60, and three points could be added to offenders' licences (with 12 points comes a ban from driving). It was also announced that motorists will be prosecuted for using a hands-free phone if they are not in control of their vehicle.

Much effort has been taken by the government to support the legislation via educational campaigns, with particular reference to the Think! Campaign in 2009. The THINK! Road Safety publicity campaign was launched in 2000, as part of the Government's road safety strategy, Tomorrow's roads: safer for everyone (see earlier).

With the stricter legislation coming into force in February 2007, the campaign activities took place between January to March 2007 in order to raise awareness of the new penalties and of the dangers of using a hand held mobile phone whilst driving. TV, radio and on-line material was produced and the evaluation focussed on:

(1) Awareness and recognition of the Mobiles campaign
(2) Awareness of the change in legislation for using a hand held mobile phone whilst driving
(3) Attitudes towards use of mobile phones whilst driving
(4) Communication of the campaign's key messages

It was found that campaign awareness saw a steady decline since the high level of awareness achieved at the original post stage of research conducted in April 2007. Surveys to monitor mobile phone use by drivers have been carried out, commissioned by the government, since 2002. Each year the survey is carried out at 30 sites in the South East of England. Surveys take place throughout daylight hours and involve observers recording mobile phone use by drivers in free-flowing traffic, aided by a mobile phone detector. Since the previous survey in September 2008, the proportion of drivers observed using hand-held mobile phones whilst driving increased (from 1.1 per cent to 1.4 per cent for car drivers and from 2.2 per cent to 2.6 per cent for van and lorry drivers). There was also an increase in the number of drivers who appear to be using hands free mobile phones (from 0.5 per cent to 1.4 per cent for car drivers and from 1.1 per cent to 2.4 per cent for van and lorry drivers) was observed in the same period.

There is thus still room for improvement with regards to the effectiveness of the legislation – education and enforcement are key here. Further discussions within the academic community are taking place regarding the appropriateness of banning only hand-held mobile phones, when hands free phones have the potential to cause cognitive distraction (e.g. Lin et al., 2006).

3.5 Drink Driving Legislation

Driving whilst impaired by drink or drugs has been an offence in the UK since 1930. However, until the 1960s, impairment had to be proven. Following the publication of international research documenting the relationship between blood alcohol levels and involvement in road traffic accidents, in 1967 legislation was introduced such that it was illegal to drive with a blood alcohol limit above 80mg/100ml. Following that, evidential breath tests in police stations were introduced in the 1980s. This required a suspect to undergo road-side screening, and then, if the breathalyser indicated a positive result, this further breath test at the police station was performed which can be used as evidence.

Policies on drink driving have combined the enforcement of heavy penalties for drink driving and high profile advertising. A cultural shift has occurred – among the general driving population, drink driving is longer considered acceptable. Over recent decades there has been a reduction in deaths and serious injuries associated with drink driving, with current levels at around 400 deaths and 1600 serious injuries. The North Report (North, 2010) reported that "there is very considerable public support for a reduction in the current drink drive limit, ….that support is clear from the evidence to the Review, both written and oral". It has been estimated that a reduction to 50 mg/100 ml would save between 43 - 168 lives.

3.6 Investment in Road Engineering

The variety of engineering solutions for improving traffic safety is too wide to go into detail here. However, the introduction of 20mph zones in the UK serves as a good example. They were introduced on the premise that urban roads account for a high number of casualties and that the majority of pedestrian casualties occur on residential roads. Given that speed significantly increases the chance of being injured in a collision and that studies have shown that accidents at speeds above 20mph are more likely to result in severe injuries, rather than slight injuries (Cuerden et al., 2007) it was thought that urban 20m zones could provide a way of significantly reducing the likelihood of a serious injury.

In December 1990 the Department of Transport set out guidelines for the introduction of 20mph speed limits whereby local authorities had to apply for consent from the Secretary of State to introduce one in their area. There were 450 20mph speed limits introduced between 1991 and 1999. Following that the law changed giving Highways Authorities more flexibility so they no longer had to apply for permission to implement a zone. The updated legislation made two distinct types of 20mph speed limit possible:

(1) 20mph limits, which consist of just a speed limit change to 20mph and indicated by the speed limit (and repeater) signs, and

(2) 20mph zones, which were designed to be "self-enforcing" due to the traffic calming measures that were also introduced

The Department for Transports encourages and supports Local Authorities to implement 20 mph limits and zones where there is a particular risk to vulnerable road users (DfT, 2006). The advice is that they should be implemented where average speeds are already low (below 24mph) or along with traffic calming measures. The latest figures in England are that by 2008 there were an estimated 2,148 20mph zones, of which 399 were in London.

With regards to their effectiveness, the first widespread evaluation of 20mph zones in the UK was carried out by Webster in 1996. They reported that injury accidents were reduced by 60%, and child injury accidents were reduced by 67%. Whilst there was a decrease in traffic by 27% in the zones during the evaluation, this was attributed to parallel bypass schemes. Hull, in the North of England led the way in wide-scale implementation of 20mph schemes – by 2003, there were 120 zones covering 500 streets and with a reported 56% decrease in accidents. The largest reductions were pedestrian casualties, which fell by 54%, with child pedestrian casualties falling by 74%.

TRL examined the effectiveness of 20mph limits that were implemented with and without traffic calming measures (Mackie, 1998). It was found that traffic calming was a more effective way of reducing vehicle speeds than signs only, which only produced a small reduction in speed.

The Department for Transport (DfT) guidance for the implementation of 20mph limits has evolved over time and currently stipulates that they should not be implemented on roads with a strategic function or on main traffic routes, and that they should be generally self-enforcing.

3.7 Primary and Secondary Safety Measures

While primary safety systems provide assistance to the driver in normal driving and in crash scenarios, secondary safety measures aim to lessen the consequences of the accident. The development of policy for both of these has been driven at the European level, but they are worth discussing in relation to theirs on the UK situation. A notable example of each will be covered.

With regards primary safety, Euro NCAP organises crash-tests and provides motoring consumers with a realistic and independent assessment of the safety performance of some of the most popular cars sold in Europe. It was established in 1997, and in its own words “has rapidly become a catalyst for encouraging significant safety improvements to new car design”. It is a non-profit international association, independent of the automotive industry, supported by seven European governments (France, Germany, Sweden, the Netherlands, the United Kingdom, Luxembourg, and the Catalonia region of Spain), consumer groups through International Consumer Research and Testing, European motoring clubs through the Fédération Internationale de l’Automobile, and the Motor Insurance Repair Research Centre (Thatcham).

By law, all new car models must pass safety tests before they are sold, but these are minimum standards. On the other hand, Euro NCAP encourages manufacturers to exceed these minimum requirements. Following testing, Euro NCAP releases an overall rating with a maximum of 5 stars for

each vehicle. The rating is comprised of scores for:

- adult protection (driver and passenger)
- child protection
- pedestrian protection
- safety assisting technologies

The underlying dynamic tests include full-scale frontal and side-impact tests, front-end component tests for pedestrian protection, and sled tests for whiplash prevention during rear-end crashes. The types of technologies that can increase a rating are seat belt reminders, speed limiters, and electronic stability control.

Since 2010, Euro NCAP Advanced awards higher rating to vehicles that are equipped with new technologies with a scientifically proven safety benefit for consumers and society. These technologies are usually crash-avoidance ones, which inform, advise or alert drivers to a potentially dangerous situation. Some also initiate autonomous braking. This provides an incentive to manufacturers to accelerate the availability of new safety equipment across all their vehicles (not just the luxury ones).

As an example of secondary safety, seatbelt and child restraint legislation has become more stringent in the past 50 years. Whilst home-made devices were used by some U.S. physicians as early as the 1930's and competing racing drivers in the U.S. were required to wear one, it was not until much later were they made mandatory. Voluntary belts were supplied in Volvos throughout the 50's and 60's, it was not until 1962 when the consumer magazine Which? strongly advocated belt wearing, revealing that a "first survey" of their effectiveness in Britain showed they would reduce the likelihood of death and serious injury by 60%. In 1965 it became compulsory to fit seat belts in the front of cars built in Europe (but not compulsory to wear them) and in 1967 front seat belts by law in the UK. A period of compulsory retrofitting took place in parallel there were various attempts to introduce a seat belt Bill.

Finally, in 1981, with an amendment to the Transport Bill which introduced seat belt wearing for a trial period of three years the Bill became law and from 31 January 1983, it became compulsory for drivers and passengers (adult and children) to wear seat belts for a three-year trial period. Over 90 % of drivers complied at that time. The law was retained, and modified to include a requirement that rear seat belts required to be fitted to new cars, with compulsory use following shortly after. The law continues to be effective, with the most recent observational survey reporting that the proportion of car drivers observed wearing seat belts is 95%., with rear passenger compliance being at 90% (PACTS, 2009).

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Changes in Traffic Safety Policies and Regulations in USA (1950-2010)

1. Introduction

Since the beginning of the widespread use of automobiles in the USA, the federal and state governments have implemented various policies and regulations to improve traffic safety. This report aims to examine regulatory changes implemented from 1950 through 2010, annual traffic safety trends, and any possible relationship between them. Regulatory changes include tougher restrictions on drinking and driving, the mandatory use of seat belts and helmets, setting safe speed limits and a graduated driver licensing plan. The report will also examine the judgment, if any, available in the literature on the successes and failures of various policies.

The first task in this regard is to examine the annual trends on traffic fatalities and injuries along with related variables such as annual automobile/motorcycle usage and ownership, as well as population trends. These trends are presented in the next section. The data used to examine these trends were obtained from official government sources, the National Safety Council (NSC) and specific individual sources, which are noted below.

2. Trends in Traffic Safety and Vehicle Ownership Data

2.1 Population Trends

The USA is one of the few industrialized nations whose population growth has remained above the replacement level in the recent past. The best estimate of the US population comes from the US Census Bureau data, and this estimate is available for every census year. Figure 1 shows the US population from 1950 through 2010, which is the study period for this report [1].

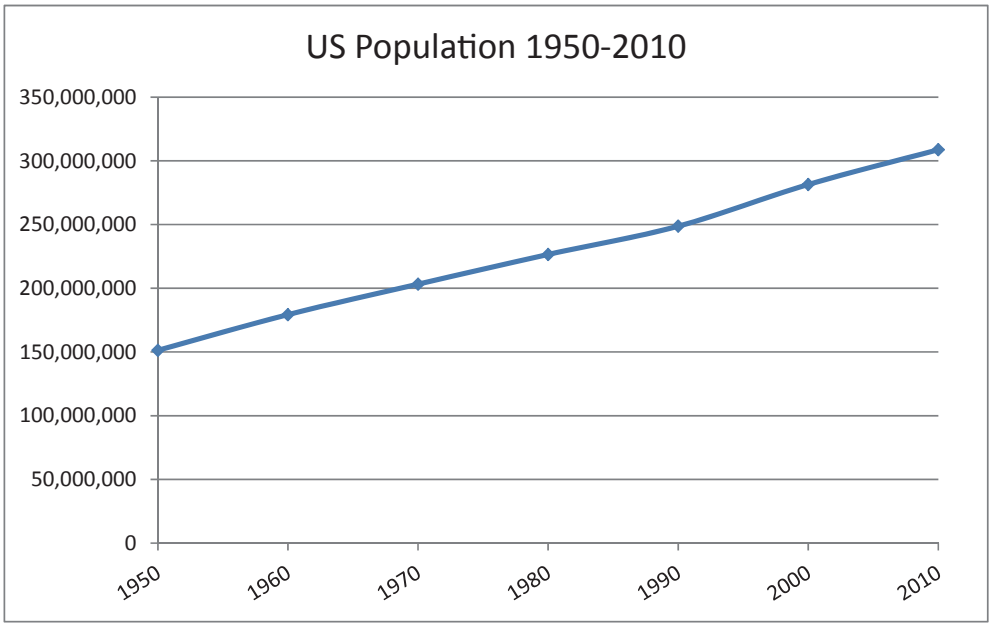

Figure 1 US population 1950-2010[1]

It can be observed that the US population grew from close to 150 million in 1950 to about 310 million in 2010. With such a large increase in population, traffic injuries/fatalities per capita were all but certain to go down over this period. Moreover, as noted below not only have per capita fatalities gone down in recent years but so have the overall fatalities.

2.2 Car Usage and Driving Trends

A more relevant figure (compared to total population) for examining the traffic-related injuries and fatalities in the USA would be the Vehicle-Miles Traveled (VMT). The trend since 1950 is shown in Figure 2 [2] along with the annual number.

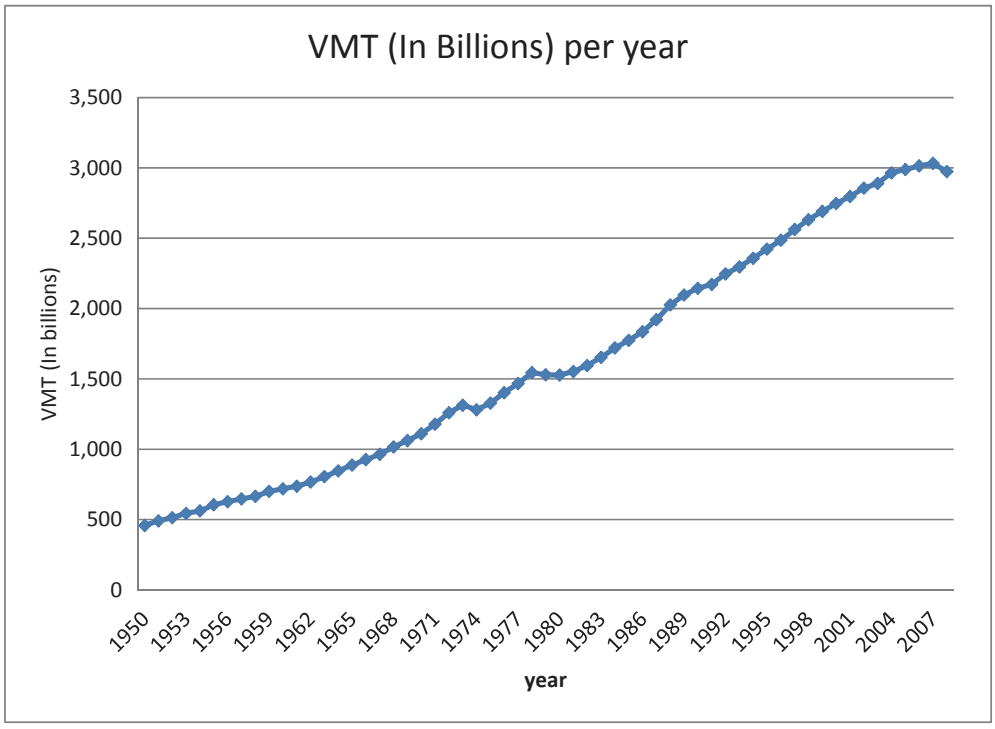

Figure 2 US vehicle miles traveled (VMT) per year, 1950-2010 [2]

VMT increased from close to 500 billion in 1950 to about 3 trillion in 2010, representing a six-fold increase. As shown in Figure 2, the annual VMT flat-lined or declined slightly only in the 1970s (during the oil embargo and economically challenging periods in late 1978 through 1981) and during the recent downturn (starting in 2008). The increase in VMT is not surprising since the number of people who owned at least one car in 2010 was 255.9 million, compared with close to 50 million in 1950 [2]. The increases in VMT also correspond closely to the increases in the miles of paved roads in the USA. The trend in paved roads is shown in Figure 3 [3].

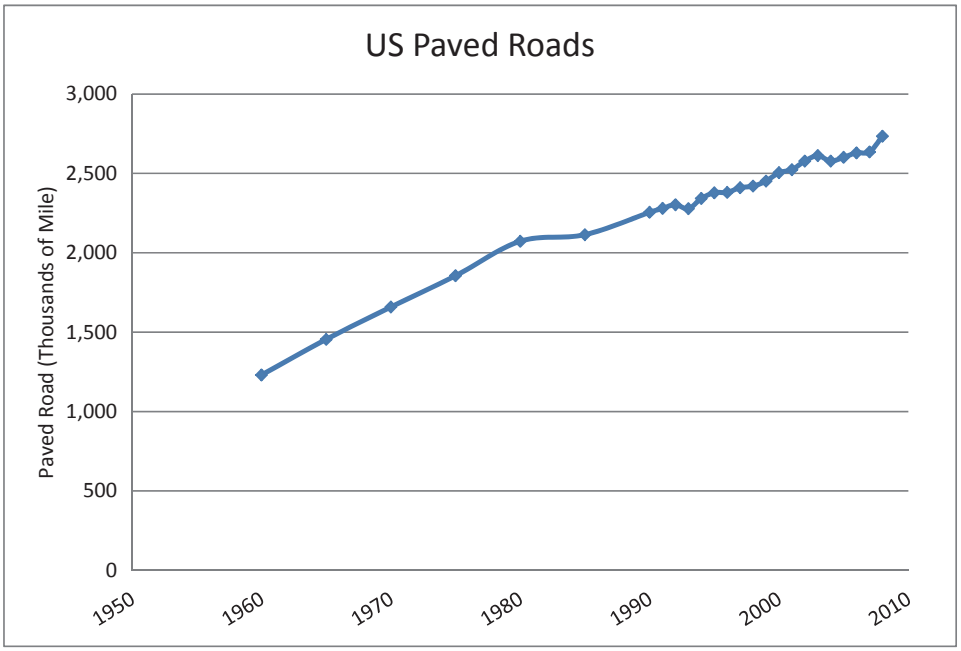

Figure 3 Paved road mileage in the USA by year [3]

2.3 Automobile Ownership per Capita

Since 1950 the USA has maintained one of the world's highest vehicle ownership rates. Vehicle ownership in the USA grew rapidly in the decades leading up to the 1980s, but slowed thereafter. Figure 4 shows the trend since 1950 in terms of vehicles per 1,000 people [4].

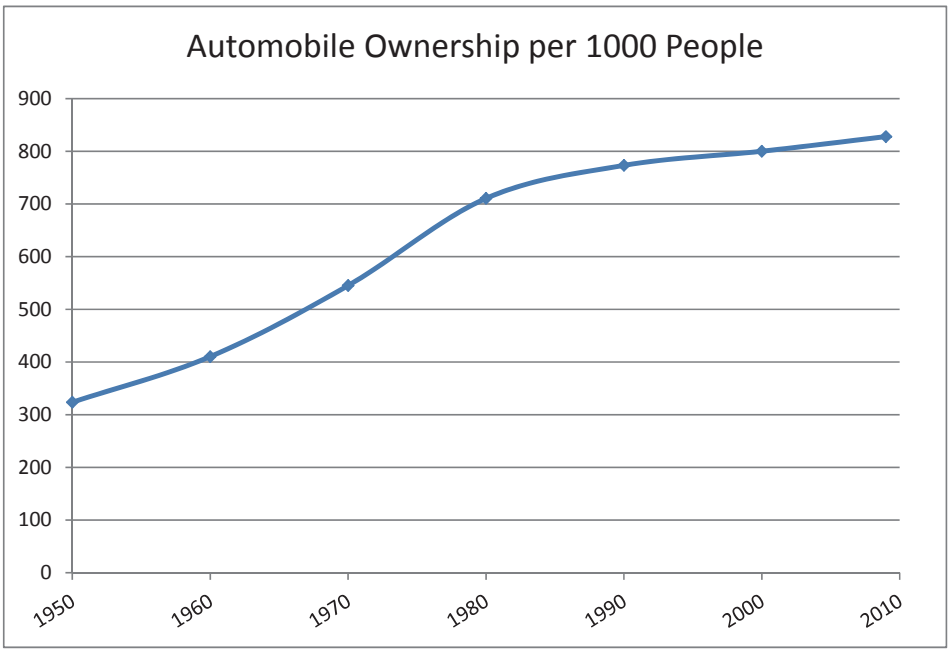

Figure 4 Automobile ownership per 1,000 people [4]

Figure 5 shows the trend in the number of registered motorcycles in the USA. The number declined during the 1980s, but has been steadily growing since the mid-1990s [5].

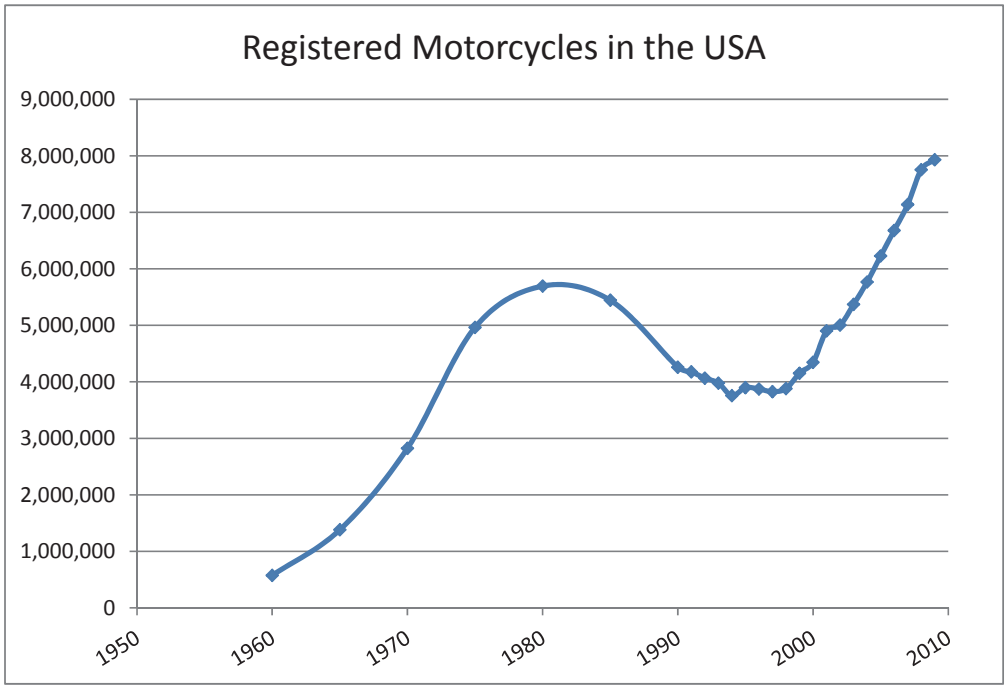

Figure 5 Number of motorcycles in the USA since 1960 [5]

2.4 Traffic-related Fatalities

In this section the trends in traffic-related fatalities are presented with respect to the raw numbers as well as normalized by VMT and population. It may be observed in Figure 6 that while the annual number of fatalities increased in the 1960s and then again slightly in the first few years of the new millennium, the more recent trend in fatalities has been downward since 2006. It will be interesting to examine if there are some recent regulations that may have affected these trends.

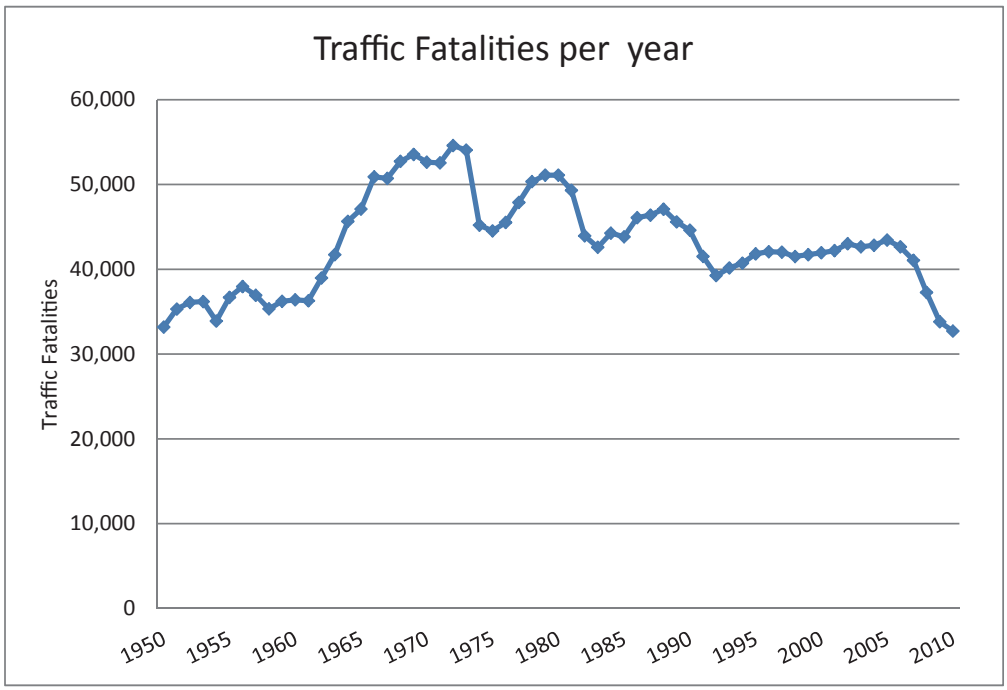

Figure 6 US traffic fatalities per year (1950-2010) [2]

In fact, according to the National Highway Traffic Safety Administration, traffic fatalities are at their lowest since 1950, despite the increases in the population and VMT. Fatalities as a fraction of population have gone down as shown in Figure 7. This was not the case in the 1960s, and while the fraction trended downwards between 1970s through 2005 it was not a consistent decrease [2].

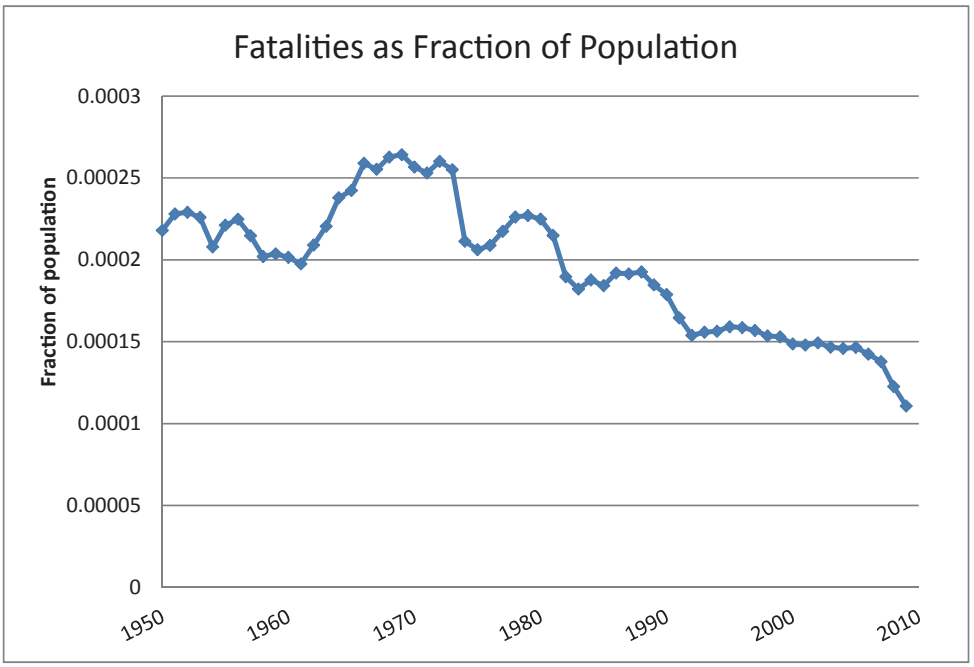

Figure 7 US traffic fatalities as a fraction of population (1950-2010) [2]

The fatalities normalized by VMT follow a far more consistent trend. The number of highway deaths normalized by VMT declined in the 1950s, increased in the 1960s, and has been on a steady decline since the 1980s [2].

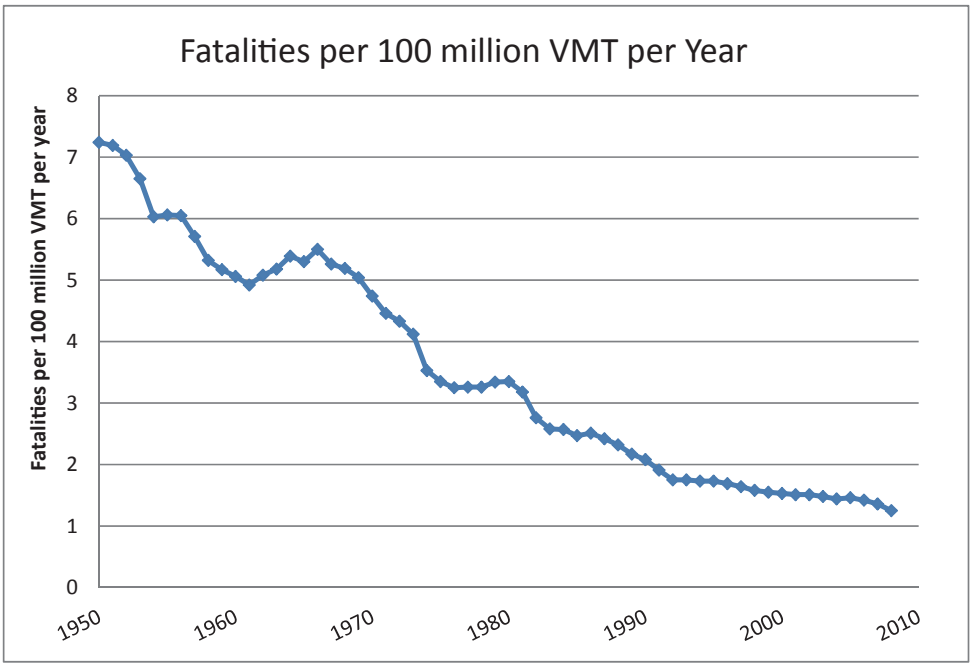

Figure 8 US fatalities per 100 million VMT 1950-2010 [2]

2.5 Pedestrian Fatalities

Information on pedestrian fatalities was gathered from the Federal Highway Administration (FHWA) website, which used two different sources, namely, the National Safety Council (through 1989; [6]) and the Fatality Analysis Reporting System (FARS; 1994 onwards; [7]). It appears that the pedestrian deaths have been reduced in terms of their absolute number, as well as a fraction of total traffic fatalities.

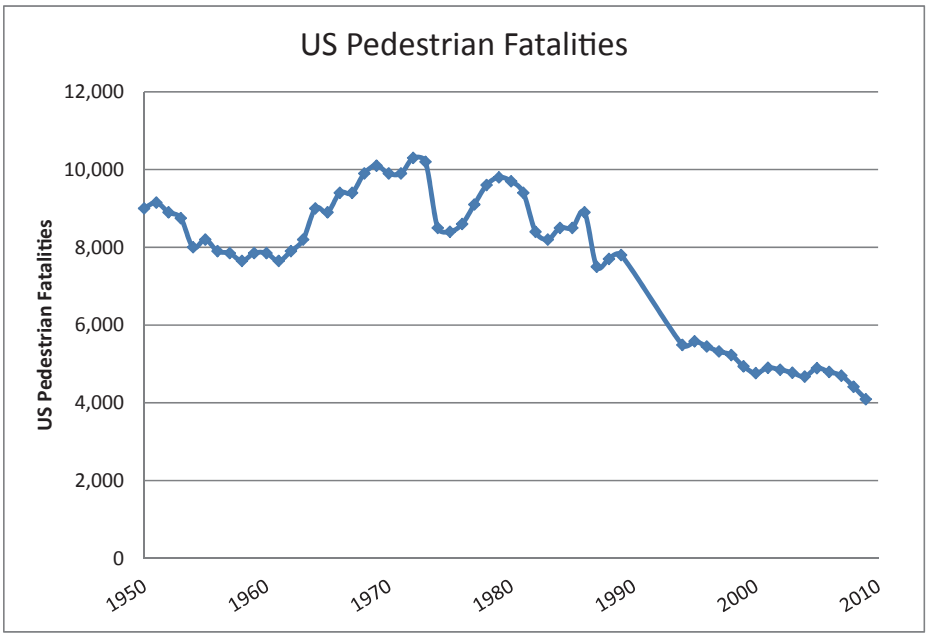

Figure 9 US pedestrian fatalities per 100 million VMT 1950-2010 [6] [7]

Figure 10 shows the number of motorcycle fatalities since 1994. The number consistently increased till 2008, and then dropped significantly in 2009 [7].

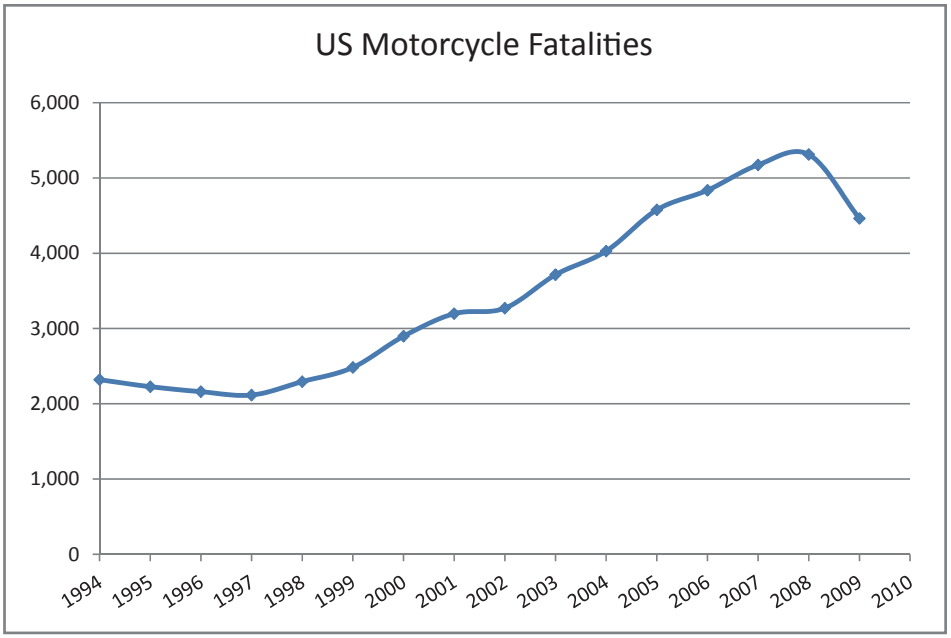

Figure 10 US motorcycle fatalities (1994-2009) [7]

Figure 11 shows the number of bicycle fatalities from the FARS dataset since 1994 [7]. It is apparent that while the overall trend is downward and the numbers are below 1,000, the trend is not as significant as that for pedestrian fatalities. Note that the accurate data for pedestrian, bicycle, and motorcycle fatalities from FARS are available only from the year 1994 onwards.

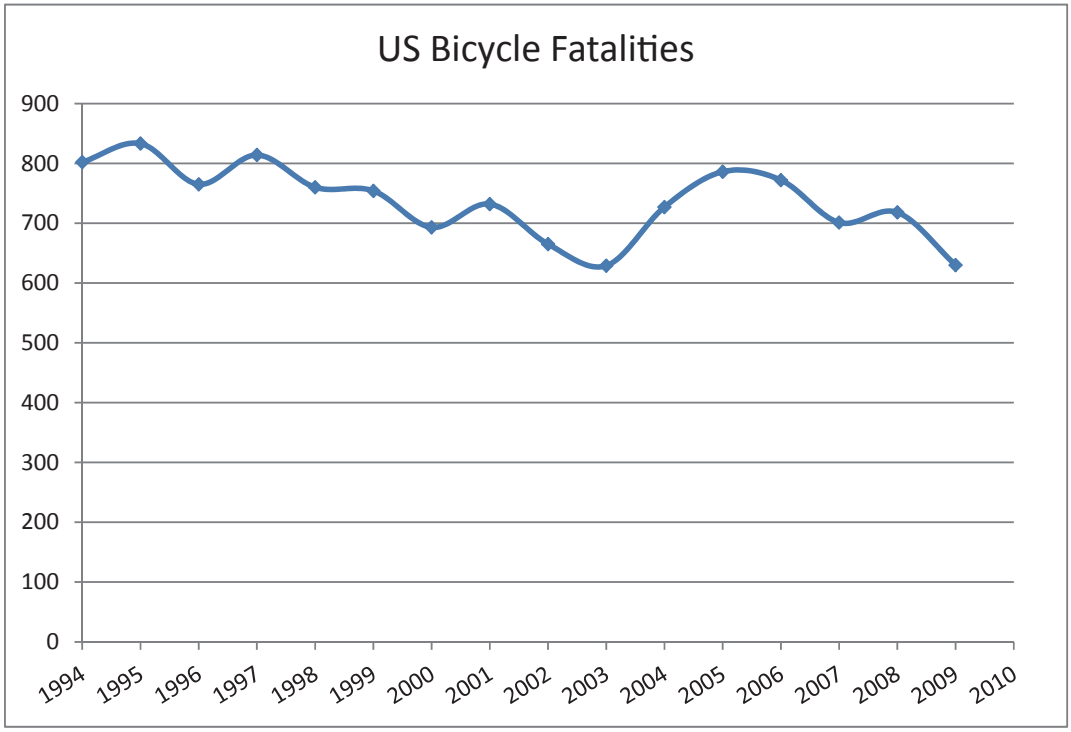

Figure 11 US bicycle fatalities [7]

Note that the injury information is not as accurate as the fatality information due to poor reporting reasons, especially if one wants to examine data from 1950 onwards. For example, FARS and the GES estimates on traffic crash injuries are only available from the early 1990s and thereafter. The author concluded that reliable and accurate nationwide traffic injury data that can be correlated with nationwide regulatory regime from the year 1950 onwards are not readily available for the USA.

3. National Organizations for Traffic Safety

3.1 A Brief History since 1950

In 1950, the Bureau of Public Roads under the Department of Commerce was the agency responsible for overseeing highway transportation [8]. In the mid-1960s (possibly due to the rise in fatalities we observed in the last section) concern about improving highway safety rose significantly in the USA. It was around the same time that the National Academy of Sciences published *Accidental Death and Disability—The Neglected Disease of Modern Society* [9]. In 1966, the US Congress held a series of hearings regarding highway safety and passed legislation to create the US Department of Transportation as a cabinet department of the executive branch of government. It began operation on

April 1, 1967. The mission of USDOT [10] is to "serve the United States by ensuring a fast, safe, efficient, accessible, and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future."

The same act created the Federal Highway Administration (FHWA), which took over the functions of the Bureau of Public Roads [8]. Several other agencies were also established around the same time, including the National Traffic Safety Agency, the National Highway Safety Agency, and the National Highway Safety Bureau. These agencies later became the National Highway Traffic Safety Administration (NHTSA), which is a coordinated national highway safety program aimed at reducing death on nation's roads. The legislation passed in that era also allowed and provided incentives to use federal funds to develop and strengthen state-level highway traffic safety programs [11].

3.2 Federal Highway Administration (FHWA): Role in Traffic Safety

FHWA supports state and local jurisdictions in the design, construction, and maintenance of the highway system (Federal Aid Highway Program). In terms of traffic safety, FHWA performs research in the areas of automobile safety, congestion, highway materials and construction methods. FHWA also publishes the Manual on Uniform Traffic Control Devices (MUTCD), which is used by most highway agencies in the United States. The MUTCD specifies standards for traffic control devices, such as traffic signals, and defines conditions that may justify putting a signal at an intersection [12].

3.3 National Highway Traffic Safety Administration (NHTSA)

NHTSA was officially established in 1970. As we observed in the preceding section, highway fatalities (normalized by VMT) have been on a decreasing trend since then. The decline is partially due to the following factors: automobile enhancements that provide better protection to vehicle occupants in collisions, improved highway signage standards, and increased use of restraints by drivers.

The agency is a division of USDOT and was created to carry out safety programs formerly governed by the National Highway Safety Bureau (one of its predecessor agencies). Specifically, the agency directs the highway safety and consumer programs established by the legislation passed since the mid-1960s [11]. It is safe to say that consumers today have a far greater access to vehicle safety information through NHTSA than they would in its absence.

3.4 Insurance Institute for Highway Safety (IIHS)

IIHS is a non-profit organization aimed at reducing deaths, injuries, and property damage that result from crashes on the nation's roads. It was founded in 1959 by the three major insurance associations of the time, and initially focused on supporting the highway safety efforts of state and federal agencies.

In 1968, however, it became an independent research and communications organization. IIHS produces ratings for popular passenger vehicles and certain consumer products associated with road safety (e.g., child seats) [13].

The next section examines the various state and federal regulations that may have contributed to the downward trends in fatalities and injuries presented this section.

4. Traffic Safety Regulations

Since 1950 several policies and regulations have been implemented to improve traffic safety in the USA. Some of them have been in response to events while some have been pre-emptive responses to research showing the risk to drivers, passengers, and/or pedestrians. In general, these policies can be divided into: i) mandated improvements to vehicular technology; ii) regulations aimed at driver/passengers, including licensing and equipment requirements (seat belts, helmets, etc.) and efforts to curb driving under the influence; and iii) changes in the national speed limit. All three sets of regulations have led to consequences, including potentially some unintended ones.

The next section focuses on mandates on vehicular technology and their possible relationships with traffic fatality/injury trends, followed by regulations aimed at drivers and the national speed limit.

4.1 Vehicular Technology

In terms of vehicular improvement mandates, air bags are the most significant for saving lives. Airbags were introduced into automobiles in the USA in the 1960s with the aim of reducing injury associated with frontal impacts. Since 1991, airbags have been required on the driver's side and as a result, air bags are widely credited with saving lives. In a study [14], it was found that the odds of a passenger dying in an automobile collision were reduced by approximately two-thirds when the airbag was deployed. The same study found that the combination of seat belt use and air bag deployment reduced the driver’s risk of dying in a head-on collision by over 80 percent, representing a very significant improvement. In addition to airbags, the NHTSA has mandated that all 2012 model passenger automobiles weighing less than 10,000 lbs. be equipped with ESC (Electronic Stability Control) [15].

4.2 Driver/passenger-related Regulations

There have been several regulations that require the drivers to behave in a certain way. Some of these regulations attempt to protect the drivers themselves while some others protect other road users. Seat belt regulations are an example of the former while the DUI (driving under the influence) laws exemplify the later.

4.3 Seatbelt Laws

When driving on the road, there is always a possibility of ending up in a crash. Even when a driver is careful enough not to cause a crash, he or she may become involved in a crash caused by someone else. Use of seatbelts is one of the ways in which one can decrease the impact of a crash. Seat belts hold the riders in place so that they will not be thrown out of the vehicle in a crash, and thus lower the level of potential injury. In the USA, a federal law requiring seat belts to be installed on all automobiles was enacted in 1968, and from 1984 onward states gradually began requiring passengers to wear seat belts. After these laws were enacted, seat belt use rose from 50 to 70 percent in the first month alone. The US Department of Transportation estimated a 16 to 20 percent reduction in front seat occupant fatalities due to these regulations [16].

As of right now, 32 states, the District of Columbia, and territories including American Samoa, Guam, the Northern Mariana Islands, Puerto Rico and the Virgin Islands have primary seat belt enforcement, while 17 states have secondary enforcement. Primary enforcement means that a police officer can fine individuals who do not wear seat belts, even when another traffic offense has not been committed. Secondary enforcement means that police cannot ticket a driver solely for lack of seat belt use [17]. State laws also vary depending on whether the passenger is seated in the front seat or in the rear seat. New Hampshire is the only state that has no seat belt law for adults. It is expected that the stricter the enforcement of seat belt use, the higher the number of people who use them. A study by Calkins and Zlatoper [18] compared the fatality rates of crashes in states with primary enforcement against those of states with secondary enforcement. Information on the fatality count from a year prior to the mandatory seat belt laws and a year after the enforcement of the law was examined in the research. This study showed that on average the primary states observed a 17% reduction in traffic fatalities, while in the secondary enforcement states the reduction was only 3%. It was argued that in the secondary enforcement states only the “safe” drivers followed the law and put on the seat belts while “unsafe” drivers, such as the younger drivers, did not [18]. In fact, subsequent research has shown that the drivers/passengers most likely not to obey seat belt laws are teenagers [19].

4.4 Helmet Laws

The laws requiring use of protective headgear while riding a motorcycle or bicycle vary state by state. The current disposition of laws is documented by IIHS [20]. In some states there are no specific laws that require individuals to wear a helmet while riding a motorcycle. In several others, there are no laws requiring individuals over the age of 18 to wear helmet while riding a bicycle. It is obvious that wearing a helmet while riding a bicycle or motorcycle is much safer than not wearing one. In fact, as noted by Macleod et al. [21], in 1975 all but three states in the USA had mandatory helmet use laws. However, it is interesting to note that some states that required the use of helmet in the past have rescinded those laws. The reason for the change was the cause of individual rights prevailing in some

cases over public safety. In this regard, the trends in traffic safety have been clear, with increased incidence of head injuries and related fatalities. For example, Muller [22] examined the monthly time series of motorcycle occupant deaths from 1/1994 to 12/2001 in Florida, a state that on July 2000 exempted adult motorcyclists from wearing helmets provided they had medical insurance of $10,000 or more. It was estimated that this exemption led to a 48.6% increase in motorcycle occupant deaths. The results showed a lower increase at 38.2% and 21.3% respectively, when trends in miles traveled and motorcycle registrations were controlled [22]. Similar results were obtained from Pennsylvania by Mertz and Weiss [23] following the relaxation of helmet use laws in that state.

4.5 DUI Laws

Driving under the influence (DUI) of alcohol/drugs is a significant problem in the USA, especially due to the dependence on automobiles and lack of public transportation options in large swathes of the country. As a result, according to FARS more than 1/3 of all traffic fatalities are associated with alcohol consumption [24]. This statistic remained fairly consistent from 1994 through 2009. The citizen action groups that have contributed significantly towards the campaign against drunk driving include Mothers against Drunk Driving (MADD), Students against Drunk Drivers (SADD) and Remove Intoxicated Drivers (RID). Most of these groups emerged in 1980s in response to fatalities and injuries of minors and then prevalent light sentencing for drunk drivers [25].

Following the repeal of Prohibition in the 1930s, some states lowered their drinking age to 18-20 and until the late 1960s, individual states had the right to make their own DUI laws ([25], [26]). During the 1970s, research emerged which suggested that a lower drinking age correlated to increased alcohol related traffic fatalities in youth. As a result, a few states reinstated the age of 21 as the minimum legal drinking age (MLDA) either incrementally or immediately during the 1970s ([25], [26]). McCartt et al. [26] also noted that states with a MLDA of 21 began seeing lower crash rates in the under-21 demographic group. In 1984, the Federal Uniform Drinking Age Act was passed to encourage states to set their MLDA to 21. [25]. Since MLDA establishment remained within states' jurisdiction, individual states were not obligated to comply. However, the Federal Uniform Drinking Age Act stipulated that any state wishing to receive federal highway funding needed to enact a zero tolerance law for those under 21 by the year 1999 [27]. Recently, it has been argued that MLDA-21 results in increases in binge drinking [26].

The literature clearly shows that from 1966 through 1975 (when many states lowered their minimum drinking age) the rates of alcohol-related crashes among the under-21 group increased (e.g., [26]). However, the study did point to the possibility that the lower rates of underage alcohol-related crashes during select time periods could be due to the lower numbers of people in that age group. In addition to a reduction in crashes, there was a decline in the prevalence of drinking and driving from 1973

through 1996. For example, the estimated percentage of weekend nighttime drivers with a positive BAC (blood alcohol content) fell from 36% in 1973 to 26% in 1986 and to 17% in 1996 [28].

In terms of most effective policies, the literature has suggested that dram shop liability laws (holding alcohol selling establishments liable for crashes involving their patrons) strongly correlates with a decrease in alcohol-related crashes [27]. Another successful strategy was lowering the BAC limit from .10 to .08, which reduced alcohol-related crashes anywhere from 3 to 40% [29]. However, studies of individual states do not consistently reflect this reduction rate due to the wide variability among different states [30]. On the other hand, McCartt et al. [26] found little to no evidence to support that zero tolerance MLDA-21 was effective in lowering prevalence of drunk driving or crashes. Although the crash rates among minors did show a decrease, it may have been attributable to other causes such as increased prevalence of seat belt use, stricter DUI laws and improved vehicle safety [26].

4.6 Graduated Licensing Programs

Before the 1990s, most states had a single-stage driver licensing system in which 16 or 17 year olds could obtain full driving privileges in one step. In the past 15 years, however, almost all states have implemented the graduated driver licensing (GDL) programs for teenagers trying to obtain a license. The goal of such programs is to lower traffic fatalities caused, and suffered in most cases, by young drivers by making them better prepared for the task of driving. Research in the mid-1990s showed that the fatality rate for drivers between the ages of 16 and 20 was almost three times that of middle-aged, experienced drivers [31]. While individual details may vary, the overall structure of the GDL programs is as follows [31]:

- First stage: The student driver learns how to drive for 6 months with a supervisor over the age of 21 always present.
- Second stage: After passing the driving test, the new driver receives a limited license that allows them to drive alone under certain restrictions. For example, they cannot drive during high-risk times, such as at night, or with more than two passengers.
- Third stage: The probationary restrictions on the license are removed.

Research evaluating GDL programs [32] found that they were quite effective in reducing traffic fatalities among 15 to 17 year olds. Their analysis indicated that the average GDL program led to at least a 5.6% reduction in fatalities. GDL programs with more restrictive policies (characterized as "good" by the IIHS) were noted to have reduced fatalities among 15 to 17 year olds by as much as 19%. It is clear that this kind of program is seen as a step in the direction of saving lives, and hence has been adopted by almost all states.

4.7 Speed-limit Laws

Higher speed increases the distance it takes to safely stop a vehicle, which can make it harder to avoid crashes. The reaction time necessary to prevent collision is decreased significantly as speed goes up. Hence, it is critical from a safety standpoint that vehicles be driven at an appropriate speed. Speed limit regulations can play a critical role in that regard.

Up until the mid-1970s, there was a wide variance in highway speed limits from state to state. The national maximum speed limit (NMSL) of 55 miles per hour (mph) was instituted as an energy conservation measure in response to the 1973 oil embargo [33]. Vernon et al. [33] noted that the number of traffic fatalities decreased nationwide, from 54,000 in 1973 to 45,000 in 1974 following the implementation of NMSL. This was widely attributed to the decrease in speed limits, leading the US Congress to pass Public Law 93–643 to make the change in speed limits permanent, with highway safety being cited as the main purpose [33]. In 1987, however, states were allowed to raise the speed limit to as high as 65 mph on certain rural interstates, and in 1995 the national speed limit was eliminated completely, with the responsibility of setting speeds on highways once again going back to individual states. The state-by-state information on existing highest speed limits on freeways can be found in [34]. Most of the studies that attempted to assess the impact of this change on traffic safety concluded that the number and/or rate of severe crashes went up after the removal of the NMSL, but the impact on overall crash rate and frequency was somewhat mixed ([33]; [35]; [36]; [37]).

More recently, in 2006 the daytime speed limit for passenger vehicles on segments of I-10 and I-20 in the state of Texas was increased from 75 to 80 mph [38]. The study examining these changes found that the increase in speed limits led to higher travel speeds and that to reduce the risk of speed-related crashes highly visible police traffic enforcement and speed cameras should be implemented, accompanied with publicity [38].

5. Conclusions

Highway traffic deaths have long been a concern for public health officials. Legislators and regulators have implemented several changes over the years to make highways safer for motorists, pedestrians and bicyclists. To make a philosophical case that highway crashes and related fatalities can be eliminated; NHTSA carried out a campaign titled “crashes aren’t accidents” to change the prevalent terminology in the traffic safety community [39]. The term “accident” gives the impression that highway crashes and the resulting injuries/fatalities are a matter of chance. Therefore, “crash” is a more appropriate term since one can take steps to avoid crashes. The efforts of policymakers towards eliminating crashes include legislation specifying maximum speed limits, seat belt usage, etc. While the mere existence of such laws may influence motorists’ behavior, enforcement of these laws may also significantly affect highway safety. This study tried to determine the trends in highway fatalities

and several regulations and their effect on highway safety. Recent trends suggest that USA is moving in the right direction in terms of improving highway safety. However, it cannot be ruled out that this is merely the reflection of a slow economy and this safety improvement trend will reverse with an improving economy. In this regard, the USA should be vigilant about continuing to implement policies that have been identified as successful in the literature (documented in this report) as well as attempt to learn from efforts abroad toward achieving zero fatalities.

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Dr. Pande has significant experience in the collection and analysis of traffic data related to safety measurement. His research interests also include driver behavior, traffic simulation, emergency evacuation, and the scholarship of teaching. He received the "Young Researcher Award" from the Transportation Research Board's Committee on Safety Data, Analysis, and Evaluation in 2007. He has co-authored close to 30 papers that have been either published or are forthcoming in peer reviewed journals such as *AAP*, *TRR*, and *IEEE Transactions on ITS*. He is currently working on several sponsored projects including a study of driver behavior funded by the National Science Foundation.

Changes in Traffic Safety Policies and Regulations in Japan (1950–2010)

1. Introduction

Japan's economic recovery in the aftermath of the Second World War and its rapid economic development thereafter have been called "an Asian miracle," placing Japan in a position of leadership in the world economy and bringing unprecedented prosperity, both materially and spiritually, to the Japanese people. Road transportation has undergone extensive motorization and played a major role in Japan's economic growth by enabling movement of both people and goods.

Improvements to Japan's roadway infrastructure, however, have not always kept pace with rapid increases in traffic volume. In 1956, a report submitted to the Japanese government by a group of experts headed by Ralph J. Watkins characterized Japan's roadways with the frank statement: "The roads of Japan are incredibly bad. No other industrial nation has so completely neglected its road system. "

With economic growth comes increased traffic volume, which in turn leads to increased traffic accidents. This is a pattern that has been observed in all countries worldwide. Any country that experiences rapid economic growth as Japan did will be hard pressed not to repeat this experience. Yet, within this process are elements unique to Japan's situation. Despite the rapid pace at which Japan's traffic volume increased, not only were the existing roadway infrastructure and traffic safety facilities woefully inadequate, a lack of financial resources meant that only a limited number of slowly-proceeding improvements could be made. Tax revenues earmarked for roadway construction was first established in 1954, and in 1957 financing from the World Bank enabled the start of construction for a series of expressways that were intended to open in time for the Tokyo Olympics in 1964. Despite all this, however, there was little funding available for improvements to traffic safety facilities. The result was rapid increases in both injuries and fatalities due to traffic accidents.

This trend was finally reversed around 1970, at which point injuries and fatalities due to traffic accidents in Japan began to decrease. With the allocation of funding specifically for the enhancement of traffic safety, programs to improve traffic safety facilities nationwide were at last implemented. Additionally, law enforcement throughout Japan also continued its efforts, which had begun during the 1960s or even earlier, to stem the sharp increase in traffic accidents. In these efforts can also be seen a resourceful approach by postwar municipal police departments toward the adoption of policies that would contravene the draconian image created by the Peace Preservation Police and the Security Police during the prewar era. In fact, it is difficult to overstate the extent to which traffic safety policy is associated with postwar democratic law enforcement. This particular point, which municipal police departments nationwide struggled incessantly with at a time when the image of prewar police remained ingrained in much of the general public, is something that many developing countries would do well to consider in the formulation of traffic safety policy.

Throughout the rest of this paper, I will use a variety of statistics to illustrate historical trends in traffic accidents and the effect they had on the development of Japan's traffic safety policies up to the present time.

2. Basic Traffic Safety Statistics

2.1 Japan's Population

According to the National Census, Japan's population in 2010 was 128 million, including non-Japanese residents, which is a slight increase over the previous census taken in 2005. Looking only at Japanese nationals, we see a slight decrease during this same time frame of approximately 37,000 people. This is the first time since the National Census began that the native population has shown a decrease, and as many have noted, Japan's population has peaked and is about to enter an era of negative growth.

Figure 1 shows Japan's population and growth rate during the postwar era. Although Japan's population during the prewar era did not reach the 80 million mark, the influx of postwar returnees helped boost it over that figure in 1948, after which it continued to grow rapidly, reaching 90 million in 1956, 100 million in 1967, and 1.2 million in 1984.

In contrast, even as the population continued to grow, the population growth rate showed a tendency to decline, and although it averaged approximately 1.1% throughout the 1970s, it fell to 0.5% in the 1980s, 0.2% in the 1990s, and to 0% during the first decade of the 21st century.

Looking at demographic age distribution, we see that Japan's population is aging faster than any other country in the world. The graying of Japan's population, as measured by the percentage of the population that is 65 years of age or older, had reached 23.1% in the 2010 National Census, and statistics issued by the National Institute of Population and Social Security Research indicate that this is expected to reach nearly 40% by 2050, as shown in Figure 2. In fact, protection of the elderly is a major topic of concern in the planning of traffic safety policies in Japan, and in the not too distant future, Japan's initiatives in this area could serve as models for similar policies in other countries that must deal with declining populations.

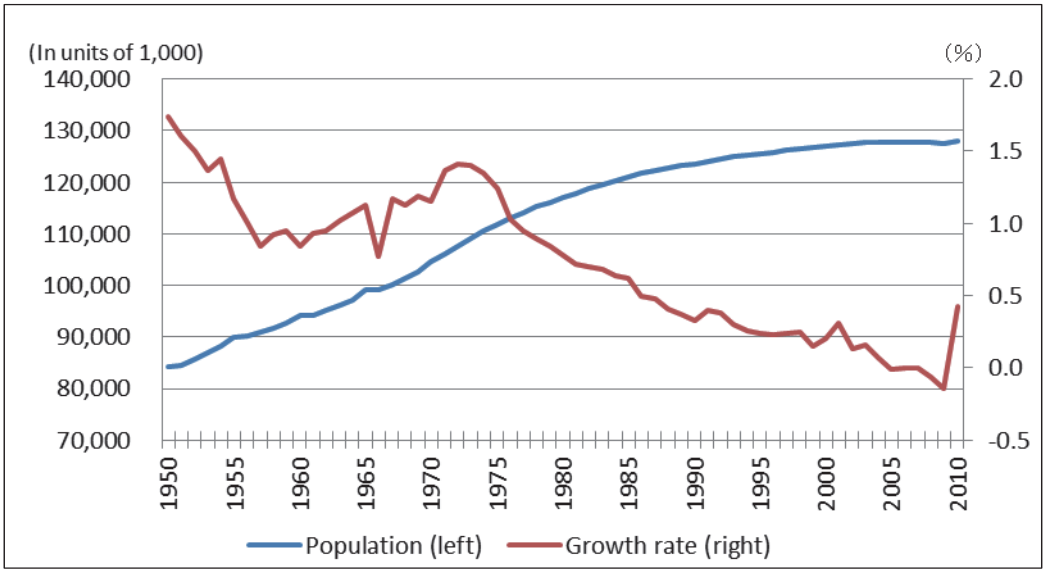

Figure 1 Population growth and growth rate in Japan from 1950 to 2010

Source: Japan Statistical Yearbook 2011 published by the Statistics Bureau, Ministry of Internal Affairs and Communications pp. 34–35

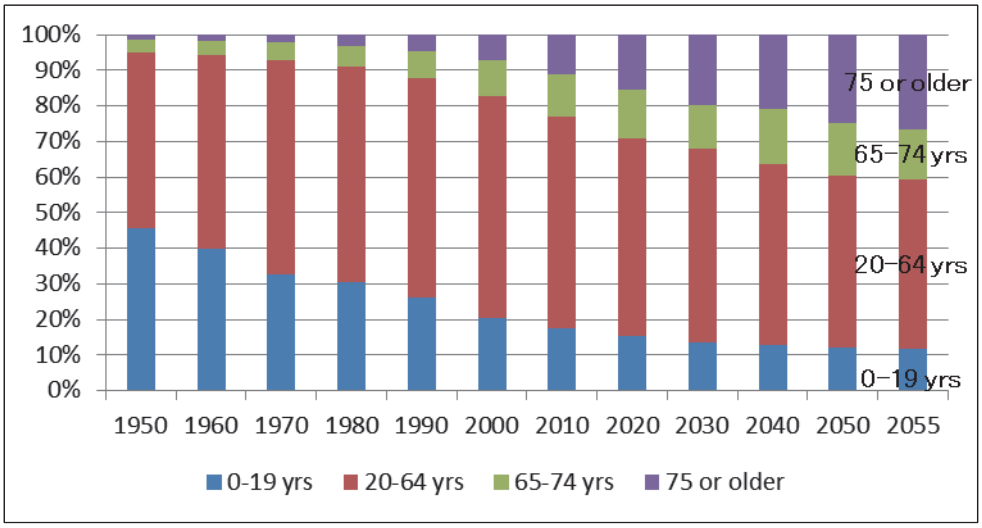

Figure 2 Historical population age distribution in Japan from 1950 to 2010 with predictions to 2055

Source: National Institute of Population and Social Security Research Website (http://www.ipss.go.jp) Population Statistics II, Population by Age, Table 2-9 Actual and Projected Population by Age: 1920–2055(in Japanese)

2.2 Road and Highway Lengths

Figure 3 shows the total length of public roads and highways in Japan, which comprises nationally-maintained highways, prefecturally-maintained roadways, and municipally-maintained roads. In the 1950s, the total length of all public roads and highways had exceeded 900,000 km and had been extended to over 1.2 million km by the end of FY2009. Since 1954, maintenance and improvement of these roads has been provided for by tax revenues earmarked for roadway construction, which is a major factor in this growth.

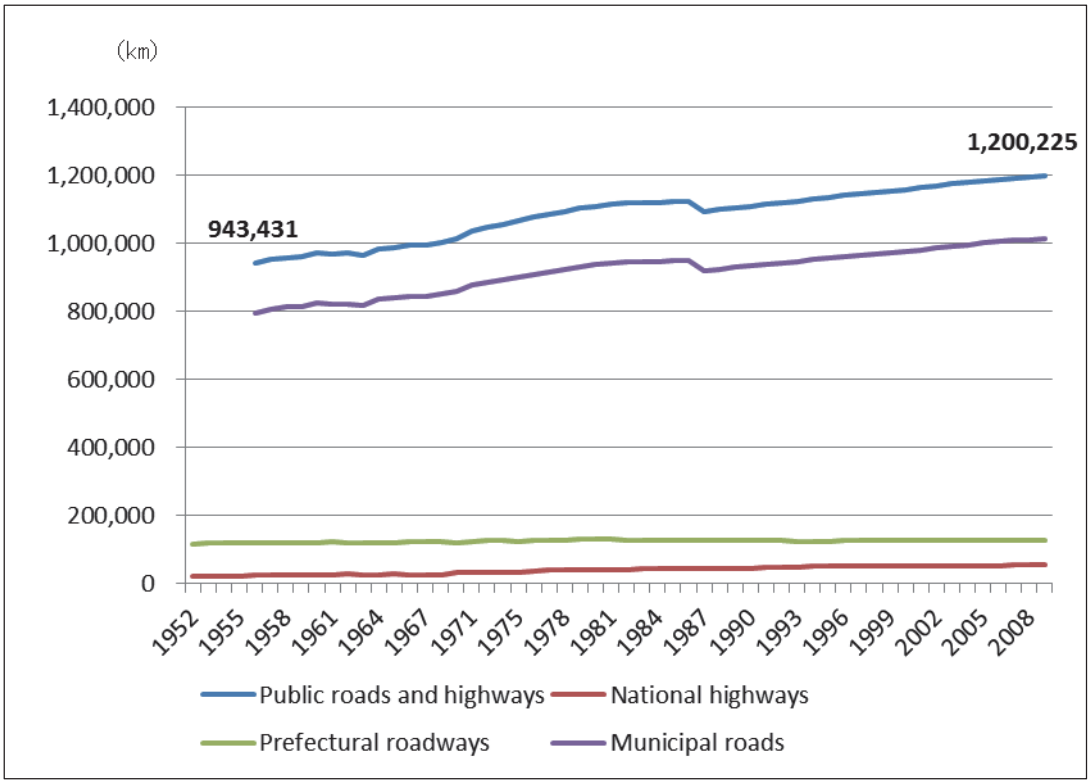

Figure 3 Public road and highway construction from FY1952 to FY2009

Source: Ministry of Land, Infrastructure, Transport and Tourism Website, Road and Traffic Yearbook 2011, (http://www.mlit.go.jp/road/ir/ir-data/tokei-nen/index.html) (in Japanese)

Note: The figures used do not reflect lengths of overlapping routes, routes not in service, or ferry routes.

Figure 4 shows the total length of expressways in service. Starting with the 1963 opening of the Meishin (Nagoya–Kōbe) Expressway, construction of new expressways in Japan has continued steadily year by year and reached a total length of 7,642 km by the end of FY2009.

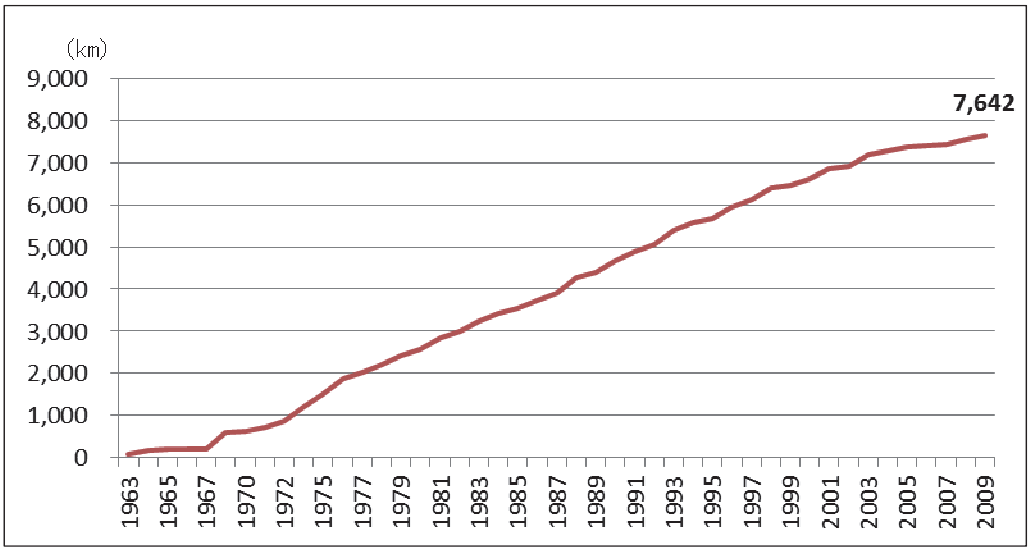

Figure 4 Expressway construction from FY1963 to FY2009

Source: Ministry of Land, Infrastructure, Transport and Tourism Website, Road and Traffic Yearbook 2011, (http://www.mlit.go.jp/road/ir/ir-data/tokei-nen/index.html) (in Japanese)

2.3 Number of Motor Vehicle Ownership

Figure 5 shows changes in ownership of motor vehicles during the period from 1956 to 2009, and Table 1 shows the rate of change over most of that period expressed in five-year increments. In consumer theory, motor vehicles are generally considered to be superior goods, which means that demand increases as income rises, but increased income from Japan's sharp economic growth meant that, irrespective of slight disruptions such as the 1974 oil shock, ownership of motor vehicles increased rapidly during this period.[1]

Ownership of automobiles saw double-digit growth annually until 1970, as did motorcycles until 1965. 1966, in particular, became known as the First Year of the Family Car, with Japanese automakers launching new-model mass-market cars one after the other, vastly expanding car ownership in Japan. Entering the 1970s, however, car ownership began to grow more slowly, and growth from 1990 onward has declined steadily, with annual averages of 2.11%, 1.09%, and 0.57% for the three five-year periods from 1991 to 2005.

Although mopeds were extremely popular as an inexpensive mode of transportation during the late 1970s and early 1980s, motorcycle ownership in general has declined steadily over the course of the four five-year periods since 1986. Rapid increases in the number of accidents involving mopeds led to mandatory use of helmets starting in 1986.

[1] In 1956, the Annual Economic Report contained a passage that has become famous as an example of the rhetoric of era: *We have left the "postwar" behind and are now about to face an entirely new situation. Our economic recovery is now complete. Future growth will be supported by modernization. The advances of modernization will in turn be achieved through rapid and stable economic growth.* From this time on, the Japanese economy has undergone multiple cycles of expansion and contraction but has continued to grow rapidly

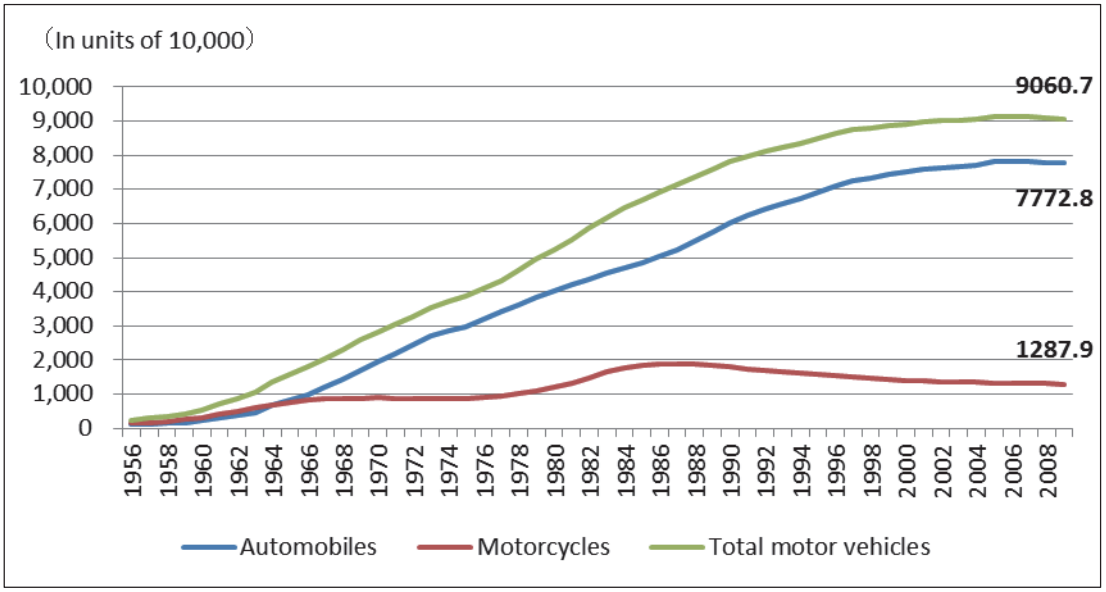

Figure 5 Motor vehicle ownership from 1956 to 2009

Source: Ministry of Land, Infrastructure, Transport and Tourism, Motor Vehicle Ownership Monthly

Table 1 Rate of change of motor vehicle ownership (%)

Year	Automobiles	Motorcycles	Total Motor Vehicles
1956–60	15.72	18.11	17.09
1961–65	23.16	13.21	17.72
1966–70	14.72	1.65	9.53
1971–75	6.54	-0.13	4.79
1976–80	4.69	6.20	5.03
1981–85	2.98	6.81	3.95
1986–90	3.59	-1.04	2.41
1991–95	2.11	-2.09	1.25
1996–2000	1.09	-1.71	0.62
2001–05	0.57	-0.77	0.37

Source: Ministry of Land, Infrastructure, Transport and Tourism, Motor Vehicle Ownership Monthly

2.4 Number of Individuals Holding a Driver's License

According to the National Police Agency, 81 million people held a driver's license in Japan during 2010, which is 3.3 times the number of license holders there were when the driver's license management system began collecting statistical data in 1969. Except for a brief rise in the late 1970s, however, the growth rate has been declining steadily, and it has fallen to nearly 0% in recent years. Figure 6 shows the number of individuals holding a driver's license and the growth rate of that number from 1969 to 2010.

Looking at age distribution, in 2010, 16% of all individuals holding a driver's license were 65 years of age or older, and this number is expected to increase. It will become increasingly important to take measures to reduce the opportunity for the elderly to drive, such as a program to encourage voluntary relinquishment of driver's licenses, as part of traffic safety policies specifically for elderly drivers.

Moreover, there are currently two programs for the elderly: markers for elderly drivers and courses for the elderly. The former program has been proven to contribute to traffic safety, but the effectiveness of the latter remains unclear (Sugimoto, 2012)

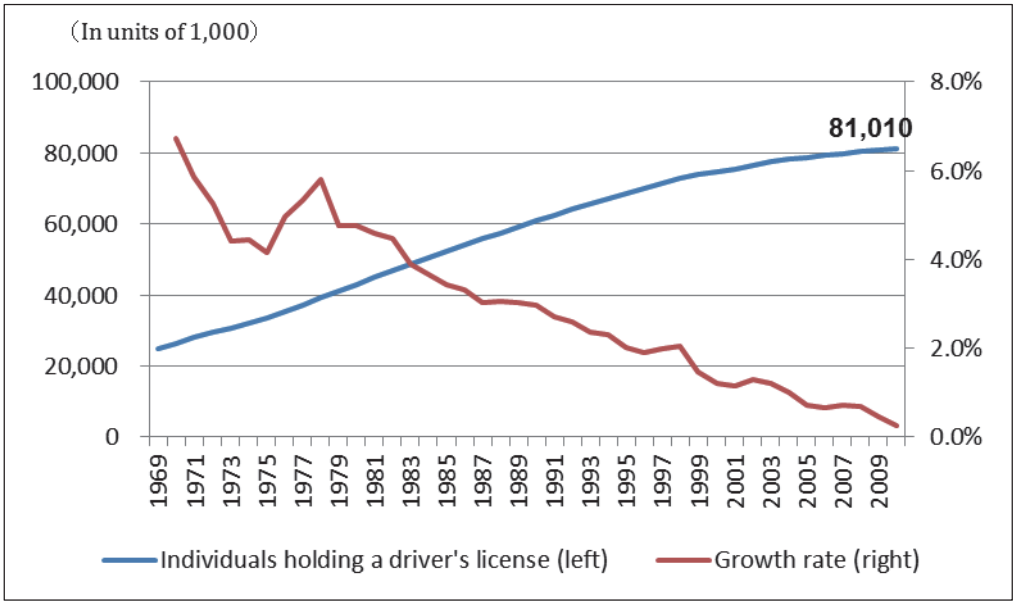

Figure 6 Number of individuals holding a driver's license and growth rate from 1969 to 2010

Source: Page 1 of Driver's License Statistics 2010, published in 2011 by Driver's License Dept., National Police Agency

2.5 Number of Fatalities and Injuries due to Traffic Accidents

Figure 7 shows fatalities due to traffic accidents in Japan from 1950 to 2010. The rapid increase in motor vehicle ownership that began in the 1950s was accompanied by a rapid increase in fatalities due to traffic accidents. For example, there were 8,200 traffic fatalities in 1958, more than 10,000 in 1959, and more than 12,000 in 1960. Despite a brief respite immediately thereafter, the number of traffic fatalities generally continued to escalate rapidly, reaching a record high of 16,765 in 1970, which still stands as the worst year ever in Japan. The latter half of the 1960s in particular, which became known as the "First Traffic War" witnessed dramatic increases in the number of both traffic accidents, as seen in Figure 11, and fatalities.

This led to a public call for policies to reduce traffic accidents, which resulted in the Traffic Safety Policies Basic Act being passed into law in 1970.[2] This Act also served as the basis on which the

[2] The objective of this Act, as given in its first article, is to contribute to the enhancement of public welfare through comprehensive and systematic promotion of traffic safety policies, by clarifying the responsibilities of national and local public service organizations as well as of both passengers and operators of motor vehicles, marine vessels, and aircraft with regard to traffic safety, establishing basic structures needed for traffic safety through national and local public service

Central Traffic Safety Policy Council issued the First Traffic Safety Basic Action Plan in 1971. Since that time, new plans have been drafted every five years, and 2011 saw issuance of the Ninth Traffic Safety Basic Action Plan.

With the issuance of Traffic Safety Basic Action Plans and the joint cooperation of the public and private sectors in implementing traffic safety measures, the targets specified in each five-year plan had helped reduce traffic fatalities to just over 8,000 by 1979, or roughly half of the figure for 1970. The effect was temporary, however, and traffic fatalities began to rise yet again, reaching the 10,000 mark for a second time in 1988 and continuing to rise until 1992. But the trend has been downward since that time, reaching 4,863 in 2010 and 4,611 in 2011, which marked the 11th consecutive year in which traffic fatalities had declined.

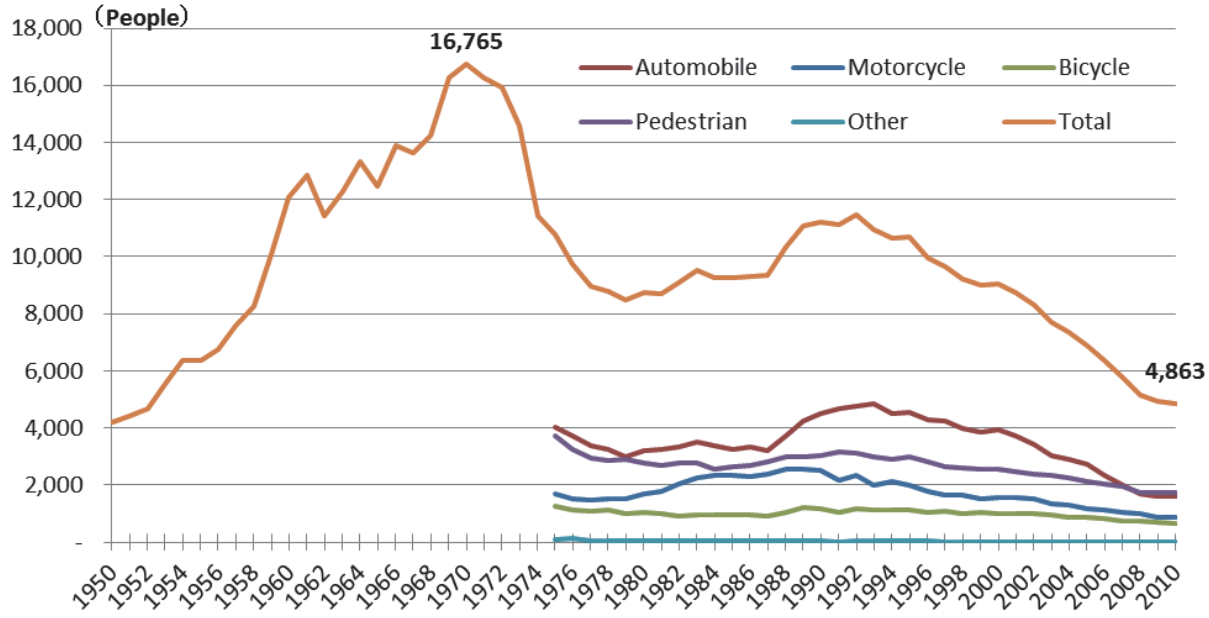

Figure 7 Fatalities (within 24 hours) due to traffic accidents from 1950 to 2010

Source: Traffic Accident Statistics published annually by the Traffic Bureau of the National Police Agency

The 9th Traffic Safety Basic Action Plan, drafted in 2011, identified the following characteristics of traffic fatalities in recent years:

(1) As shown in Table 2, traffic fatalities in which the victim was 65 years of age or older continue at a high rate, comprising half of all fatalities. In more than 60% of these, the elderly victim was a pedestrian or was riding a bicycle. Also, the number of fatal accidents involving elderly drivers has increased in recent years.

(2) Fatalities of youths between the ages of 16 and 24 have dropped significantly, especially in terms of deaths of passengers.

(3) Compared with North America and Europe, the percentage of traffic fatality victims who were pedestrians or riding bicycles is high.

organizations, and providing for the establishment of traffic safety planning and other measures to be implemented by national and local public service organizations .

(4) The number of fatal accidents involving speeding violations or driving under the influence of alcohol is declining.

Other reasons given for recent declines in traffic fatalities include the effects of improvements to roadway and traffic control facilities, diffusion and thoroughness of traffic safety education, greater awareness and implementation of defensive driving techniques, enhanced safety features on motor vehicles, continued enforcement of and compliance with traffic safety laws, and improvements to emergency response. Major factors that can be defined quantitatively include the following:

(1) Reduced incidence of malicious or irresponsible behavior such as driving under the influence of alcohol
(2) Reduced incidence of fatalities among automobile passengers, attributed to increased use of seat belts
(3) Enhanced hazard perception at lower speeds (vehicle speeds immediately prior to accidents)
(4) Reduced incident of jaywalking and other violations by pedestrians
(5) Enhanced safety features on motor vehicles

Table 2 Traffic fatalities by age for 2010

15 yrs. or younger	16–24 yrs.	25–29 yrs.	30–39 yrs.	40–49 yrs.	50–59 yrs.	60–64 yrs.	65 yrs. or older	Total
111	469	198	378	395	489	373	2,450	4,863
2.3%	9.6%	4.1%	7.8%	8.1%	10.1%	7.7%	50.4%	100%

Source: Page 10 of the Traffic Safety Report, published by the Cabinet Office in 2011

In 1993, the National Police Agency, recognizing a need both to track fatalities caused by traffic accidents for more than just 24 hours and to make accurate comparisons with statistics from other countries, began to compile statistics on fatalities after the first 24 hours but within 30 days of the accident. Total fatalities from 1993 to 2010 are shown in Table 3 and classified as being within 24 hours (A) and within 30 day (B). Although B is naturally larger than A, the ratio B/A has been relatively steady at a value of between 1.15 and 1.20.

Table 3 Traffic fatalities within 24 hour and within 30 days from 1993 to 2010

	Fatalities within 24 hours (A)	Fatalities within 30 days (B)	B/A
1993	10,942	13,269	1.21
1994	10,649	12,768	1.20
1995	10,679	12,670	1.19
1996	9,942	11,674	1.17
1997	9,640	11,254	1.17
1998	9,211	10,805	1.17
1999	9,006	10,372	1.15
2000	9,066	10,403	1.15
2001	8,747	10,060	1.15
2002	8,326	9,575	1.15
2003	7,702	8,877	1.15
2004	7,358	8,492	1.15
2005	6,871	7,931	1.15
2006	6,352	7,272	1.14
2007	5,744	6,639	1.16
2008	5,155	6,023	1.17
2009	4,914	5,772	1.17
2010	4,863	5,745	1.18

Source: Traffic Safety Report, published annually by the Cabinet Office

Figure 8 shows injuries from traffic accidents. As with traffic fatalities, the number of injuries due to traffic accidents reached a peak in 1970, declined until 1977, but peaked again during the early 2000s.[3]

[3] With traffic deaths once again passing the 10,000 mark, the years from 1988 onward, during which numerous traffic safety policies were implemented, became known as the "Second Traffic War," just as the 1970s had been known as the "First Traffic War." For example, both stronger penalties for driving under the influence of alcohol enacted in 2001 as well as the establishment of mandatory imprisonment for dangerous driving resulting in vehicular manslaughter in 2007 have clearly had a major effect.

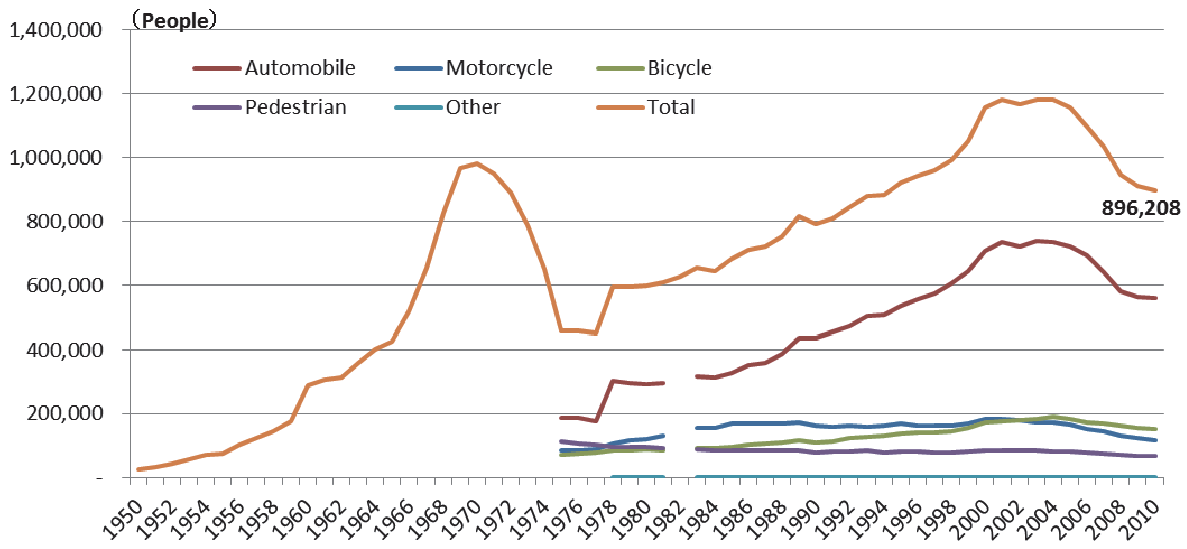

Figure 8 Injuries due to traffic accidents from 1950 to 2010

Source: Traffic Accident Statistics published annually by the Traffic Bureau of the National Police Agency

Note: Data other than Total was unavailable for 1982

Looking at changes in the number of fatalities and injuries due to traffic accidents, we see that, from the 1990s on, major reductions in the number of fatalities have been accompanied by increases in the number of injuries, and that although the percentage of passengers who become fatalities in traffic accidents has decreased, the percentage of pedestrians who become fatalities has increased, as shown in Figure 9. Also, the percentage of passengers as well as the percentage of people riding bicycles who suffer injuries due to traffic accidents has increased, as shown in Figure 10.

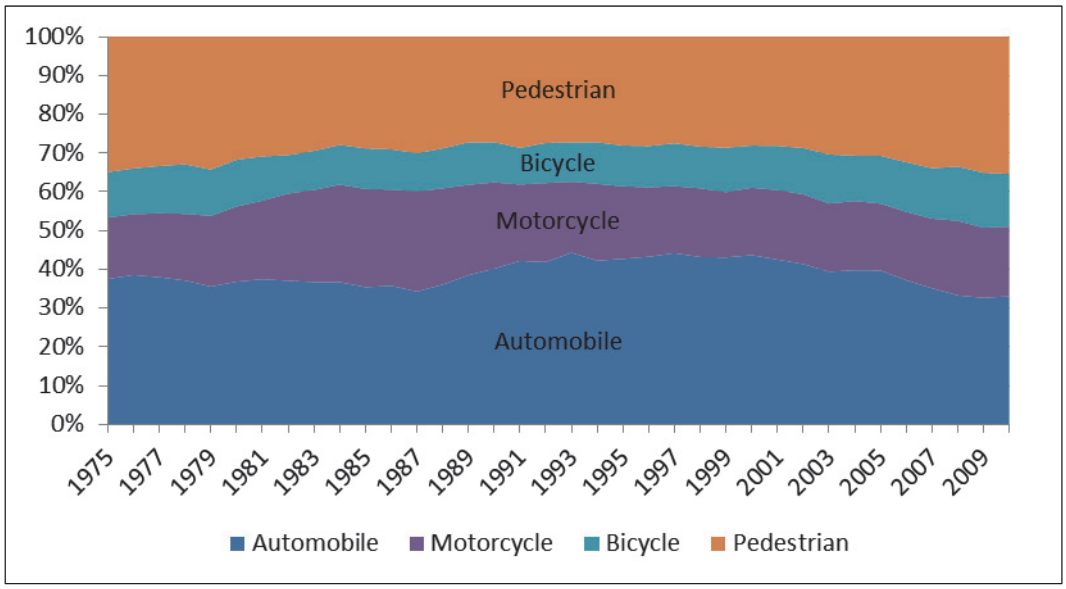

Figure 9 Breakdown of fatalities due to traffic accidents from 1975 to 2010

Source: Traffic Accident Statistics published annually by the Traffic Bureau of the National Police Agency

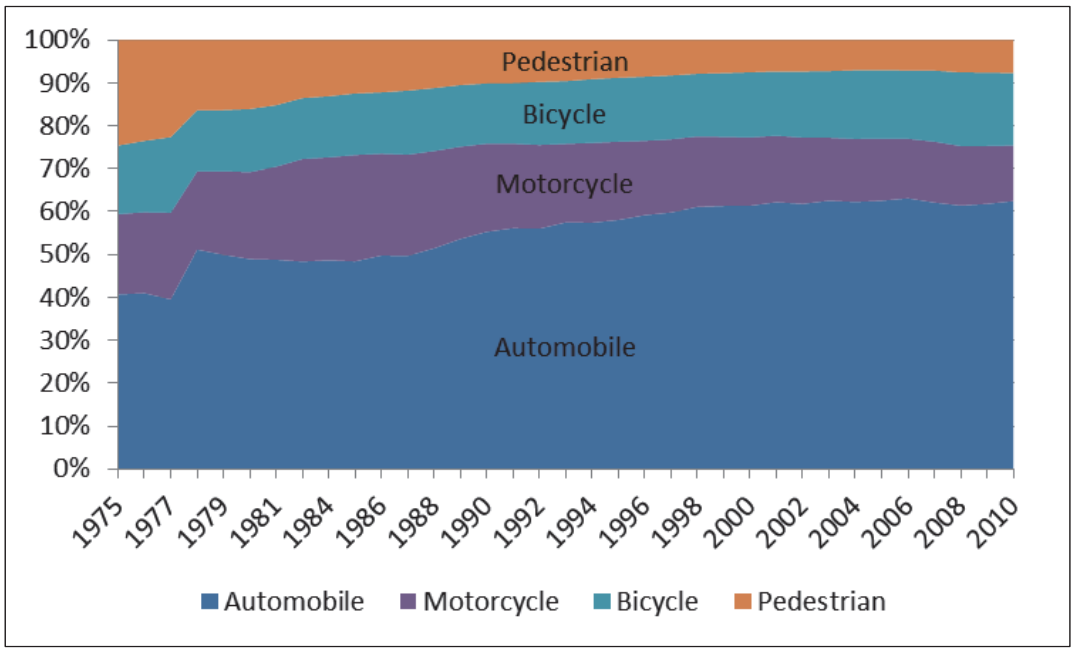

Figure 10 Breakdown of injuries due to traffic accidents from 1975 to 2010

Source: Traffic Accident Statistics published annually by the Traffic Bureau of the National Police Agency

Note: Data for1982 unavailable

2.6 Number of Traffic Accidents

Figure 11 shows the number of accidents as well as fatalities and injuries per 10,000 vehicles from 1950 to 2010. The number of traffic accidents peaked in 1969 at slightly more than 720,000. Although this number initially dropped in the following years, from the 1980s on, Japan witnessed a slow and steady climb that eventually exceeded 950,000 in 2004, which was the worst year on record. Since that time, there has been a downward trend that dropped to 725,000 in 2010.

Fatalities and injuries per 10,000 vehicles have remained stable at a relatively low level since the 1970s, and figures of 0.6 and 113.3, respectively, were recorded in 2010.

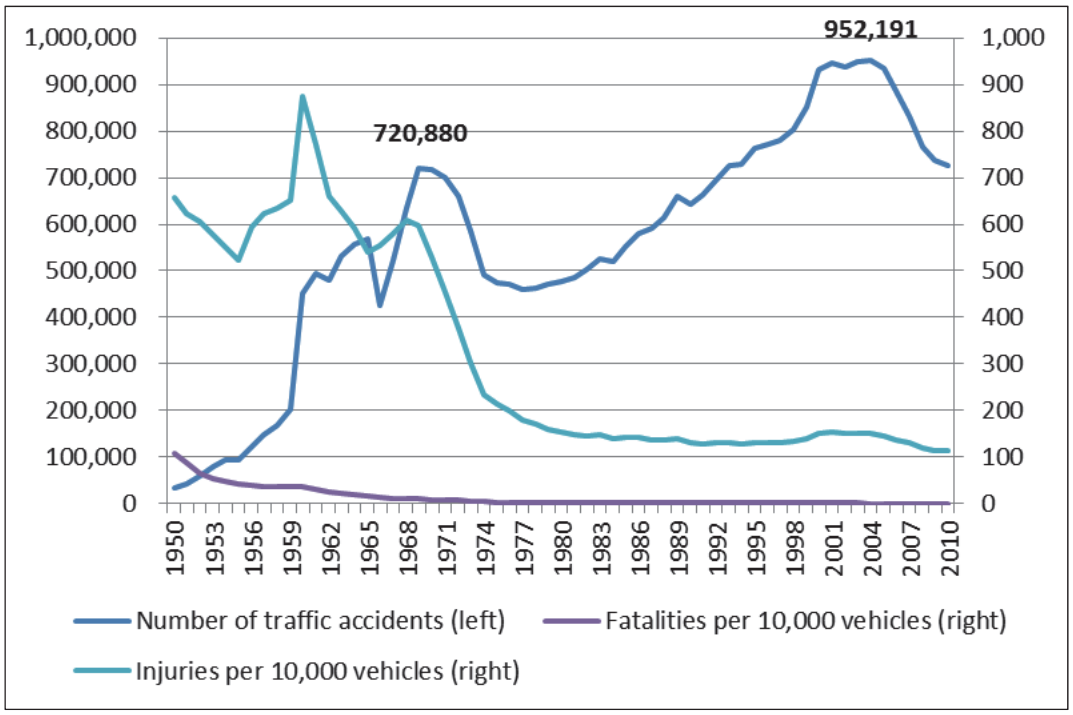

Figure 11 Number of accidents as well as fatalities and injuries per 10,000 vehicles from 1950 to 2010

Source: Page 1 of the Traffic Accident Statistical Yearbook 2010, published by the Institute for Traffic Accident Research and Data Analysis in 2011

3. Governments Agencies and Research Institutions Involved in Traffic Safety

3.1 National Programs for Promoting Traffic Safety

(1) Central Traffic Safety Policy Council

Under the provisions of the Traffic Safety Policies Basic Act, which passed into law in 1970, the Prime Minister's Office established a Central Traffic Safety Policy Council, which was later moved to the jurisdiction of the Cabinet Office in 2001. This Council, which is chaired by the prime minister, comprises the chief cabinet secretary, the heads of specified government agencies, and other ministers of state for special missions as named by the prime minister and is responsible for promoting the drafting and implementation of Traffic Safety Basic Action Plans.

(2) Traffic Policy Institute

In 1960, the Traffic Accident Prevention Policy Institute, which had been a part of the cabinet since its inception in 1955, was dissolved and reorganized under its present name as part of the Prime Minister's Office. Later, in 1984, it was transferred to the Management and Coordination Agency. The Institute is responsible for promoting policies specified in Traffic Safety Basic Action Plans as well as for the planning and promoting of other important comprehensive policies related to traffic safety.

(3) General coordination of traffic safety measures and administration

With the passing into law of the Traffic Safety Policies Basic Act in 1970, the Overland Traffic Safety Survey Office, which had been established as part of the Prime Minister's Office in 1965, was reorganized as the Traffic Safety Policy Office. Later, in 1984, it was transferred to the Management and Coordination Agency. During reorganization of the central ministries in 2001, most of the duties performed by the Traffic Safety Policy Office as part of the Management and Coordination Agency were transferred to the office of the Director-General for Policies on Cohesive Society Planning in the Cabinet Office. Accordingly, the director-general is now responsible for administration of planning and proposals necessary to promote unification of government measures for ensuring traffic safety as well as general coordination and administration of the drafting and promoting of Traffic Safety Basic Action Plans.

3.2 Prefectural and Municipal Programs for Promoting Traffic Safety

(1) Prefectural Traffic Safety Policy Councils

The Traffic Safety Policies Basic Act provides for the establishment of Prefectural Traffic Safety Policy Councils in each prefecture as well as for the voluntary establishment of Municipal Traffic Safety Policy Councils in municipalities that wish to establish them. These Councils are responsible for promoting deliberation and implementation of comprehensive measures related to overland traffic safety as well as the drafting and implementation of traffic safety plans.

(2) Prefectural Traffic Policy Institutes

Prefectural Traffic Policy Institutes are established in each prefecture to function in a manner corresponding to the national Traffic Policy Institute.

(3) General coordination of traffic safety measures and administration

These prefectural and municipal organizations are to establish traffic policy departments, traffic safety policy offices, and other agencies as necessary to coordinate administration and comprehensive promotion of traffic safety policies on their behalf.

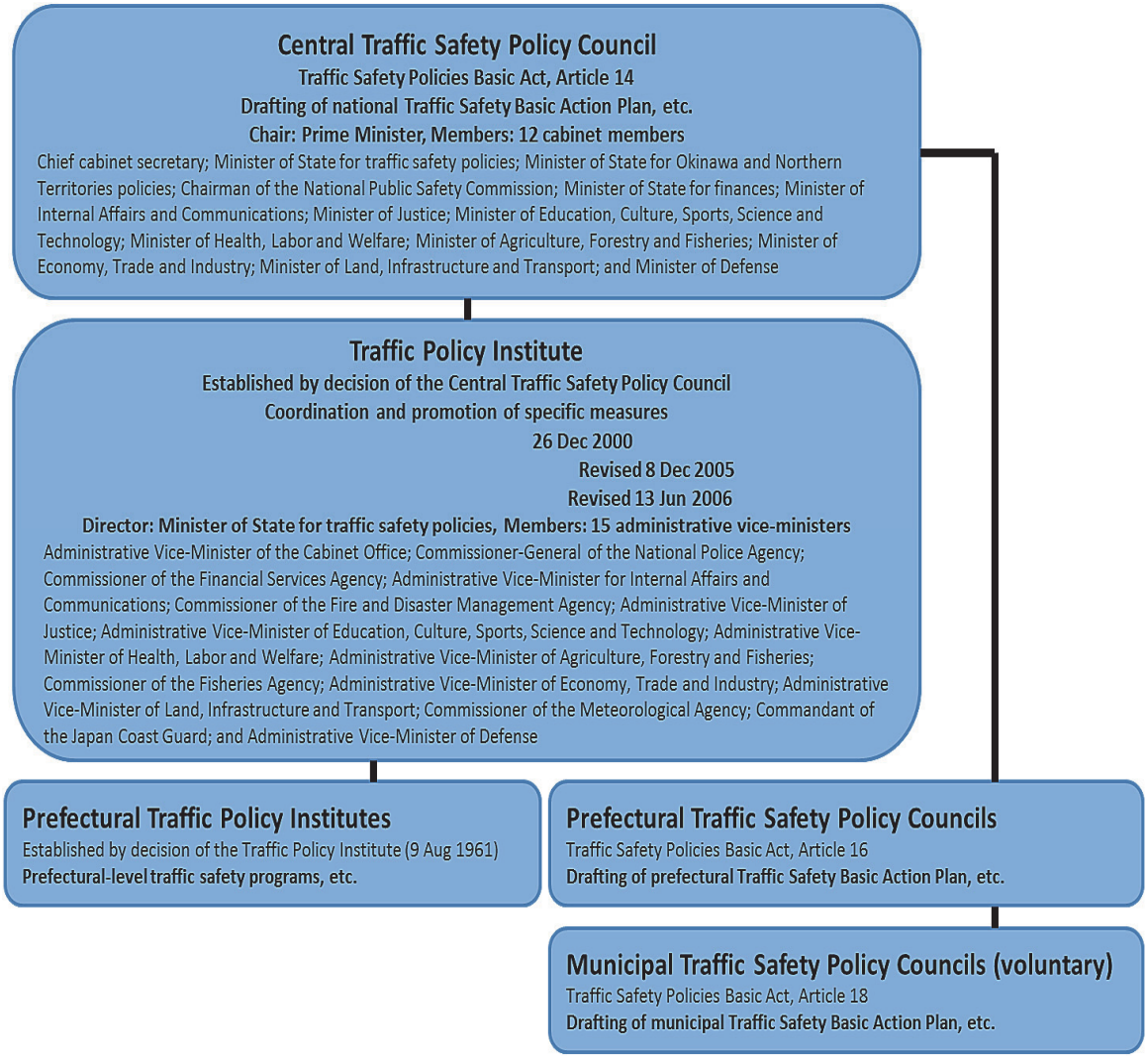

Figure 12 National, prefectural, and municipal programs for promoting traffic safety

Source: Cabinet Office Website (http://www8.cao.go.jp/koutu/taisaku/suishin.html) (in Japanese)

3.3 Major Research Institutions Involved in Traffic Safety

(1) Institute for Traffic Accident Research and Data Analysis (ITARDA)

Established in 1992 under the auspices of the Ministry of Land, Infrastructure and Transport, ITARDA performs comprehensive survey research on topics related to traffic accidents and their relationship to humans, road traffic conditions, and motor vehicles. URL: http://www.itarda. or.jp/english/

(2) National Agency for Automotive Safety and Victim's Aid (NASVA)

Established in 2003 under the auspices of the Ministry of Land, Infrastructure and Transport, NASVA provides services related to the prevention of motor vehicle accidents and the promotion of aid to victims of traffic accidents. URL: http://www.nasva.go.jp/mamoru/en/

(3) National Research Institute of Police Science (NRIPS)

Established in 1959 as an affiliated organization of the National Police Agency, NRIPS provides a wide ranges of services related to forensic sciences, crime prevention, and the prevention of traffic accidents. URL: http://www.npa.go.jp/nrips/en/index.html

4. Changes in Traffic Safety Policies

Traffic safety policies in Japan can be generally classified into one of four categories: investment in traffic safety facilities, improvement of the driver's license system, traffic safety education, and enforcement of traffic rules. Of these, full-fledged investment in traffic safety facilities began in the late 1960s, while earlier policies focused on the remaining three categories. The one requiring the most effort, however, was enforcement of traffic rules. Given that it is the role of the police department to enforce traffic rules, great care was taken to contravene any perception of draconian authority.

For example, the Road Traffic Enforcement Act was passed into law in 1947, but when this act was revised in 1960, the word enforcement was removed from the name, so that it became the Road Traffic Act. The reasoning behind this decision had to do with the fact that traffic regulations are not a part of criminal law as well as the desire to distinguish postwar law enforcement from its prewar predecessors and to create legislation that would foster trust between the law enforcement and the general public. This has become an enduring theme of postwar traffic regulation, and one characteristic of traffic safety education in this period is cooperation between the public and the private sector, with only indirect contributions from law enforcement. The following is a roughly chronological all review of the history of traffic safety policy in Japan.

4.1 Driver's License System

The basic laws affecting the driver's license system in Japan are the prewar Regulations for Motor Vehicle Enforcement of 1919 and the postwar Road Traffic Enforcement Act and Regulations for Road Traffic Enforcement, both of 1947. In addition, driver's licenses were originally handled at the prefectural level. A distinction is made between licenses for automobiles and those for motorcycles, with the exception of small-displacement motorcycles that may also be operated by holders of other licenses. Since 1965, all two-wheeled vehicles with displacements of 50 cc or higher may be operated by holders of a motorcycle license. Figure 6 above shows the number of individuals holding a driver's license in Japan from 1969 to 2010.

A characteristic of Japan's driver license system is that 95% of all holders of driver's licenses receive driver education at an authorized driving school. Although similar driving schools exist in Europe and North America, there is no obligation to undergo class work and training at an authorized institution, as there is in Japan. Although driving schools existed during the prewar era, there were no unified

standards. Just as with driver's licenses, the Road Traffic Enforcement Act and Regulations for Road Traffic Enforcement of 1947 are the basic laws affecting driving schools, and the Road Traffic Act of 1960 provided for the current system of authorized driving schools. The schools must be authorized by the National Public Safety Commission, and the requirements for receiving authorization include certified instructors; the construction of a course with a specific area, geometry, and structure; and the use of educational programs and facilities that conform to criteria given in the Road Traffic Act. Students are required to pass a driving proficiency test prior to graduation, and a unique characteristic of this system is that those who do graduate are exempted from having to retake the proficiency test when they apply for a driver's license.

Another characteristic is that holders may renew their license at a minimal cost and after only a brief refresher course even without any actual experience behind the wheel. In fact, since even people who do not actually drive are able to renew their driver's license just as long as they are not guilty of any violation or accident, a driver's license is automatically "good for life," and as a result is often renewed merely for its convenience as a means of identification. Many have pointed out, of course, the disadvantages of a system that permits so-called "paper drivers" to continue to renew their license indefinitely in spite of the fact that their proficiency is never retested and thus the level of their driving skills or their ability to drive safely remains unknown.

4.2 No Honking, Please—Public and Private Sector Cooperation in Traffic Safety Education[4]

The present day issue of noise pollution due to overuse of car horns that is prevalent throughout Asia was an issue in postwar Japan, as well. The following case study of the No Honking, Please movement in Japan is presented as an example of how law enforcement can contribute to public awareness of traffic safety.

The No Honking, Please movement was part of grassroots efforts to reduce traffic noise in the 1950s that were also known under names like Stop Traffic Noise or Refrain from Honking. Noise came from things like trolleys, construction sites, and advertising attractions, but the single largest source was the horns of motor vehicles. Noise levels in 1953 were 70 to 75 phons.

The use of horns as necessary to ensure safety when passing or when driving slowly had been recognized legally. Article 13 of the Road Traffic Enforcement Act that came into effect in 1948 stated that "actions necessary when following or passing vehicles or horses are hereby stipulated." In addition, Article 24, Paragraph 2 of the same Act further stipulated that "when overtaking another vehicle, the following vehicle must whistle, shout, or otherwise signal its presence to the leading vehicle as a warning to ensure traffic safety when passing." Moreover, Article 20 of the Road Traffic Enforcement Act stated that "actions necessary when a vehicle or horse, or railway vehicle must move

[4] This section is based on Kato's contribution to International Association of Traffic and Safety Sciences, Research Project Report H2296 (2011).

slowly are hereby stipulated," and Article 29 of that same law states that "a vehicle or horse, or railway vehicle must whistle, shout, or otherwise signal its presence when passing intersections where visibility is poor or the top of slopes, curves, crosswalks or crowded areas."

Thus, the sounding of a horn was a legal obligation in instances such as these. As reported by Tominaga (1993), when movements to mitigate noise began, traffic officers requested clarification as to whether or not they should enforce laws requiring the sounding of horns, and were told that once movements to mitigate noise began, there would be no need for enforcement.

In Tokyo, an anti-noise ordinance was enacted in November, 1953, and the Refrain from Honking movement began on January 1, 1954. The effect, however, was less than hoped for, because the affected areas included only the area bounded by Hibiya, Otemachi, Nihonbashi, Edobashi, Shinbashi-ichome, Toranomon, and Keishicho [the Metropolitan Police Department].

The first area to achieve results was Osaka. In the postwar period, rampant use of loudspeakers on city streets led to numerous complaints to Osaka City Hall. After consultations involving the Osaka Prefectural Police Department, other related organizations, and citizen's groups, a Quiet City movement began on March 1, 1958. The original objective was to reduce noise from car horns and improve the manners of pedestrians. An early slogan was Go Slow and Pay Attention without Honking, and a Thank You, Drivers campaign as well as an essay and a poster contest were held to publicize the event to elementary-school students and small children. With the success of these activities in Osaka, similar programs were seen throughout Japan.

The No Honking, Please movement emphasized the importance of quality of life over the letter of the law, and showed that cooperation between the public and private sectors as well as grassroots movements could achieve change without the participation of law enforcement, and a review of this era is certain to provide plenty of useful ideas to other countries where there is concern over noise from car horns.

4.3 Improvements to Traffic Safety Facilities

4.3.1 Improvements and financing

Article 2, Paragraph 3 of the 1966 Act for Promotion of Improvements to Traffic Safety Facilities specifies two types of improvements for special consideration. The first is projects for the installation either of (1) traffic signals, roadway signage, and roadway markers or for (2) traffic control centers, both of which are undertaken by Prefectural Public Safety Commissions.

The second is projects for the installation either of (1) overhead or underground pedestrian crossings as well as other emergency measures necessary for ensuring traffic safety within sidewalks, bicycle paths, and other segments of roadways or other enhancements of roadways as specified by government ordinance and (2) roadway signage (route number markers and maps for pedestrians), guardrails, street lamps or other appurtenant devices specified by government ordinance as necessary to ensure traffic

safety, and lane markers, both of which are undertaken by the roadway administrator. The funding for these improvements was also divided into two major classifications, which are explained below.

4.3.2 Road improvement special accounting and improvements to traffic safety facilities

(1) Road improvement special accounting and road finances

Article 13 of the Public Finance Act specifies that accounting procedures for the Japanese government be divided into general accounting and special accounting, but both the Japanese constitution and the Public Finance Act treat special accounting procedures in the same manner as general accounting procedures. Moreover, there are transfers from general accounting to special accounting that prevent these two from being completely independent. The difference between special accounting and general accounting lies in provisions for itemized reporting of annual revenues and expenditures. Based on this, a budget specifically for roadway construction must allocate specific annual revenues to specific annual expenditures—in other words, road improvement projects—which are reported under road improvement special accounting procedures (and later as a road improvement account under social capital improvement project special accounting procedures).

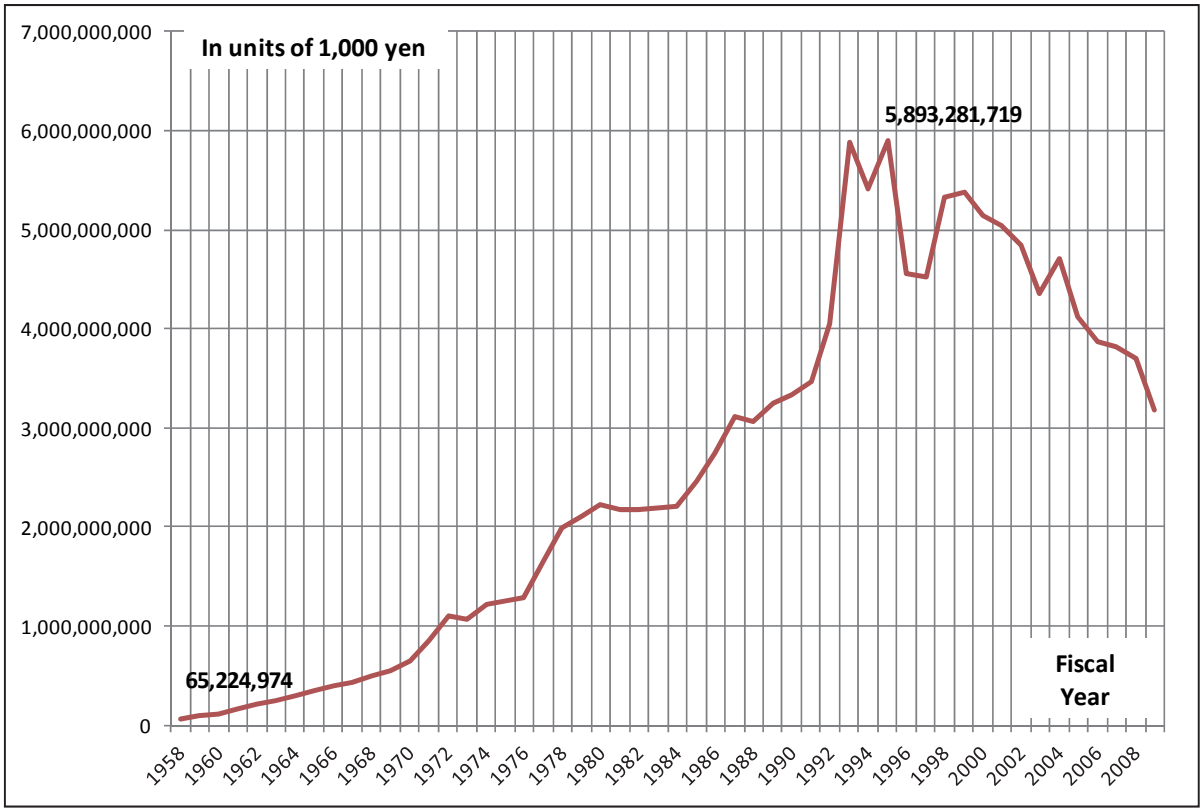

Figure 13 Road improvement special accounting annual expenditures from FY1958 to FY2009

Source: Table No. 8—Special accounting annual revenue and expenditure since FY1890, published by the Ministry of Finance in 2011 Note: Using data for road improvement accounts under social capital improvement project special accounting from FY2008 settlements

Figure 13 shows road improvement special accounting annual expenditures from FY1958 to FY2009. This figure shows that what was originally a 65 billion yen budget eventually grew in scale to a record

5.89 trillion yen in FY1995. Naturally, these figures would need to be adjusted for inflation in a serious comparative study, but even the raw data shows us the extent that road improvements in Japan grew in a short period of time.

Table 4 Road finances and administrative authority

		National (Road special accounting)	Prefectural	Municipal
National taxes	Gasoline tax	100%		
	LPG tax	50%	50%	
	Motor vehicle tax	Approx. 53%		Approx. 13%
Local taxes	Diesel oil delivery tax		100%	
	Motor vehicle acquisition tax		Approx. 30%	Approx. 70%
	Local road tax		58%	42%
	Local motor vehicle tax			100%
	Local LPG tax		100%	

Source: Excerpted from budget deletions given on page 36 of Goto (2009)

Note: All LPG tax (prefectural rate of 50%) goes to local LPG taxes, and all motor vehicle tax (municipal rate of 13%) goes to local motor vehicle taxes. Two-thirds of all revenues from motor vehicle taxes go to national taxes, 77.5% of which are used for road finance.

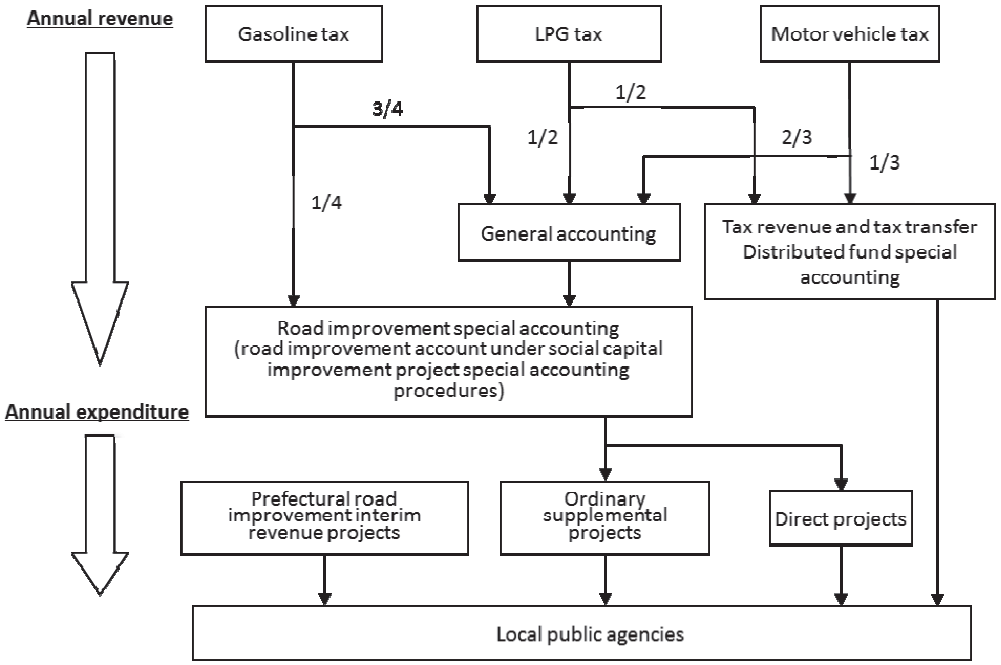

Figure 14 Flowchart for road improvement special accounting annual revenue and expenditure until FY2008
Source: Excerpted from page 36 of Goto (2009)

Note: The fractions in the chart indicate portions of tax revenue distributed. Also, road improvement special accounting includes funds from other industrial investment special accounting and NTT finances.

Road users pay a variety of taxes related to that use, as shown in Table 4. This system is based on the concept that those who extract benefit from roadway improvement should also bear the cost, and is modeled on the Highway Trust Fund in the United States. Funds earmarked for roadway construction include national taxes such as gasoline taxes, LPG taxes, and motor vehicle taxes, which are subject to road improvement special accounting procedures. As shown in Figure 14, funds from road improvement special accounting are distributed to local public agencies through prefectural road improvement interim revenue projects, ordinary supplemental projects, and other projects. The framework for financing of road improvement in Japan has not changed significantly since 1958, but the system shown above was discontinued in March of 2009 and road finances were reclassified to fall under the general budget the following April.

One advantage of specifically allocated budgets is the underlying logic of expecting those who extract benefit to bear the cost—a relationship that is not always clear when financing comes from the general budget. Another benefit lies in the fact that road improvement is an investment with a long period of gestation, and a specifically allocated budget helps ensure stable financing. Disadvantages include a lack of flexibility and the potential for wastefulness or surpluses when revenues are high. Yet many feel the same disadvantages still exist even under a general budget, and cite difficulties in comparing systems on a qualitative basis.

(2) Financing for traffic safety facilities

The law that provides the basis for expenditure of road financing on traffic safety facilities is the Emergency Measures for Improvements to Traffic Safety Facilities Act, which passed into law in 1966. After a number of revisions, this law was revised and renamed Promotion of Improvements to Traffic Safety Facilities Act in March, 2003. Later, the Traffic Safety Facilities Improvement Five-Year Plan was integrated together with other long-term social capital improvement plans into the Social Capital Improvement Priority Plan.

Under this same law, based on the incidence of traffic accidents and other criteria such as traffic volume, the Japanese government designated “roads recognized as being particularly important to ensuring traffic safety” as eligible for “complete or partial funding, or provision of supplemental funding, from the national government for improvements to traffic safety facilities.” These were called “special traffic safety facility improvement projects.” In addition, the Prefectural Public Safety Commissions and roadway administrators who were to be responsible for implementing these projects were required to create traffic safety facility improvement plans based on a national Traffic Safety Facilities Improvement Three-Year Plan (which was later revised into a Traffic Safety Facilities Improvement Five-Year Plan and integrated into the Social Capital Improvement Priority Plan Act).

Under this law, the Japanese government would bear one-half the cost of special traffic safety facility improvement projects undertaken by the roadway administrator of national highways, prefectural roadways, and municipal roads as well as provide supplemental funding amounting to 55% of the cost

of traffic safety projects undertaken on municipal roads designated as school routes by government ordinance.

(3) Traffic safety policy special funding accounts

A system for traffic fines was instituted as part of the 1968 revision of the Road Traffic Act, and served as the basis for the collection of fines.[5] Accounting procedures for these monies specified that they should be used to defray the cost of improvements to road traffic safety facilities. Specifically, these monies were to defray the cost of the installation and maintenance for road traffic safety facility projects undertaken independently by local public agencies that were designated by government ordnance, and were used for traffic signals, roadway signage, pedestrian crossings, and other facilities, under the terms of special accounting, as described above.

Since FY1983, financing that had previously been handled with general accounting procedures has been performed as special accounting procedures for distribution of tax revenues. Special accounting procedures for distribution of tax revenues is a special accounting procedure that was instituted together with the establishment of a system for distribution of local tax revenues in 1954, and is handled by the Cabinet Office, the Ministry of Internal Affairs and Communications, and the Ministry of Finance.

[5] After the Road Traffic Act passed into law, the number of traffic violation tickets issued continued to increase, and in order to provide prompt processing, a common format for traffic violation tickets was used after January, 1963. The number of tickets issued, however, continued to increase, and to further expedite prompt processing, payment of a fine to a local government agency in lieu of criminal prosecution was instituted for violations that did not involve criminal negligence. Thus, a system for traffic fines was introduced. Drivers stopped for traffic violations were now given traffic violation tickets rather than a summons to appear. Summons to appear were thereafter used only for [more serious] infractions that were not subject to fines. Traffic violation tickets included traffic violation notifications, license storage receipt, traffic accident form, traffic violation notification, enforcement form, notification form, traffic law violation ledger, and other documentation.

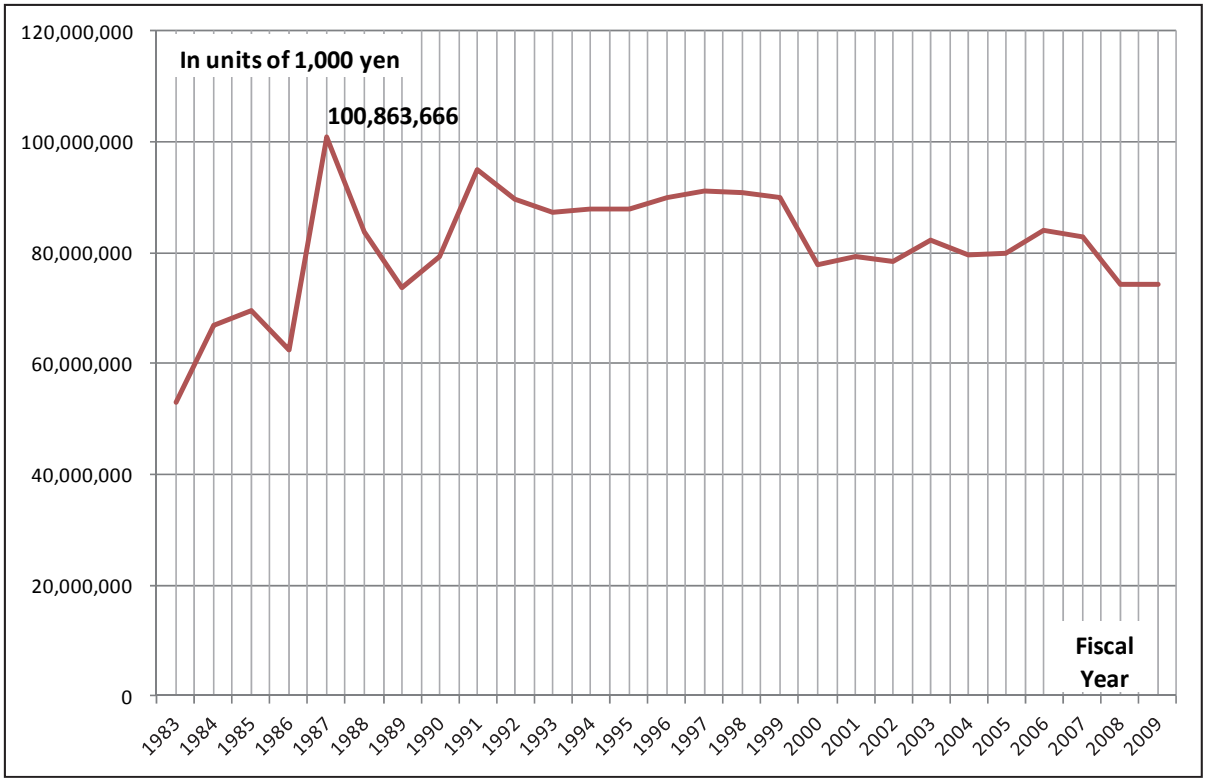

Figure 15 Expenditures from traffic safety policy special funding accounts per special accounting procedures for distribution of tax revenue from FY1983 to FY2009

Source: Table No. 8—Special accounting annual income and expenditure since FY1890, published by the Ministry of Finance in 2011

Figure 15 shows expenditures from traffic safety policy special funding accounts per special accounting procedures for distribution of tax revenue from FY1983 to FY2009. As can be seen, expenditures from traffic safety policy special funding accounts peaked in FY1987 at just over 100 billion yen, but expenditures continue at a rate of approximately 80 billion yen annually. Also, annual revenue for FY2009 was 79,876,220,000 yen, the majority of which (73,864,300,000 yen, in fact), came from fines paid against traffic violation tickets. A comparison of these figures reveals a shortfall of approximately 5,191,830,000 yen, which was attributed to "less revenue than anticipated from payment of fines" in the Ministry of Finance's Settlement of Special Accounts for FY2009.

A review of traffic safety policies will show the benefits of allocating monies from payment of fines to specific uses and of having a budget specifically for roadway construction. In Japan, the conversion of specific budgets to general finance has brought about a reduction in public works projects. In the United States, as well, even at the state level, allocation of fuel taxes to general finance usually leads to reduced expenditure on roads. History shows us the necessity for having those who extract benefit bear the cost and for handling improvements to roadways and safety facilities as a single entity.

4.3.3 Traffic safety facility improvement plans and social capital improvement plans[6]

Since 1955, motor vehicle traffic volumes in Japan have continued to increase rapidly, as has the incidence of traffic accidents. In response to this, the government established a Traffic Accident Prevention Policy Institute in 1955. This organization was dissolved and reorganized under the auspices of the Prime Minister's Office as the Traffic Policy Institute in 1960. Another measure for implementing traffic accident policy was the establishment of a Special Traffic Ministers Conference in 1961, which was dissolved and reorganized as the Traffic Ministers Council in 1965.

Despite these measures, traffic accidents continued to rise, and in order to implement further policies against traffic accidents, the aforementioned Emergency Measures for Improvements to Traffic Safety Facilities Act was passed into law and served as the basis for establishment of the First Three-Year Plan and implementation of traffic safety facility improvement projects in 1966.

Prior to this, improvements to roadway signage and other traffic safety facilities were considered the responsibility of prefectural Public Safety Commissions, which were authorized to enact traffic regulations, and because of this, the cost of such improvement projects was borne by the prefectures, with few subsidies from the Japanese government. With the dramatic rise in traffic casualties that accompanied increased motorization, however, the need for all traffic safety facilities throughout Japan to conform to a given standard was recognized. Thus, in 1965, with the publication of Emergency Measures to Effect Thorough Traffic Accident Prevention, the Traffic Policy Institute called for prioritizing the upgrading and expansion of traffic safety facilities, thereby paving the way for the Emergency Measures for Improvements to Traffic Safety Facilities Act.

The purpose of this Act was "to provide for improvements to traffic conditions, thereby preventing traffic accidents and promoting the smooth flow of traffic, through implementation of traffic safety facility improvement projects based on comprehensive planning for roadways that are sites of frequent accidents or that are considered to be necessary to ensuring traffic safety in emergencies," and it contained specific provisions for planning, roadway designation, and financing.

With these measures began a system under which the government systematically supplemented prefectural efforts to raise traffic safety facilities to a specific level. The Emergency Measures for Improvements to Traffic Safety Facilities Act continued to serve as a basis for government subsidy of traffic safety facility improvement projects until 2002. Under the provisions of this Act, projects which were subsidized partially or in whole were referred to as "Designated traffic safety facility improvement projects" and all other projects were referred to as "local independent traffic safety facility improvement projects," and authorization of subsidies was reviewed each time a new plan was implemented.

As shown in Table 5, improvement plans based on the Act were three-year plans until 1971, and with the passing into law of the Traffic Safety Policies Basic Act, all new plans after 1970 were expanded

[6] Much of this chapter is based on material from Sumitomo (2008) and pages 551–562 of the Japan Highway Users Conference (2009).

to five-year plans. In 1996, the need for structural reform of public finance led to a further expansion of two years, resulting in the sixth plan becoming a seven-year plan but without any change in volume (budget) of projects.

Table 5 Traffic safety facility improvement project plans

Description		Designated projects			Local independent projects		
		Plan (10^9 yen)	Actual (10^9 yen)	Achieved (%)	Plan (10^9 yen)	Actual (10^9 yen)	Achieved (%)
First Three-Year Plan	Roadway administrator	72.19	72.21	100.0	13.40	25.32	–
(1966 to 1968)	Public Safety Commission	6.03	6.03	100.0	3.80	11.20	–
Second Three-Year Plan	Roadway administrator	75.00	50.74	67.7	62.30	45.62	73.2
(1969 to 1971)	Public Safety Commission	4.63	2.85	61.6	23.07	15.11	65.5
First Five-Year Plan	Roadway administrator	229.28	238.09	103.8	230.41	232.4	100.9
(1971 to 1975)	Public Safety Commission	68.55	72.09	105.2	105.27	100.01	95.0
Second Five-Year Plan	Roadway administrator	570.00	592.21	103.9	411.53	452.55	110.0
(1976 to 1980)	Public Safety Commission	150.00	142.41	94.9	230.00	163.64	71.1
Third Five-Year Plan	Roadway administrator	910.00	815.38	89.6	687.69	614.40	89.3
(1981 to 1985)	Public Safety Commission	190.00	131.20	69.0	304.96	236.54	77.6
Fourth Five-Year Plan	Roadway administrator	1,350.0	1,159.60	100.8	1,023.50	773.91	75.6
(1986 to 1990)	Public Safety Commission	135.00	116.50	101.3	368.01	350.91	95.4
Fifth Five-Year Plan	Roadway administrator	1,850.00	1,763.50	110.9	1,440.00	1,309.10	90.9
(1991 to 1995)	Public Safety Commission	165.00	167.80	108.3	497.00	514.90	103.6
Seven-Year Plan	Roadway administrator	2,130.00	2,560.60	120.2	1,950.00	1,584.40	81.3
(1996 to 2002)	Public Safety Commission	190.00	279.70	147.2	630.00	614.40	97.5

Source: Page 552 of the Japan Highway Users Conference (2009)

Note 1: Local independent projects in the First Three-Year Plan include school routes for the FY1967 and FY1968 only.

Note 2: Due to interim restructuring, achieved figures for the Second Three-Year Plan include the FY1969 and FY1970 only.

Note 3: Designated projects in the Fourth, Fifth, and Seven-Year Plans reflect total values that include adjustment costs.

In contrast, based on the Social Capital Improvement Priority Plan Act (2003 Law No. 20), traffic safety facility improvement projects were incorporated together with projects from eight other fields (roadways, airports, ports, urban parks, sewage systems, flood control, steep slopes, and shorelines) into a five-year social capital improvement priority plan for the period from FY2003. Table 6 shows major changes that came about with the passing into law of the Social Capital Improvement Priority Plan Act, as compared to roadway improvement five-year plans. These include (1) changeover from the conventional project volume base to one of outcome evaluation and (2) integration of plans from a variety of fields into a single, interdisciplinary plan.

Table 7 describes specific traffic safety facility improvement projects implemented as part of the Second Social Capital Improvement Plan for the period from FY2008 to FY2012. Of these, the “safe

walking area" was intended for implementation in areas with a relatively high percentage of traffic fatalities among pedestrians and bicycle riders as a [multi‐]faceted approach to preventing accidents, which was considered necessary for the 796 locations nationwide designated by the National Police Agency or the Ministry of Land, Infrastructure, Transport and Tourism in areas where policies are implemented primarily by municipalities. Also, the term "sites of multiple accidents" refers to one of the 3,956 locations nationwide designated by the National Police Agency or the Ministry of Land, Infrastructure, Transport and Tourism for priority implementation of countermeasures due to a high incidence of accidents.

Table 6 Comparison of conventional roadway improvement five-year plans with social capital improvement priority plans (typical items)

	Conventional roadway improvement five-year plans	Social capital improvement priority plan
Targets	Roadway extension, area, improvement rate, or other project volume basis	Evaluation of resultant impact based on multiple new indices (increased use of ETC, etc.)
Cost reduction targets	No particular targets	15% reduction compared with FY2002
Tie-ins with other plans	Independent roadway improvements (few tie-ins)	Integration of plans from nine different fields

Source: Excerpt from page 34 of Goto (2009)

Table 7 Specific traffic safety facility improvement projects implemented as part of the Second Social Capital Improvement Plan for the period

Policy	Measures	Indices
To create a safe and secure road traffic environment suitable for a low birthrate, graying population.	Improvement of traffic safety	**Rate of casualties in traffic accidents** *Approx. 1.09 accidents per million vehicle kilometer in 2007 reduced 10% to 1.0 accidents per million vehicle kilometer by 2012.*
	Promotion of policies for pedestrians and bicycle riders as well as policies for community roads	**Reduce casualty rates for pedestrians and bicycle riders in safe walking areas** *20% reduction by 2012 of casualty rates for pedestrians and bicycle riders in areas where policies are implemented* **Universal access at traffic signals along major community thoroughfares** *Increase from 83% in 2007 to 100% by 2012* **Universal access along designated roadways** *Increase from 51% in FY2007 to 75% by FY2012*
	Promotion of policies for truck roads and arteries	**Reduce casualty rates at sites of multiple accidents** *30% reduction by 2012 of casualty rates at sites of multiple accidents* **Reduce casualty rates at locations with advanced traffic signals** *Reduce by 40,000 casualties per year by 2012*
Policies for maintaining smooth flow of traffic as well as countermeasures for environmental issues	Promotion of policies for smooth traffic flow	**Reduce waiting times through advanced traffic signal control systems** *Reduce waiting time by 220 million person-hours annually by 2012 in areas where policies are implemented* **Lost time at railway crossings** *10% reduction from 1.32 million person-hours per day in FY2007 to 1.18 million person-hours per day by FY2012* **Reduce CO_2 emissions through advanced traffic signal control systems** *Reduce by 460,000 tons annually by 2012*

Source: Excerpted from pages 33–34 of Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism (2011)

With the passing into law of the Social Capital Improvement Priority Plan Act, the Emergency Measures for Improvements to Traffic Safety Facilities Act was revised and renamed the Act for Promotion of Traffic Safety Facility Improvement Projects, thereby establishing a framework that enabled the designation of roadways eligible for subsidies, the drafting of implementation plans compliant with social capital improvement priority plans, the implementation of priority projects such as special subsidies requiring the coordination of both the National Police Agency and the Ministry of Land, Infrastructure, Transport and Tourism. Specifically, the following three points are worthy of mention.

(1) Deletion of provisions related to comprehensive traffic safety facility improvement project seven-year planning as well as proposals for plans related to traffic safety facility improvement projects by municipalities
(2) Designation of roadways considered to be particularly in need of improvements to traffic safety conditions as "designated traffic safety facility improvement project roadways" by the National Public Safety Commission and the Ministry of Land, Infrastructure, Transport and Tourism.
(3) Drafting of plans by Prefectural Public Safety Commissions and roadway administrators per implementation of designated traffic safety facility improvement projects that are compliant as well as by agreement concurrent with priority plans

4.4 The Japan Traffic Safety Movement and the Japan Traffic Safety Association[7]

4.4.1 Objectives and organization of the Japan traffic safety movement

Japan's traffic safety movement began with the objective of promoting and promulgating traffic safety. Based on a general outline for implementation of a national traffic safety week by national and local law enforcement, it coordinated nationwide traffic safety programs. The original national traffic safety week began on December 10, 1948. In 1952, similar events were held in both the spring and the fall, and in 1954 began to use the name "traffic safety movement" in place of "traffic safety week." In 1961, national traffic safety movement programs were held in the fall, but in spring of the following year, the Traffic Policy Institute, which had been established by the Cabinet Office in 1960, took the reins in the planning and implementation of the movement. Starting in 1976, the Traffic Policy Institute began holding activities in both spring and fall, a pattern which continues to this day. Festivities include parades and other promotional activities throughout Japan.

A general outline of the autumn 2010 Japan traffic safety movement is as follows.

[7] This section is based on Kato's contribution to International Association of Traffic and Safety Sciences, Reseach Project Report H2296 (2011).

(1) Objective: To promote comprehensively the prevention of traffic accidents by promulgating traffic safety principles extensively to the Japanese people, encouraging compliance with traffic rules and proper traffic etiquettes, and fostering initiatives from the Japanese people for improvements in the road traffic environment

(2) Period: For 10 days from September 21st to 30th, 2010. September 30 has been designated a "Day of Zero Traffic Deaths" since 2008.

(3) Sponsoring government agencies include the Prime Minister's Office and nine other ministries, prefectural and municipal governments, and 14 private organizations. In addition, more than 150 private organizations participate as cosponsors.

(4) Nationwide priority points include 1. Prevention of traffic accidents involving pedestrians or bicycle riders at dusk or at night (in particular, promote the use of reflective materials), 2. The proper use of seat belts or child seats by all passengers as well as the elimination of driving while under the influence of alcohol. Previously, 5 to 8 priority points were featured, but starting in 1969 were reduced to 2 or 3 at most.

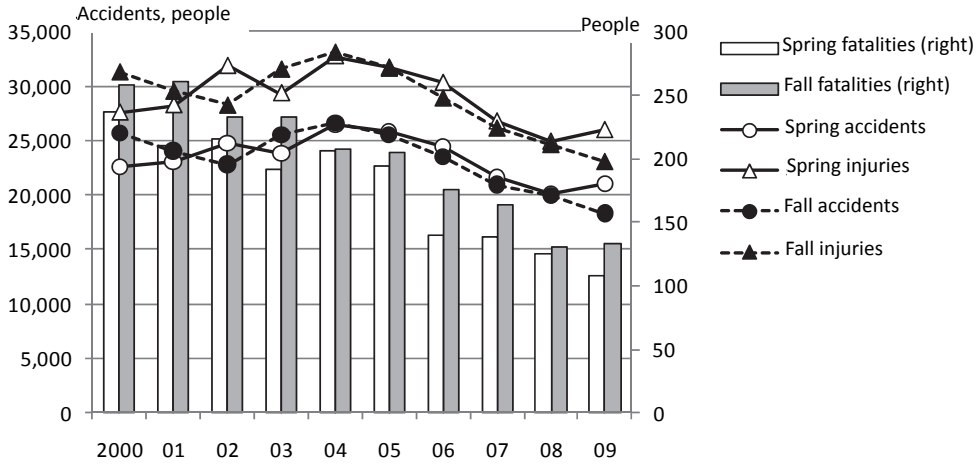

Figure 16 Traffic accidents during traffic safety movement activities for the past 10 years
Source: Traffic Safety Report

Figure 16 shows the number of traffic accidents, injuries, and fatalities that have occurred during traffic safety movement activities for the past ten years. As can be seen, all these have declined in recent years. Although there are no significant differences between the figures for spring and fall, we see that from 2001 to 2002, 2002 to 2003, and from 2008 to 2009, the trend in spring was the reverse of the trend in fall.

4.4.2 The Japan Traffic Safety Association

(1) History

The Japan Traffic Safety Association is the centralized coordinating agency for other regional, prefectural, and local traffic safety associations throughout Japan. It is one of the organizations that helps organize traffic safety movement activities nationwide and was established for the purpose of

promoting safety policies for the promulgation of traffic safety awareness and the prevention of traffic accidents.

As ownership of motor vehicles increased in Japan, so did awareness of traffic accidents, leading to the establishment of traffic safety associations throughout the country. With economic growth came the widening use of motor vehicles for transportation, and in recognition of a need to unify nationwide policies for preventing traffic accidents, the Japan Traffic Safety Association was established in 1950. Membership originally comprised prefectural traffic safety associations, traffic safety associations in major urban areas, the National Public Safety Commission, and law enforcement officials. Reorganization of law enforcement on a prefectural level in 1955 also led local traffic safety associations to a similar reorganization and to membership in the Japan Traffic Safety Association. As traffic accidents continued their rapid increase, however, the Road Traffic Act was passed into law, and in 1961 the Japan Traffic Safety Association was incorporated as a foundation.

Within the articles of incorporation of the foundation, as a means to achieve the objectives of preventing traffic accidents and furthering compliance with traffic safety laws, it was stated that, in addition to improvements to traffic conditions and the implementation of suitable measures by the government, heightened awareness of the need for traffic safety in each and every individual is paramount. The Japan Traffic Safety Association was established to serve as a central institution for the organization of public sentiment into a grassroots movement capable of answering the need for public action through understanding and cooperation at every level of society.

(2) Programs

The Association has undertaken a wide variety of programs since its establishment, including its role as co-organizer of national traffic safety movement activities, and continues to operate major programs, some of which are given below.

1) Organization of the Traffic Safety National Movement Central Conference: held annually in January since 1961, this conference includes presentations by special-interest groups (regional and family working group, traffic safety education working group, and corporate working group) as well as a general assembly.
2) Traffic Honor and Green Cross Awards (gold and silver awards)
3) Contests for annual traffic safety slogans and family traffic safety essays
4) Publication of “People and Vehicles,” and educational traffic safety magazine

These traffic safety programs were even influenced in some small way by student protests of the 1960s. Hora (1978) points out that, despite a lack of conclusive documentation, the importance of community relations in establishing close connections with individual citizens became evident in the association’s activities at that time.

I’d also like to provide a brief explanation regarding the annual traffic safety slogan.
The first national contest for a safety slogan was held with the cooperation of the National Police

Agency, the Prime Minister's Office, and the Mainichi Newspaper in 1965, and the winning slogans were used in national traffic safety movement activities the following spring. The winning slogans received an award from the prime minister, and that year's choices were "Brake early, and go slow" (for drivers), "Look again and raise your hand before you cross the street" (for pedestrians), and "The world prays for traffic safety" (general audiences).

Since that time, these contests of been held annually and the Association's Website claims that it has received more than 10,000,000 entries all told. Particularity notable were 1967's "Stay out of the street! Cars can't stop that quickly" (for children) and 1973's "Japan isn't that big. Where are you going is such a hurry?" (for drivers), which became buzzwords in their day. Starting in 1971, a poster contest featuring the annual slogan was begun, and has garnered 300,000 entries in total.

Each of these slogans are a reflection of the times in which they were created, and popular topics include speed, driving under the influence of alcohol, keeping proper distance with the lead car, seatbelts, helmets, and other major themes of traffic safety. Themes for FY2010 included the use of cell phones by drivers, the wearing of reflective materials by pedestrians and bicycle riders, and the proper use of lights, brakes, and helmets by children on bicycles.

While it is true that national traffic safety movement activities are government operated, their effectiveness can be seen by the decline in traffic accidents during the programs. Given that traffic conditions and the causes of traffic accidents vary from region to region, it is worth noting that prefectural law enforcement and local traffic safety associations work hard to develop programs that are best suited for their localities.

5. Conclusion

At the end of the Second World War, Japan entered a phase of rapid economic growth and equally rapid motorization. Despite this, there was a notable lack of capital investment in not just good roads but traffic signals, roadway signage, and other traffic safety facilities. Since the passing into law of the Traffic Safety Policies Basic Act in 1970, a total of eight traffic safety basic action plans have been implemented. As a result, fatalities due to traffic accidents in 2001 reached the 4,611 mark after declining steadily for a 11 years in a row. This is roughly one quarter of the 16,765 deaths recorded in 1975, which was Japan's worst year ever for traffic fatalities. In the roughly 40 intervening years, we have been blessed by the efforts of organizations concerned with traffic safety to reduce traffic fatalities. And although injuries due to traffic accidents have been on the decline for the past several years, both the number of injuries and the number of accidents continued to rise into first decade of the 21st century. Clearly, our efforts must now turn towards reducing traffic accidents overall.

Trends toward a low-growth, graying population in Japan continue to gather momentum. As these trends advance, holders of driver's licenses, automobile ownership, and the population itself will a

either remain stable or begin to decline, but recent data clearly shows that these things in and of themselves will not necessarily lead to a decline in traffic accidents. This suggests an obvious urgency to emphasize traffic safety to the elderly. The elderly are more likely not just to be victims of traffic accidents but to be perpetrators, as well, and looking at recent trends in traffic accidents, we see that traffic fatalities of the elderly remain high and traffic accidents caused by elderly drivers are on the increase.

In this way, as social conditions change over time, so do public expectations concerning traffic safety policy. Researchers must demonstrate the effectiveness of these policies. Those responsible for policy must then apply the research results to improving policies to make them more effective. In other words, a prompt response to changing times by government and related agencies with farsighted and effective policies will lead to a reduction in future traffic accidents.

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