CLIMATE AND TRAFFIC SAFETY IN MOUNTAIN ROADS OF IRAN: CASE STUDY KARAJ-CHALOUS ROUTE

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Received March 03, 2009  Accepted May 15, 2009

ABSTRACT

Different factors affect on road traffic safety, one of them is the climatic, among the climatic hazards affecting on the road traffic safety, it can be mentioned about the avalanche, rain, snow, frost and fog phenomena. In this research, in addition to evaluating the relation between each of climatic hazards as well as road transportation safety in the Karaj Chalous route, it was took an action for providing the accident hazard probable maps in each climatic different manners using the observed information and data in the arc view. According to the obtained results, there are the most hazard probable during the raining from the kilometer 95 to 145, while being the frost phenomenon from the kilometer 35 to 85, during the snowing from the km 45 to 85 as well as during the fog from km 96 to 130 and during falling avalanches from km 56 to 70 of the Karaj Chalous route being shown in the map.

Key Words: Road Transportation, Accidents, Karaj Chalous route, Climate, Traffic Safety.

INTRODUCTION

Traffic safety is one of the principles of the traffic engineering, as well as being taken into consideration by the developed countries accompany with the extension of other sections of the traffic engineering, it is tried to perform the necessary study and endeavors the resulted accidents being conveyed as possible as it may minimally exist; (mahmoudi 2005). But in the developing countries, in the reason of non-attention to the effective factors on the road traffic such as the climatic hazards- before or after constructing and extending the routes- it is caused to devote the damages based on the road accidents only about 1-3% of national gross in come of these countries to itself and more unfortunately, the Iran country has devoted to itself with the most accident rates in the world (as average in year 25000 dead) as the first position among the all countries in the world.

Posing the problem, goals and study

Among the effective factors on the road traffic safety, the climatic hazards have much importance, though the stand against these phenomena is inevitable and they are almost out of ability and option of human, but some of them can be conveyed by doing many
methods in designing the ways and Some of them, with the presence of the timely maintenance factor in the area. Among the climatic hazards being taken into account in programming, designing and maintaining the roads as much as possible, are as: snowing, raining, fog, frost and falling avalanches; because these types of hazards exist so many extended damages in the background of the road transportation annually. The goals being followed in this research are as following:

1. Evaluation of communication between the climatic hazards and the road accidents in the Karaj Chalous route
2. Recognition of places affected on from the climatic hazards in the length of the Karaj Chalous route.
3. Presentation of the suitable executed methods during happening the climatic hazards for elevating the road safety coefficient.

The antecedent of the study

For the first time, in 1960s, in England, during the programming the transit road between Liverpool and hall, the importance of climatic phenomena effective was determined in local ratio; this caused to pose the factor of climate in the English new road programmings. Sherets and farher (1978) in USA, performed a research about the raining effects in American road accidents.

These both researchers showed that the accident relation in rainy days in – in comparison with non-rainy days- more than 30 percents. Perry and simons (1980) did study the snow tempest effect on scotch road transportation, they took a result that the road accidents are more than 25% during the snowy days in comparison with the non-snowy days.

The drastic rains have expensive outlays for toll-men for repairing and holding roads, as, the more raining, more than 50 mm/h, causes to exist floods on the road levels. YAMAMOTO (2002) has done a research about the fog effect in Japanese road accidents, resulting that the occurrence time of the all accidents based on fogs being concentrated in the cold seasons of the year, he also found that, the view rate in the near of accident occurrence place decreases drastically. In England, smith (1982) inferred that, in rainy days, the numbers of accidents are more than the non-rainy days. According to these researches, the main problem in the road transportation, exits the decrease of vehicle stand against the slipperiness, lack of enough view and reflection of lights from the wet road levels during the nights. In a research done on siatel zone, USA, for evaluating the accidents using powason model, the information bank of accidents has been used as the information sets as wall as determining the indicators; and the applied variables in the model, are factors such as, environmental effectives (road level manner and climatic conditions), seasonal effects (different months indicators) and the weekly procedure; these state the variables of traffic volume, interactions of non-measured climatic conditions as well as the road geometrical characteristics. Little attempt has been made for evaluating the climatic condition interactions and the road geometrical characteristics related to the accidents. Evaluation of these studies is important, because they can show the climatic condition effectives on the geometrical design indicators during the critical times, being applied as an indicator in designing the road-geometry, for minimizing the accident probable accompanied with sufficient climatic conditions. One of the most important results of the climatic effects on road-
transportation is that, based on the frost end and beginning times as well as snow falling, can be estimated and managed, in order to beginning, ending and winter toll thorough volume and the expense ratio for this affair has evaluated the road- geometrical condition role and the environmental factors such as: climate as the road- accidents.

Obtained results of the research, show the mentioned variants importance, on occurring the accidents.

The studied route whole characteristics

The Karaj Chalous road in length of 150 km, is of the type of the main roads placed on both Tehran and Mazandaran protected provinces zone (from Karaj Chalous to the Kandovan tunnel in the Teklran protected province zone and from the Kandovan tunnel to Karaj Chalous in the mazandaran protected province zone).

This road, connects the Tehran province through the ALBORZ heights to the mazandaran province (Fig. 1).

The maximum of the height for this route from the sea- level is 3000m in the pass- way of the Kandovan tunnel and its minimum is 100m, in the northern low zones. The before and the after of the Kandovan tunnel, the full-snowy winters accompanied with storms and fogs, the most traffic difficulties are usually created for vehicle drivers. In the length of this route, a road meteorology station has been established on pass-way Kandovan tunnel, recording the needed data as a test case.

The used information and data

1. The topographical maps of the studied zone, at the ratio of 1:250000, provided by army forces geographical organization.

2. Hourly data of the climatic parameters; temperature, raining and the relative humidity of Karaj Chalous sinoptical stations as well as noshahr and siabhishe sinoptical stations for a two- year period (2005-2006) taken by the machinery service section of the country's meteorological organization.


4. Related in formation to the geometrical characteristics of Karaj Chalous route taken by both way and
transportation general offices of Tehran and Mazandaran provinces.

5. Using softwares access, spss, Excel, arc view.

METHODOLOGY

In respect to characteristics of the Karaj Chalous route (being and area among the sub-bried mountain- side, high and mountainous zones of Alborz and the low coasts of the Caspian sea).

Can be invied into three climatic zones as: southern sub-dried mountain- side central cold mountainous and northern humid plain. Statistics and information of the stations being evaluated into this section, stating the desired climatic conditions of each mentioned zones, as the central cold mountainous zone used from siahbisheh sinoptical station's statistics and information, and the northern humid plain zone used from the noshahr sinoptical station's statistics and information.

For determining the limitation of each stations along the studied route being made in arc view and interpolate grid for finding-depth operations using both temperature and raining parameters, as a result, the limitation of meteorology stations was determined in the viewpoints of raining and temperature. It is worthy noting that, the determined limit is mostly adaptable on the limitation of these stations in the view point of temperature among stations as well as in the view point of raining; so, for evaluating the relation between the climatic phenomena and the road accidents in the Karaj Chalous route, from Karaj Chalous to kilometer 43, of Karaj Chalous station statistics and information, from kilometer 43 to kilometer 110, of siahbisheh station's statistics and information and from kilometer 110 to Karaj chalous, has been used of the noshahr station's statistics and information. In this research, the map of the leveled lines and the studied route were firstly recorded into the arc view; for determining the accident points, the studied route was divided into the one- kilometer parts, then, the road- accident information bank was arrived into arc view as well as being connected to the layers of the accidents, so, the accidental places were determined on the studied route. For obtaining the weather situation of the occurrence moment for each accident, it has been taken actions as both following methods:

1. Use of sinoptical stations hourly data collected along this route.
2. Use of weather condition data registered on the form com 113.

One of the strengthened point in the form com 113, is the weather condition registration during the accident occurrence, as it is observed in the table 1, the accident time weather situation has been determined by codes 1 to 6, playing the most important role in analyzing the accidents in the viewpoints of water and meteorology.

Table 1: Different weather situations into form com 113

<table>
<thead>
<tr>
<th>Code</th>
<th>Weather situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clear</td>
</tr>
<tr>
<td>2</td>
<td>Foggy</td>
</tr>
<tr>
<td>3</td>
<td>Snowing</td>
</tr>
<tr>
<td>4</td>
<td>Raining</td>
</tr>
<tr>
<td>5</td>
<td>Storm</td>
</tr>
<tr>
<td>6</td>
<td>Cloudy</td>
</tr>
</tbody>
</table>

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RESULTS AND DISCUSSION
Evaluation of relation between the climatic hazards and the road. Transportation safety

In this research, in addition to evaluate the relation between the climatic hazards and the road accidents in the Karaj Chalous, it has been taken actions on providing the accident dispersion plans in each environmental situation into Arc View.

Raining and the road-accidents

Of the totally 357 accidents being made into climatic unsuitable conditions, 193 items have been occurred during the raining; for providing the accident dispersion map, the accidents have been occurred during the raining, were determined onto the Karaj Chalous route. In respect to that, a half of the Karaj Chalous route passes from the Alborz northern mountain-sides, the most rainings, being occurred onto the road (in the reason of the climatic nature of the zone). Looking at Fig. 2, it is observed that, the most accident dispersion based on raining, has been occurred from kilometer 95 on.

The frost and road-accident

Of totally 357 accidents being made in the unsuitable climatic conditions, 64 items occurred during the fogging. For providing the accident dispersion plans, the accidents occurring during the frost were determined onto the Karaj Chalous route. This part of the road passes through the heights higher then 2000 m. averagely there are 78 days frost in every year. By looking at the accident dispersion, being observed in the frost manner that, the most of these accidents has been occurred from km 35 to 88.

Fog and the road accidents: of totally 357 accidental items being made in the unsuitable climatic conditions, 45 items occurred during the fogs. For providing the accidental dispersion map. The accidents occurred during the fog, were determined onto the Karaj Chalous route.

With a look at Fig. 2, it is observed that, the most accident dispersion based on the fog, occurred from km 96 to 130.

For providing the avalanche fall danger probability plan in the studied route of the field operations the road- police report as well as the road and transportation office report have been used. As such, firstly both the leveled lines base plan and the studied route were registered into the arc view, for determining the hazardous points, the studied route were divided into the one-kilometer parts; then, the obtained information arrived to the arc view from the hazardous points of The road; and therefore, the parts of the Karaj Chalous route encountered to the avalanche fall hazard, were determined onto the plan. It is observed by the look at the Fig. 2, that; the most avalanche fall hazard probability exists in the kilometers 56, 64, 68 and 70 of Karaj Chalous route.
The importance of coefficient of each climatic hazards in occurring the accidents

The importance coefficient of each climatic feature in appearing the accidents, has been determined in the attention with the accident plenty in that climatic phenomena (Table 2 and Fig. 3), as instance, the importance coefficient of the frost phenomena in the road accidents has been calculated using the following equation:

\[
\text{Importance coefficient of the frost phenomena} = \frac{\text{Plenty of accidents in each climatic unsuitable manners}}{\text{Wholly plenty of accidents in all climatic unsuitable manners}} \times 100
\]

\[
= \frac{64}{357} \times 100 = 18\%
\]

Table 1: Importance coefficient of each climatic phenomena in occurring accidents

<table>
<thead>
<tr>
<th>Climatic phenomena</th>
<th>Plenty of accidents</th>
<th>Importance coefficient (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain</td>
<td>193</td>
<td>54</td>
</tr>
<tr>
<td>Frost</td>
<td>64</td>
<td>18</td>
</tr>
<tr>
<td>Snow</td>
<td>55</td>
<td>15</td>
</tr>
<tr>
<td>Fog</td>
<td>45</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>357</td>
<td>100</td>
</tr>
</tbody>
</table>
According to the obtained results, in the sections that the Karaj Chalous road has the most curves and declivities, the accident plenty maximum during raining has been made. In the interpretation of this gist, it can be mentioned to two options:

1. In the climatic unsuitable conditions specially during raining – both curve and declivity factors, play very effective role in increasing the danger of accidents in the Karaj Chalous route.

2. In respect to, the most dangerous curves and declivities of the Karaj Chalous route, placing in the northern Alborz Zone, as well as the most rainings occur in the studied route, in the zone of Alborz, therefore, in the relation of both factors voles, the road geometrical conditions and the climatic unsuitable characteristics exist the most accident danger probability in the sections of the Karaj Chalous route in increasing the accidents pass thru the caspean rainy zone (Table 3).

Table 3: The accidental places of the Karaj Chalous route, caused to the geometrical difficulties during the climatic unsuitable conditions.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Situation</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adran Curve km5.5 Karaj chalous</td>
<td>In the reason of unsuitable curve and declivity, in winter during sliding the road level, the accident danger probability is high</td>
</tr>
<tr>
<td>2</td>
<td>Curve and bow of ray- zamin km 35 Karaj chalous</td>
<td>In the reason of speed curve, has lack of view, in winters exist the slide probability of vehicles</td>
</tr>
<tr>
<td>3</td>
<td>After the bridge gerduforushan km 78 Karaj chalous</td>
<td>In the reason of declivity and unsuitable curve, during rainings the road level is slidery</td>
</tr>
<tr>
<td>4</td>
<td>Hezar cham curve km 97 Karaj chalous</td>
<td>In the reason of declivity and curve during rainings the road level is slidery</td>
</tr>
<tr>
<td>5</td>
<td>Ayineh curve km 135 Karaj chalous</td>
<td>Speed curve, has lack of enough view, during rainings, has the highly accident danger probability</td>
</tr>
</tbody>
</table>
CONCLUSION

According to the obtained result of the accidents dispersion in the Karaj chalous, the most accidents during rainings from km 95 to 145, have been occurred as well as during snowings from km 45 to 85, during fogs from km 96 to 130 and during falling avalanches from km 56 to 70. in the Karaj Chalous route along the studied period; the most accident has occurred in the climatic unsuitable manners during rainings on august, so, it can be said that, a meaningful increase in the accidents are in this month is observed over the other months, in increasing the rainy days of August, that is, from a set of 357 items for accidents have occurred in climatic unsuitable manners, 193 items (54%) have had during the rainings. The accident plenty maximum during the rainings has occurred in the sections from the Karaj Chalous route containing the most and the most dangerous curves and declivities. In respect to, the most curves and the dangerous declivities placed on the Alborz half northers sides, as wellas the most ranings occur in the studied route; e.g in this half of Alborz; so there are the most probability of accident dangers in the sections of the Karaj Chalous route, pass through the half of northern sides of Alborz, in the relation with the role of both factors road geometrical phenomena and the climatic unsuitable conditions in increasing the accidents. (half of northern sides of Alborz means the caspian zone).

REFERENCES

9. Disciplinary force, Road accident information bank, the road accident


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If U Protect NATURE….

….NATURE will Protect U