

CASE STUDY OF THE EFFECTS OF THE WEATHER CONDITIONS ON THE ROAD ACCIDENTS IN THE MOUNTAINOUS AREA OF IRAN: HARAZ ROAD

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1.ABSTRACT

The traffic safety of the mountainous roads is often in danger of extreme weather condition such as freezing and temperature variations especially in winter conditions. Most of the roads of IRAN are located in the mountainous areas which cause economic and human losses. This study was undertaken to identify these extreme conditions and develop an early warning system to forecast them temporary and spatially. The Haraz road between Tehran (capital of IRAN) and Amol (located on the Caspian Coast) was taken as a sample of the mountainous roads of IRAN , the hourly weather data of Abali station in Haraz road were acquired from the meteorological organization of IRAN for the month December to April of 1990-1996. The hourly accidents data for the same period were provided by the ministry of road and transportation.

First the daily accidents were classified according to reported weather conditions. Then the frequency of accidents for each weather condition was computed on the monthly and whole period basis.

The result showed that 75 percent of the accidents happened during the raining days with the temperature between -7 to 0 Celsius. On the monthly basis, March showed the highest accidents frequency which was followed by December.

Based on the result of this study and in order to establish an early warning system a numerical weather forecast model for the roads of IRAN was developed. In order to better implementation of this model it was suggested that the number of road weather stations should be increased.

2.Introduction

The road traffic safety is very important to the general health of the society. But in most of the countries, especially in the third world, the concern and investment in this area is not adequate. Therefore about 1 to 3 percent of their gross national product is spent in the road accidents each year. Among the factors affecting road accidents the climate causes more than 30 percent. As a result the climate of each area is very important in its road security and should be paid more attention in any road traffic planning. The research results in the United Kingdom shows that there is a reverse relationship between road accidents and the January temperature. It was in this country that for the first time (1960) the climatic factor was considered in the planning of the road M62(Musk, 1991). Following this program 10 meteorological stations were established along the main roads to measure and report the weather conditions to the road planning and maintenance centers. The weather station reports showed that the invisibility of less than 400 meters is 30 to 40 percent more in the mountainous roads than the low land area roads and snowing is 20 percent and frost is 10 percent more than the low land roads.

In road planning besides the weather conditions, the opinion of the local, police, experts, and analysis of the past accidents in terms of the climatic conditions are important. Working in this way improves the planning achievements (British Meteorological Office, 1985). Most of the road accidents happen during rainy days when the surface of the roads are slippery and rain occurs more than other climatic phenomena such as frost and fog. The research in the UK (Smith and Colding), Australia (Robinson) and US (Sheretz and Fahar) indicate that rainy days accidents are about 30 percent more than non rainy days.

Snowstorms make hard conditions and most of the times close the roads. During snowy days the average rate of accidents doubles (OECD, 1967). Snow accumulation of even 20 millimeter slows down or even blocks the traffic (Perry and Symons, 1980).

Wind also causes damage to cars and buses mostly through deviating them from the road or colliding together. Speeds more than 15 meters per second are dangerous for the road traffic (TRRL, 1975). For example the storm of January 26, 1990 in England took 27 casualties. Most of the damage was caused by the collision of the cars with each other and trees.

Frost is another climatic factor affecting the road accidents. Three factors intensify the frost action: 1. Temperatures below 0C. 2. Soft grain soil with high capillary capacity. 3. Ground water at the depth 3 meters or lower. Frost damages the surface of the road through the compression and expansion which develops cracks on the road and lowers its traffic capacity.

The analysis of the relation of the weather conditions with the road accidents by Plutikof (1991) has shown that 21% of road accidents during snowy and rainy days have happened during day hours and 23% of them at nights. Wet and frost roads caused accidents about 46% in the day and 43% at nights.

The above discussion makes clear that climatic studies are very important for establishing roads and their maintenance. With correct and complete climatic information we can make roads according to the prevailing weather conditions and hence increase their capacity and life. After the roads are made the weather conditions help us to select the correct and suitable methods of maintenance. In case of the roads with no previous climatic studies, the present climatic studies helps to identify the climatically dangerous points of the road and establish suitable hazard preventing facilities. Climatologists are working together with engineers and planners in order to: select the correct pathos of the roads, identify the hazardous parts of the existing roads, do quantitative analysis of the effect of the climatic conditions on the road accidents, and finally modify the climate hazards.

As far as the authors know there were not any complete studies about the road accidents in relation with climatic conditions in Iran. Therefore we have decided to study the relation of the climatic conditions with the road accidents in Iran. For this purpose then Haraz road was chosen as a case study.

3.Data and Methods

The Haraz road is one of the hazardous roads of the country which connects Tehran to the Caspian Sea shore lands through the Alborz Mountains (Figure 1). It passes through the highest mountains and deep valleys in most of its way. Most of the winters it has problems and weather causes dangerous situations. It seems very important to analysis the climatic conditions of this road during the course of the year and suggest applicable recommendations to its maintenance and management. For this purpose the following data were gathered:

1. The statistics of the daily accidents for the 1990-96 period, the road traffic of the 1995- 99 period, and the road closures and traffic jams for the 1995- 99 period from the Traffic and Terminals Organization.
2. Daily weather data of temperature of Abali synoptic station for the period of the 1990-1996 from the Meteorological Organization of Iran.

Haraz road is divided into 5 section (table1) as follows:

Table 1: Classification of Haraz road according to Traffic Police

Distance (km)	Departing Point	Destination	Under the supervision of rout	Code
15	Serahi Azmayesh	Jajrood Police Station	Haraz	3118000
35	Jajrood Police Station	Emamzadeh hashem	Haraz	3118001
45	Bayjan Police Station	Emamzadeh hashem	Gazanak Police Station	2315001
14	Bayjan Police Station	Pinjab	Gazanak Police Station	2315000
47	Serahi Kamarbandi	Pinjab	Amol Police Station	2314000

Only two sections of the road located on both sides of Abali station were selected (Figure 1). The analysis was carried only for the cold period (December – April) of the year. During the study period all of the accidents were identified in terms of their date and time of the day. Then the accident causes reported by the police were taken down. Of all the accidents the ones caused by the weather conditions were extracted. A sample work is shown in Table 2.

Table 2: A sample of compound table of accidents of the weather

Road code	Iranian Calendar	Roman Calendar	Kilometer of accidents	Time of accidents	Time in Greenwic h	Wind (speed M/S)	WW Code (Weather condition)	Temperature 0 C	Visibility (M)
3118	1369.11.5	1991.1.25	13	11	7.5	5	70	-5	2000
2315	1369.12.2	1991.2.21	1	18	14.5	15	71	-1	1000

These accidents were grouped according to the standard synoptic codes for each study section. Then for each accident the weather conditions were extracted from Abali station data. Finally the results were grouped and their relations were studied.

4.Results

According to the results of the study most of the accidents were happened during 1994 and March had the highest frequency which is followed by months December and January. The kilometer 20 (near Rodhen), 35 (Emamzadeh Hashem), kilometer 45 and 40 between Manzarieh and Plor showed highest accidents (Hazard point or black point). Among the climatic phenomena frost caused 73.4% and snow

caused 17% of the total climate related accidents. Most of the frost caused accidents happened in the area between kilometers 18 and 20 (fig 1).

Based on the findings of this study the most important factor in the safety of the Haraz road is the frost. In any safety study and planning this phenomenon should be considered. The best way is to deice the road during winter months. Most of the frost days occur in December and the frost possibility of its days is more than 80% (fig 2). Therefore it is suggested that the road managing authorities should be ready during this month and enough salt be prepared for spreading over the road. More over the public informing system should be adequate and active so that they can inform the drivers and people in advance of any probable frost or any climatic problems.

5. Proposition

In order to provide adequate safety measures the following suggestions are made:

- 1- Establishing of more weather stations in the mountainous parts of the road,
- 2- progressive analysis of the climatic data ,
- 3- providing the regular 24-hour service according to the climatic analysis all over the road , especially in the area between kilometers 18 and 20 ,
- 4- Regular cooperation between different authorities especially police, weather stations and road managers,
- 5- Full control of the drivers and cars safety measures such as :
 - anti icing
 - Heater
 - Tires
 - Lamp
 - Batteries
 - Breaks

6.References

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