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The Impact of Climate(Temperature, Precipitation, Freezing) on the Accident in Shirvan City (North Khorasan, Iran)

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ABSTRACT

Accident is one of the most important problems in urban planning. This problem may be occurred by human, vehicle, road agents or environmental factors. Weather is the most important factors among the environmental factors. In this study we want to evaluate the effect of climatic factors (temperature, precipitation, freezing) on the rate of the accidents in Shirvan city. The method of research is analytic-descriptive and the period is between 2004 to 2011. It was obvious that the most accident in the city was happened in the warm months such as May, June, July, august, and September.
KEYWORDS: temperature, precipitation, freezing, accident, Shirvan city.

INTRODUCTION

Talking about road safety and transport is one of the topics that form the basis of traffic engineering and transportation urban planning. however today in developed countries along with the development of other sectors of traffic Engineering, safety issues have also been considered and with performance of necessary studies have tried that messages of the consequences of accidents minimize .But unfortunately, in our country and other third world countries and the rate of accidents caused by lack of attention to safety rules andfactors have been consistently to upward,So the cost of damage caused by accidents, imposes both economically and in terms of mental health, the society.

Several factors may have been involved in accidents including can be point human factors and environmental factors. And from the among environmental factors can be point to the causes of climate that has been identified the effects of weather conditions on the accident as documentary and logical .Although one can say has been done in this area very little research, but abundant evidence of the effects of climatic factors such as rain, snow, ice, fog, wind and temperature as a factor in the accident and found to be effective.Julia Edward have been done on the relationship between road accidents and climatic phenomena and timeaccident in 1966 he in this research has been examines the relationship between water and road accidents in Walesand England.He in the level place of safety to comparison show accidents on rainy days,smoggy days, or days with strong winds and rainy days compared with no rain during.in the days, along with the fog, statistics of accidents the have increaed but in the case of strong wind gency,results did not show significant results.Nokhndan Habibi was the first one that particular, the influence of climatic parameters chose on accidents in 1999 as the subject of his research. He in this study after extraction accident to the separation date, time,And suervy communicate each one of accident with weather conditions (temperature, strong winds, visibility and present weather) came to the following conclusions.Weather elements and phenomena have been the segnificent causes ocure accidents axces of haraz in the coldmonths such as that with seurvey the frequency of accidents on climate phenomenon was found in March 237 cases (26 percent) in December 206 cases (22 percent), and in December 170 cases (about 17 percent) of the 931 accidents, with most of the phenomena associated with frost and snow was falling and other accidents with frequently less have been climate phenomena Andrei and ouli (1990) deals to investigate accidents in winter, summer in Edmonton - Canada This result is income 2 percent of the accidents that occur in the summer when the road surface is wet.While 40 percent of the accidents that occur in the winter. When is ice road surface is wet and snowing Vlyndkvyst Erickson (2002)deal with to investigate the causes slippery road surface as falling the snow and raine on the road surface during rain. this conditions occurs during the passage of a warm front over the area where the cold air is dominent road surface temperature is well below freezing. They In two regions of southern Sweden deal with eurvey .time and space distribution of rainfall and snow icy on surfaces find as results October , the road surface is still warm of months ago avd not were ice and in April, the same for the incoming solar radiation is high critical situation occurs less Yamamoto (2002) have been study about fog effects on great road accidents in Japan. he with using of level ifferent maps and environment to pay upon how effect of fog in accidents . he eventually came to the conclusion the tim ocure most of accident has focused to fog cause of cold years seasons. also he found that the upper atmosphere condition has been different at the time of accidents . of other his findings can be noted visibility near the scene of the accident severely reduced about 20 minutes before the accident. but in the iran seurvey safety of roads with attention to very limited the phenomenon of climate is related to the past few years. which is related to academic work.

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This is followed by the effects of climate parameters (temperature, precipitation, frost) Brtsadfat Shirvan city to examine.

METHOD

Method performance in this study was analytical and collecting data was to the research library that were collected with using of databases, charts, satellite images,books, magazines, papers.firstly, the statistics for daily, monthly and annual meteorologicalstations in Shirvan have been prepared for a period of eight years (2004-2011).the next step statistics of accidents receive of Shirvan city of Rahvr police for above period and data collected and by computer software SPSS recorded then both descriptive and inferential statistics were adjusted.

In cross section have used from frequency tables, graphs frequency, mean, mode, and coefficient of variation and in inferential statistics section were used of the correlation coefficient and ANOVA tests

The climate of shirvan city

This city is located at the geographical position 37 degrees 23 minutes and 30 seconds north latitude and 57 degrees 54 minutes and 30 seconds east the Greenwich meridian and at an altitude of 1067 meters above sea level. based on Amberge method for an 8-year period (2004-2011), the city has a semi-arid cold climate.

Air masses affecting on Climate of city Shirvan is as follows:

1- Mass of cold weather of Siberia (anti-cyclone Siberia), typically entered north of Shirvan and Zolfaghar mountain and the cause of extreme cold in late winter as severe cold in Shirvan is so cold air to 26 - degrees Celsius below zero range, air dry , is a cool and steady

2- Air masses were formed from northern Europe. after crossing the Black Sea to the Caspian sea and receive high humidity, the area north formed into of Shirvan outer heavy snowfall in the winter 3- Forming Centers of low pressure, summer in the deserts dry of Pakistan and plains of southern Afghanistan led to the displacement of air from the north-eastern Khorasan is known Aush in Shirvan 4- Caspian air masses from Atrac River Valley, the impress of Shirvan. the air mass is caused by rainfall, wind direction northwest - southeast.

5- Air masses from the Mediterranean, though its intensity is reduced in the region of Shirvanbut is one of the fronts rainfall in this area. this flow is the main of air masses in the winter throughout the country are affected by snow is perhaps the cause of the most precipitation city. (azarakhsh, 2007: 107).

Shirvan city has a temperate and cool mountain climate hot and dry.

the average temperature in January is the coldest month of the year

- 2 ° C and minimum temperature also in February is usually the month and rarely - 20 ° C or more. (office of Meteorology Northern Khorasan province,2011)

Warm weather in the spring is slower than other northern cities **because** in April is 10 ° C the monthly average temperature and in July, the warmest month of the year is reached monthly average temperature of 6/20 + degrees Celsius.

the highest temperature in the area does not exceed 38 + degrees**.** the average annual rainfall is 235 mm**.**

Annual temperature shirvan city

Information obtained from the Bureau of Meteorology Northern Khorasan the average annual temperature in the city is 12.5 ° C or more. warm weather in the spring in this area has been slower than other regions of Khorasan. so, in April mean monthly temperature is about 11.7 ° C is and the cold weather in autumn is higher than other areas in late October temperatures of 13.6 ° C did not exceed (meteorology Department, North Khorasan, 2011).

in 2010 year Temperatures is reached peak in July means came to 35 degrees above zero and in January the -6 degrees below zero. figure 1 is based on annual changes in temperature.

(2004-2011)years between 10 and 15 degrees C has oscillator. the lowest temperature of the year 2006, an average of 10 degrees Celsius and most of 2008 with an average annual temperature is 15 degrees Celsius.

Annual preticipation of Shirvan city

Average annual preticipation in Shirvan is about 251.8 mm. preticipation rate across different areas is not the uniform distribution and preticipation rate in the north-south lines are reduced by almost half. preticipation in Shirvan 254.7 mm. this is because when the preticipation is equally distributed with so much rain in March 41.3 mm the lowest preticipation in August with a 2.5 mm it has not the same distribution so much rain in August with 3.6 mm.

according to The seasonal distribution, based on reports of studies of Shirvan plains - Quchan 30percent of the annual precipitation in the spring, 41 percent in winter and 26% in autumn, and 2.5 percent in summer with. (Meteorology Department, North Khorasan, 2011). figure 2 is based on the the lowest preticipation since 2008 with an average preticipation of 160 mm Hg the most preticipation in 2009 the average preticipation is 350 mm Hg.

Annual freezing of Shirvan city

According to statistic collected of the city of Shirvan is glacial period is 8 months. which usually begins in late October and continues until late April. Intensity frost are mainly in the months of December, January, February and March. glacial Maximum days occurring in January. the average frost on per year in the region of Shirvan is 98 days. the months of May, June, July, August and September, are frost-free. (meteorology Department, North Khorasan, 2011).

Based on Figure 3 is the observation that between 2008 and 2009 with an average of 83 days in ice minimum days of frost and ice in 2007 years with a mean of 122 days most days are devoted to ice.

Based on the above diagram(figure 3) can be seen that the changes have been significant fluctuations in the number of frost days so that in 2004 years is 85 days Ice that shows an increasing trend up to 2007 years and with steep back a initial state dates 2008 years this is fixed for one year and in 2010 years, a sudden increase in graph with a steep slope is visible.

Accident-prone spots in Shirvan

Because Palestine Street with offices, prisons, schools and residential areas are the transportation routes and also due to lack of proper drawing table, poorly laminated asphalt, no lines, accident-prone parts of the city.located in the towns of the Republic of Iran, Imamdue to the large width of the boulevard, lack of speed, lack of flashing lights the rest is accident prone.

The high volume of traffic, stopping unauthorized different vehicles, lack of discipline moving vehicles, lack of appropriate width of sidewalks and pedestrian volume occupied by shopkeepers and pedestrians in the roadway surfaces, gutters and not respecting the priority of problems Imam Reza, Imam Khomeini in Iran is important, and the city is considered Accident-prone (Khodaverdi Zadeh, 2010). (Shirvan city Accident-prone spare shown on Map 1).

Status of urban accidents in Shirvan

Based on studies and statistics obtained from Shirvan Rahvr police , accident situation in Shirvan despite increasing its vehicles has declined it so that the statistics of the number of accidents have dropped from year 2004 to 2011 (Table 3)

The According to figure 4 have declined exchange trend of the 2004 years accidents the despite since the rise of vehicels has been reduced.

The According to figure 5 is determined since 2004 years to now despite being the number of accidents has declined but the number of victims has remained relatively constant. in this tutorial we have survey impact of any climate parameters on charges of accidents in Shirvan.

The effect of temperature on the accident of Shirvan city:

Based on studies of the year, 2004 to 2011 years the number of urban accidents in different months has been the report (table 3). as is clear from the table 3 accidents are not the same city in different months in according to changes of the temperature number of urban crashes alo urban contingency is change so that, for example, the in the warm months are, such as May, June, July, August, September, , 55,70,72,76,54 respectively.

While in the cold months such as December, January, February and March accidents were declined 51, 52, 49, 50.51 respectively figure 6 is clear compares the trend. figure7 shows the average monthly temperature please see the comparison chart accident rate increases with increasing temperature.

preticipation impact on accidents Shirvan city:

Based on studies from (2004-2011) years the number of urban accidents in the city during the year are reported in Table3.figure 6 Average monthly number of accidents compared to two years (2004-2011) and Figure 8 please see average monthly rainfall for the period,with rainfall increasing in cold months accidents are reduced Conversely, a decrease in precipitation in the warm months of the year, the number of accidents is increasing.

Effects of freezing on the city of Shirvan accidents:

based on studies of urban accidents (2004-2011) years, in different months of the year are reported in Table 3.

Comparison two figure 6 of the number of accidents average monthly during the period (2004-2011) and Figure 9 Monthly mean ice please see with the increase in the freezing cold months is reduced the urban traffic conversely, in the months when there is no frost have accidents urban increases.

Data Analysis:

Analysis of the data shows (2004-2011) years despite an increase in the trend of urban vehicle crashes has declined (Table 3).

Reducing traffic accidents in the city are a number of reasons, including:

1 - disability awareness

2 - The new rules of law, hindering police, especially police Rahvr urban accidents has reduced by 20% (police Rahvr Shirvan, 2011).

3 - standard for urban streets and alleys

4 - install traffic lights at the crossroads of the city's main squares
5 - Education, Culture traffic via radio, television,
6 - vehicle repair and

Comparing Figure 6 (mean number of accidents from 2004 to 2011 years) And Figure 7 (average temperature 2004 to 2011 years) is observed increasing the temperature of the increasing number of urban crashes and conversely, with reduce temperature of the number of accidents in urban recede reduced, the main reason for the increase in accidents in warm months due to the increased traffic of vehicles, especially motorcycles more than 70 percent of the city. another cause of this is mentioned fatigue due to stress caused by heat and pressure result of this situation, most urban crashes occur between 10-18 hours (Rahvr police Shirvan).

Table 2 : summary of north khorasan weather station data for years 2004 to 2011

Number of frost per annual	Annual precipitation	Annual temperature	Factor
88	254	159.4	**2004**
100	189.8	166.4	**2005**
131	319.1	121.1	**2006**
143	206.4	143.7	**2007**
85	161.1	178.5	**2008**
86	350.8	152.9	**2009**
134	246	150	**2010**
128	252.1	138.2	**2011**

Comparing Figure 6 (mean number of accidents from 2004 to 2011 years) and Figure 8 (average preticipation of 2004 to 2011 years) is observed the increase in preticipation in different months of the year the city reduced the number of accidents is and conversely reduced preticipation will increase in urban crashes.

The reason for this is especially on rainy days in the snow for fear of car accidents refuse to pull vehicles out of the house and reduce traffic in the city are vehicles such as motorcycles, the second reason precipitations when vehicle speed is reduced drastically this helps to reduce urban traffic.

Comparing Figure 6 (mean number of accidents from 2004 to 2011 years) and Figure 9 (average freezing 2004 to 2011 years) is observed the number of accidents on ice months like January, February and March are reduced in the absence of frost and ice throughout increae the accidents, the reason for this is ice days for refusing to pull the driver out of the vehicle home vehicles including motorcycles reduce traffic in the city are this will help to reduce urban traffic.

Overall, the data analysis shows the most season crashes, that occure in the summer season, spring, winter will autumn and the highest monthly casualty in warm months like July, august, septamber does.

at the end of a brief comparison between urban and road impact of climate parameterson urban accidents , we as I mentioned looking at urban accidents and freezing,precipitation, low vehicle traffic and the number of accidents is reduced urban but in urban accidents is situation different. several factors can make in bad weather (rain and frost) to 30% increase in the number of road accidents:

- Reduction of vehicle resistance on slippery
- Reflections light from wet roads at night
-Reduce friction tire of car with the the lecel of the road in snow and ice days
-Lack of awareness of drivers, especially young drivers driving in bad weather conditions
- Stress and reduced driver concentration
- Drivers rush to get home early on rainy days
- Stress, disturbed concentration, and changes in driver behavior in the days of smooth and hot
- Increase or decrease the speed of the vehicle during wind days
- Overturning vehicles: the effect of wind on transport in impermanence moving vehicle,a long, double-deck buses, cars Karvanhav style.
- road block and fasten the roads finally make accidents.

Table 1: informatin on climatic parametrs (temprature- preticipation- freezing) 2004 to 2011 years

Number of frost per month	Monthly precipitation	Monthly temprature	Factor
9.3229	20.6177	12.8638	**Average**
2.5000	15.1500	13.1000	**Middle**
.0	.0	22.50	**Mode**
11.37171	22.12491	9.45895	**Standard deviation**

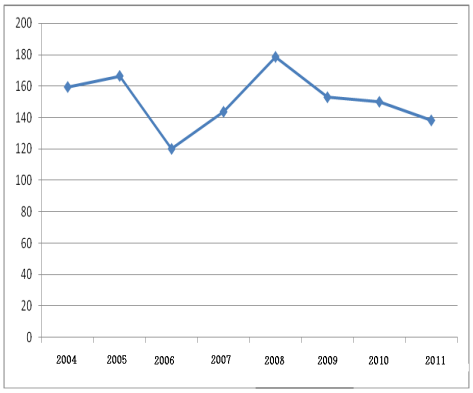
Table 3 : status of urban accident in shirvan for years 2004 to 2011

mount	2004		2005		2006		2007		2008		2009		2010		2011	
	accidents	victims	accidents	victims	accidents	victims	accidents	victims	accidents	victims	accidents	victims	accidents	victims	accidents	victims
Apr	68	55	65	52	57	45	59	47	58	46	54	42	51	39	47	35
May	63	49	60	48	52	39	54	42	53	41	50	38	52	40	56	44
June	52	42	58	45	53	40	55	43	50	38	54	42	57	45	53	41
July	87	70	80	63	76	58	72	56	74	57	65	49	66	50	76	60
Aug	79	59	75	60	70	54	75	61	62	47	72	56	67	51	74	58
Sept	60	51	84	65	68	52	64	57	71	59	69	57	74	59	65	50
Oct	58	50	64	52	59	48	64	50	55	41	59	45	61	47	56	42
Nov	63	52	58	44	52	38	58	45	53	39	55	41	56	42	53	39
Dec	66	48	61	48	53	39	49	36	51	38	51	35	41	37	50	36
Jan	59	43	56	45	48	38	52	40	47	35	50	39	42	30	43	32
Feb	61	50	61	48	52	41	47	38	51	39	51	40	45	34	40	31
Mar	57	47	55	44	54	42	58	44	53	42	43	31	50	39	48	37
Total	773	617	777	614	694	534	707	549	678	522	673	516	662	513	661	505

Map 1: Accident- prone spots in shirvan

Figure 1 : annual temprature 2004 to 2011

Figure 2 : Annual , precipitation 2004 to 2011



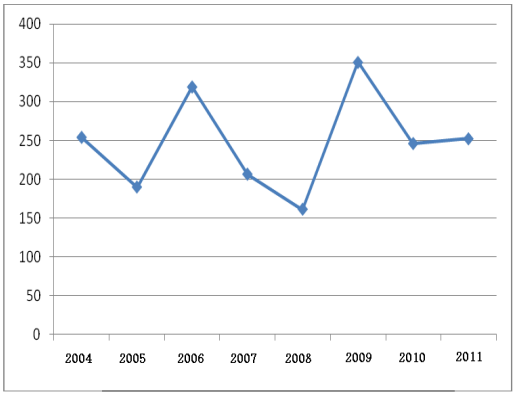
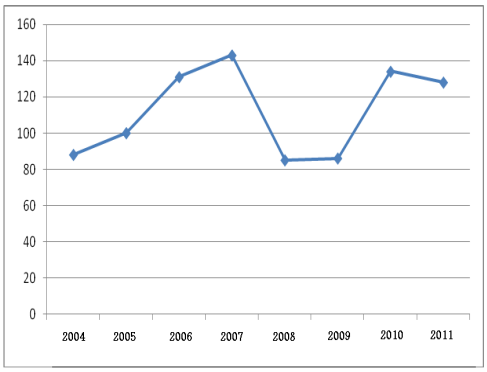


Figure 3 : the number of frost days per years 2004 to 2011

Figure 4: Number of accident per years 2004 to 2011



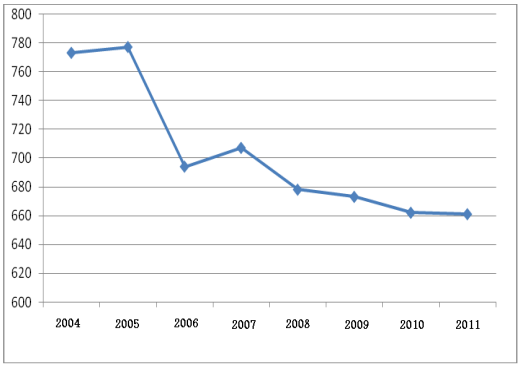


Figure 5: The annual nuber of victims 2004 to 2011

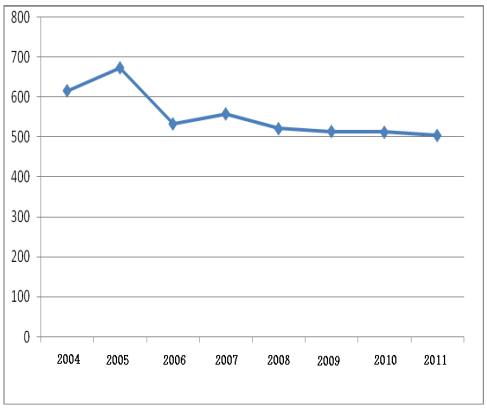


Figure 6: avrage number of accident from 2004 to 2011

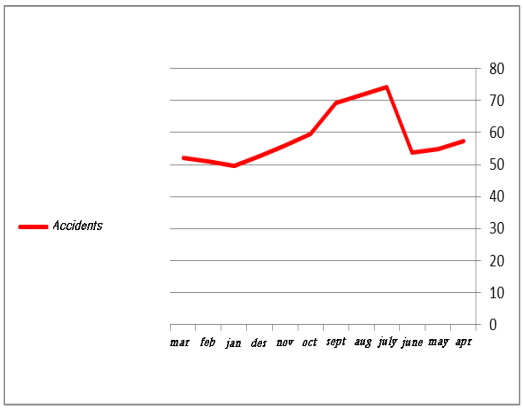


Figure 8: avrage monthly preticipation from 2004 to 2011

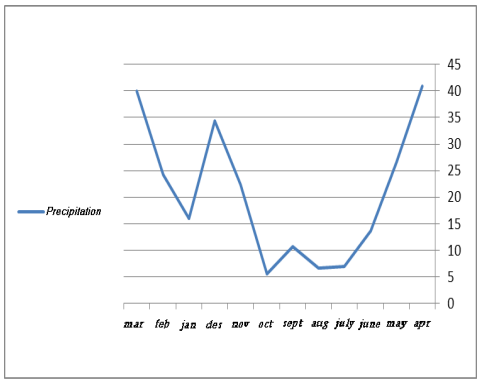


Figure 7: avrage monthly temprature from 2004 to 2011

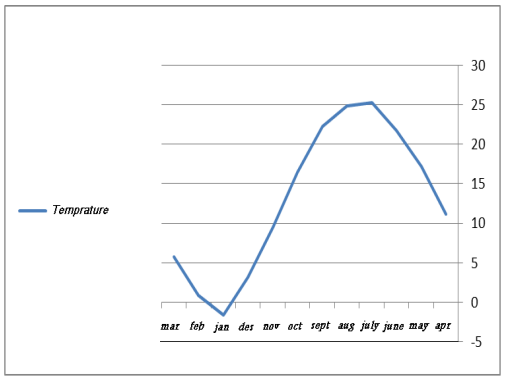
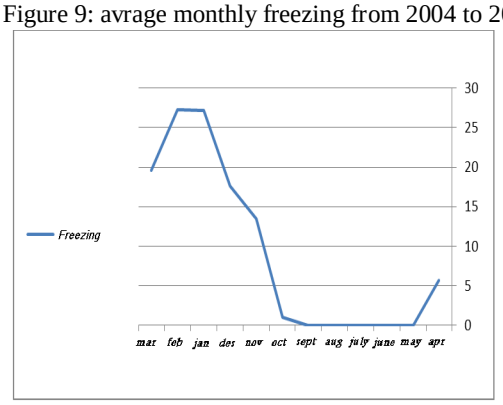


Figure 9: avrage monthly freezing from 2004 to 2011



Conclusion

According to the findings of given this study weredetermined The highest temperure number of accidents in the city in the summer to summer, spring, winter and warm months also June, September august ... Occur conversely lowest urban crashes i in the cold months of December, January, February and March occurs.
Investigation showed that the temperature rise due to vehicle traffic the number of motorcycle accidents is increasing, especially in urban conversely, the lower the temperature and reduce vehicle is reducedof urban motorcycle accidents. the research was based on theThe increase in the number of frost days, precipitationand the number of urban traffic is reduced conversely, decreased precipitation and reduced frost days, increased accidents are urban.

Suggestions:
1 - accurate and timely information about the status of the city streets.
Unfavorable particularly Weather by weather conditions, in the local press
2 - substitution of less harmful chemicals instead of salt to melt snow quickly
3 - Installation of safety signs in the city where there is a possibility Slip
4 – proving information on climate variables influencing city planning against atmospheric phenomena
5 - Preparation statistics and information from black spots around the city, and efforts to reform and standardize
6 - coordination and continuous communication between the police Meteorological Organization, Red Cross, emergency services,transportation and city council for crisis situations
7 - Control of public transport, such as a single line, taxi and private city
Terms of possessing equipment to ensure safety and the safety level of the vehicle
8-physical and mental health status of urban drivers
9-Observing speed limits by driving in snow and ice city level
10-Standard for safety of streets and passages city level from the point of view safety in of the Inappropriate weather conditions

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