Statistical analysis of weather related Road Accidents in Iran

Dr. Majid Habibi Nokhandan
Faculty Member of Atmospheric Science and Meteorological Research Institute,
E-mail: habibi@irimet.net

ABSTRACT

Iran has a specific kind of climate due to its geographical location and some effective factors like topography and distance from water bodies. Most of the country is covered by mountain ranges of Alborz and Zagros and some sparce mountains in the interior parts. Most of roads pass through these mountainous areas. There are 237 dangerous and snow prone passes. Many of these passes are blocked during cold months by heavy snowfalls, avalanches, blizzards, black ice, dense fogs. Which causes considerable damage to the economy of the country.

Inclement weather creates a chronic hazard on Mountainous roads in Iran. Past studies indicate that road collisions rate increase during precipitation & road frosts. The goal of the current study is assessment of relationship between Road accidents and weather condition with statistical Methods.

Keywords: Inclement weather, Weather related road accident, Pavement conditions, adverse condition.

1. INTRODUCTION

Road accidents are a significant cause death and injury the world over. Despite the enormous improvements in road safety in some countries over the past few decades, nearly 1.2 million people are killed every year in road traffic accidents around the world (9). About 90 percent happen in developing countries, most of them among pedestrians, bicyclists, motorcyclists and passengers of publish transport. Between 20 and 50 million more people are seriously injured in such incidents every year, often resulting in disability.

Iran has one of the highest rates of road accident in the world with more than of 200,000 reported annually (table.1). 46.8 percent of car accidents take place inside cities, 21.5 percent outside cities, 19.5 percent in rural routes, 4.2 percent in suburban highways (9).

The vast majority of road accidents occur in 1998 (about 232407 road accidents) with raise about 701 percent from 1991 to 1998(Fig. 1).

Table 1.Number of accidents in Iran

Year				
	Fatal	Injury	Property Damages	Total
1991	1790	13513	13700	**29003**
1992	2271	22771	47649	**72691**
1993	2065	24057	63209	**89331**
1994	468	23578	76866	**100912**
1995	1656	20987	81931	**104574**
1996	2628	34295	166891	**203814**
1997	2137	33749	188570	**224456**
1998	2064	37584	192759	**232407**

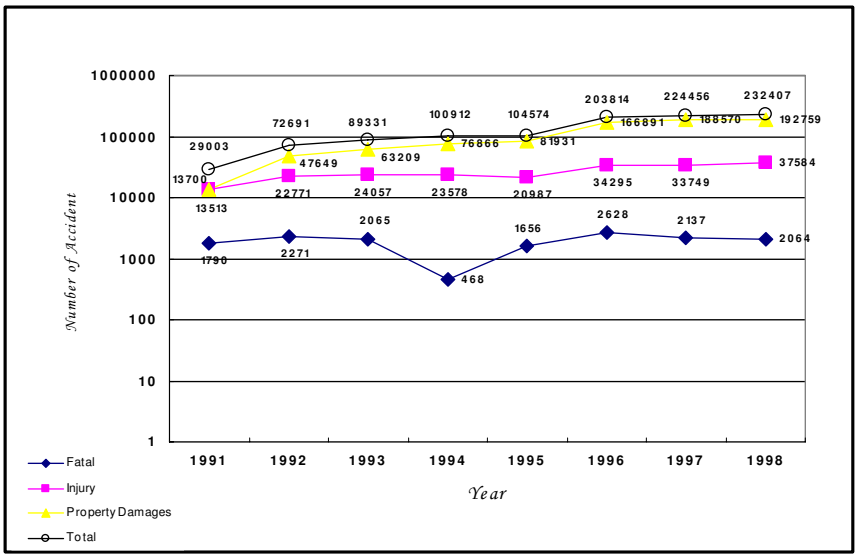

Fig 1. The number of road accidents in Iran (1991-1998).

The number of fatal crashes decreased from 1790 in 1991 to 468 in 1994 before increasing to 2064 in 1998. Overall the number of fatal, injury and property damages has increased in this period (1991-1998).

1.1. The Role of the Weather

It has long been recognized that road accidents are the consequence of the combined effects of several different factors, broadly grouped as behavioral, technological and environmental. The absence of any one of these factors could prevent an accident from occurring. Weather may not be a principal cause of such accidents, but nonetheless is an important component. Most people perceive the weather not to be a deterrent to driving unless conditions become so severe that the journey becomes impractical, rather than canceling the trip merely because it is " less safe"[11], [12]. In spite of this, several studies have demonstrated a relationship between weather and road transport [1].

There has been considerable research, using published national road accident statistics, into the effects of weather road accidents [5],[11],[7],[6]. There have been studies examining geographical variations in road accident casualty rates [13],[10]. In neither case has the issue of regional weather related road accident been addressed.

2. DATA & METHODS

Data concerning road accident in Iran are become available at the national level from 1991 to 1998. Prior to that year, only information concerning fatal accident was collected. Today published national road accident data are compiled by the transportation organization based on information received from the police office.

In Iran data concerning weather at the time of an accident is available. Current information concerning the weather condition at the time of an accident is recorded under one of six codes (table2).

Weather Condition	Code
Fine	1
Fog	2
Snowing	3
Raining	4
High wind	5
Cloudiness	6

Table2. Weather Conditions

This study is based on analysis of weather- related road accidents records for an eight year period (1991-1998) in Iran. Weather-related crashes are defined as those crashes that occur in poor pavement or weather

conditions. It should be noted that these conditions may not necessarily be the cause of weather-related crashes [5].

2.1. Crashes on Pavement Conditions

Figure 2a and 2b show the number of injury and fatal crashes occurring on different pavement conditions. Most fatal and injury crashes occur on dry pavement, but on slick pavement, most fatal and injury is related to wet pavement.

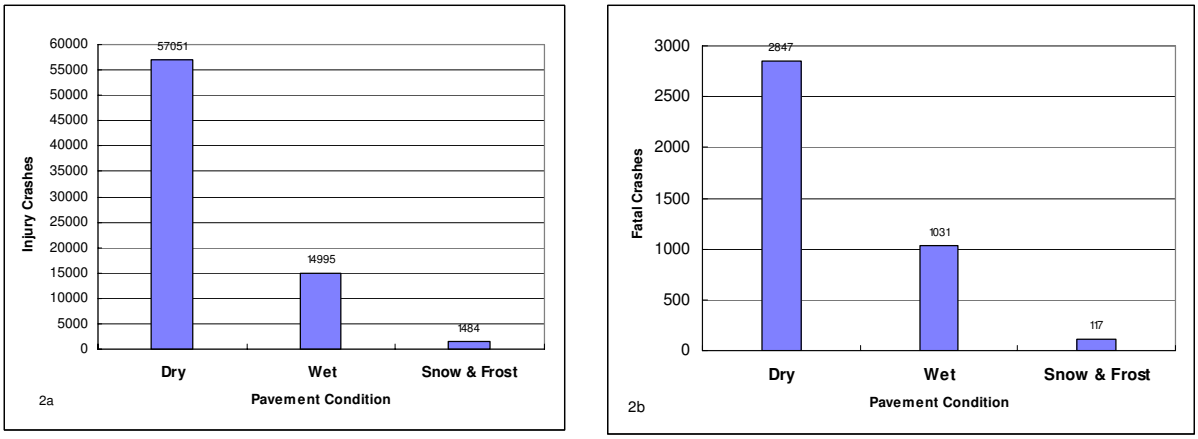

Fig 2a & 2b. Injury & fatal crashes on pavement conditions (1991-1998)

In Figure 3 crash trends on pavement conditions are shown from 1991 to 1998. Over this period, dry pavement crashes decreased from 3002 in 1991 to 558 in 1992 before increasing to 10030 in 1998. The number of injury and fatal crashes on wet pavement has generally risen over time from 161 in 1991 to 2828 in 1998. Crashes on snow and frost pavement have also generally risen from 8 in 1991 to 370 in 1998. Overall the number injury and fatal crashes on different pavement conditions was increased from 3171 in 1991 to 13,228 in 1998.

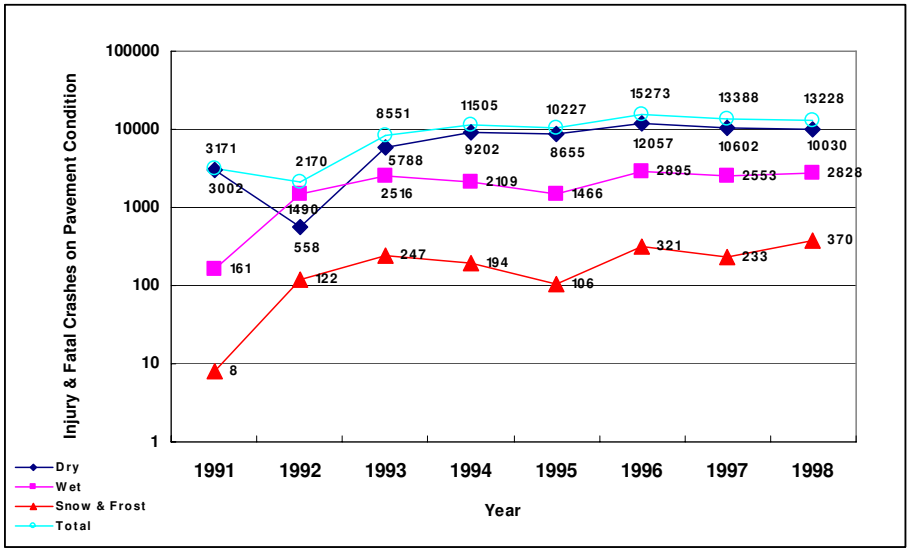

Fig 3. Injury & fatal crashes on pavement conditions

2.2-Crashes in Adverse Weather

Four adverse weather categories are included in the figures below. Among this, rain, snow and fog are the most important. The number of injury and fatal crashes occurring in "Adverse Weather" is shown in figure 4. Nearly 67 percent of injury occurs in rain and 23 percent happens in snow. Fatal crashes in rain, snow and fog account for 55 percent, 33 percent and 10 percent.

	Fatal	Injury	Total	%	
Weather Condition				**Fatal**	**Injury**
Rain	1109	16069	17178	55	67
Snow	662	5514	6176	33	23
High Wind	37	237	274	2	1
Fog	201	2197	2398	10	9
Total	2009	24017			

Table3. Injury & fatal crashes in adverse weather

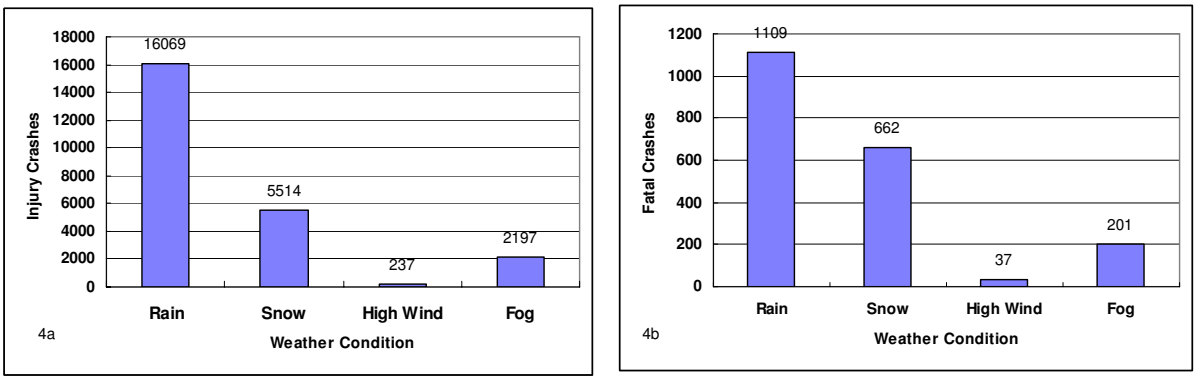

Fig 4a & 4b. Injury & fatal crashes in adverse weather (1991-1998)

Crash trends in adverse weather from 1991 to 1998 are shown in figure 5. In this period, the number of injury and fatal crashes in rain increased from 1302 to 2693. Crashes in snow decreased from 788 in 1991 to 152 in 1995 and then increased to 393 in 1998. The incidence of injury and fatal crashes in fog rose from 148 in 1991 to 327 in 1996 before decreasing to 271 in 1998. Crashes in high wind increased from 18 in 1991 to 48 in 1992 before falling to 35 in 1998.

Overall, the number injury and fatal crashes in "Adverse Weather" increased from 2256 in 1991 to 3392 in 1998.

Table4. Injury & fatal crashes in adverse weather by year

Year	Rain	Snow	Fog	High wind	Total	%			
						Rain	Snow	Fog	High wind
1991	1302	788	148	18	2256	58	35	7	1
1992	1695	266	230	48	2239	76	12	10	2
1993	1958	349	368	24	2699	73	13	14	1
1994	1753	220	301	31	2305	76	10	13	1
1995	1311	152	252	21	1736	76	9	15	1
1996	2597	392	327	38	3354	77	12	10	1
1997	2351	277	333	45	3006	78	9	11	1
1998	2693	393	271	35	3392	79	12	8	1

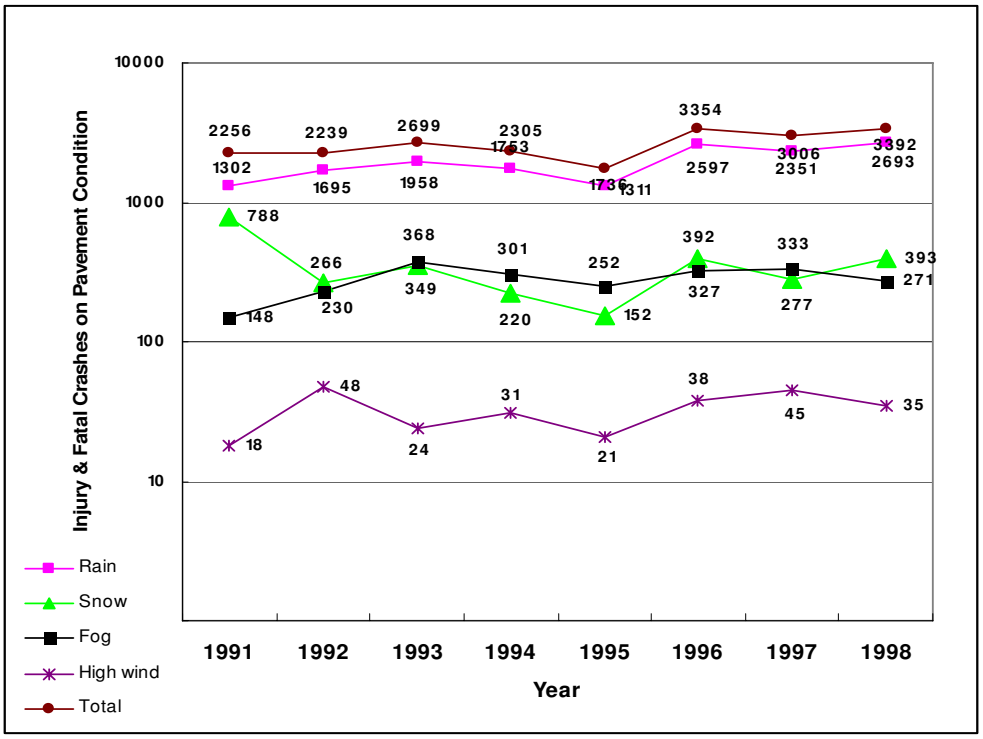

Fig 5. Injury & fatal crashes in adverse weather (1991-1998)

3-CONCLUSION

This paper is the first study to compare weather – related Road accident risks in Iran. It is evident from the conclusions of this study that there is a marked positive relationship between the incidence of weather hazards and road accidents reported under such conditions.

It is evident that vast majority of accidents in Iran Occur during non hazardous fine weather because Iran is a one of the sun sky countries that is located in the world desert belt; therefore, fine conditions road accident is high apparently. In adverse condition, most injury and fatal crashes happen when the pavement is wet and during rainfall.

Having concentrated on the category of weather alone, additional research is required which should take into account the interaction of weather conditions, with other Parameters, such as vehicle type, road category, vehicle manoeuvre being undertaken and the age, experience and sex of the drivers concerned.

Future investigations should focus on:

Expanding the study to include more regions – both urban and rural – in order to determine a national risk index.

Exploring the importance of different weather variables (e.g. intensity, duration) and the interaction between various weather and non-weather factors as they affect driving risk; and

Documenting the relationship between weather – related accidents and particular adjustments to road-weather hazards (e.g., winter road maintenance and weather forecasts.

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