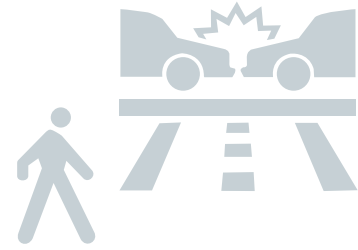


ISSUE 14

KOTI Knowledge Sharing Report



**KOREA'S BEST PRACTICES
IN THE TRANSPORT SECTOR**



Handbook of Measuring Socio-economic Consequences of Traffic Crashes

by JUNG Namji and SUL Jaehoon



Korea's Best Practices in the Transport Sector

**Handbook of Measuring
Socio-economic Consequences
of Traffic Crashes**

KOTI Knowledge Sharing Report: Korea's Best Practices in the Transport Sector

Issue 14: Handbook of Measuring Socio-economic Consequences of Traffic Crashes

Author_JUNG Namji

Supervisor_SUL Jaehoon

Copyeditors_KIM Gunyong, Richard Andrew MOORE

Copyright © 2014 by The Korea Transport Institute

All rights reserved. No part of this book may be reproduced in any form or by any means without the prior written consent of the publisher.

Published by The Korea Transport Institute (KOTI)

315, Goyangdaero, Ilsanseo-gu, Goyang-si, Gyeonggi-do 411-701, Republic of Korea

Phone +82-31-910-3114

Fax +82-31-910-3222

Homepage: www.koti.re.kr

Contact email: info@koti.re.kr

Price 15,000 Korean Won

ISBN 978-89-5503-630-5 93320

ISSUE 14

KOTI Knowledge Sharing Report

Korea's Best Practices in the Transport Sector

Handbook of Measuring Socio-economic Consequences of Traffic Crashes

by JUNG Namji and SUL Jaehoon

• Author



JUNG Namji

Dr. JUNG Namji was an Associate Research Fellow in the Korea Transport Institute (KOTI). Upon joining KOTI in October 2012, she has conducted research on traffic safety issues including “An International Comparison of Traffic Safety Education” and “A Study on the Socio-Economic Impact of Traffic Accidents.”

Before joining KOTI, Dr. JUNG has been teaching and conducting research in the area of economic development planning. More specifically, research agendas lie in the interdisciplinary area including innovation in high-tech industries, industry clusters, labor dimension in local economic development, and sustainable land use and transportation. She previously had taught at planning schools internationally including University of Sydney, Australia and Florida State University, Cornell University and University of Seoul City. Dr. JUNG received her Masters Degree from the Department of Urban and Regional Planning at the University of Michigan, Ann Arbor, and a doctoral degree from the Department of City and Regional Planning at Cornell University. She enjoys various outdoor activities including hiking, cycling, and sailing. Cooking is a way to get in touch with her inner-self.

E-mail: namji.jung@gmail.com

• Supervisor



SUL Jaehoon

Dr. SUL Jaehoon is the former Vice President for Transport Safety and Highway in the Korea Transport Institute. He is in charge of institute's Center for Transport Safety and Highway Research. His main research areas are road safety policy and road traffic engineering. He has carried out various transport projects in Korea such as the National Transportation Safety Master Plan, Safety Management System Development and Road Safety Strategy.

He graduated from the Department of Civil Engineering at Seoul National University, later returning there to complete his Ph.D. in Traffic Engineering. He conducted further study at the University College London as a visiting scholar.

After he entered the Korea Transport Institute in 1987, he held a number of positions such as Director of Transport Safety, Director of Highway Research, Director of Transport Technology Research and Vice President.

He worked as a special advisor at the Presidential Commission for National Competitiveness of President's Office and at the Safety Management Task Force of the Prime Minister's Office. He received the national medal from Korean government in 2006 for his contributions in reducing road accidents in Korea.

E-mail: jhsul@koti.re.kr

• Contents

Author • 5

List of Tables • 10

List of Figures • 11

Preface • 12

CHAPTER 1 **What this Book is About** • 15

CHAPTER 2 **What Motivated this Book**

01. World Traffic Crash Trends • 20

02. Korean Experience • 28

03. Socio-economic Cost of Traffic Crashes • 35

CHAPTER 3 **Measuring the Impact of Traffic Crashes at an Individual Level**

01. Understanding the Mechanism in which a Traffic Crash Affects Individuals in the Long-run: The Chain-effect • 42

02. Conceptual Framework for the Long-term Effects of Traffic Crashes • 45

03. Measurements • 48

04. How We Surveyed • 54

CHAPTER 4 Survey Results

- 01. Key Findings for General Traffic Crash Victims • 58
- 02. Key Findings for Disabled Traffic Crash Victims • 60
- 03. Comparison of General and Disabled Traffic Crash Victims • 74

CHAPTER 5 Impacts and Suggestions

- 01. Socio-economic Costs of Traffic Crashes • 80
- 02. Suggestions • 82

References • 84

Appendices

- 1. Survey Questionnaires • 86
- 2. Abstract of “A Study on the Socio-economic Consequences of Traffic Accidents” (Korea Transport Institute, 2013) • 90

• List of Tables

- Table 2.1** Estimated global research and development funding for selected topics • 20
- Table 2.2** Changes in the number of child traffic fatalities • 31
- Table 2.3** Crash cost calculation methods • 38
- Table 3.1** Before and after accident variables • 53

• List of Figures

- Figure 2.1** Shift of our view on traffic crashes over time • 21
- Figure 2.2** Lifetime disruption of human development caused by a traffic crash • 22
- Figure 2.3** Changes in traffic fatalities in industrialized countries • 23
- Figure 2.4** Changes in traffic fatalities in middle and low-income countries • 23
- Figure 2.5** Comparison of vehicle ownership and traffic fatalities by income level • 25
- Figure 2.6** Unsafe privately operated public transportation • 26
- Figure 2.7** Changes of traffic crashes in relation to GDP per capital and vehicle ownership • 28
- Figure 2.8** Traffic safety policy intervention timeline and their effects • 29
- Figure 2.9** World map of traffic fatalities • 30
- Figure 2.10** Child traffic fatalities by country • 31
- Figure 2.11** Number of pedestrian fatalities by street width (1995-2001) • 32
- Figure 2.12** Number of child traffic fatalities in Seoul by street width (2001-2012) • 33
- Figure 2.13** Example of a school zone • 33
- Figure 2.14** Comparison of child traffic fatalities between OECD nation average and South Korea • 34
- Figure 2.15** Market and non-market traffic crash costs • 36
- Figure 2.16** Direct and indirect traffic crash costs • 36
- Figure 2.17** Total social costs from injury crashes of 2012 in New Zealand • 37

- Figure 3.1** Minor injury timeline • 45
- Figure 3.2** Severe injury timeline with re-employment opportunities • 46
- Figure 3.3** Severe injury timeline with permanent disability • 46
- Figure 3.4** Selecting samples and conducting surveys • 55
- Figure 4.1** Age distribution of the sample • 58
- Figure 4.2** Types of crashes • 59
- Figure 4.3** Number of crashes experienced between 1995 and 2010 • 59
- Figure 4.4** Proportion of the disabled and their distribution using disability level standards from the Disabilities Act • 60
- Figure 4.5** Loss of job post crash • 61
- Figure 4.6** Reasons for job loss • 61
- Figure 4.7** Number of re-employed and length of unemployment • 61
- Figure 4.8** Average length of unemployment • 62
- Figure 4.9** Income discrepancy between those injured in traffic crashes and the national average • 63
- Figure 4.10** Proportion of those who divorced after the crash • 63
- Figure 4.11** Types of separation using standards • 63
- Figure 4.12** Changes in social activities • 64
- Figure 4.13** Reasons for those who experienced a decrease of social activities using standards from the Disabilities Act • 65
- Figure 4.14** Age distribution of disabled respondents • 66
- Figure 4.15** Number of traffic crashes experienced between 1995 and 2010 • 67
- Figure 4.16** Job loss after a disabling traffic crash • 68
- Figure 4.17** Reasons for the disabled experiencing job loss • 68
- Figure 4.18** Occupation before and after the traffic crashes • 69
- Figure 4.19** Number of re-employed and length of unemployment for the disabled • 69
- Figure 4.20** Age distribution of job loss of the disabled • 70
- Figure 4.21** The income discrepancy between those disabled from traffic crashes and national average • 71
- Figure 4.22** Change of housing conditions for those disabled in auto crashes • 71
- Figure 4.23** Proportion of those divorced after becoming disabled • 72
- Figure 4.24** Reasons for separation from their spouse after crash • 72

Figure 4.25 Changes in social activities for those disabled in a crash • 73

Figure 4.26 Reasons for the decrease of social activities for those disabled in a crash • 73

Figure 4.27 Number of crashes experiences by the injured or disabled • 74

Figure 4.28 Comparison of the length of hospitalization between injured and disabled victims • 75

Figure 4.29 Comparison of average income among injured, disabled and national average • 76

Figure 4.30 Gross loss of personal income caused by traffic crashes • 77

• Preface

Traffic crashes are one of the main causes of fatalities and physical injury across the globe. According to the World Health Organization's (WHO) annual report, 3,400 people die on the world's roads everyday. Every life lost or person injured in a traffic crash brings us sorrow, agony, physical, psychological, and socio-economic costs. More importantly, various impacts of traffic crashes carries a disproportionately greater magnitude to the poor. It is because the poor do not have deep enough pockets to survive through a period of injury or after losing their breadwinners. Once victimized, physical injury or disability is frequently followed by loss of employment and other economic means which lead them to an even worse level of poverty.

As such, in the long run traffic crashes and injuries stop being a safety and public health issue and instead takes a qualitative turn and becomes an economic development issue: more precisely a mechanism regenerating income inequality and poverty.

Unfortunately, people currently in low-income countries are exposed to far higher rates of traffic crash. WHO reports that the total cost of traffic crash is more than the world's total Official Development Assistance (ODA) fund. Considering the long-term impacts of traffic crash and the socio-economic costs involved with it, the total amount of traffic crashes cost will subsequently increase.

Despite the imperative nature of physical and socio-economic costs of traffic crashes is imposed on individuals, less is known in how a traffic crash changes one's life over the course of time and in what mechanism. We can identify two aspects of the benefit of knowing the long-term costs. If the more people know to what degree a collision affects one's life, it will heighten public awareness to the critical importance of reducing traffic collisions. Second, heightened awareness

leads to reducing traffic fatalities and injuries, thereby saving many lives as well as high socio-economic costs. This will carry great weight in the goal of reducing poverty.

This handbook is to share our experience and knowledge obtained from our research project. In particular, we would like to share how we have framed the concept for the long-term consequences of traffic crashes, what kind of measures were used, what kind of problems were faced in preparing and conducting the survey, as well as the final outcome.

We hope that this will be useful for both developed and developing countries in measuring the socio-economic consequences of traffic crashes and contribute to raising awareness of the critical consequences of traffic crashes occurring at individual level.

KIM Gyeng Chul

President

The Korea Transport Institute

ACKNOWLEDGEMENT

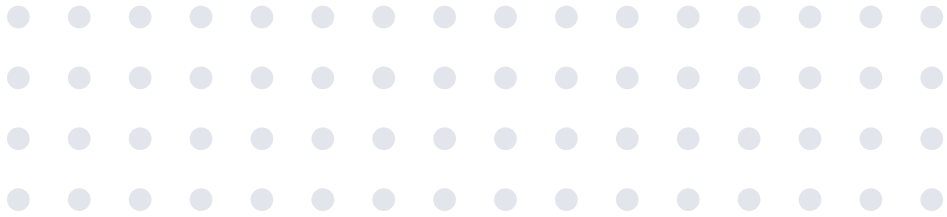
This handbook is based on the research project “A Study on the Socio-economic Consequences of Traffic Accidents” conducted by Dr. SUL Jaehoon and Dr. JUNG Namji at the Korea Transport Institute in 2013.

CHAPTER

1

What this Book is About





This handbook is planned and designed as a toolkit for researchers, policymakers, non-profit organization staff members and individuals who want to understand how a traffic crash affects individual's life in the long-run. Nowadays, many countries, especially middle and low-income countries, experience a high number of traffic collisions and fatalities because in many cases they do not have the necessary traffic safety practices and regulations in place. The more fundamental problem is that despite low-income countries experience a high rate of traffic collisions, the devastating and tragic consequences of those collisions are not well understood or shared; nor do most law enforcement authorities or policymakers provide sufficient accurate statistics. It is partly because of the lack of proper data leads to a lack of understanding what happens after the collision.

In order to understand how a traffic crash affects one's life over time, the database should be periodically updated. Establishing a high quality database for victims is costly and takes time. Thus while the addition of traffic crash victims might be a helpful addition, it will not be the foremost policy priority for low-income countries. Different ways to approach and understand the consequences of traffic crash was needed. In a quest to find better ways to measure the consequences of traffic crashes, we used survey questionnaire methods in the project "A Study on the Socio-economic Consequences of Traffic Accidents."

By using survey questionnaire on traffic crash victims, we were able to capture a partial picture of long-term socio-economic consequences of

these collisions. We have found that injuries, especially disabilities, greatly affect victims' workability, psychological conditions, social relations, and mostly importantly, family relations. Now that the survey questions and measurements are established and the results of the survey is informative, we believe our method can be useful for other countries as well.

In sharing our knowledge and experience, this book has the following three primary aims:

- 1) to raise the level of awareness on the socio-economic consequences of traffic crash by sharing the survey results.
- 2) to share the knowledge and know-how about how to measure the socio-economic consequences of traffic crash by using a questionnaire survey.
- 3) to create consensus on further investment in traffic safety especially in low-income countries.

Each aim has its own value and the order does not necessarily reflect the importance of one over another. Although it does not shed light on the entire picture, it at least helps us to understand in what way and how much traffic crashes affect individuals and families.

- 1) Despite the great impact of traffic crashes on human development, economic growth, and welfare, few research has tried to measure the lingering consequences of traffic crashes.
- 2) One of the reasons is that not many countries collect the statistics of traffic crash victims. Thus, systematically studying the consequences of traffic crashes on individuals and families is difficult. This is the reason that we chose to survey traffic crash victims.
- 3) With our improved understanding, we should act on reducing traffic crashes throughout the world, especially in low-income countries.

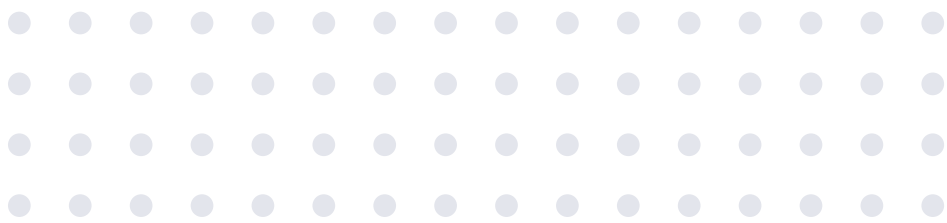
As a toolkit, this book is structured as follows: First we discuss what this book is about. The second section explains the theoretical background which motivated our study and review existing related studies and reports. In the third chapter, we discuss the methods used to create the survey questionnaire and survey results are introduced and discussed presenting major findings from said surveys.

CHAPTER

2

What Motivated This Handbook





01

World Traffic Crash Trends

Escalating Traffic Fatalities

According to WHO’s Global Status Report on Road Safety, over 1.2 million people die each year from road traffic accidents. Between 20-50 million people experience non-fatal injuries (WHO, 2009). Road traffic injuries are the eighth leading cause of death (WHO, 2013). 2013 report also predicts that, if the current trend persists, by 2030 road traffic deaths will become the fifth leading cause of death.

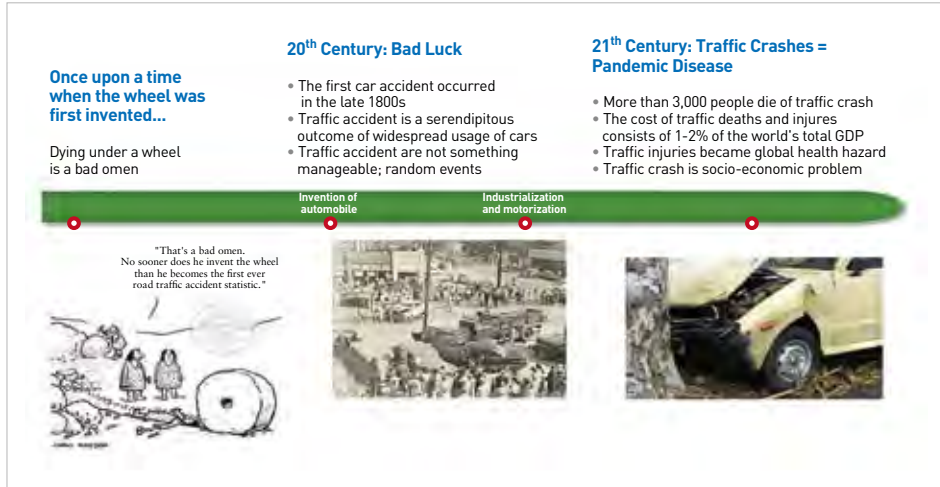
From The high number of traffic fatalities and injuries, WHO declared

Table 2.1 Estimated global research and development funding for selected topics

Disease or Injury	USD \$ millions	1990 DALYs ranking	2020 DALYs ranking
HIV/AIDS	919-985	2	10
Malaria	60	8	-
Diarrhoeal disease	33	4	9
Road traffic crashes	24-33	9	3
Tuberculosis	19-33	-	7

DALYs: Disability-adjusted life years
Source: WHO, 2004.

Figure 2.1 Shift of our view on traffic crash over time



that we should treat road traffic crashes as a pandemic global disease. However, research done to understand the causes and outcomes of traffic crashes are substantially limited compared to other global health threats such as HIV and malaria (Table 2.1).

Pandemic occurrences of road traffic accidents means that traffic collisions are not random ‘accidents’ as we used to think. As illustrated in Figure 2.1, in the earlier stage of motorization, traffic crashes might had been considered randomly occurring accidents as results of bad luck. However, this perspective has changed overtime. With accumulated knowledge on traffic crashes, we now know that human factor largely contribute to traffic crashes. This realization has changed our perspectives on traffic crashes from something spontaneous and unmanageable to human error involved events which are preventable and manageable.

The high cost involved with traffic fatalities and injuries is another reason to prevent traffic crashes. The annual cost of traffic deaths and injuries consists of 1-2% of the world’s total GDP.

Not only in terms of the monetary cost but also in terms of disruption of human development, traffic crashes carry significant cost. Regardless at which point the traffic crash occurs, it creates a certain level of impact that might

Figure 2.2 Lifetime disruption of human development caused by a traffic crash



last for the remainder of a lifetime. However, we seldom consider the long-term consequences of traffic crashes. To fill this gap, this handbook is more concerned about how to measure the long-term impacts of said collisions.

World Traffic Fatalities Sorted by Wealth

Low-income countries suffer more from traffic crashes. The even more troubling aspect is that the high fatality rate is unevenly distributed, harming more lives in middle and low-income countries. Whilst there is a general decline in the numbers of fatalities in industrialized countries, the opposite is true in middle and low-income countries. As can be seen in figures below, high-income countries such as England have successfully curbed their traffic crashes from the 1980s and continuously show that declining trend (Figure 2.2).

On the other hand, middle and low-income countries show exponentially increasing traffic fatality rate curves which do not seem to be slowing down in the near future if no intervention occurs (Figure 2.3). This trend probably has to do with the massive population movement to big cities, the lack of

transportation infrastructure and proper safety measures. Also the rapid increase of car ownership is probably part of the reason too.

As the number of road traffic crash fatalities in low-income countries

Figure 2.3 Changes in traffic fatalities in industrialized countries

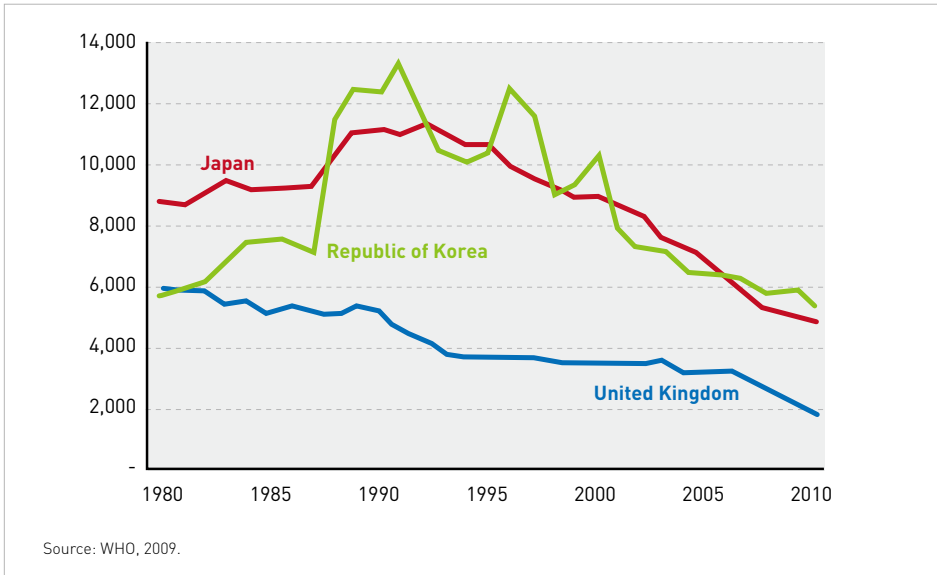
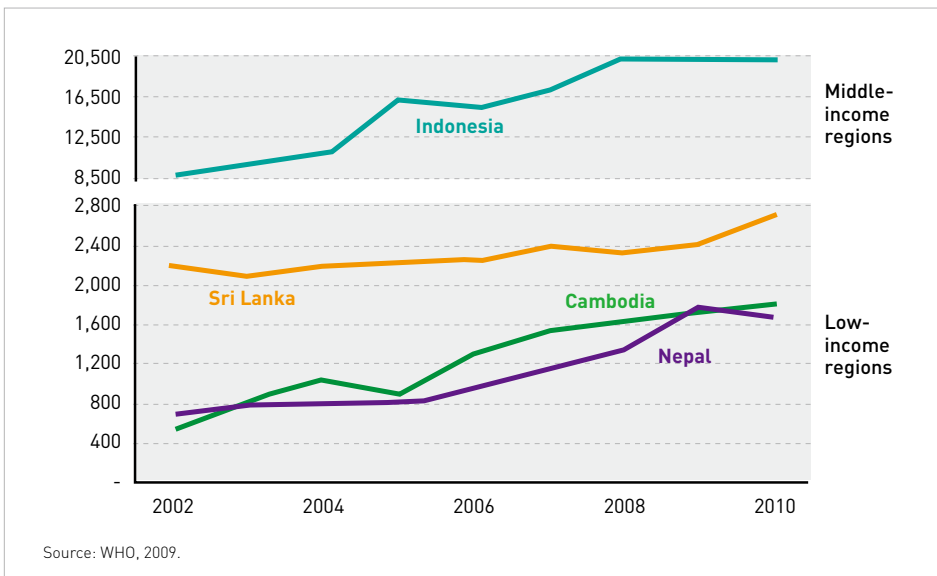


Figure 2.4 Changes in traffic fatalities in middle and low-income countries



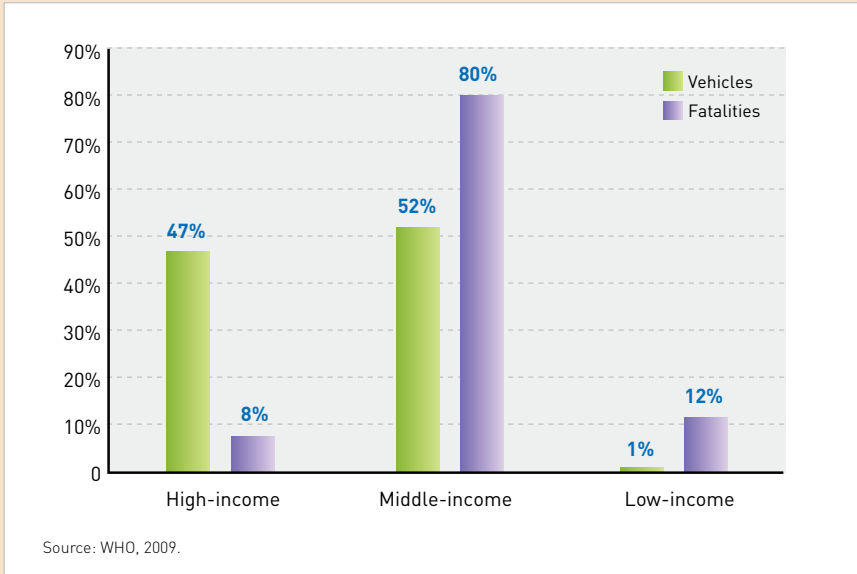
have grown, their relative importance as a cause of death has increased. To comprehend the magnitude, road accident fatalities have been compared with trends in deaths due to violence and disease.

Road accidents are usually classified as being fatal if a victim dies within 30 days of the accident occurring; thus, while the higher level of road accidents in developing countries may be attributable to factors such as driver error, poor road conditions or poor traffic management, it is also possible that a lack of medical facilities contribute to the high fatality levels. If medical attention can be given to an accident victim promptly, then the chance of survival is increased.

Riddle 1. Low automobile ownership rate but high traffic fatality rate in middle and low-income countries?

In the high-income country context, what determines a traffic crash includes the density of cars and people as well as the distance to drive. Basically the more cars that drive longer in more populated areas, the higher traffic crash rates will be. However, this logic does not apply to some low-income countries. As can be seen in Figure 2.4 the car ownership rate in low-income countries is only 1% while the traffic fatality rate occupies 12%. In other words, if we consider the level of motorization by expressing accident statistics as per registered vehicle, then low-income countries have 10 to 12 times the rate of fatalities than high-income countries.

This discrepancy stems from high public transportation fatalities. In Kenya, buses and other small public transportation modes account for 38% of total traffic fatalities (WHO, 2009). This explains why despite the low automobile share in low-income countries, the traffic fatality rate is higher than most high-income countries.

Figure 2.5 Comparison of vehicle ownership and traffic fatalities by income level

Who Are The Victims?

More importantly, people in low-income countries are the most vulnerable road users. As mentioned earlier, according to WHO's Global Status Report on Road Safety (2009), in middle and low-income countries, a large proportion of traffic injuries and deaths are related to public transportation. And most public transportation users are from economically marginalized groups because they would have changed their transportation mode if they had the economic means to do so.

The main problem of public transportation in middle and low-income countries is the lack of safety and overcrowding. While many cities in middle and low-income countries experience rapid population growth, many cities are lacking the ability to provide proper means of transport to support people's commute to work and school. In order to make up for the failure

Figure 2.6 Unsafe privately operated public transportation



Source: <http://digitalphotopix.com/people/shocking-public-transportation>

of transportation supply, many middle and low-income countries liberalized their transportation market thereby driving the high risk in public transportation. For instance, privately owned bus companies are less stringently regulated by government safety rules: drivers' eligibility, safety maintenance of the bus, and safe vehicle operation are poorly performed compared to government operated bus systems (WHO, 2009).

The Cost of Traffic Crashes in Low-income Countries

It is estimated that the global cost of road accidents is US \$230 billion per annum and the cost to developing countries is around US \$36 billion.

Riddle 2. What causes less traffic crash costs in low-income countries where more people die in traffic crash?

Although 70% of road fatalities occur in the developing world, the cost of traffic crash in low-income countries is only a fraction of high-income countries. This apparent discrepancy results from the methods used to estimate the cost of an injury or fatality that relies on the loss of production by victims. In low-income countries, the wages are lower, thus the production loss calculated from the wage loss is substantially less than high-income countries.

If we agree that the value of every life is equal and the weight of pain, grief, and loss of opportunities are also equally important for every traffic crash victim and their family, then the cost of traffic injuries and fatalities in low-income countries will probably well exceed that of high-income countries. This implies that the loss of output is higher than would be estimated from using national average wage rates, thus the cost of road accidents may be underestimated by current methodology which uses average wage rates.

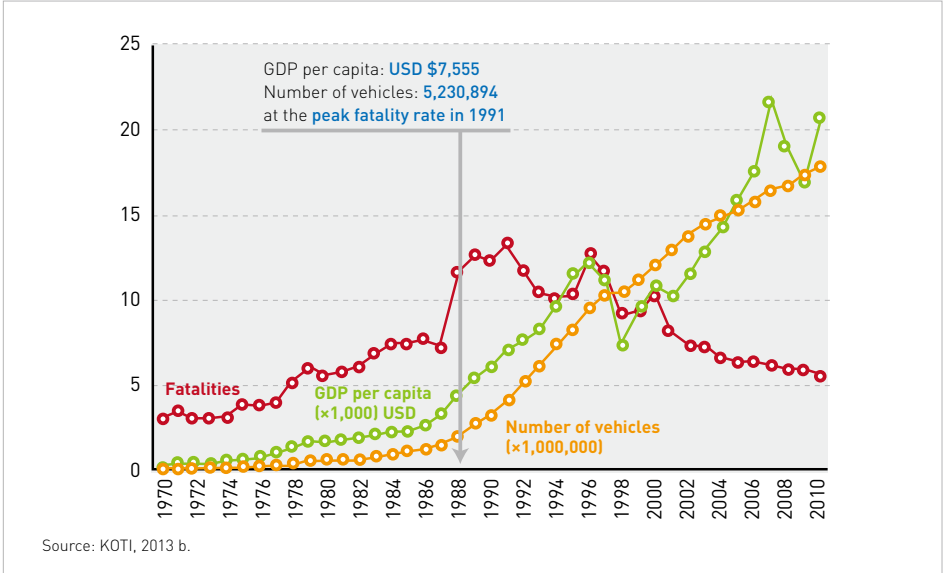
Even more, the magnitude of a traffic crash to low-income people is much greater than high-income people because they are lacking the resource to survive through the time away from work and afford medical treatment related bills that are not covered by insurance policies. In other words, preventing and decreasing traffic crash injuries and fatalities and every life saved will carry significantly high value in low-income countries.

02
Korean Experience

South Korea Struggled with High Traffic Crash Rates

South Korea once was the poorest country in the world directly following the

Figure 2.7 Changes of traffic crashes in relation to GDP per capital and vehicle ownership



Korean War. With rapid industrialization, automobilization also took off in the 1970s. Since then traffic fatalities has almost exponentially increased and the trend continued until the mid 1990s.

Difficulties to Subdue High Traffic Crash Rates

Traffic fatalities in South Korea finally began declining in the late 1990s and the trend continues today. It happened as Korean GDP per capital hit \$10,000 and government began rigorously introducing a series of policies to curb traffic crashes.

However, the decrease of traffic fatalities is not achievable over night. The ups and downs of fatality rates in Figure 2.7 clearly shows the difficulties in putting a safe driving culture in place. The jagged line suggests that safe driving culture in place takes time and the reinforcement should repeatedly occur over time.

For instance, after fatalities hit 6,000 in 1980, the Korean government

Figure 2.8 Traffic safety policy intervention timeline and their effects

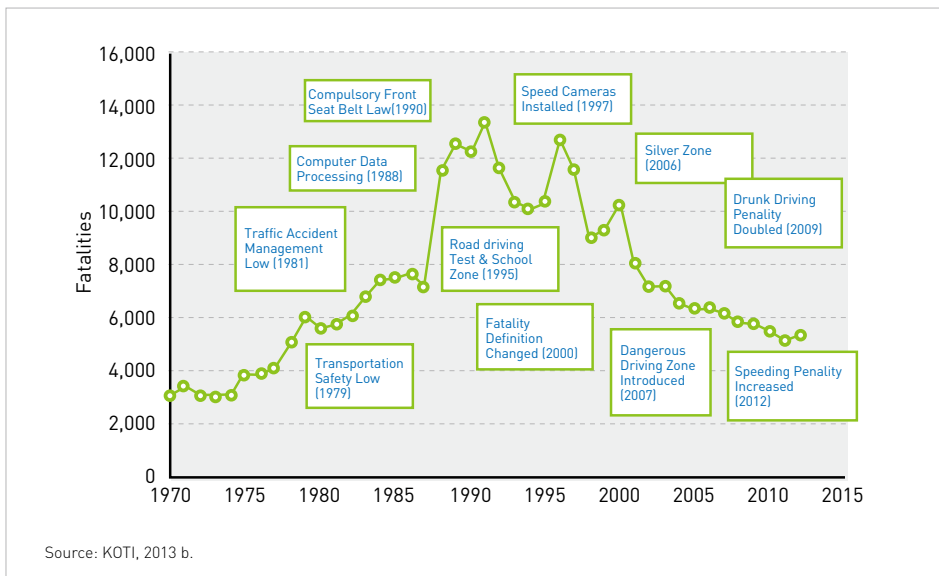
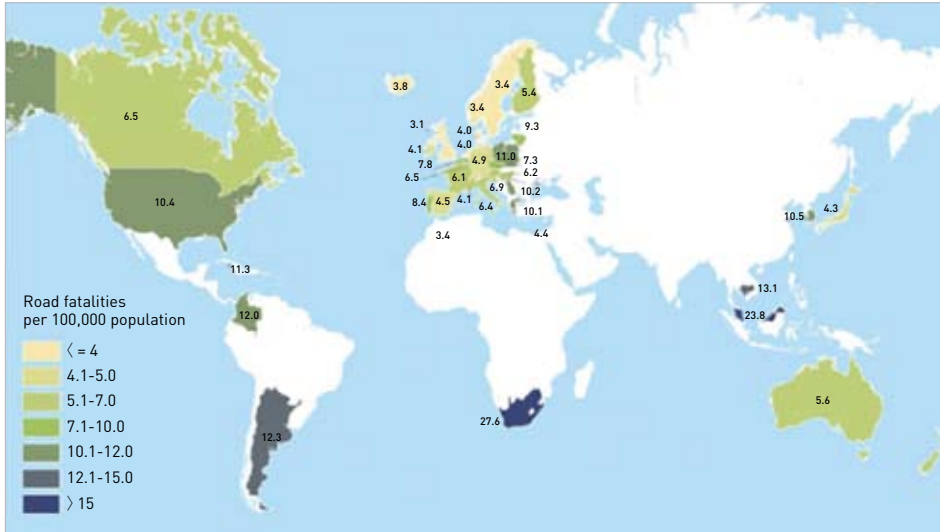


Figure 2.9 World map of traffic fatalities



Source: IRTAD, 2013.

introduced Traffic Accident Management Law. After the 1988 Olympic Games, car ownership exponentially increased as did traffic fatality rates. In response to this, in 1990, the government made wearing seat belt compulsory (Figure 2.8). The fatality rate rose again the following year. After two decades of struggling with traffic fatalities, it has finally declined since.

However, South Korea still has a long way to go. In transport safety, South Korea's traffic fatality rate is still high compared to other OECD countries, as can be seen in Figure 2.9. It is 10 times higher than Sweden. Unlike the country's leading status in the global auto-industry and high domestic vehicle ownership, the traffic fatality rates has maintained the worst rank among OECD member countries.

School Zone Program Success Story

High Child Traffic Crash Fatalities

While fatality rates of adult vehicle occupants has reduced substantially, the

high child traffic death rates have been a serious problem in Korea (Table 2.1). Among OECD countries, Korea ranked the bottom in children's traffic safety in 2001, which means the nation had the highest rate of child traffic fatalities per 100,000 children (Figure 2.10). However, in 2011, this figure reduced substantially down to 1.3 fatalities per 100,000 children (Figure 2.14). In the following sections, we will discuss the causes of the high child traffic fatalities and ways in which Korea successfully reduced it.

Figure 2.10 Child traffic deaths by country

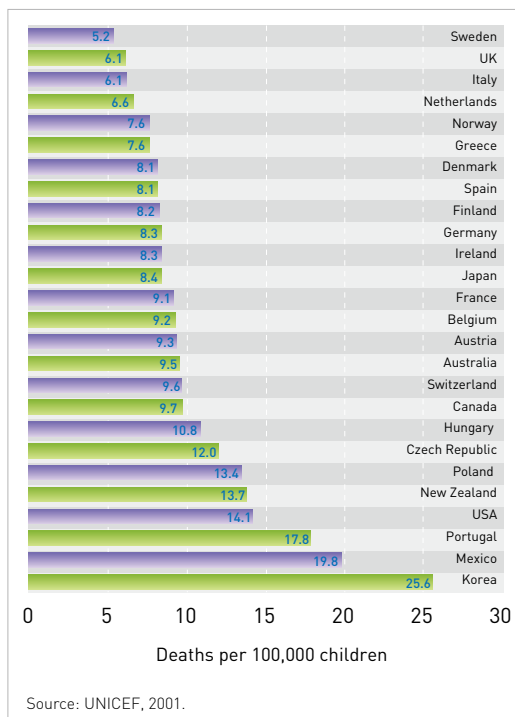


Table 2.2 Changes in the number of child traffic fatalities

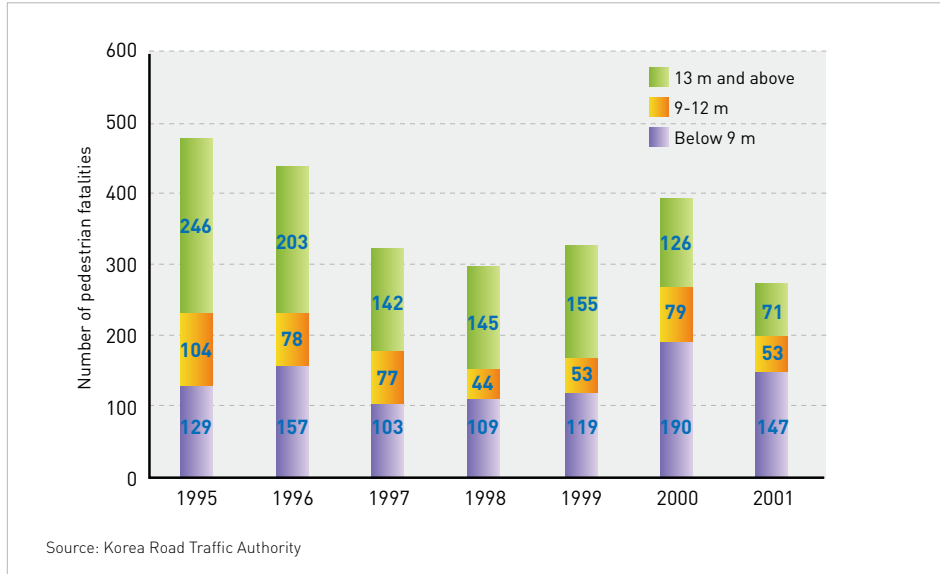
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012
Children under age 14 (in thousands)	9,911	9,854	9,747	9,606	9,446	9,241	8,996	8,734	8,458	8,180	7,907
Number of children deaths from accidents	1,413	1,265	1,207	1,015	893	755	642	538	508	440	386
Number of children deaths per 100,000	14.3	12.8	12.4	10.6	9.5	8.2	7.1	6.2	6.0	5.4	.9

Source: Data provided by the Korea Statistics Bureau.

Problems with Community Road Safety Management

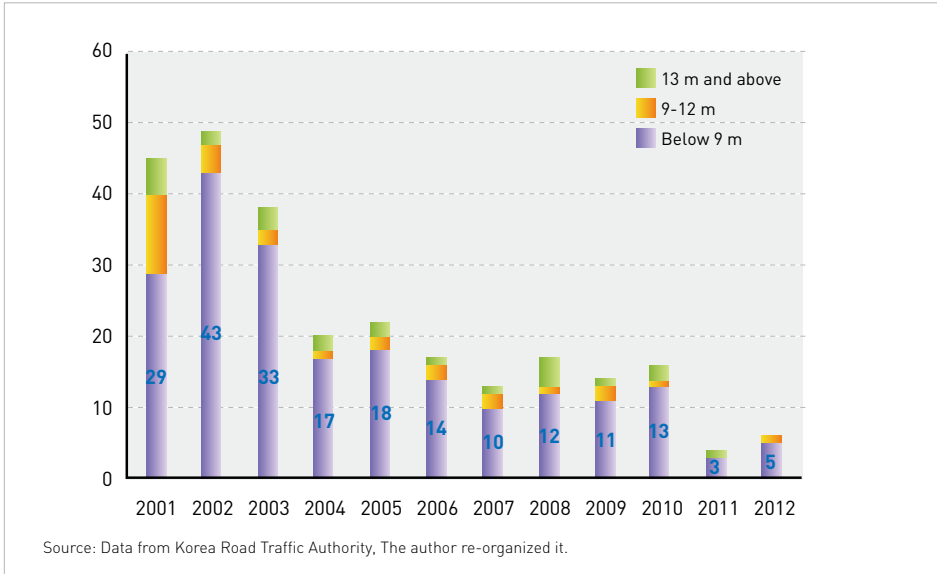
The more important reason behind the high child traffic fatality rate is the poor road safety in smaller roads. Let's take Seoul, the capital of South Korea for example. While the number of pedestrian deaths in Seoul reduced between 1995 and 2001, the proportion of pedestrian deaths in streets smaller than

Figure 2.11 Number of pedestrian fatalities by street width (1995-2001)



12 meter in width had substantially increased from 47% in 1995 to 74% in 2001. Oppositely, the proportion of pedestrian deaths in streets wider than 13 meters was reduced from 50% in 1995 to 26% in 2001. Most astonishingly, the proportion of pedestrian deaths in streets smaller than 9 meters in width, continued to increase from 129 among 493 deaths (27%) in 1995 to 147 among 271 traffic deaths (54%) in 2001 (Figure 2.11).

The high traffic accident risk in smaller local and community-level streets carries significant implications to child traffic death because they are the streets where much of children’s day-to-day activities, including commuting to school and playing, take place. This is apparent in traffic deaths in streets narrower than 12 meters. 80% of pedestrian deaths in 12 meter streets and smaller occurred during the crossing of the street and the rest of deaths occurred during walking and playing. The high number of traffic fatalities in smaller streets applies to child fatalities in the same manner. For instance, in 2001, 614 children traffic fatalities occurred in South Korea and 307 (50%) of those deaths occurred in small streets, especially in front of schools, near homes and within apartment complexes. 307 children were killed in

Figure 2.12 Number of child traffic fatalities in Seoul by street width (2001-2012)

traffic crashes while walking to and from school and running and playing near home. In Seoul, almost 90% of the child deaths occurred in local and community-level streets narrower than 12 meters. While the number of child traffic fatalities has reduced over time, the high proportion of these occurred in streets narrower than 12 meters and stayed almost the same (Figure 2.12).

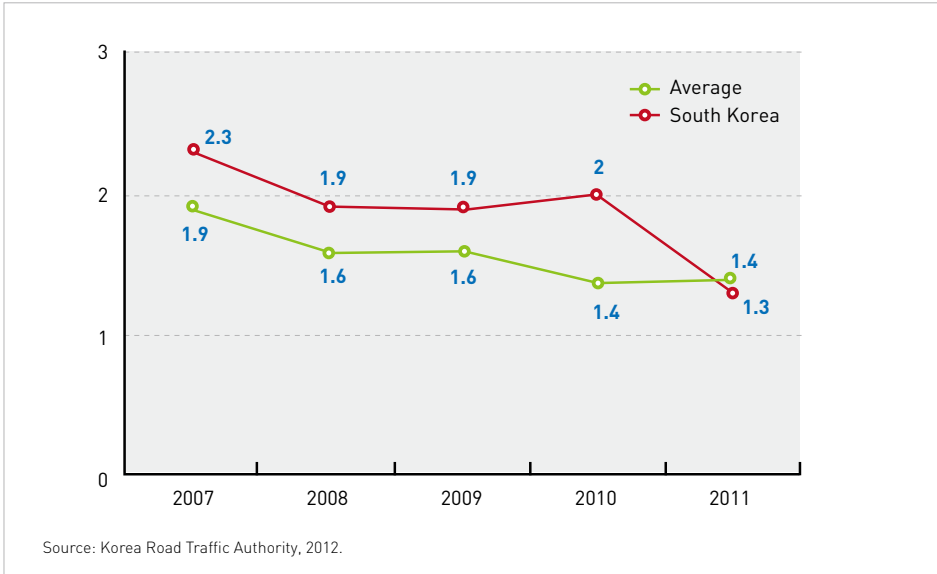
Reinforcing the School Zone Program and Its Effect

The School Zone Program was originally adopted in 1995 in order to increase child safety on school commuting routes and was legislated under the Road and Traffic Code. This code advises and recommends the local authority (such as the mayor) to initiate a school zone when it was considered


Figure 2.13 Example of a school zone

Source: Wellbeing Korea News
<http://www.wbkn.tv/?m=bbs&where=subject%7Ctag&keyword=%EC%8A%A4%EC%BF%A8%EC%A1%B4&uid=3892>, January 7, 2013.

Figure 2.14 Comparison of child traffic fatalities between OECD nation average and South Korea



necessary. The engineering and design aspects of the school zone are supposed to be regulated under the special code of the Ministry of Domestic Affairs, the Ministry of Education, and the Ministry of Construction and Transportation. If a deputy principal requests a designation of a school zone, then the policy implements the physical designation of the school zone within a 300 circle around the school. The School Zone Program includes the installation of pedestrian crossing, elongated green lights for pedestrian crossing (in order to allow enough time for children to cross the road safely), and the regulation of parking. The number of school zone was increased from 8,429 to 14,921. At the same time, the child fatality rate was significantly reduced from 2.3 fatalities per 100,000 children in 2007 to 1.3 fatalities in 2011. This figure was even lower than the OECD average at 1.4 fatalities.



03

Socio-economic Cost of Traffic Crashes

Ways to Categorize Traffic Crash Related Costs

There are various ways to conceptualize and categorize the cost involved with traffic crashes. First, the cost of traffic crash can be categorized into market and non-market costs. The most immediate and prominent cost is the physical damage that requires medical attention followed by crash victim's pain and suffering, and the lost quality of life. These are considered market costs. Other more economic outcomes such as property damage to vehicles and other objects, lost income, emergency response services, and medical treatment are considered to be market costs because they occur within the market system (Figure 2.15).

Another approach divides the cost into direct and indirect costs. According to Altes and Perez, in the case of Barcelona, 10.8% of the traffic crash related cost is distributable to the indirect cost and 89.2% is distributable to direct cost. For direct cost, authors included healthcare costs, hospital stays, emergency response, transportation, policy, insurance administration, property damage, and total non-healthcare costs. For indirect cost, the loss occurs due to hospitalization, death, and years of potential life

Figure 2.15 Market and non-market traffic crash costs

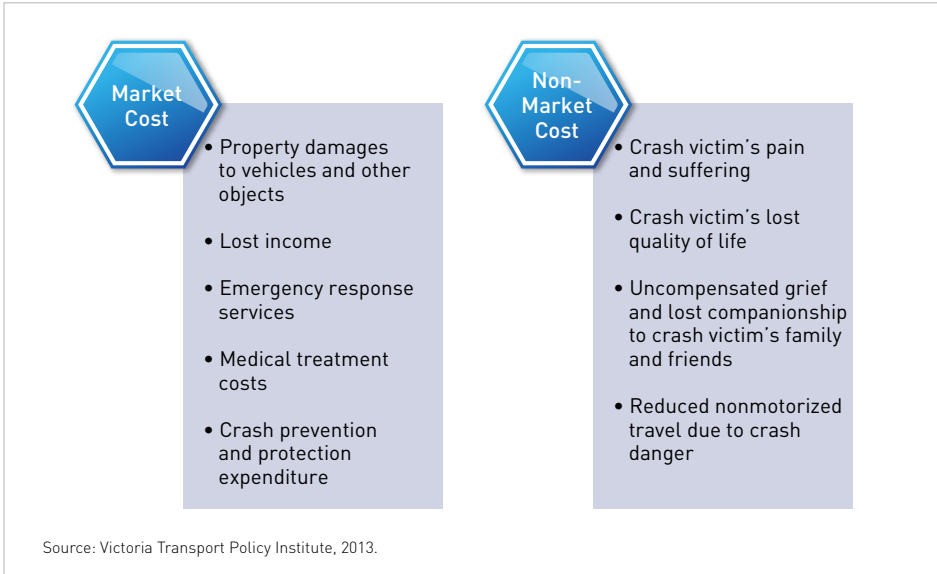
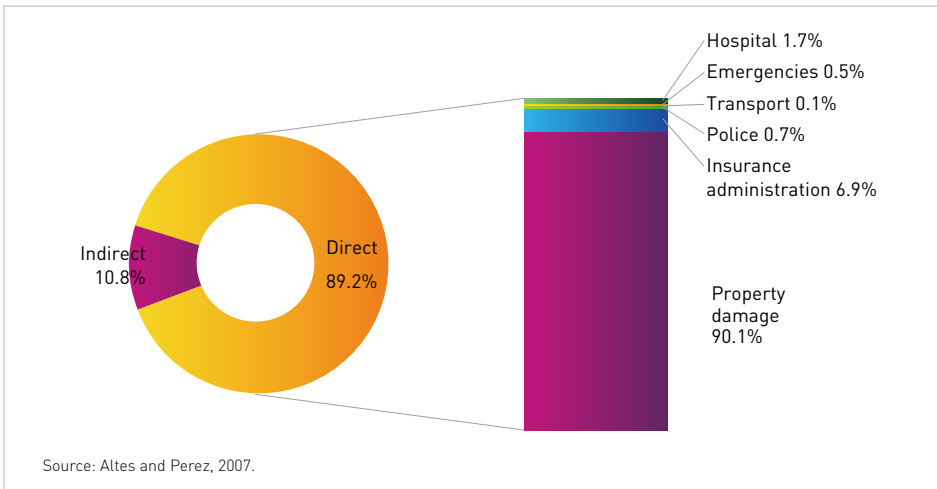


Figure 2.16 Direct and indirect traffic crash costs

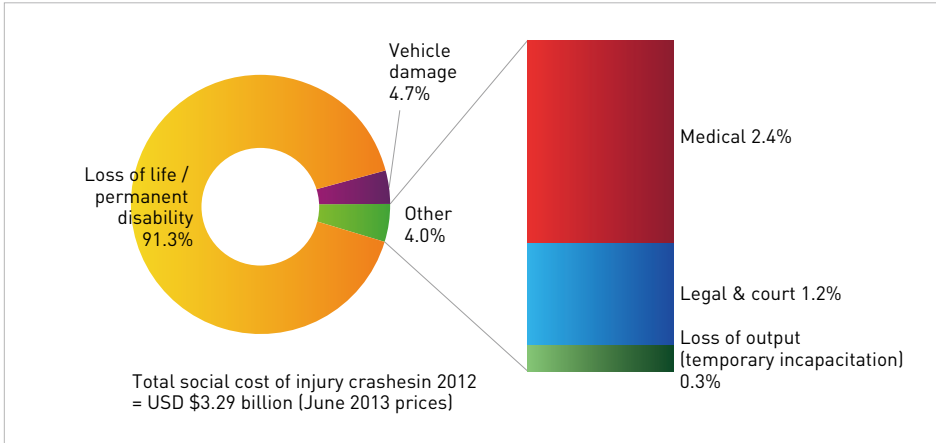


lost (Figure 2.16).

In New Zealand, the social cost of traffic crashes includes the following components:

- Loss of life and life quality
- Loss of output due to temporary incapacitation

Figure 2.17 Total social costs from injury crashes of 2012 in New Zealand



- Medical costs
- Legal costs
- Vehicle damage costs

In measuring the social costs, New Zealand uses a “willingness to pay” valuation technique (Figure 2.17) and will be discussed further in the next section. This method captures the pain and suffering from loss of life or life quality in dollar terms. In this calculation, the cost stemming from loss of life/permanent disability, what may have been included in the indirect cost (which is only a small portion) became the major cost accounts for 91.3% of the total traffic crash cost.

Calculating Traffic Crash Costs

Just as there are various ways to categorize the cost of traffic crashes, there are different ways to calculate traffic crash cost. This section summarizes the current methods briefly and discusses the shortcomings of each approach.

The ‘gross output’ approach sums the value of lost production (by the accident victim), medical costs, property damage and other administrative

and police costs to society. A subjective allowance can then be added to represent the ‘pain, grief, and suffering’ of the victim and his/her loved ones. Because the value of lost production is calculated on the basis of wage rates, it is important to have a clear profile of road accident victims and their status in society.

Willingness to pay is also another way to calculate accidents, replacing the gross output methods. This new method results in considerable increases on costs of road accidents. For example, vehicle purchasers must sometimes decide whether to pay extra for safety equipment, such as air bags, that provide small safety gains. Such tradeoffs indicate the value consumers place on marginal changes in risk, described as willingness to pay.

Willingness to accept is similar to willingness to pay but different in that it measures the compensation a person would require before the individual would or should volunteer to experience such damages. This method results higher values than willingness to pay as when people consider how much to pay to reduce the certain level of risk under the consideration of their budget constraints.

However, current cost methodology estimates the economic consequences of road accidents, but cannot fully represent the social consequences of the loss of a breadwinner in a large family group, or the grief caused by the loss of a child. As the full report shows, road accidents cause an undue proportion of lost working years and of childhood deaths in the developing world.

Table 2.3 Crash cost calculation methods

Methods	Descriptions
Gross output	This sums the value of lost production (by the accident victim), medical costs, property damage and other administrative and police costs to society. A subjective allowance can then be added to represent the “pain, grief, and suffering” of the victim and his/her loved ones.
Willingness-to-pay	Tradeoffs indicate the value consumers place on marginal changes in risk
Willingness-to-accept	The compensation a person would require before he or she would volunteer to experience such damages.

Source: Victoria Transport Policy Institute, 2013.

In addition to loss of life or reduced quality of life, road accidents

carry many other consequences to the survivors such as legal implications, economic burden, home and vehicle adaptations as well as psychological consequences.

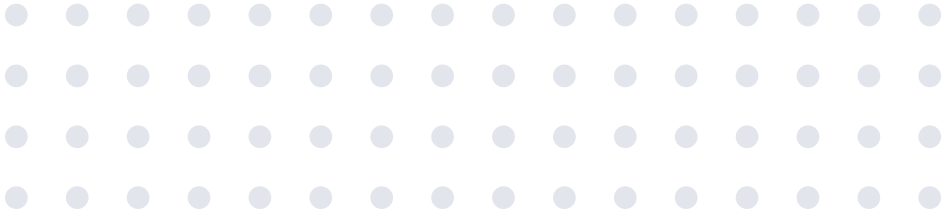
When it comes to describing the long-term consequences of injuries the situation is less clear. The reasons for this are partially the lack of ideal scales for measurement of outcome and also different opinions regarding how long-term impacts should be expressed (in monetary or non-monetary terms).

CHAPTER

3

Measuring the Impact of Traffic Crashes at an Individual Level





01

Understanding the Mechanism in which a Traffic Crash Affects an Individuals in the Long-run: The Chain-effect

Existing studies show that the injury and disability stemming from traffic crash limits the victims labor market access and creates discrepancy in labor market outcome. Consequently, after a certain period of time, traffic crash victims also experience a loss of income and weakening social network. In this section, we will review some important studies that highlight the chain effects of injuries and disabilities from traffic crash that goes to individuals employment, income, and to social aspects.

According to a study conducted in Norway (Haukeland 1996), while rather few reported that the injury had affected their ability to perform most daily life tasks (for instance, cooking meals, dressing and undressing, doing housework or going shopping), more reported that they had become more afraid in traffic, lost concentration, developed a poorer memory, or needed more time to think. These impacts can carry significant consequences to any duties that require concentration and mental processing which are part of most of occupations nowadays.

Lund and Bjerkedal (2001), by using records from the Norwegian Social Security Administration, estimated that from 1992 to 1997, 3,309 individuals became disability pensioners in Norway as a result of traffic injuries. Being

permanently disabled may result in a significant loss of income, in addition to the loss of social network and support that is often associated with leaving the labor force.

There is another statistics that we should pay attention. During the same period, the officially recorded number of critically injured traffic accident victims in Norway was 1,035 including those with life-threatening injuries or who get permanent impairments. This figure is only one third of the number of disability pensioners. Therefore, it is possible to assume that the traffic crash victims are currently under-reported in official Norwegian road accident statistics.

This assumption is supported by data. The Danish Institute of Local Government Studies found that traffic injuries are associated with a permanent reduction in disposable income and employment (Møller Danø, 2004). The data was taken from a random 10% sample of the adult population of Denmark for the years 1981-2000. This data included attributes of traffic crash victims such as demographics, work status, income, and detailed information on traffic injuries.

The results show that traffic injuries are associated with significant differences in the labour-market outcomes between injured persons and matched controls. Importantly, the effect of traffic injuries on disposable income varies by age. In the long run, after six years, injured youth do not seem to have a lower disposable income than non-injured persons. This is in contrast to older persons who have significantly lower earnings than older non-injured persons.

Another data indicates the long-term effect of traffic crash on the employment. The average employment rate declines sharply for men in the year of the road accident. Within a 6-year period of time, the declined employment rate does not approach the level of the matched controls which clearly indicating that crash related injury lowers one employment opportunities. The employment rate is around 10% lower for the injured men.

Average earnings are reduced for both men and women, but at the

10% significance level, only effects for men were found. Six years after the instigating accident, earnings were 10% lower for men than they would have been had they not been involved in the accident.

As such while no single study comprehensively investigates the chain effect of the traffic crash injury and disabilities and its long-term effects, existing studies indirectly show that the effect of traffic crash continues to carry its influence through labor market dynamics and the consequences of losing economic and social opportunities. Based on these existing studies, our study sets up a basic conceptual framework which will be discussed in the section below.

02 Conceptual Framework for the Long-term Effects of Traffic Crashes

Not all Victims Experience Long-term Consequences

Not all traffic crash victims suffer from long-term consequences. If the injury is minor then the victim can quickly recover from it and return to normal life without much consequences. In this case, the impact of the traffic crash is short-term and the cost involved with it is minimal. According to the Korean Insurance Development Institute's data, among all traffic injuries, minor injury consists of 97% and heavy and severe injury consists of only 3%.

Figure 3.1 Minor injury timeline



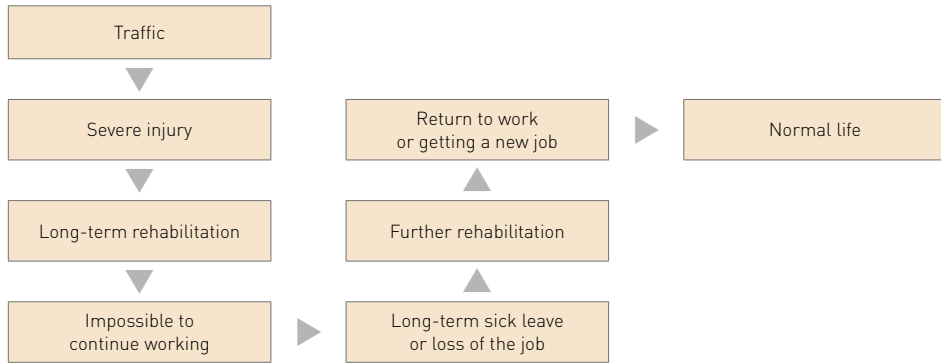
Source: KOTI, 2013.

The Long-term Impact of a Traffic Crash is Complex and Compounded

Even if the victim is severely injured, if they successfully complete

rehabilitation and return to the previous job or get a new job, one might be able to catch up with the loss in a short period of time.

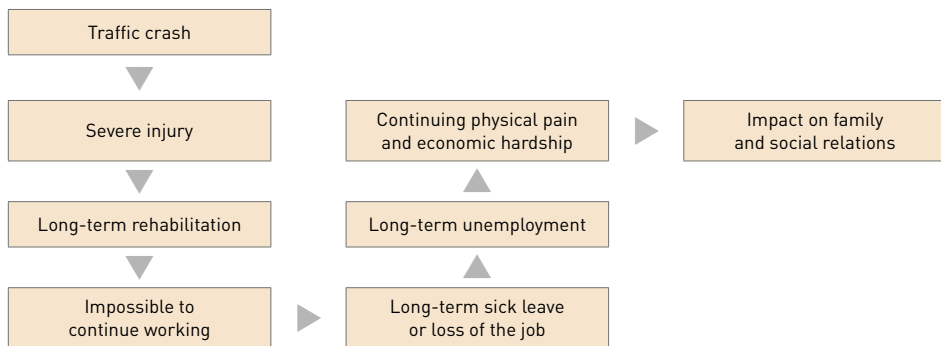
Figure 3.2 Severe injury timeline with re-employment opportunities



Source: KOTI, 2013.

But if the traffic crash leads to long-term unemployment and takes significant time to find new employment, the economic consequence will become greater. Additionally, even after return to an employed status, there is a greater chance to experience depreciation of wages as a job loss penalty according to the labor market system. This economic loss will also trigger subsequent changes in one’s life. If one continues with unemployed status, the impact of traffic crash greatly magnifies.

Figure 3.3 Severe injury timeline with permanent disability




Source: KOTI, 2013.

Our study focuses on those who experienced severe physical injuries from a traffic crash. According to the data from the Korean Insurance Development Institute, as of 2011, severely injured traffic crash victims totaled 44,935 which is about 3% of all traffic crash victims who reported to auto insurance companies.

In order to measure the long-term consequences of traffic crashes on the severely injured, we established a hypothesis as follows:

We assume that the physical limitation caused by severe injury from a traffic crash will manifest in a form of ceasing work. This will in turn cause economic hardship for individuals or a household, which will again lead to problems in family and social relationships.



03 Measurements

Demographic Characteristics

① Age

The long-term effects of traffic crashes varies depending on the age of the individuals. For instance, a traffic crash victim in their twenties will recover from injury faster than the victim in their 50s if they had the same degree of injury. The quick recovery will allows the victim to catch up with economic losses faster. Our study surveyed those who are older than twenty years old at the time of survey.

② Marital status

Our questionnaire asked the respondents before and after the traffic crash their marital status to understand the impact of a traffic crash has on family relationships. For those who were single before the crash may also be affected and lose a chance to get married.

③ Gender

According to Korean traffic crash statistics, men are more exposed to traffic

crashes than women.

④ Educational attainment

According to the ETRC report, less education is correlated with a higher possibility of traffic crash. Educational attainments are categorized by elementary school, middle school, high school, community college, four year college, and higher than graduate school.

Traffic Crash Related Aspects

The Traffic Crash Itself

① Frequency of major traffic crashes experienced

Individuals may experience multiple traffic crashes in their lifetime. Thus we asked respondents to choose the most severe traffic crash they experienced and answer the questions based on that specific crash.

② Type of crash

To determine the main cause of the traffic crash, we asks whether the crash was car-to-car, pedestrian-to-car, or a single car crash.

③ Number of traffic crash experiences

Traffic crashes may occur more than once in one's lifetime. According to an ETRC report, high wage earners tend to be exposed to more traffic crashes in developed countries. It is because they are economically and socially active and tend to travel longer distances.

Post Traffic Crash Emergency Response

After a crash the emergence response can play a critical role in minimizing the trauma. While high-income countries can expect a relatively consistent quality of emergency response, it may not be the case for low-income countries. In our survey questionnaire we asked about the time to get to a

hospital and the method in which the victim was moved to the hospital.

① Time to first response hospital

We asked how long it took to get to a hospital after the crash. Given the traumatized and injured status of the victim, however, the time given by the respondent might not be highly reliable. We can use this data as a reference.

② Means of transport to the hospital

The categories given included personal vehicle, taxi, hospital ambulance, privately operated ambulance, other emergency response, and other.

After Crash Injury and Disability

① Area of injury

Area of injury might be related to the length of hospitalization, sick leave, and job loss. We surveyed this in a form of an open-ended question. When injuring more than one part of body (which is usually the case), we asked the respondent to answer the most severely injured area.

② Area of disability

Not all traffic crash injuries lead to disability. Therefore we first inquired whether the respondent was permanently disabled and if so, we asked to identify which area in a form of open question.

③ The degree of disability

In our survey, we asked respondents to identify the degree of disability according to the categorization between 1 to 6 degree with 1 being the most severe disability as described in the Disability Act.

④ The length of hospitalization

In our survey we used the length of hospitalization as a proxy to measure the severity of injury. In Korea, an injury that requires longer than two months of hospitalization is considered severe.

Monetary Compensation for Traffic Crash

① Compensation

In our survey, we asked the respondents to report the amount of auto insurance compensation and any monetary compensation from the individual who caused the traffic crash.

If the victim did not receive any monetary compensation, we inquired the reason. If the respondent was a victim of a hit-and-run or not insured, they were not able to receive any monetary compensation which leaves them in a financially devastated status.

② Time to exhaust compensation

The time to exhaust the monetary compensation may vary depending on victim's marital and family status, before-crash economic status and so forth. If the victim is the family breadwinner and exhaust the compensation during their recovery and before return to their job, it might put the family in an economically challenging situation. Inquiries were made in an open ended question.

Labor Market Dynamics and Economic Aspects

① Occupation change before and after the traffic crash

Depending on the area of injury, disability or severity, one could be forced to lose a job or change the type of occupation. For instance, if a day laborer lost a limb, they might not be able to return to the previous job. Instead, they are forced to find an occupation that the disability will not interfere with their work. Or one could be forced to stay unemployed due to a severe disability.

In surveying the before and after traffic crash occupations, we used the Korean Standard Occupational System published by the Korean government.

② Income change

Due to a long hospitalization, sick leave or job loss, traffic crash victims may experience a decrease of personal and or household income. Our survey asked for changes in both personal income and household income. When the respondent did not have any income due to unemployed status, we asked them to write 0.

For the total household income, we asked the respondent to report the average gross income of the entire household which includes salaries, sales earnings and government subsidies.

③ Housing status change

Housing status change also can be an indicator of an economic status change. If the income decline is minimal, then it will not affect the housing situation. If the income decline carries significant impact to a household's economic situation, it might require downsizing or downgrading housing in the long term.

Our survey categorized the housing types to personally (family) owned, lump-sum payment rental, monthly rental, government affordable housing, and rent-free through friends or relatives.

Social Changes

① Marital status change

Traffic crash related physical injury and psychological trauma might burden family members with economic and psychological pressure. This could in turn spawn relationship distance among family members.

Our survey investigated the impact of a traffic crash on family relationships, specifically focusing on marital status. We asked whether those respondents who were married at the time of their crash experienced a separation from their spouse. If yes, we asked them to choose the main reason for the separation among economic hardship, psychological withdrawn,

difficulties in maintaining social relations, or other.

② Social activities change

Traffic crash related physical injury or psychological trauma might limit one's social activities. While some might experience increased social activities, many in fact experience a decrease of social activities.

We asked whether the respondent experienced a decrease of social activities. If yes, we asked them to choose the main reason for the separation among economic hardship, psychological withdrawn, difficulties in maintaining social relations, and other.

Table 3.1 Before and after accident variables

	Before Accident	After Accident
Personal information	Age, marital status, residential address, educational attainment	Age, marital status, residential address, educational attainment
Traffic accident	-	Number of accidents experienced, year the accident occurred, type of the accident
Post accident emergence response	-	Time to reach emergency room, method of emergency transport, length of hospitalization
Post accident injury and disability	-	The area of injury, the area of disability, the level of disability
Monetary compensation	-	Type of monetary compensation, the amount of compensation, time to exhaust compensation, recipient of government subsidies, type of government subsidies
Occupation	Type of occupation before the accident, the length of daily work before the accident	Type of occupation before the accident, the length of daily work before the accident, post accident leave of absence or job loss experience, reemployment, length of unemployment
Income change	Before accident average personal income, before accident average household income	After accident average personal income, after accident average household income, current personal income, and current household income
Changes in the type of housing	Before accident residential type	After accident residential type, the reason for change
Family relationship	Marital status before the accident	Post accident relationship with spouse (if any), if separated the reason for separation, post accident relationship with children
Social activities	-	Changes in social activities and reason
Post accident supporting organization	-	Supporting organization for post accident response process and compensation



04

How We Surveyed

General Traffic Crash Victim

Under the rubric of general traffic crash victim, we survey individuals who have been hospitalized longer than two months as the direct results of any traffic crash between 1995 and 2012.

The survey was conducted online using a panel group. A custom online panel or internet access panel is a group of pre-screened respondents who have expressed a willingness to participate in surveys. A panel can range in size from 100 to 100,000 or more people. Larger panels can enable surveys of smaller target groups. Panel quality is not determined solely by size; how panel members have been sourced is also important.

In order to increase participation in a panel for our survey, we provided gift tickets to participants. And to increase reliability, approximately ten screening questions were included. These questions are designed to determine whether respondents actually experienced traffic accidents or they falsely answered. We gathered 520 survey participants and used 457. The survey was conducted on those who experienced more than one traffic crash between 1995 and 2012.

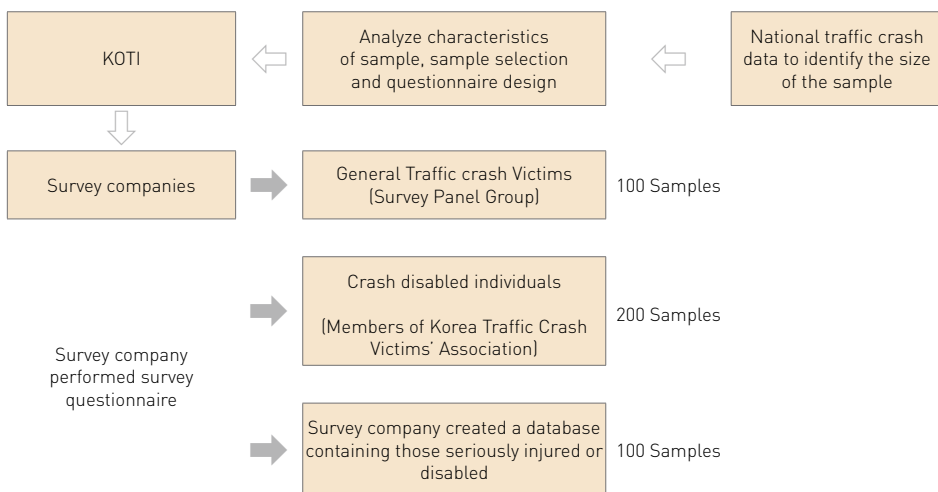
Disabled Traffic Crash Victims

Disabled traffic crash victims experience different levels of impact from traffic crashes. Because the disability would bring not only social stigma and discrimination but also deprivation of education and social opportunities which will lead to economic difficulties.

However, identifying disabled traffic crash victims is not easy for various reasons. First, not many countries have a well established traffic crash victim database. Thus it is not easy to understand the characteristics of disabled traffic crash victims. Second, because of the trauma, social stigma and discrimination, disabled traffic crash victims have a tendency to socially withdraw.

In order to solve these difficulties in accessing disabled traffic crash victims, we chose to conduct the survey through a non-profit organization that supports disabled traffic crash victims. With help from the organization's staff members, we were able to gain access to traffic crash victims smoothly and achieving a high response rate and reliability of responses. 220 questionnaires were collected and of them 188 questionnaires were used for analysis.

Figure 3.4 Selecting samples and conducting surveys



CHAPTER

4

Survey Results



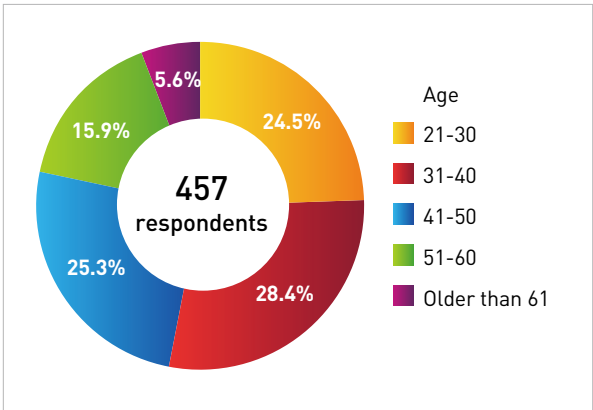
01

Key Findings for General Traffic Crash Victims

More than Half of Victims Experienced Multiple Traffic Crashes

The age distribution of the sample reflects the age distribution of actual traffic crash victims who are predominately in their 20s to 50s (Figure 4.1). Of the types of crashes, 42% were car-to-pedestrian crashes and of 49% were car-to-car crashes (Figure 4.2). Interestingly, among 457 respondents,

Figure 4.1 Age distribution of the sample



who experienced more than two traffic crashes in the last 15 years was 50% of the whole (Figure 4.3). This result is somewhat unexpected as we assumed those who experience a traffic crash will develop more safety-oriented behavior. There are several reasons to

account for this repeated traffic crash. One reason could be that people who are exposed to a traffic crash tend to maintain their behavior even after experiencing a traffic crash. Second, given that a majority of respondents are between their 20s to 50s, they actively participate in socio-economic activities.

All respondents answered that they were hospitalized. In average, respondents were hospitalized for 5.8 months. Of 457 respondents, 99 people (21%) answered that the traffic crash left them with lasting disabilities (Figure 4.4).

Figure 4.2 Types of crashes

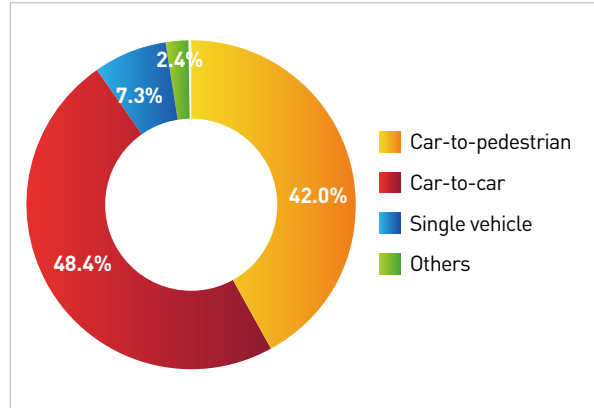


Figure 4.3 Number of crashes experienced between 1995 and 2010

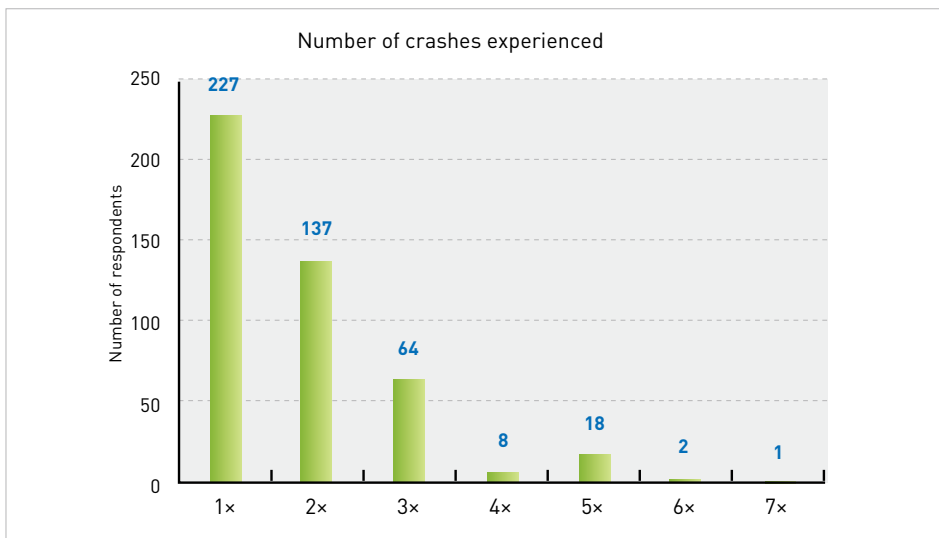
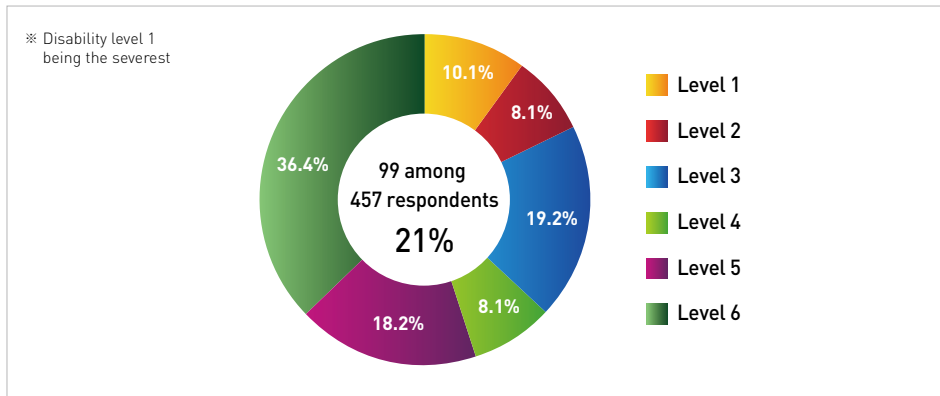


Figure 4.4 Proportion of the disabled and their distribution using disability level standards from the Disabilities Act



Impact on Employment

Among the 457 respondents, we asked 357 who were older than 20 at the time of the debilitating traffic accident, whether they experienced job loss after the crash. 114 respondents (33%) answered in the affirmative (Figure 4.5). Among these 114 individuals, 36% left their jobs for an extended rehabilitation, 42% submitted a resignation due to an inability to conduct their jobs at a normal level and seven were fired without any prior notice (Figure 4.6).

Among the 114 who lost their jobs, 87 answered that they were able to return to an employed status. Among them, 26.4% took less than 1 year, 44.8% took one to two years, and 15% took two to three years (Figure 4.7). Analysis was also done by age group on the time it took to get acquire the next job (Figure 4.8). Traffic crash victims who are in their 20s experienced the least unemployment period with 15.6 months in average. It is followed by the 40s with 15.8 months and 30s with 19.7 months. Victims in their 60s experienced the longest unemployment period; 43.7 months, almost three times longer than those in their 20s.

These figures reflect the dynamics of Korean labor market that are more flexible for younger people and rigid for older people. This finding highlights

Figure 4.5 Loss of job post crash

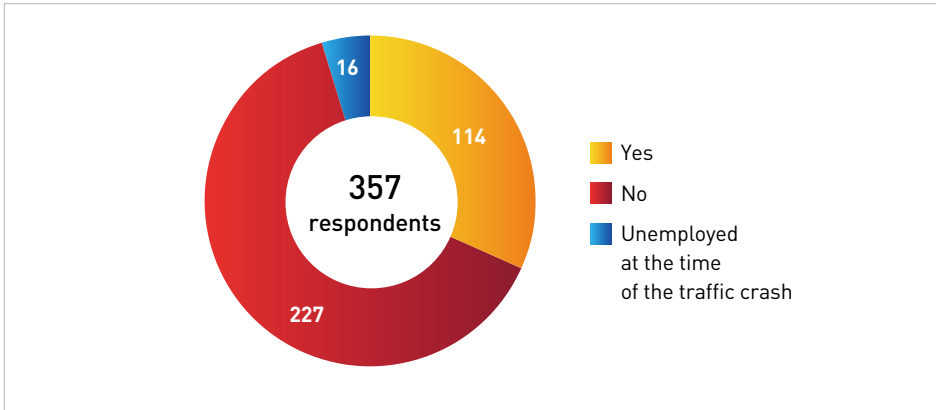


Figure 4.6 Reasons for job loss

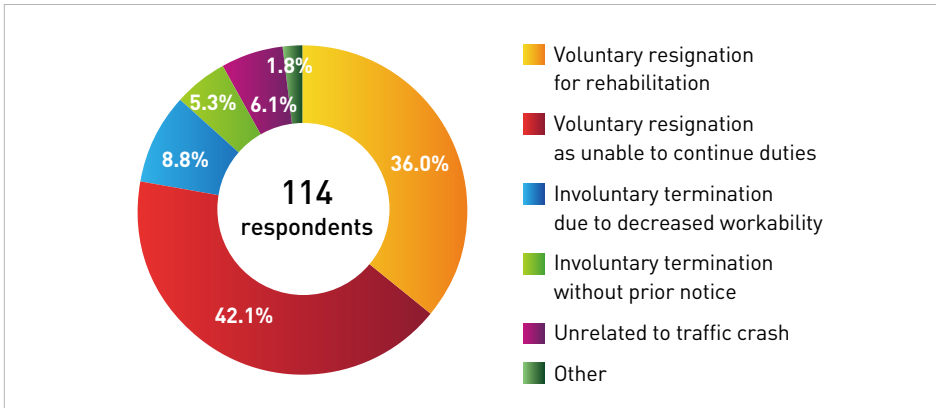


Figure 4.7 Number of re-employed and length of unemployment Act

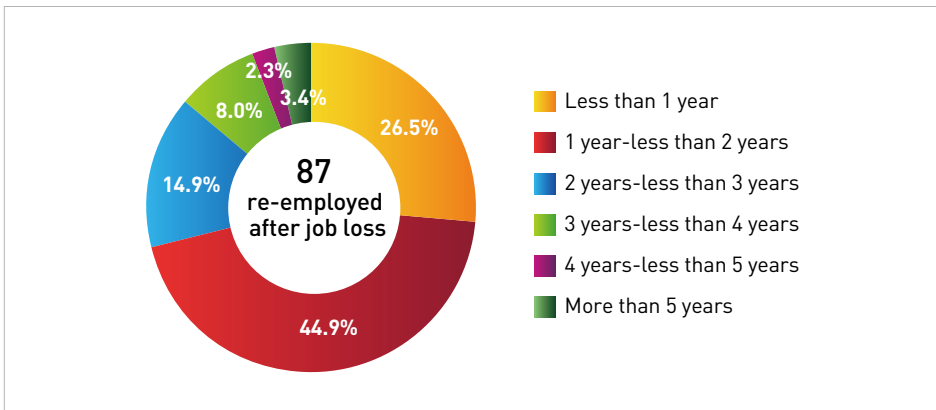
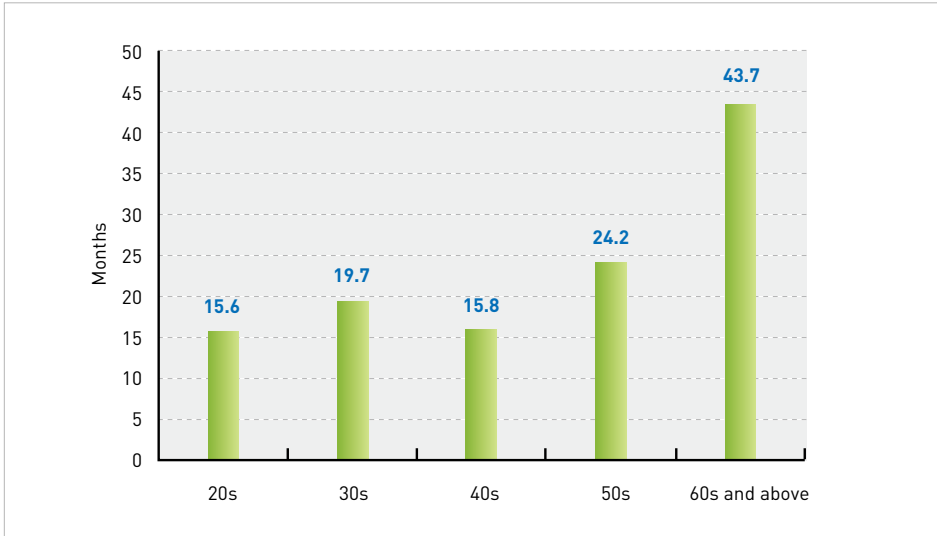


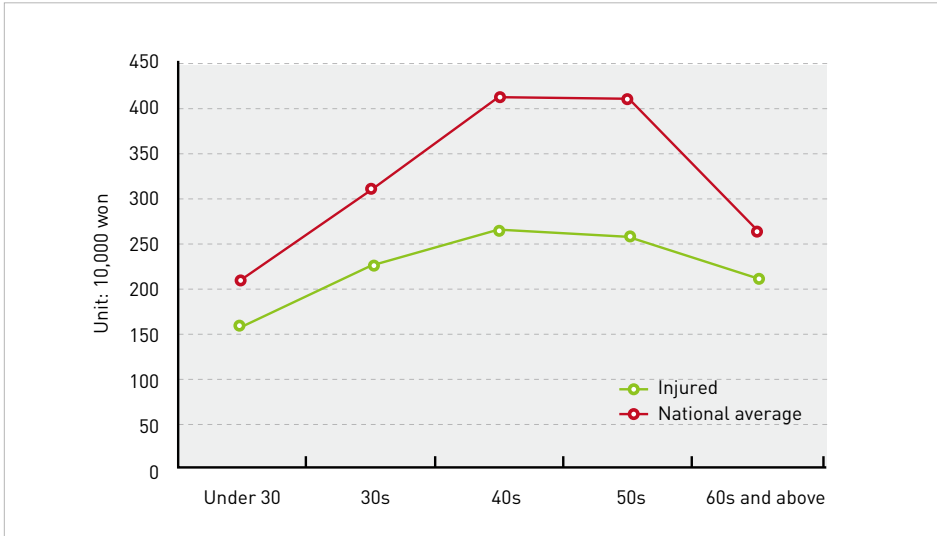
Figure 4.8 Average length of unemployment



one of important dimensions of traffic crashes: the injury or disability carries more significant consequences to those who are 50 or older.

Impact on Income and Future Opportunities

We compared the average personal income of traffic crash victims against to the national average personal income. In every cohort, the average income of the traffic crash victims is 40% lower than the national average (Figure 4.9). Even if we consider the possibility that respondents tend to provide a lower amount when they are asked about their income, this difference is not ignorable. The more important problem is that the income gap is bigger in the cohort of those in their 40s and 50s. In Korea, the personal income is structured to hit its peak in 40s and 50s as that is when families require financial resource the most to pay off children's education and marriage as well as to prepare their retirement. However, traffic crash victims' average income is much lower than the national which suggests high possibility that these households experience severe financial constraints. This again means

Figure 4.9 Income discrepancy between those injured in traffic crash and the national average

that they could be in poverty. The lack of financial means also limits various opportunities for children including proper education, marriage, and skill development that will place them in a disadvantaged position for the labor market which otherwise would have been available.

Impact on Marriage

We also asked whether the traffic crash affected victims' marriage life. Among the 223 respondents who were married at the time of the accident, 11 respondents answered that they separated from their spouse mainly due to the

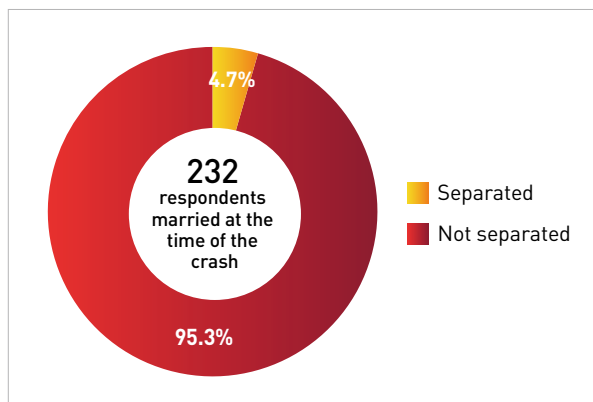
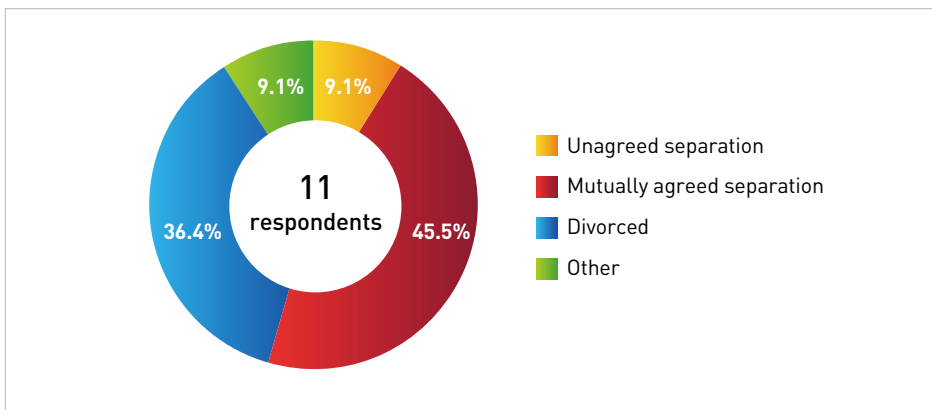
Figure 4.10 Proportion of those who divorced after the crash

Figure 4.11 Types of separation using standards



traffic accident. When asked the type of separation, 45% were separated and 36% were divorced (Figures 4.10 and 4.11).

Impact on Social Activities

Among the 457 disabled, 168 respondents (36.1%) experienced decreased social activities (Figure 4.12). When asked the main reason, 31.5% (53 respondents) answered that their physical disability limits their social activities whereas 32.1% (54 respondents) answered that they are

Figure 4.12 Changes in social activities

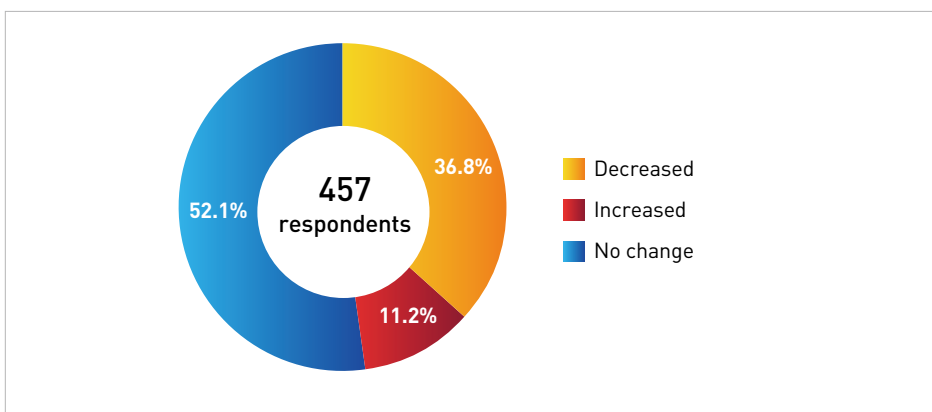
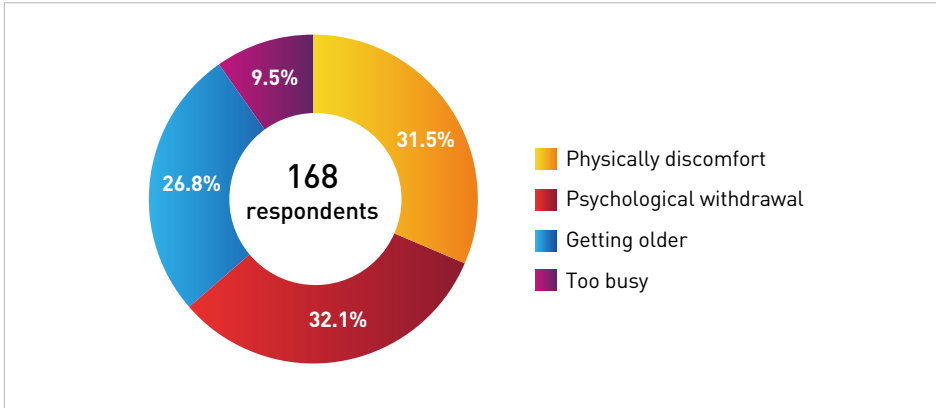


Figure 4.13 Types of separation using standards



psychologically withdrawn from social interactions (Figure 4.13). We should pay attention that those who acknowledged a negative psychological change after a crash is more than one third.

02

Key Findings for Disabled Traffic Crash Victims

The 188 respondents’ age distribution for this group reflects the age distribution of the Disabled Traffic Crash Victims’ Association. Victims who are in their 60s comprises of the largest group at 43.6% and those who are in their 50~59 are the second largest at 35.1%. Thus those who are under 50 are relatively small in this sample (Figure 4.14).

Among the 188 respondents, the majority 88% experienced one traffic crash in their lives (Figure 4.15). This differs from the general traffic crash

victims where half experienced two or more traffic crashes in the last 15 years. We assume that because once an individual is severely injured or disabled from a collision, either one’s physical mobility decreases dramatically or psychologically

Figure 4.14 Age distribution of disabled respondents

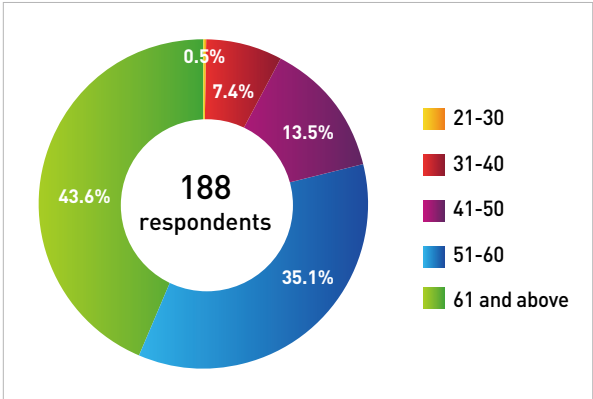
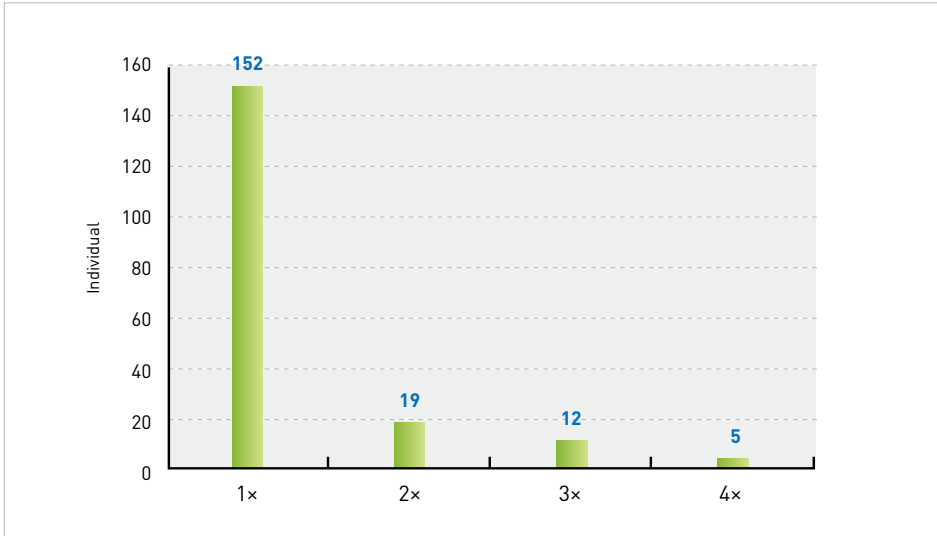


Figure 4.15 Number of traffic crashes experienced between 1995 and 2010



withdrawn from social activities, their exposure to future traffic crashes dramatically decreases.

In average, respondents were hospitalized for 13.9 months which is twice longer than the 5.8 months of general traffic crash victims. The majority of respondents are left with high degree disability where the number of people with a first, second, and or third degree disability are equally 40 (21.3% each and all together 64%).

Disabled Traffic Crash Victims Display Significantly - Higher Job Loss Rates

Among the 188 respondents, excluding those unemployed at the time of their traffic crash, 133 respondents (71%) answered that they experienced job loss mainly due to their traffic crash (Figure 4.16). This ratio is much higher than the 33% of general traffic crash victims who lost their jobs after a collision. Among the 133 who lost jobs, 6.0% left their jobs for an extended rehabilitation and 80.5% submitted their resignation due to an inability

Figure 4.16 Job loss after a disabling traffic crash

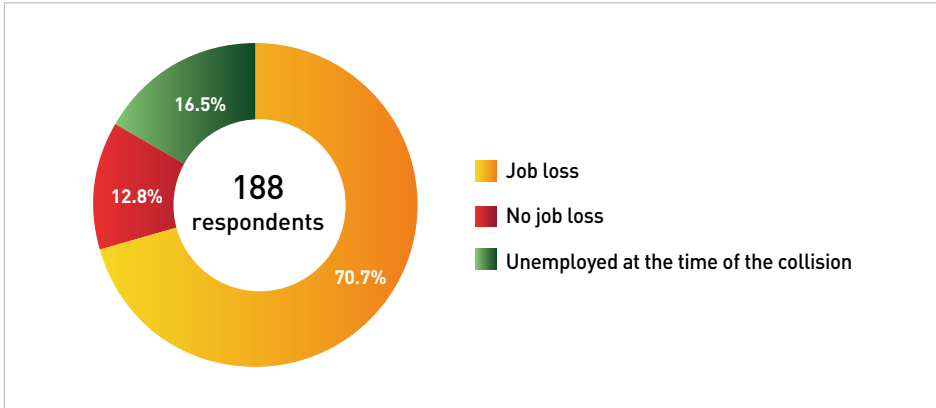
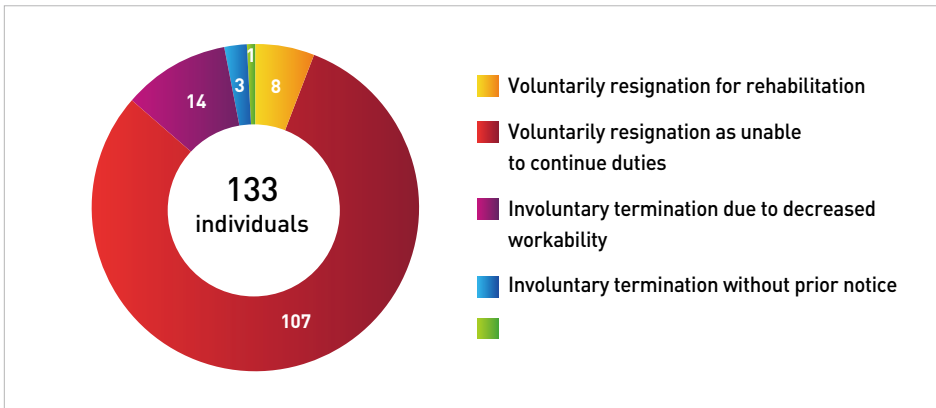
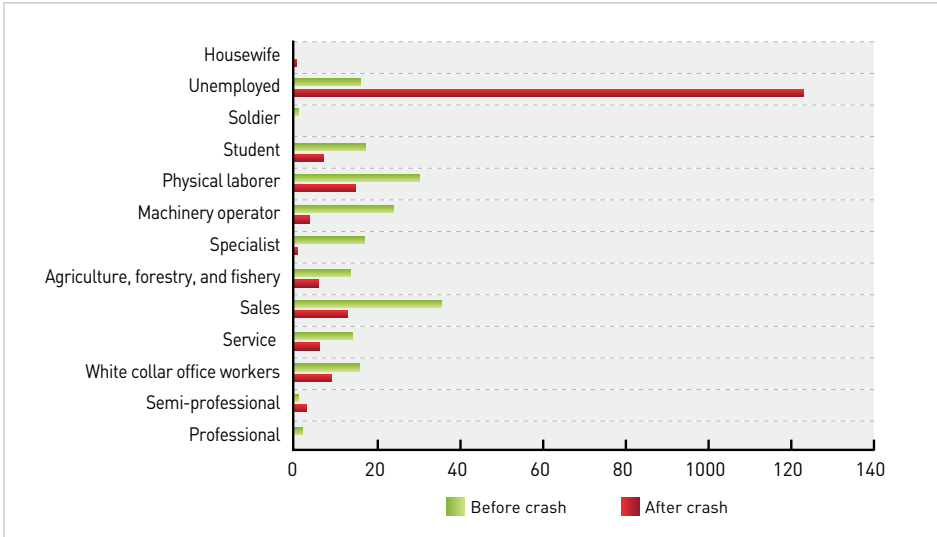


Figure 4.17 Reasons for the disabled experiencing job loss



to conduct their jobs at a normal level (Figure 4.17). Those who were unemployed at the time of the traffic crash were only 16 but it later grew to 123 after the collision (Figure 4.18). Overall, the survey results show that a lasting disability from a traffic crash carries far more significant impact on one's status in the labor market.

Figure 4.18 Occupation before and after the traffic crash



Impact on Employment

Among the 133 who became unemployed, 35 respondents were able to find reemployment and spent in average 3.1 years doing so (Figure 4.19). Of those 109 who lost their jobs after the traffic crash and are still left unemployed, respondents who are currently in their 50s occupy 40% and who are 60 or

Figure 4.19 Number of re-employed and length of unemployment for the disabled

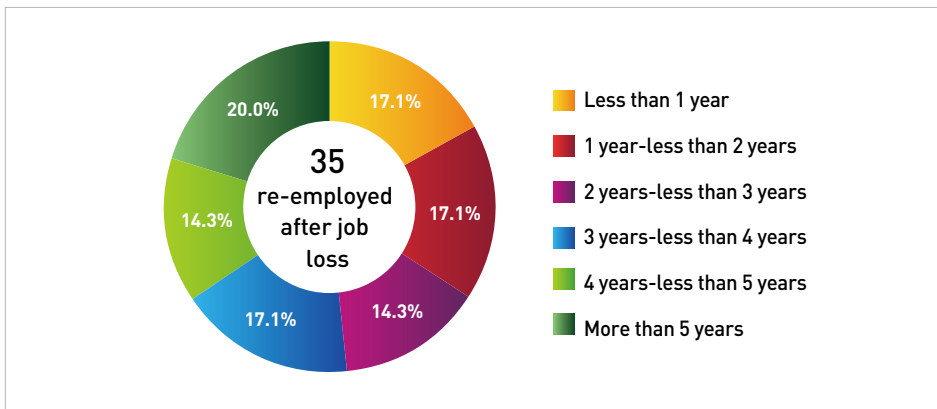
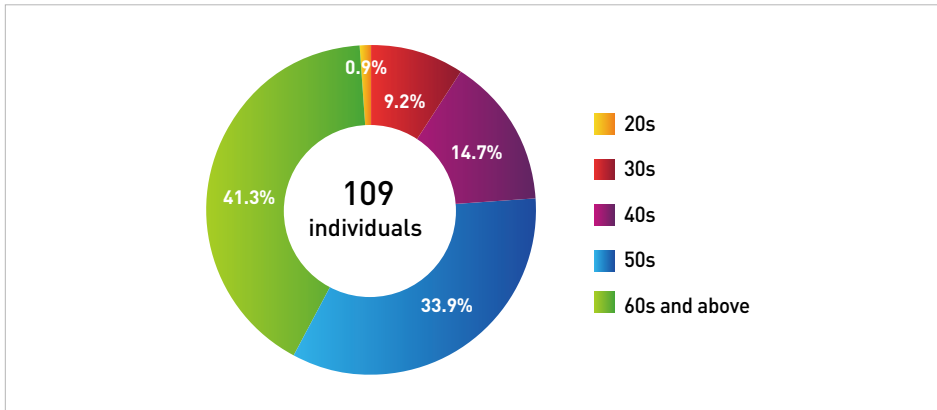


Figure 4.20 Age distribution of job loss of the disabled



above occupy 41% (Figure 4.20). As discussed above, given people in these age groups are mostly breadwinners in a household, their high unemployment rate makes it possible that their household to face deep economic difficulties.

Impact on Income and Future Opportunities

The average personal income of the disabled traffic crash victims was compared against the national average. As Figure 4.21 shows, in every cohort the average income of traffic crash victims is about 60% lower than the national average. This income gap is significantly larger than the difference between the general traffic crash victims and the national average. Actually this larger income gap is expected given the higher rate of people who lost their jobs (72% of respondents) and still held an unemployed status in their 50s and 60s.

This severe economic downturn consistently appears in the housing situation changes. As can be seen in Figure 4.22, while housing ownership and lump sum payment rentals decreased, monthly rent, government provided affordable housing and free housing have increased substantially.

Figure 4.21 The income discrepancy between those disabled from traffic crashes and national average

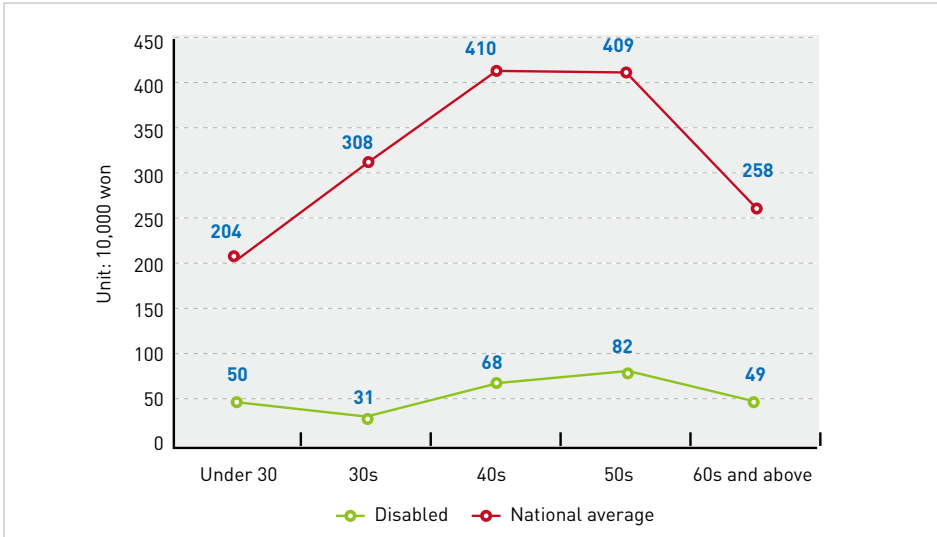
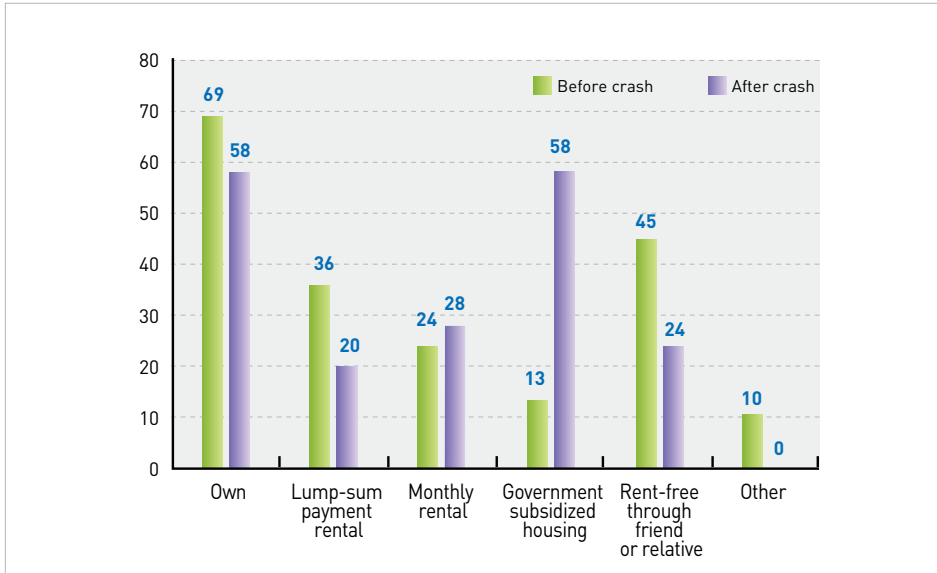


Figure 4.22 Change of housing conditions for those disabled in auto crashes



Impact on Marriage

Among the 137 respondents those who were married at the time of the accident, 41 respondents (21.8%) answered that they were separated from their spouse mainly due to the traffic accident (Figure 4.23). When asked the main reason of separation, 58.5% answered that economic difficulties after the crash became the main reason, and 34.1% answered that the burden of care caused by their disability became the main reason (Figure 4.24).

Figure 4.23 Proportion of those divorced after becoming disabled

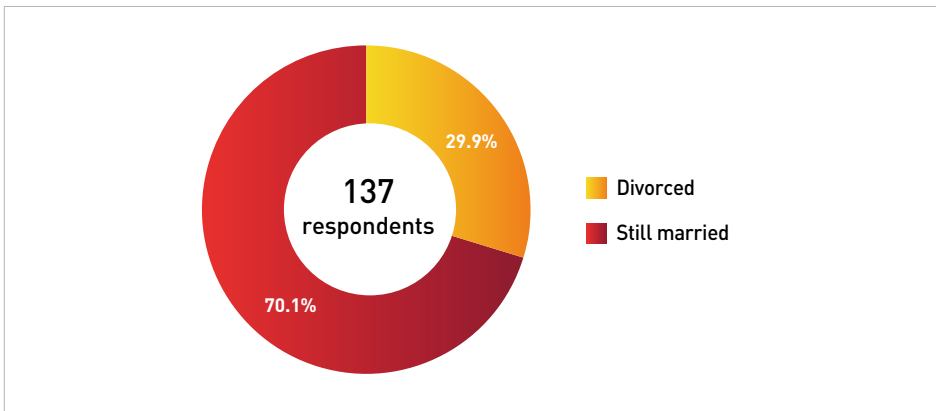
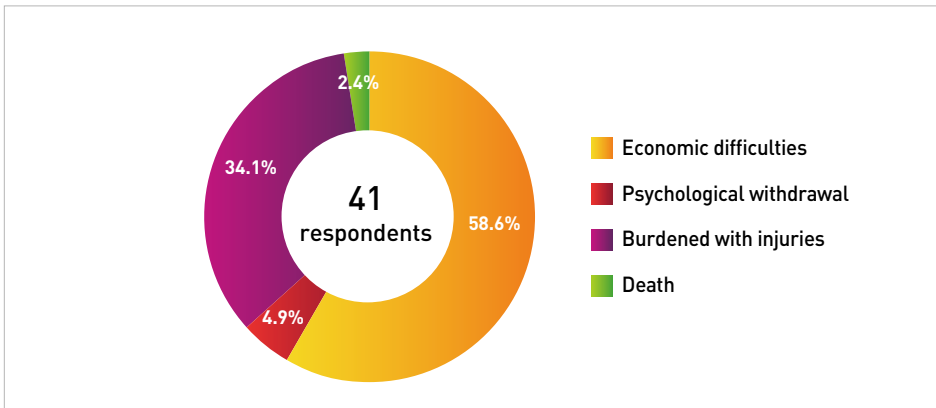


Figure 4.24 Reasons for separation from their spouse after crash



Impact on Social Activities

Among the 188 disabled, 100 respondents (53%) experienced decreased social activities (Figure 4.25). When asked the main reason, 62% answered that their physical disability limits social activities. This is a much higher proportion compared to general traffic crash victims' 31.5% in reflection of severe physical injury. On the other hand, the proportion of respondents who answered psychological withdrawal symptom as the main reason for the decreased social activities is only 23.0%, much less compared to 32% of the general traffic crash victims (Figure 4.26).

Figure 4.25 Changes in social activities for those disabled in a crash

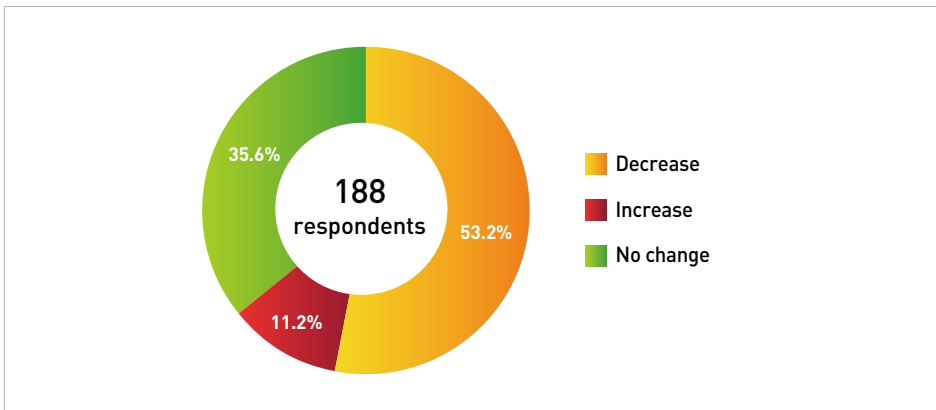
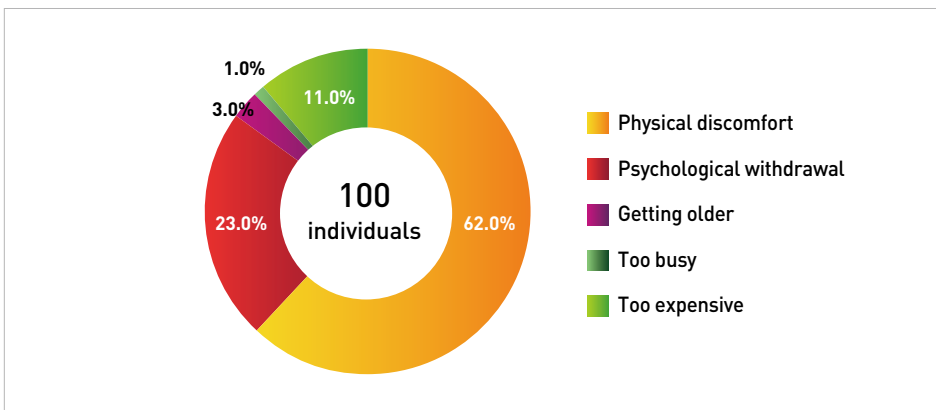


Figure 4.26 Reasons for the decrease of social activities for those disabled in a crash



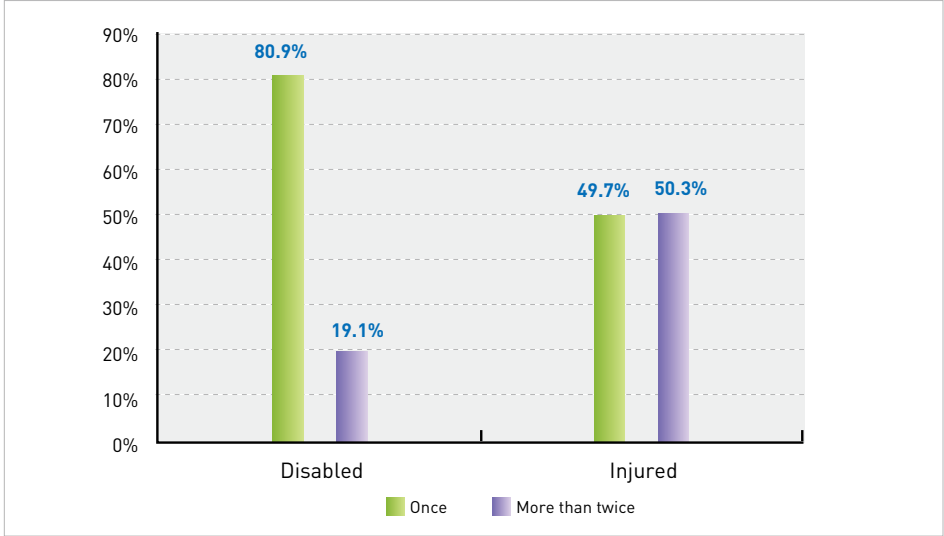
03

Comparison of General and Disabled Traffic Crash Victims

Number of Traffic Crashes Experienced

Disabled traffic crash victims present a high percentage of experiencing a single crash (80.9%) than those who experienced two or more crashes at

Figure 4.27 Number of crashes experiences by the injured or disabled



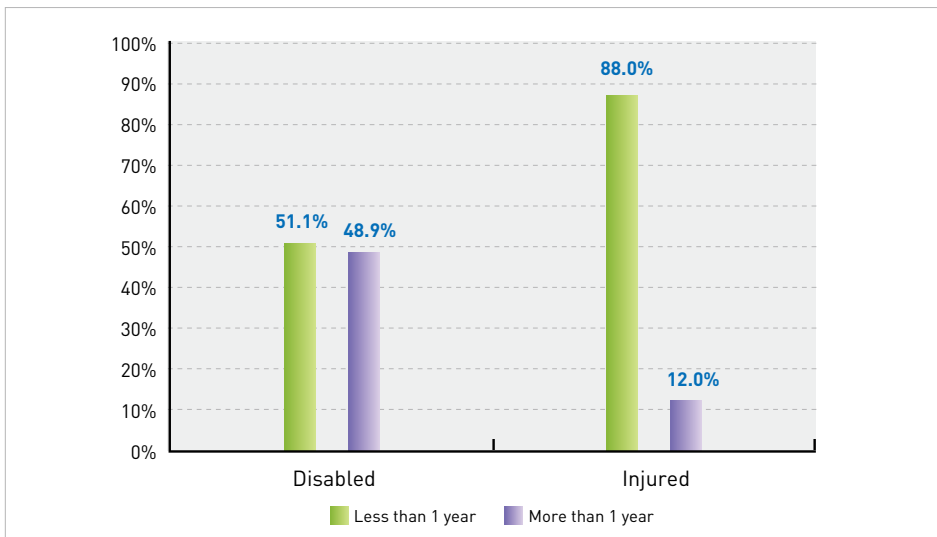
only 19.1%. On the other hand, general traffic victims show almost the same proportion between those who experienced one crash (49.7%) and two or more (50.3%). This suggests that the severe physical injury and disability limit disabled victims' mobility. Thus once they are disabled in a traffic crash, they are less exposed to another (Figure 4.27).

Length of Hospitalization

While the hospitalization period for disabled traffic crash victims is 13.9 months on average, 51.1% were hospitalized for less than one year and 48.9% were hospitalized longer than one year, while the majority of general traffic victims (88%) were hospitalized less than one year (Figure 4.28). During the period of hospitalization, people do not work and thus no income can be expected. The longer the hospitalization period the greater the economic loss will be.

Typically, injured victims receive monetary compensation for their lost working hours through auto insurance as well as medical coverage.

Figure 4.28 Comparison of the length of hospitalization between injured and disabled victims



However, the monetary compensation might not last long enough to cover the entire hospitalization period. Let's consider an example. Victim A is the breadwinner of their family and receives compensation for the loss of his working hours. However, this monetary compensation does not cover indirect costs engendered from his hospitalization. For instance, a family member had to be at the hospital to support him which is a loss of opportunity for that family member. And even then the auto insurance compensation might not last until he gets out of the hospital and recovers enough to return to his job.

Average Personal Income

The average personal income comparison is revealing. While injured victims earn 40% lower income in average, disabled victims earn substantially lower income generally 60% lower (Figure 4.29). Area A of Figure 4.30 is the gross loss of average personal income for the injured. Area B is the gross loss of average personal income for the disabled. The sum of areas A and B is the sum of gross loss of personal income caused by traffic crashes per year.

Figure 4.29 Comparison of average income among injured, disabled and national average

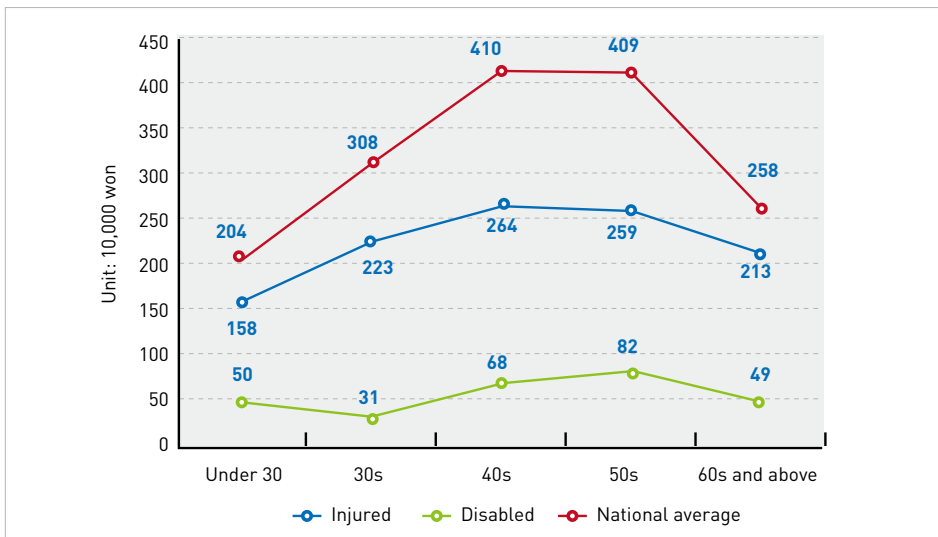
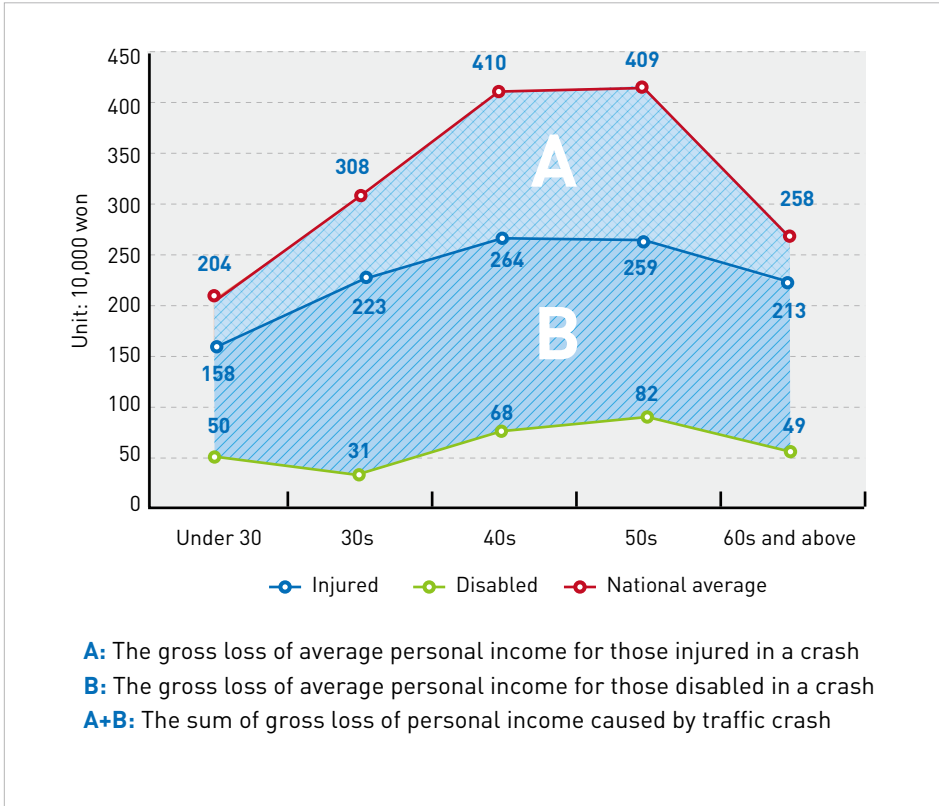


Figure 4.30 Gross loss of personal income caused by traffic crashes

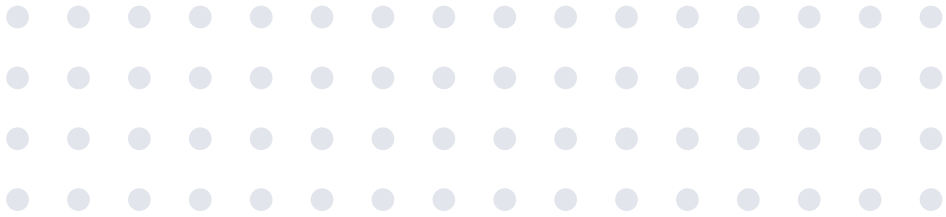


CHAPTER

5

Impacts and Suggestions





01

Socio-economic Costs of Traffic Crashes

A traffic crash happens in a fraction of a second but their consequences may last for days, months, years or the rest of someone’s life. A large number of road users involved in traffic crashes recover from their injuries, but some of them never recover fully and suffer from some kind of permanent disability. In Spain, according to a recent study, 15% of those who survive a road crash must be treated in hospitals as in-patients, while 32% are forced to take a sick leave from work lasting between one and three months and another 29% have to remain away from work for more than three months.

The tragedy behind traffic crashes does not stop at the victim’s physical impairment and the pain, grief, anger and trauma caused by the physical impairment. As time goes by, the victims and their families experience second and third impacts over time. It is usually the economic shock that comes next and social consequences follow.

Our study shows this mechanism clearly. Both injured and disabled victims lose jobs as direct results of a traffic crash. Disabled victims show higher job loss rates as their permanent physical impairment hamper their working ability to a greater degree.

In many cases, the loss of job affects the individual’s or family economic


status. If these victims can recover from injury and return to the labor market, the economic hardship can be overcome. However, disabled victims may not be able to return to the labor market which deepens the economic hardship.

Given the much longer term of unemployment of disabled victims (Korean national average of 2.5 months as of 2012), they experience the more difficult economic conditions. This appears in the personal income discrepancy between the national average and disabled victims.

Economic hardship in turn affects social relationships. This study measured changes in social relations in two aspects: the relationship with spouse and social activities. The survey shows that a traffic crash also carries significant impact on marriage and social activities.

As such, the socio-economic cost of traffic crash does not stop at property damage, lost income, and police administration. It is far more reaching in other dimensions.

First, as can be seen in the income comparison, the traffic crash is an important mechanism regenerating income inequality in society. Second, the economic hardship leads to another dimension of problems: destruction of family and limited social interactions. Third, the destruction of family also causes an opportunity loss for family members, especially children.



02 Suggestions

Preventing and Reducing Traffic Crashes Should be the World's Top Priority

World organizations have focused on ending poverty and removing pandemic diseases. By reducing traffic crashes, it seems that we can achieve both goals.

Invest in Traffic Safety Together with Building Infrastructure

Large amount of world's aid on low-income countries has been focused on building infrastructure such as roads and dams as they are considered to be essential for economic development. While that is partially true, losing working abilities and lives of millions at the other end of spectrum seems like pouring water into a bottom-less jar. Safety must not be a second thought as it must always exist when planning designing, and building infrastructure.

Developing New Safety Related Technologies for Low-income Countries

There has been great improvement in safety related technologies for automobiles, roads, and transport facilities. However, these technologies are high-end and pricy. Sometimes, they are not applicable to low-income countries' contexts where resources are scarce and roads are deteriorated. Thus in order to increase traffic safety in low-income countries, it is imperative to develop 'appropriate' levels of safety-related technologies.

• References

1. García-Altés A, and K Pérez. 2007. "The economic cost of road traffic crashes in an urban setting." *Injury Prevention : Journal of the International Society for Child and Adolescent Injury Prevention* 3 (1): 65-8.
2. Danø. A. M., 2004. *Road Injuries and Long-Run Effects on Income and Employment*. Institute of Local Government Studies. Copenhagen V, Denmark.
3. European Transport Safety Council (ETSC). 2007. *Social and Economic Consequences of Road Traffic Injury in Europe*.
4. Haukland, J. V. 1996. "Welfare Consequences of Injuries due to Traffic Accidents." *Accident Analysis and Prevention* 28: 63-72.
5. International Transport Forum. 2013. *Road Safety Annual Report*.
6. Korea Transport Institute. 2013. *A Study on the Socio-economic Consequences of Traffic Crashes*.
7. Korea Transport Institute. 2013. *Road Safety Facts and Policies in Korea*. Presentation by Dr. OH Lyong, International Transport Cooperation.
8. Lund, J., and Bjerkedal, T. 2001. "Permanent Impairments, Disabilities and Disability Pensions Related to Accidents in Norway." *Accident Analysis and Prevention* 33:19-30.
9. Ministry of Transport. 2013. *Social Cost of Road Crashes and Injuries*. Financial, Economic, and Statistical Analysis Team. New Zealand .
10. Rodríguez, J. I. and El Reto de Sobrevivir. 2005. European Transport Safety Council, Social and Economic Consequences of Road Traffic Injury in Europe. *Trafico Magazine (magazine of the Spanish Directorate General for Traffic)*. November/December issue: 24. Madrid.
11. Victoria Transport Policy Institute. *2013 Transport Cost and Benefit Analysis*. Canada. 2013.
12. World Health Organization. 2004. *Road Injury Prevention Report*.
13. World Health Organization. 2009. *Global Status Report on Road Safety: Time for Action. 2009*.
14. World Health Organization. 2010. *Global Plan for the Decade of Action for Road Safety 2011-2020*.



APPENDICES

1

Survey Questionnaire

2

Abstract of "A Study on the Socio-economic
Consequences of Traffic Accidents"
(Korea Transport Institute, 2013)

1. Survey Questionnaire

The Korea Transport Institute Survey on Socio-economic Consequences of Traffic Crashes

KOTI is conducting a survey on how traffic crashes affect the victim's life in a long run. The survey results will help us understand the difficulties traffic crash victims experience over their lifetime and will provide information on the direction government policy will engage in to reduce the welfare loss and to reduce traffic crashes. Please assist in the success of this project by completing the questionnaire.

The individual data collected from this survey only will be used for the research project and will be kept in a safe place to insure the confidentiality of individual information. The survey questionnaire will require about 20 minutes.

Thank you for your participation.

Sincerely,

SUL Jaehoon, Senior Research Fellow
JUNG Namji, Associate Research Fellow

Contact information: Dr. JUNG Namji (e-mail: namji.jung@gmail.com;
Telephone:)

(Note: From SQ1 to SQ4-2 are screening questions to identify those who experienced an actual real life when the survey was conducted online)

SQ1. What is your gender?

- 1) Male 2) Female

SQ2. What is your age? ()

[This survey is conducted on those who are older than 20. If you are under 20, please stop here]

SQ3. What is your marital status?

- 1) Never married 2) Married 3) Widowed
4) Divorced 5) Others ()

SQ3-1. Please identify all of your family members currently living together

- 1) Spouse 2) Children (number:) 3) Farther
4) Mother 5) Others (number)

SQ4. Which of following safety related accidents you have experienced (Check all that applies)

- 1) Traffic crashes 2) Fall 3) Electrocutation 4) Gas explosion
5) Fall from a horse 6) Fire 7) Drowning 8) Natural disaster
9) Others ()

SQ4-1. Were you the victim of the traffic crash or the one who caused the crash?

- 1) Victim 2) Caused the crash

SQ4-2. From that traffic crash, were you injured and hospitalized for a period of time?

- 1) Yes 2) No

1. General Aspects of Traffic Crash

1-1 How many times you have experienced a traffic crash in the last 10 years?

() times

1-2 When did it occur? If you experienced multiple traffic crashes, please answer this and the following questions based on the most severe
Year () Month ()

1-3 What type of traffic crash was it?

- ① Car-to-pedestrian
- ② Car-to-car
- ③ Single car
- ④ Other ()

※ Please answer following questions based on the most severe traffic crash, if you experienced multiple crashes.

1-4 How long were you hospitalized after that specific crash?
Months () Weeks ()

1-5 What was the degree of injury?

- ① Insurance company standard: () degree
- ② I don't know well enough

1-5-1 Where was the area(s) of injury? ()

1-6 Did the traffic crash left a permanent physical disability?

- ① Yes: The level of disability ()
- ② No

1-6-1 If yes, which part(s) of your body is disabled? ()

1-7 After the crash, how long did it take to get to the hospital?
() Hours () Minutes

1-8 What was the means of transport to get to hospital?

- ① Personal vehicle ② Taxi ③ Emergence vehicle
- ④ Hospital ambulance ⑤ Privately operated ambulance
- ⑥ Other ()

2. Occupational Aspects

► Following questions are about your occupational changes after the traffic crash

2-1 Has your occupation changed after the traffic crash?

- ① Yes ② No

2-2 What was your occupation before the traffic crash?

- ① Public sector employee ② Private corporation
 ③ Owned a business (self-employed) ④ Non-regular workforce
 ⑤ Unemployed

2-3 What is your current occupation?

- ① Public sector employee ② Private corporation
 ③ Owned a business (self-employed) ④ Non-regular workforce
 ⑤ Unemployed

2-4 Please indicate your before and after crash occupation using the following categories

	Before Crash		After Crash	
	Type of occupation	Detailed type of occupation	Type of occupation	Detailed type of occupation
Occupation Change				

2-5 Was there any change in your working hours per day and per week?

	Before Crash	After Crash
Per day		
Per hour		

2-6 Have you taken sick leave mainly because of the traffic crash? If yes, how long?

Taken a sick leave?	The length of sick leave
① Yes, but I came back.	() months
② Yes and I am still on my sick leave.	
③ No	

2-7 If you have taken a sick leave mainly due to the traffic crash, which of following best describes the reason?

- ① I was hospitalized for a long period
- ② I chose to leave for my rehabilitation after hospitalization
- ③ I wanted to take a break from work as I was not strong enough to go back
- ④ I was told to take a sick leave
- ⑤ I took a sick leave but it was not related to the traffic crash
- ⑥ Other

2-8 Have you ever experienced a job loss mainly due to the traffic crash?

- ① Yes ② No
- ③ I was unemployed at the time of traffic crash ④ Other ()

2-9 If you have experienced a job loss, what was the main reason?

- ① I resigned from my job for my medical rehabilitation
- ② I resigned from my job because I was not able to continue my duties
- ③ I was forced to resign due to decreased productivity
- ④ The employer dismissed my employment without prior notice
- ⑤ I quite my job but it was not related to the traffic accident
- ⑥ Other

2-10 After the job loss, were you able to find another job?

- ① Yes ② Still unemployed
- ③ Unemployed at the time of the traffic crash ④ Other ()

2-11 How long did it take to get the next job?

Year(s) () Month(s) ()

3. Income Related Aspect

► Following questions are about your income changes after the traffic crash.

3-1 Have you experienced any income changes after the traffic crash?
(Following cases do not apply: promotion, salary cutting due to the company's financial difficulties)

① Decreased ② Increased ③ No changes

3-2 What is your salary (before tax) or monthly earnings?

Before the crash	After the crash (when re-employed)	After the crash (when re-employed)
\$ ()	\$ ()	\$ ()

3-3 What is your monthly household income (before tax)?
(Household income: including average total salary of family members, government subsidies and any other monetary supports)

Before the crash	After the crash (when re-employed)	Current

4. Housing Status Related

► The following questions are about your housing condition changes after the traffic crash.

4-1 Have you experienced any housing situation changes mainly because of the traffic crash?

① Yes ② Changed but not related to traffic crash ③ No

4-2 If yes, which of the following best describes the condition?

- ① Physical modification of the house was needed (for handicap accessibility)
- ② For my health and recovery
- ③ Due to economic constraints
- ④ I had more money than before after receiving the insurance compensation in lump-sum
- ⑤ Changed but not related to traffic crash
- ⑥ Other ()

4-3 Please identify the housing condition changes (check applicable)

Before the crash		Current	
Type	Housing price	Type	Housing price
① Owned	()	① Owned	()
② Lump-sum payment rental	Lump-sum payment ()	② Lump-sum payment rental	Lump-sum payment ()
③ Monthly rental	Security deposit () Monthly rent ()	③ Monthly rental	Security deposit () Monthly rent ()
④ Government affordable housing	Security deposit () Monthly rent ()	④ Government affordable housing	Security deposit () Monthly rent ()
⑤ Living in another person's place for free		⑤ Living in another person's place for free	
⑥ Other ()	()	⑥ Other ()	()

5. Marital Status Aspects

5-1 Have you experienced a separation from your spouse mainly due to the traffic crash?

- ① Yes ② No ③ Not married at the time of crash

5-2 Which of the following describe the separation the best?

- ① Spouse left home without notice
- ② Separated

- ③ Divorce
- ④ Other()

5-3 Which of the following best describes the reason?

- ① Economic hardship after the crash
- ② Psychological withdrawal made it difficult to maintain marital relationship
- ③ My disability burdened my spouse
- ④ Other ()

6. Social Activity Aspects

6-1 Have you experienced a change in your social activities mainly due to the traffic crash?

- ① Decrease ② Increase ③ No changes

6-2 If decreased, which of the following best describes the reasons? Please choose two.

1 (), 2()

- ① Physical limitations from disability or severe injury
- ② Psychological withdrawal
- ③ Natural occurrence with aging
- ④ I became busier so I don't have time for socialization
- ⑤ Other ()

7. General

7-1 Which of the following describes your education?

- ① Elementary school graduate
- ② Middle school graduate

- ③ High school graduate
- ④ Two year college graduate
- ⑤ Four year college graduate
- ⑥ Graduate school or higher

Thank you very much for your participation!

2. Abstract of "A Study on the Socio-economic Consequences of Traffic Accidents"

(Korea Transport Institute, 2013)

Dr. SUL Jaehoon, JUNG Namji

This study attempts to measure the long-term socio-economic consequences of traffic crashes. A large number of road crash victims recover from their injuries in a short period of time and go back to their normal life after an accident. But some of them never recover fully and suffer from physical, psychological, or even economic long-term impacts. While medical long-term impacts of traffic crashes are rather well documented, our understanding on the socio-economic consequences of traffic crashes is still limited. It is partly because of the difficulties associated with a systematic investigation on long-term socio-economic impacts of traffic crashes.

Decline of the socio-economic status of traffic crash victims occurs over time. And the degree and range of the socio-economic conditions may vary depending on the specific conditions of an individual such as age, gender, educational attainment, and the seriousness of the injury. Thus measuring the long-term consequences requires a scientific and systematic approach.

In order to make the complex outcomes of traffic crashes measurable and operable, this study establishes a working hypothesis that guides the questionnaire survey and data analysis: a traffic crash injury may result in the loss of personal opportunity which potentially leads to long-term economic and social hardship.

Based on this hypothesis, this study measures the long-term socio-economic impacts of traffic crash by using loss of employment, income change, divorce rate, and changes in frequency of attending social occasions. This study carried out two different surveys including serious injury victims, and those disabled from a traffic crash.

The overall result is that victims of traffic crash suffer from income reduction compared to the national average. Traffic crash victims collect about 40% less than the national average while the difference widens in the 40s age group and narrows for those 60 and over.

Disabled traffic crash victims earn only 40% of the national average leaving them in a economically marginalized position. In marital status, disabled traffic victims show much higher divorce rates. Traffic crash victims also suffer from reduced social interactions due to declined health conditions, emotional despair or on their desire to avoid social contact.

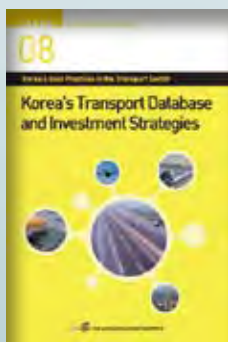
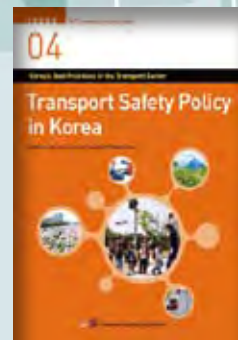
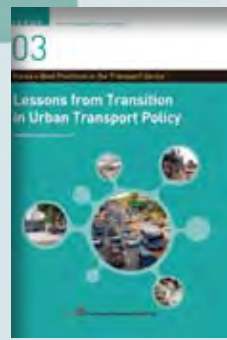
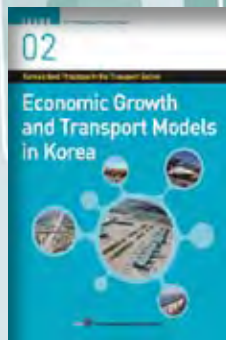
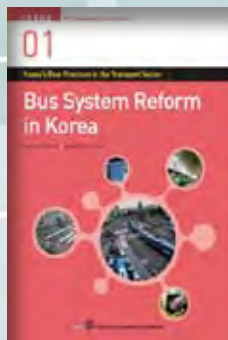
In order to reduce the negative impact, we recommend policies as follows:

- 1) Increase automobile insurance compensation for traffic crash victims, especially for those who are disabled.
- 2) Establish a long-term installment plan for the automobile insurance compensation.
- 3) Provide public counseling services for traffic crash victims to help them to deal with potential post traumatic stress disorder.
- 4) Increase public funding for the newly disabled to return to the labor market.
- 5) Initiate traffic safety campaigns to reduce serious traffic crash injuries.

KOTI Knowledge Sharing Reports

Recently, developing countries have shown interest in Korea's transport policy establishment and infrastructure construction experience on the premise that those changes have enabled the nation to promote economic growth. Against this backdrop, Korea Transport Institute (KOTI) publishes a series of Knowledge Sharing Reports series regarding Korea's transport system and policy accomplishments in the fields of roadway, railway, aviation, logistics, and public transport.

The reports are available to download for free in PDF format on our website at <http://english.koti.re.kr>.



- Issue 01** | Bus System Reform in Korea
- Issue 02** | Economic Growth and Transport Models in Korea
- Issue 03** | Lessons from Transition in Urban Transport Policy
- Issue 04** | Transport Safety Policy in Korea
- Issue 05** | Korea's Integrated Fare and Smart Card Ticket System
- Issue 06** | Bicycle Transport Policy in Korea
- Issue 07** | Korea's Railway Development Strategies
- Issue 08** | Korea's Transport Database and Investment Strategies
- Issue 09** | Best Experiences from Public Transport Reform
- Issue 10** | Road Transport Policy in Korea
- Issue 11** | Korea's Railway PPP(Public-Private Partnership) Projects
- Issue 12** | Korea's High-speed Rail Construction and Technology Advances
- Issue 13** | The Driving Force of Korea's Economic Growth
- Issue 14** | Handbook of Measuring Socio-economic Consequences of Traffic Crashes



Handbook of Measuring Socio-economic Consequences of Traffic Crashes

The Korea Transport Institute (KOTI) is a comprehensive research institute specializing in national transport policies. As such, it has carried out numerous studies on transport policies and technologies for the Korean government.

Based on this experience and related expertise, KOTI has launched a research and publication series entitled “Knowledge Sharing Report: Korea’s Best Practices in the Transport Sector.” The project is designed to share with developing countries lessons learned and implications experienced by Korea in implementing its transport policies. The 14th output of this project deals with the theme of “Measuring Socio-economic Consequences of Traffic Crashes.”

