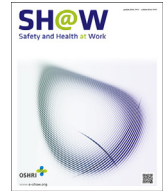




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Original Article

Comparisons of Traffic Collisions between Expressways and Rural Roads in Truck Drivers



Sangbok Lee, Byung Yong Jeong*

Department of Industrial and Management Engineering, Hansung University, Seoul, Republic of Korea

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ABSTRACT

Background: Truck driving is known as one of the occupations with the highest accident rate. This study investigates the characteristics of traffic collisions according to road types (expressway and rural road). **Methods:** Classifying 267 accidents into expressway and rural road, we analyzed them based on driver characteristics (age, working experience, size of employment), time characteristics (day of accident, time, weather), and accident characteristics (accident causes, accident locations, accident types, driving conditions).

Results: When we compared the accidents by road conditions, no differences were found between the driver characteristics. However, from the accident characteristics, the injured person distributions were different by the road conditions. In particular, driving while drowsy is shown to be highly related with the accident characteristics.

Conclusion: This study can be used as a guideline and a base line to develop a plan of action to prevent traffic accidents. It can also help to prepare formal regulations about a truck driver's vehicle maintenance and driving attitude for a precaution on road accidents.

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1. Introduction

Accident prevention plans should be in reasonable agreement with significant variables of occupational accidents, and accident analysis is a typical process in developing preventative policies [1]. Recently, efforts to analyze accidents over diverse industries workers [2–4] have helped to identify similar properties among certain groups of workers [5–7].

Truck or special purpose vehicle (SPV) drivers are classified into truck drivers, dump drivers, trailer truck drivers, and SPV drivers in the Republic of Korea Employment Information Services, and freight vehicle drivers and SPV drivers in the Korean Standard Classification of Occupations [8]. A freight vehicle refers to a truck in which the weight of freight loaded in the load space is larger than the total weight of passengers excluding the driver in it. An SPV is defined as a motor vehicle properly designed to tow, rescue, or execute special tasks. Freight vehicles and SPVs are classified as small, medium, and large sized vehicles. Freight vehicles with a

load capacity > 5 tons or a total weight > 10 tons are referred to as large sized vehicles. An SPV is classified as a large sized when its total weight is > 10 tons [9].

Truck drivers who are self-employed need to drive, take orders, and do their accounts themselves. Thus, they make a contract with a large cargo service to secure their work or to entrust their management activities to the company. Truck drivers who have their own trucks make a contract with a cargo service, and just have to pay for the management activities. However, if they do not own a truck, they purchase it by installments as a form of contract with a cargo service, in which case they have to pay installments on top of the management fees, so that the workload is very heavy in order to pay them back.

Truck drivers' tasks are comprised of checking transportation records that show cargo types, quantity, and destinations, and delivering the freight to the destinations. Most work is done by the driver and includes physical activities such as loading/unloading. In turn, the drivers become so fatigued they are likely to drive while

* Corresponding author. Department of Industrial and Management Engineering, Hansung University, 116 Samseongyoro-16Gil, Seongbuk-Gu, Seoul, 02876, Republic of Korea.

E-mail address: byjeong@hansung.ac.kr (B.Y. Jeong).

drowsy. Because of this, truck driving is known as one of the occupations with the highest accident rate in the US [10]. However, there is a lack of literature on unfolding accident characteristics in Republic of Korea, while there is much research on truck driver's accident prevention plans [11–14].

Truck drivers, in particular those who drive large cargo trucks > 5 tons, are more likely to be involved in traffic accidents because braking takes a longer distance due to the heaviness of their trucks. Moreover, the accidents are usually very severe and thus, the death rate and cost of loss are significantly high [15,16]. It is reported that 80% of accidents are caused by misbehavior of drivers [17,18]. Driving while drowsy, unconsciousness, speeding, passing, non-securing safety distance, driving style, and unlawful acts are the main reasons for accidents [19]. In addition, different accident patterns are recognized according to gender, age, driving experience, and vehicle type [20,21].

Investigating truck-accident characteristics systematically would lead us to establishing an efficient accident prevention plan. This study classifies truck driving-related accidents by road conditions (expressway and rural road). Truck driving-related accidents refer to traffic accidents that occur in the middle of freight delivery by truck drivers.

2. Materials and methods

2.1. Data collection

This study analyzes the characteristics of truck accidents based on truck drivers' accident data, officially recognized as industrial accidents because they happened in the course of truck driving. We used a dataset that includes 267 traffic accidents caused by trucks in expressways and rural roads in the country.

Table 1 shows 267 traffic accidents caused by trucks, which are classified by accident severity and road conditions. Some 38.6% of the accidents occurred in expressways and 61.4% occurred in rural roads; 10.9% of the accidents resulted in deaths and 89.1% of the accidents resulted in either severe or minor injuries. It is also shown that the death rate was greater in expressways. In this paper, expressways refers to roads only for the use of motor vehicles and rural roads refers to local roads that have traffic signals and intersections.

2.2. Data analysis

We conducted Chi-square tests to understand truck-related traffic accidents and to compare distributions of injured persons from the accidents which occurred on expressways and rural roads, based on the accident characteristics. That is, this study compares expressway accidents and rural road accidents with respect to driver characteristics (age, working experience, size of employment), time characteristics (day of accidents, time, weather), and accident characteristics (accident causes, accident locations, accident types, driving conditions). Chi-square tests were employed with a confidence level of 0.05 and SPSS statistical package version 18 (SPSS Inc., Chicago, IL, USA) was used.

Table 1
Distributions of injured persons by accident severity and road conditions (unit: person)

Severity	Expressway		Rural road		Total	
	Count	%	Count	%	Count	%
Death	14	5.2	15	5.6	29	10.9
Injury	89	33.3	149	55.8	238	89.1
Total	103	38.6	164	61.4	267	100.0

Table 2
Distributions of injured persons by age (unit: person)

Age (y)	Expressway		Rural road		Total	
	Count	%	Count	%	Count	%
< 30	8	7.8	15	9.1	23	8.6
30–39	30	29.1	44	26.8	74	27.7
40–49	38	36.9	59	36.0	97	36.3
50–59	22	21.4	35	21.3	57	21.3
≥ 60	5	4.9	11	6.7	16	6.0
Total	103	100.0	164	100.0	267	100.0

3. Results

3.1. Characteristics of injured truck drivers

3.1.1. Analysis by age of injured persons

Table 2 shows characteristics of injured truck drivers regarding age and road conditions. Some 36.3% of injuries occurred in drivers in their forties, 27.7% of injuries occurred in drivers in their thirties, and 21.3% of injuries occurred in drivers in their fifties. From these statistics, we find that truck driving is a tough task for elderly people (those in their late fifties or older). From a Chi-square test, there were no differences in the accident rates through all age groups between expressways and rural way ($\chi^2 = 0.637, p = 0.959$).

3.1.2. Analysis by work experience of injured persons

Table 3 shows characteristics of injured persons with respect to work experiences. Some 47.9% of injured persons had work experience of < 6 months and 64.4% of injured persons had < 1 year of experience. That is, novices are more likely to have accidents. In terms of the road conditions, it is shown that, between expressways and rural roads, there was no difference in the distribution of the injured persons classified by work experiences ($\chi^2 = 5.927, p = 0.313$).

3.1.3. Analysis by size of employment

Table 4 indicates distributions of injured persons by size of employment. As shown in the table, 56.6% of injured persons worked in a small business of less than five employees. Moreover, 84.7% of them work in a business which has less than 30 employees. Thus, we can say that the accident rate is higher in employees of small-sized firms. From a Chi-square test, it is shown that the distributions of injured persons by size of employment between expressways and rural roads were not significantly different ($\chi^2 = 4.080, p = 0.253$).

3.2. Characteristics of day of accidents

3.2.1. Analysis by accident day of week

From Table 5, we can see the characteristics of injured persons with respect to the day of week. The accidents rates were higher on

Table 3
Distributions of injured persons by work experience (unit: person)

Work experience	Expressway		Rural road		Total	
	Count	%	Count	%	Count	%
< 6 mo	50	48.5	78	47.6	128	47.9
6 mo–1 y	19	18.4	25	15.2	44	16.5
1–2 y	19	18.4	22	13.4	41	15.4
2–3 y	5	4.9	12	7.3	17	6.4
3–5 y	6	5.8	9	5.5	15	5.6
≥ 5 y	4	3.9	18	11.0	22	8.2

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