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Research Article

Analyzing Accidents Caused by Overturn of Vehicles (Case Study of Iran-Zanjan Province in 2010)

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Abstract: Today, issue of accidents has turned into a great complication in Iran and it can be interpreted as silent killer which causes death of tens of human. Of the major and effective factors in occurrence of accidents are vehicle and road each playing role according to the available statistics. One of the major causes which cause serious injuries and cause death of the passengers of vehicles by 50% according to the available statistics is overturn of vehicle and all of the three factors mentioned above can play essential role in its emergence which is mostly caused by human. This paper studies causes of overturn based on the available statistics in 2010 relating to Zanjan Province, one of the provinces of northwest of Iran and suggested ways for reducing it in this province.

Keywords: Accidents, human, overturn, silent killer, vehicle

INTRODUCTION

Based on reports of Iran Police Department in 2010, unfortunately, more than 4000 accidents have occurred in totally 182000 km of roads of Iran which led to death of more than 23000 persons and injury of about 312000 persons. This Department considers human factor and violation of traffic regulations, the presence of hazardous sections and points, auto scraps and many other economic factors which are effective on term and manner of driving as the fixed factors causing accidents.

Since one of the factors in death and injury of people in car accident is vehicle, the information presented by researches center of Iran Islamic Consultative Assembly shows that Asian countries and Mediterranean Sea area with 16% of total vehicles in the world experience more than 44% of mortality rate of driving accidents (Organization Police, 2010). From another perspective, study of all mortality rates resulting from driving accidents in the world shows that Asia, Africa and Latin America have 80% of mortality rate of driving accidents while share of the European countries is only 12% and the remaining share belongs to other countries.

In this study, attempt has been made to analyze road accidents caused by overturn by punching necessary information of Cam 114 forms in 2010 and using SPSS statistical software.

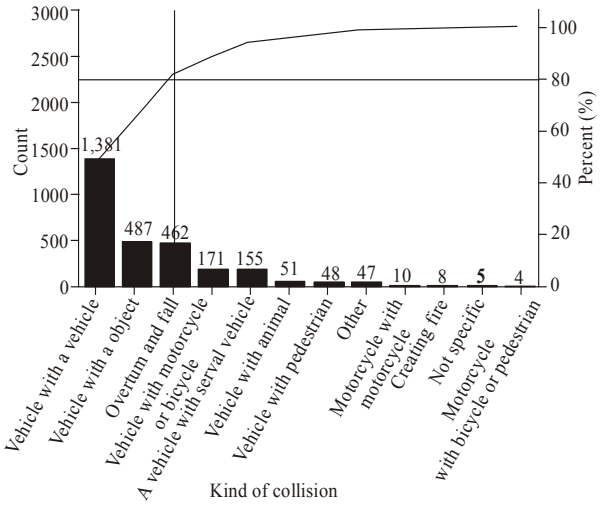

Fig. 1: Pareto diagram of collision in all accidents of the province

GOALS OF THIS PAPER

Main goal of this paper is to study factors affecting overturn accidents in extra-city roads of Zanjan Province. The following goals are the subset of main goals (Transportation and Terminals Organization of Zanjan, 2010):

- Studying status of overturn accidents compared with other accidents

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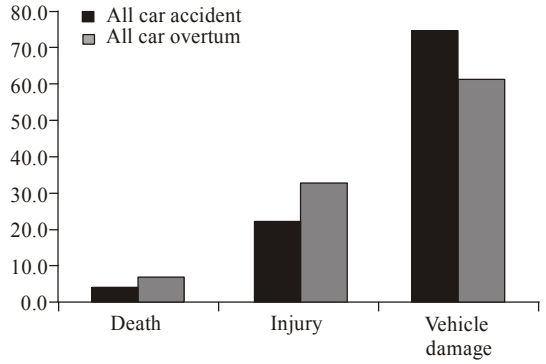

Fig. 2: Pareto diagram of road accidents of the province compared with overturn accidents

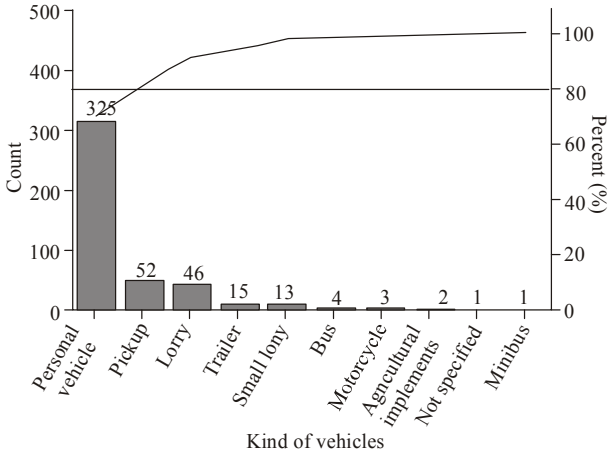

Fig. 3: Pareto diagram of road accidents of the province in terms of faulty accidents

- Identifying factors relating to time of accident in overturn road accidents
- Identifying factors relating to place of accident in overturn road accidents
- Identifying factors relating to drivers in overturn road accidents
- Identifying factors relating to weather and road condition and geometrical design of road in overturn road accidents
- Identifying factors relating to vehicle effective on overturn road accidents

Studying status of overturn accidents compared with other accidents in Zanjan province:

Collision: The diagram of Fig. 1 shows that 25% of 12 collisions in accidents i.e., a vehicle with vehicle, vehicle with object, overturn and fall have caused more than 80% of accidents of which above 16% related to overturn which is considerable.

Type of accident: Figure 2 shows that injury and death cases in overturn accidents are more frequent than those in other accidents. In other words, about 7% of total accidents leading to overturn led to death of passengers and about 33% led to injury of the passengers and about 60% only incurred damage while these percents are 4, 22 and 74%, respectively.

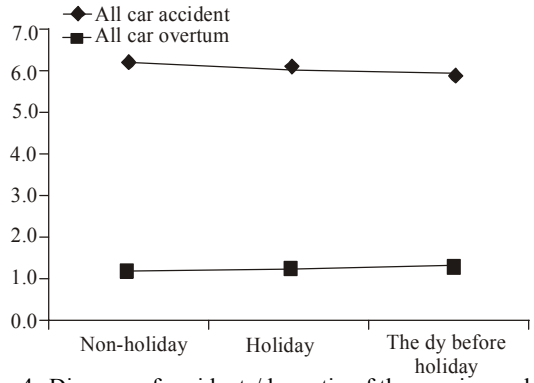

Fig. 4: Diagram of accidents/day ratio of the province relative to overturn in terms of day of accident

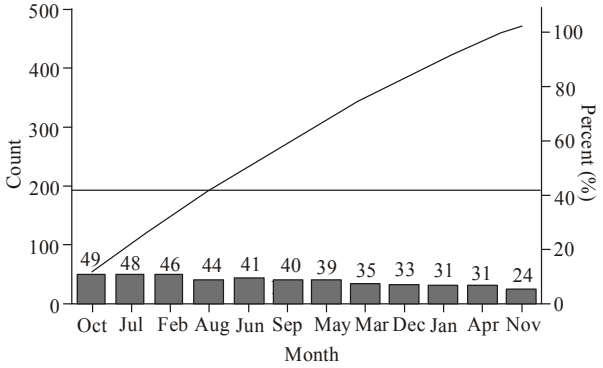

Fig. 5: Pareto diagram of overturn accidents month

Type of faulty vehicle: As shown in Fig. 3, about 70% of personal vehicle had accidents leading to overturn and some of the passengers of these vehicles die due to unsafe personal vehicle and some precautions should be taken to increase safety and strength of the hull and ceiling of these vehicles to reduce mortality resulting from these accidents.

This diagram shows that 20% of the vehicles which had accident leading to overturn (passenger and pickup) had more than 80% of accidents leading to overturn of the province and considerable percent i.e., about 70% of the accidents were caused by passenger vehicle.

Factors relating to time position at time of overturn road accidents:

Day of accident: Figure 4 shows that we see more accidents leading to overturn in the days before holiday than other days while accidents are less frequent in the days before holiday than other days.

Month of accident: Pareto diagram of Fig. 5 shows that more than 40% of accidents leading to overturn have occurred in 4 months i.e., October, July, February and August. In diagram of Fig. 6 you can see total accident percent of the province compared with overturn accidents based on month of accident.

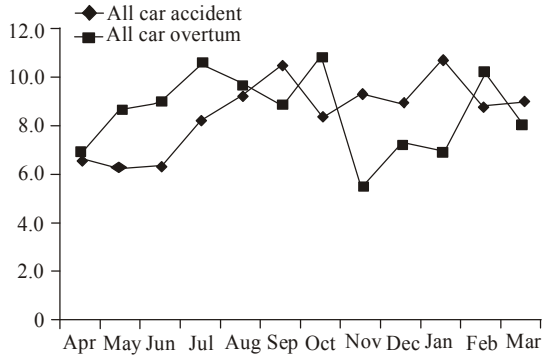

Fig. 6: Diagram of total accidents percent of the province compared with overturn accidents based on month of accident

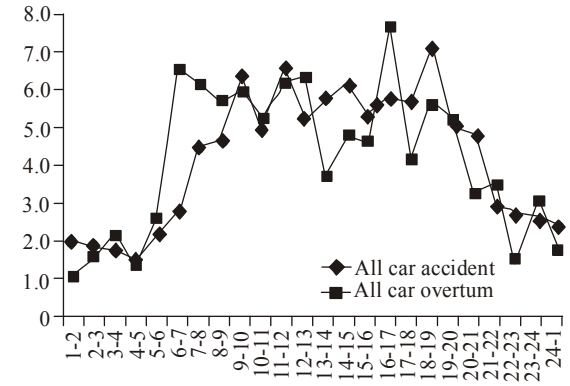

Fig. 7: Diagram of total accidents of province compared with overturn accidents in terms of hour of accident

Hour of accident: Figure 7 shows the highest number of accidents leading to overturn in 4-5 P.M while other accidents have reached its peak at 6-7 P.M.

Factors relating to spatial position in occurrence of overturn road accidents:

Distance of accidents: Diagram of Fig. 8 doesn't show a special trend considering distance between overturned vehicle and origin. This diagram shows that distance from origin has no special effect on overturn of vehicle.

Accident place axis: Pareto Diagram of Fig. 9 shows that more than 60% of accidents leading to overturn occur in 3 out of 14 routes available in Zanjan Province which are Zanjan-Qazvin Highway, Zanjan Tabriz Highway and Zanjan-Mianeh Highway due to long driving time and fatigue of driver, excessive failures of asphalt, traffic more than the expected capacity of road etc. In diagram of Fig. 10 you can see total accident of the province compared with overturn accidents in terms of accidents axis.

Position of accident: Diagram of Fig. 11 shows that about 65% of overturn accidents has occurred in street lane. This diagram can make human factor and factor of quality of road in overturn accidents more evident.

Accident place specification: Diagram of Fig. 12 shows that more than 90% of overturn accidents has occurred in ordinary condition of road which shows evident effect of human factor on occurrence of these accidents.

Use of the region of accident place: The diagram of Fig. 13 shows that about 60% of the accidents leading to overturn have occurred between cities and about 30% in agricultural regions. Considering this diagram, factor of pavement quality in agricultural regions can be

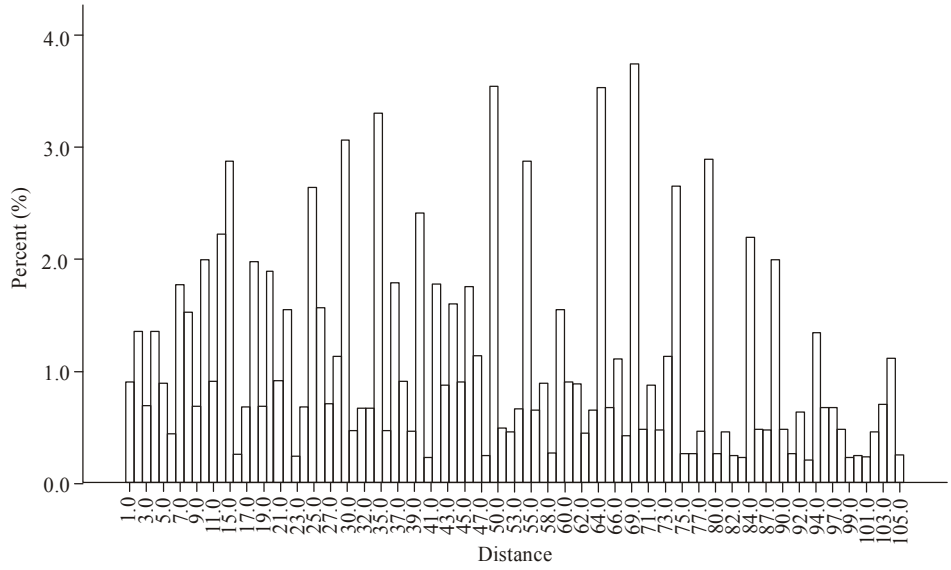

Fig. 8: Diagram of overturn accidents in terms of distance between place of accident and origin

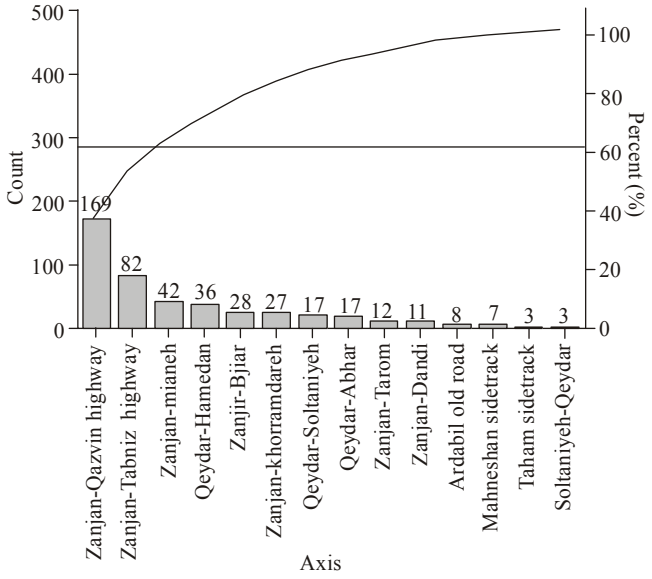

Fig. 9: Pareto diagram of overturn accidents place

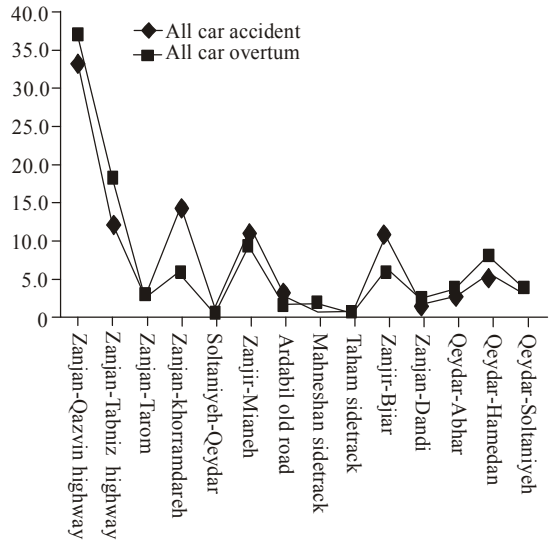

Fig. 10: Diagram of total accidents of the province compared with overturn accidents in terms of accidents axis

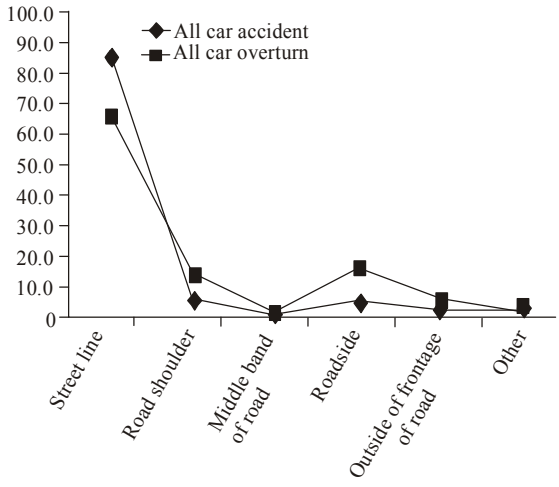

Fig. 11: Diagram of total accidents of the province compared with overturn accidents in terms of accidents position

regarded as important factor of accidents caused by overturn in these regions.

Identifying factors relating to drivers in overturn road accidents:

Effective human factor: Diagram of Fig. 14 shows that about 35% of the causes of overturn accidents is unreasonable hurry of driver and more than 25% of cases relates to exhaustion and somnolence of driver. Both cases above can result from factors such as economic, cultural and social issues of driver. Cultural issues can be regarded as the most important factor of such accidents which can be taught by culture building through mass media of drivers.

Absolute cause of accidents: Diagram of Fig. 15 shows that the most important cause of accidents leads to overturn is inability to control vehicle by driver and lack of attention to the front and vehicle control test should be included in practical tests for issuing certificate.

Age of faulty driver: Diagram of Fig. 16 shows that about 60% of overturn accidents occurs in 30% of age range of 21 to 40 years and this age range can be named dangerous age range. One of the reasons for increase of overturn accidents in this age range is unawareness of people with driving and high emotion which can be reduced through proper training. In diagram of Fig. 17 you can see the total accidents of the province

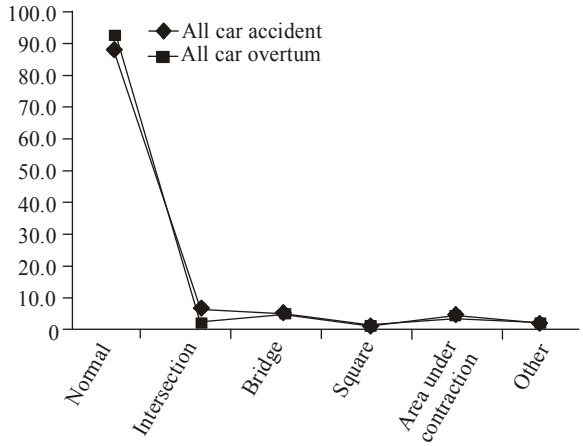

Fig. 12: Diagram of total accidents of the province compared with overturn accidents in terms of accident place specification

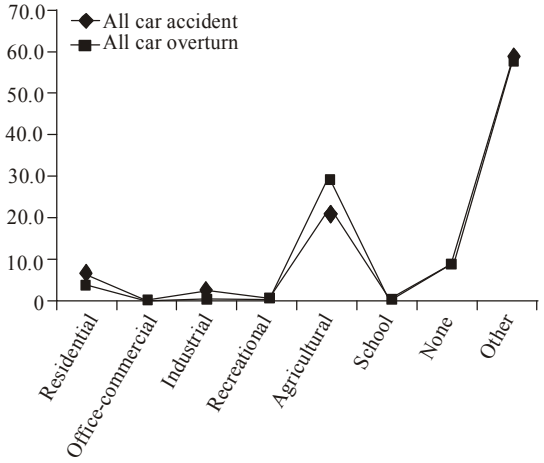

Fig. 13: Diagram of total accidents of the province compared with overturn accidents in terms of accident place use

compared with overturn accidents in terms of age of faulty driver.

Education of faulty driver: Diagram of Fig. 18 shows that educational level plays role in reduction of accidents which indicates awareness of people with proper driving and outcomes of hurried and improper driving. In diagram of Fig. 19 you can see the total accidents of the province compared with overturn accidents in terms of education of faulty driver.

Identifying factors relating to weather and road condition and geometrical design of road in overturn road accidents:

Weather condition at time of accident: Diagram of Fig. 20 shows that more than 70% of overturn accidents have occurred in clear sky which can indicate that speed of vehicles was higher than other conditions and one of the most important factors in overturn accidents which should cause to reduce speed of

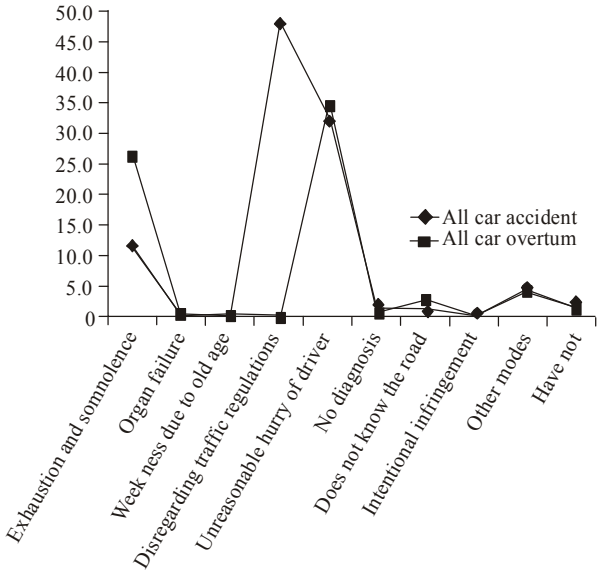

Fig. 14: Diagram of total accidents of the province compared with overturn accidents in terms of effective human factor in accident

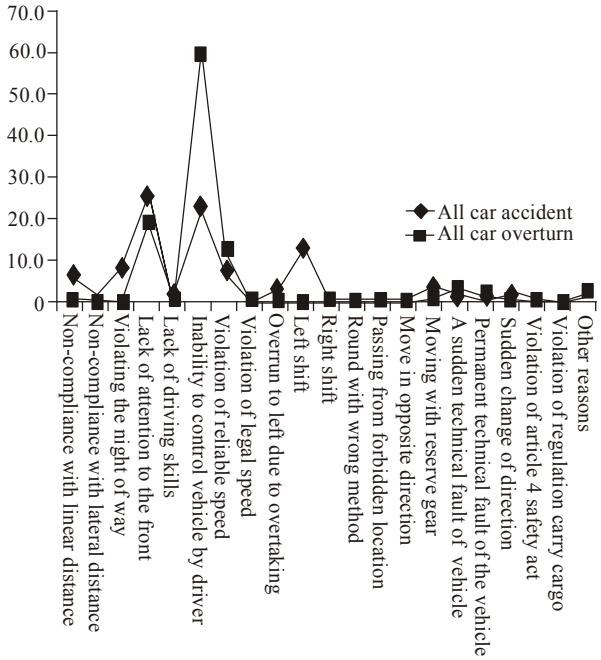

Fig. 15: Diagram of total accidents of the province compared with overturn accidents in terms of absolute cause in accident

vehicles by building public culture and increasing tangible and intangible control of speed of vehicles.

Conditions of sidewalk surface at time of accident: Diagram of Fig. 21 shows that about 80% of overturn accidents has occurred in dry condition of sidewalk which can indicate high speed and lack of attention of driver to the front. About 10% of overturn accidents has occurred in icy and snowy sidewalk which is due to failure to use snow chain and the absence of reliable brake in vehicles.

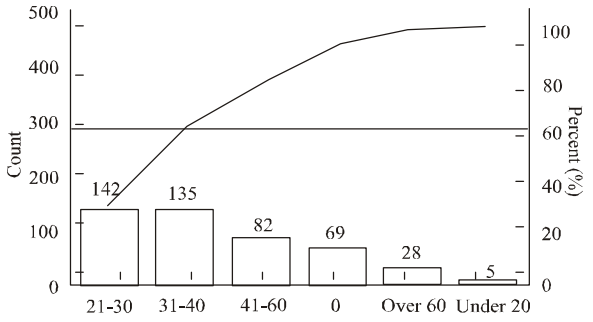

Fig. 16: Pareto diagram of age of faulty driver in overturn accidents

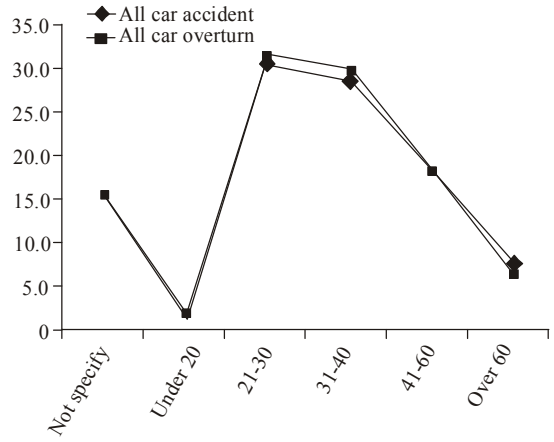

Fig. 17: Diagram of total accidents of the province compared with overturn accidents in terms of age of faulty driver

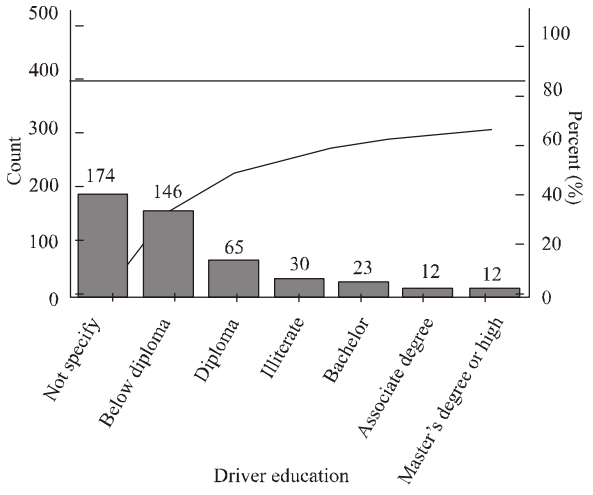

Fig. 18: Pareto diagram of faulty driver in overturn accidents

Defects of sidewalk effective in accident: Diagram of Fig. 22 shows that about 50% of sidewalk in which overturn accidents occurred had no defect and 20% of the cases related to narrowness of sidewalk for which necessary actions should be taken for increasing width of road and about 10% of cases relate to slipperiness of

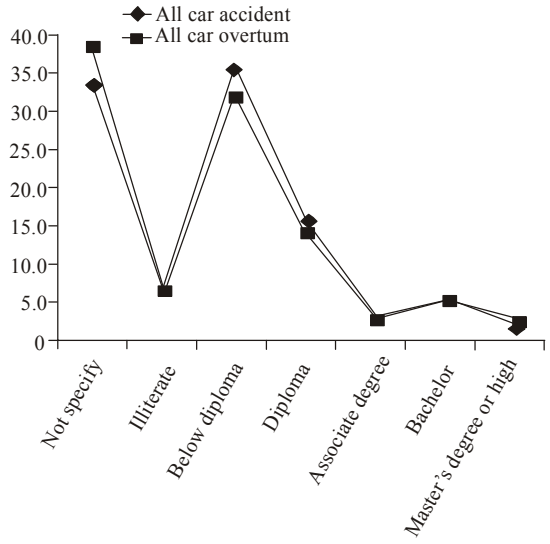

Fig. 19: Diagram of total accidents of the province compared with overturn accidents in terms of education of faulty driver

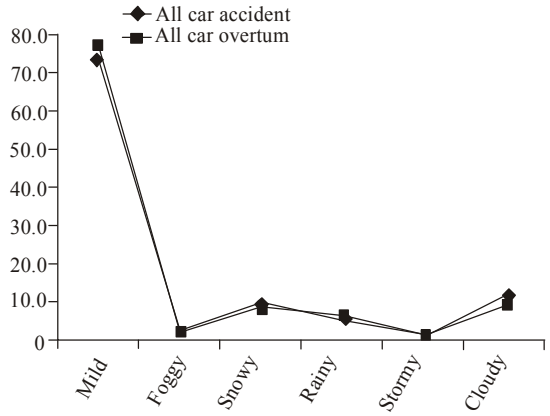

Fig. 20: Diagram of total accidents of the province compared with overturn accidents in terms of weather condition of faulty driver

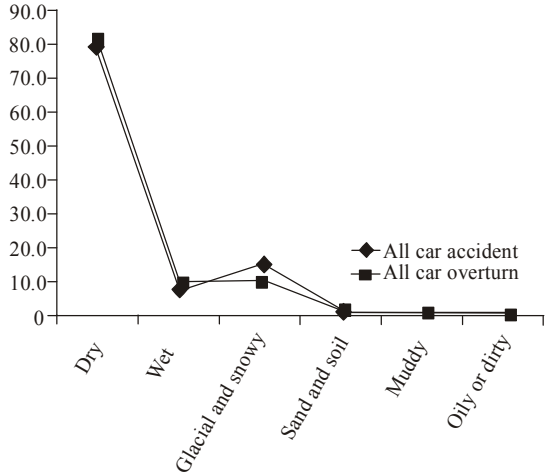

Fig. 21: Diagram of total accidents of the province compared with overturn accidents in terms of sidewalk surface at time of accident

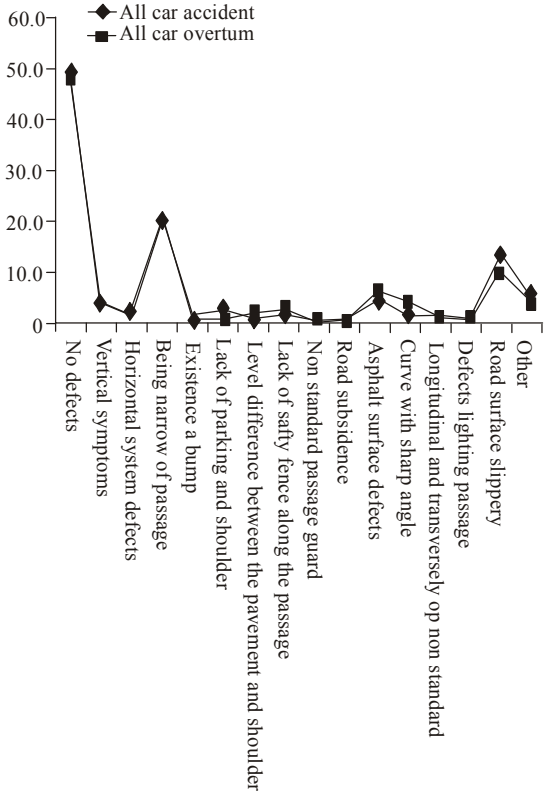

Fig. 22: Diagram of total accidents of the province compared with overturn accidents in terms of defects of sidewalk effective in accident

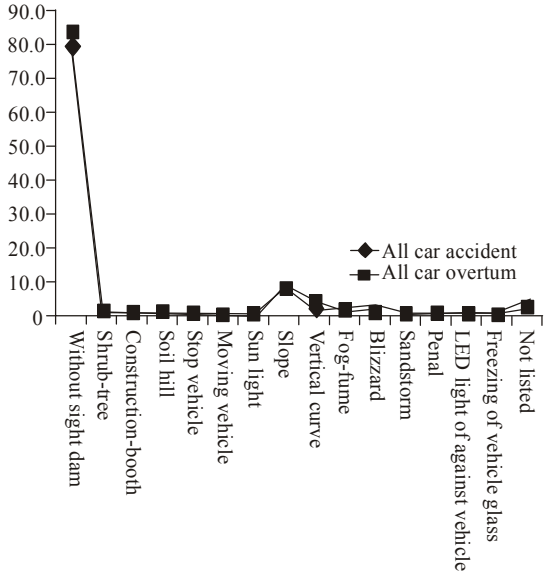

Fig. 23: Diagram of total accidents of the province compared with overturn accidents in terms of barriers of vision effective in accident

the sidewalk surface and necessary precautions should be taken to use snow chain and correct coating of asphalt.

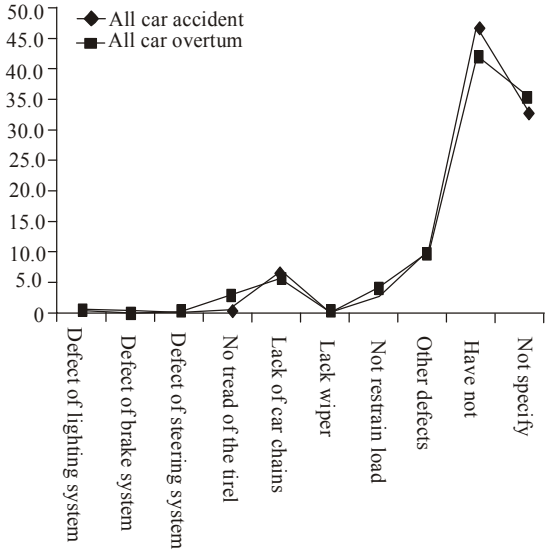

Fig. 24: Diagram of total accidents of the province compared with overturn accidents in terms of factor of faulty vehicle in accident

Barriers of vision effective in accident: Diagram of Fig. 23 shows that there is no barrier of vision in more than 80% of cases and there is blind spot in about 10% of the cases due to interference of slope with horizontal arc and has caused accident and these places should be identified and steep routes located in horizontal arc should be removed.

Identifying factors relating to drivers in overturn road accidents:

Factor of faulty vehicle in accident: Diagram of Fig. 24 shows that vehicle has no defect in more than 40% of cases and factors which cause accident relate to driver and road.

CONCLUSION

It is concluded from the presented diagrams and discussion that human factor plays considerable role in emergence of accidents leading to overturn in the first instance which includes high speed and lack of attention to the front and then factors of road and vehicle are important and such accidents which lead to death and injury of many passengers of cars should be prevented by increasing public culture building and controlling vehicles tangibly and intangibly i.e., by increasing fines.

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