Prevention to Reduce Traffic Accidents by Using Data Mining: Case Study Alghat Province

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Abstract:- *The purpose of this paper is to use data mining techniques to search for additional factors have an impact in reducing traffic accidents, despite the regulation and control of highways and Cars safety standards and previous studies in this area, but did not drop of traffic accidents, where the present study addressed the group by using data mining to help reduce traffic accidents and research objectives that prospecting database leads to grab and extract useful data patterns, and modern technology has become Task under rapid development and widespread use of databases, prospecting techniques to many questions, and in record time particularly complex questions difficult to answer them using classical statistical techniques that take a long time and many actions. The study used to build future predictions and explore the behavior and trends through data mining, which allow estimating the right decisions and taking timely and scientific solutions through a form to reduce traffic accidents increased community awareness of the factors that lead to traffic accidents. The importance of the study is to address modern technologies address multiple aspects not mentioned in previous studies relying on data traffic and define the community strategies for prevention of traffic accidents and the limitation of Al ghat province has been selected for hazardous geography in which the vital road link between Riyadh, central area, and Medina Manawra and the important roles the Department of traffic and General Hospital and civil defense in province. The study pointed out that there is no coordination between the concerned authorities to register traffic accident, also reported that the collision between two cars and a collision fixed object crashes accounted for the highest percentage of the quality of the accident (73.4%), most of the accidents were on the highway was (64.1%), the behavior of users the road is the most causes of accidents. The researchers have made some proposals to reduce from traffic accidents.*

Keywords: - Data mining, traffic accidents, reduce, Prevention, SPSS

I. Introduction

Traffic accidents have become represents significantly obsession and concern for all members of society, and has became one of the most important problems that drain physical resources and human energies and target communities in the most important necessities of life which is the human element in addition to incurred from the social and psychological problems and huge material losses. They must confront these problems be based on scientific grounds based on the combination of the various efforts and disciplines and requires access to data relating to the problem and this data can be obtained from official sources, traffic devices, and if you did not get it becomes necessary to do a field study of a collection of facts, and develop solutions and proposals to remedy them or prevention to reduce them. In this research were obtained statistics from the traffic department in Ghat province, which was the reference to the size

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of this phenomenon, but it does not give any indication to look at the causes of traffic accidents, was there a field study to investigate the causes of traffic accidents, as is well known to all the elements that share the responsibility in traffic Accidents are the driver, the road and the vehicle . Data mining is a promising area to deal with the increase in data storage that is generated in recently .It is the extraction of implicit, previously unknown and useful data. In this research we have used some of the data mining techniques, tools and Applications to clarify more factors that cause traffic accidents [18].

II.   Traffic accidents

A. *Definition of traffic accident*

Traffic accident is a sudden event that occurs without prior planning by the car (vehicle) and one or more with the cars (vehicles) or other or pedestrian or animals or objects on the road to a public or private. And usually it results in traffic accident damages between minor to property and vehicles to heavy lead to death or permanent disability [6]. Another definition: Defined as a traffic accident and incident occur without expectation and without a previous measure because of the availability of certain circumstances likely they occur and result in bad and unwanted results [8]. They also Defined that the problem of traffic resulting in damage or injuries or deaths inadvertently caused by the use of the vehicle [9].

B. *Types of traffic accidents [10]*

1. A collision between a car opposite (face to face)
2. Collision in the form of angle (collision between cars at intersections)
3. A collision from the rear (cars going in the same direction)
4. A side collision.
5. Coup accident
6. Collision during the rotation (turn around)

7. Rammed a parked car.
8. Rammed the fixed body.
9. Accident for one car (usually a coup or lost control of the car)
10. Run over pedestrians.
11. Rammed a bicycle.
12. Rammed animal.

C. *The reasons for traffic accidents*

1. Tiredness and driver overstrain.
2. The driver is busy driving.
3. Non-compliance with traffic regulations.
4.   Reckless driving.
5. Lack of car maintenance or testing.
6. Road conditions (work on the road, dangerous curves, lack of safety factors.

Weather conditions (rain, fog and sand)

The statistics and figures on accidents and traffic infractions give an idea about the traffic situation in the Kingdom of Saudi Arabia during the past years, and underline the responsibility of the human element in the traffic problems of the incidents and irregularities which are located in this country [11]. Where a large proportion of traffic accidents occur at the responsibility of the driver.

Most researchers and interested parties agree that the rate of traffic problems (85%) of traffic accidents are caused by the human aspect and that more factors that lead to traffic accidents are:

1. Speeding.
2. Lack of driver efficiency.
3. Lack of efficient means of transport processing (composite).
4. Traffic violation.
5. A lack of attention and focus from the driver.
6. The leadership in climatic conditions unsuitable.
7. The leadership in psychological states strong and emotionally charged [12].

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The fact that the driver is controlling element in how to deal with the vehicle and the road, the greatest responsibility lies upon himself to avoid falling or in a traffic accident. Therefore there must be interested and specialists in traffic safety research and study how you can help the driver avoid the traffic accidents, as well as protect it and his passenger from the intensity of the seriousness of the incidents.

III. Data mining

A. Definition of Data Mining

Data mining is the operation of determine valid and understandable patterns in the data set. It helps in extracting and refining useful knowledge from large data sets. The tasks of Data mining can be classified in to two categories: descriptive and predictive. The tasks of the Descriptive mining to distinction the general properties of the data in the database. The tasks of Predictive mining to performed Inference on the current data in order to make predictions [18].

Many people handle data mining as a synonym for another popularly used term, "Knowledge Discovery in Databases", or KDD. Instead of, others view data mining as simply an essential step in the process of knowledge discovery in databases [1] [7].
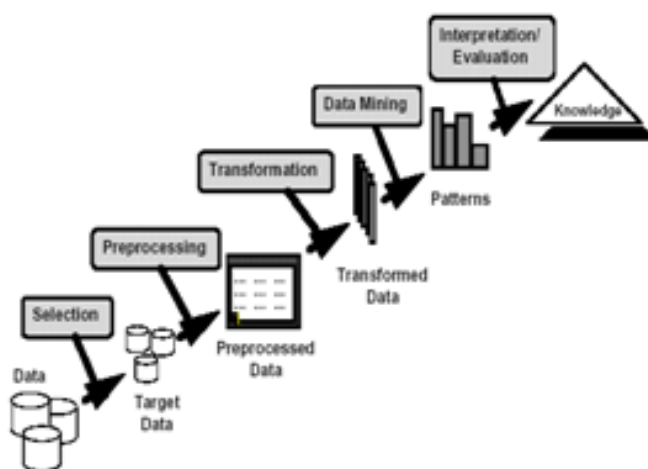

Fig (1): Data mining as a process of knowledge discovery [3]

B. How Data Mining Works

How is data mining able to say you important things that you didn't know or what is going to happen next? That technique that is used to perform these fears is called modeling. Modeling is simply the act of building a model (a set of examples or mathematical relationships) building on data from cases where the answer is known and then applying the model to other cases where the answers unknown. Modeling techniques have been around for centuries, of course, but it just recently that data storage and communication capabilities necessary to collect and store huge amounts of data, and the computational power to automating modeling techniques for work directly on the data, have been available.

C. Data Mining Technologies

The analytical techniques used in data mining usually well-known mathematical algorithms and techniques. What is new is the application of these techniques to general business problems made possible by the increased availability of data and inexpensive storage and processing power. Use of graphical interfaces has led to tools becoming available that business experts can easily use. There are many tools used to extract the data we mention some of them:

Artificial neural networks - Nonlinear predictive models that learn through training and resemble biological neural networks in structure.

Decision trees: Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset.

Nearest neighbor: A classification technique that classifies each record based on the records most similar to it in an historical database.

SPSS: Is a widely used program for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, [3] and others. Used for survey authoring and deployment (IBM SPSS

Data Collection), data mining (IBM SPSS Modeler), text analytics, and cooperation [2].

IV. The use case study methodology

This study was based on secondary data collected from governmental areas in addition to drawing a sample of 700 RTAs forms[13]for the past three years from Traffic Department (TD); Red Crescent (RC); Civil Defense (CD) and General Hospital (GH) , also from primary data collected by distributing a questionnaire for road users in of Alghat province in KSA, this province was selected because of the importance of its geographical location, where the highway road joining Riyadh AL medina passes beside it.

The population of the study was the highway road users in Alghat province and the visitors to this town. A simple random sample was designed to collect data from road users in order To study the behavior of the citizens and residents to use the road, as well as the knowledge of the causes of traffic accidents to develop a proposals and recommendations to reduce them.

First of all secondary data related to traffic accidents were collected from Traffic Department (The number of accidents per year, including the number of injured and deaths)[13] Red Crescent(Number of traffic accidents that have been resuscitated)[15]. Civil Defense (Number of monthly incidents that necessitated intervention)[16] General Hospital(RTA)[1].

The second part of secondary data was "the recording a traffic accident" to look at the data that is recorded for each accident, the data were collected by drawing a sample of 655 form. The information recorded included of location (25 location points, 12 of them on the highway joining Riyadh with Alqaseem area, 13 are distributed in the province), time (day, night), driver (Saudi, resident), type of accident (20 types of accidents reduced to 16 for the similarity of some), number of injured and number of deceased if any.

The primary data were collected by questionnaire designed and tested by Ethics Committee of Scientific Research[17], the questions were written in Arabic, 25 variables were included in questionnaire divided into four parts: personal information(age, educational level, occupation, nationality , marital status and place of resident), vehicle & driver relation information(vehicle type, model, cylinder size, insurance, driving experience ,the purpose of using the car),Driver behavior on the highways(7 questions), Traffic accidents that took place for the driver during the past two years(Do you have an accident during the last two years, How many times happened to you a traffic accident, What kind of traffic accidents happened to you?, Mention the damage that occurred to you).

The participants were categorized into 4 age categories depending on the values of X1 being

$$\left(\prec 20 \ , 20 \leq x_1 \prec 30 \ , 30 \leq x_1 \prec 40 \ , x_1 \geq 40 \right)$$

Respectively.

Traffic accidents were analyzed by age group for the driver and the place where it occurred, as well as by nationality, occupation, marital status and number of years of experience in driving.

V. RESULTS AND DISCUSSIONS

Table (1) presents the number of accidents happened in the past three years, the data show the 25% increase of accidents in 1434 compare with 1433 and 25% in 1435 comparing with 1434.

Table (1): The Distribution of road accident for years (1433-1435) [13]

year	Total number of accidents	Injured	death
1433	375	117	21
1434	472	138	68
1435	500	170	30

Table (2) shows the monthly data of R.T.A admission cases to hospital holed by R.C.The analysis show the increasing number of cases that have been resuscitate by the R. C, from the accident location to the hospital.

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Table (2): Distribution of R.T.A patients, cases and patients helped by R.C. during (1431 to 7/ 1436) [14, 15, 16]

| | | | MONTH | | | | | | | | | | | | Total |
			1	2	3	4	5	6	7	8	9	10	11	12	
			count	*count*	*count*	*Count*	*count*	*count*	*count*	*count*	*count*	*count*	*count*	*count*	*count*
YEAR	1431	R.C.	12	13	13	15	30	9	10	9	23	24	12	20	190
		R.T.A.	65	61	30	52	49	40	45	42	41	42	40	43	550
	1432	R.C.	11	10	14	17	28	22	9	18	18	23	7	13	190
		R.T.A.	52	42	45	34	53	41	2	39	41	46	39	33	476
	1433	R.C.	26	7	16	24	29	22	19	10	11	22	26	20	222
		R.T.A.	34	28	29	61	52	37	38	34	34	35	45	36	463
	1434	R.C.	16	26	17	13	15	35	22	21	15	21	20	9	230
		R.T.A.	32	35	38	36	49	50	37	46	19	41	36	24	443
	1435	R.C.	13	12	20	11	19	21	9	18	17	15	19	37	211
		R.T.A.	17	34	50	30	56	33	21	49	31	23	24	58	484
	1436	R.C.	10	28	10	15	7	25	22	.	.	.	.	.	117
		R.T.A.	34	45	13	31	22	44	29	.	.	.	.	.	218

Table (3) represents the information gathered from T.D., R.C., C.D. and G.H. Which show the different form to collect   traffic accident data? The analysis of the second part of secondary data was 655 T.R. forms, the proportion of daytime incidents (59.4%) a little more than night incident (40.6%).

Table (3): Distribution of accidents according to the time

Time					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	*Night*	266	40.6	40.6	40.6
	Day	389	59.4	59.4	100.0
	Total	655	100.0	100.0	

Table (4) presents the percentage of accidents according to the type. The highest three types were collision with other vehicle 322(49.2%) which is almost equivalent to half of the total number of incidents, preceded by collision with fixed object and fail down which represents 159(24.3%), 101(15.4%) respectively. The rest of types represent 73(12%). The finding further indicated that the collision with other vehicle and with fixed body represent 481(73.4%) which is due to the behavior of the driver.

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Table (4): Distribution of accidents according to the type of accident

Type of Accident					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	collision with other vehicle	322	49.2	49.2	49.2
	collision with fixed object	159	24.3	24.3	73.4
	fall down	101	15.4	15.4	88.9
	collision with fence	13	2.0	2.0	90.8
	Crash & scope	2	.3	.3	91.1
	Crash& fall down	3	.5	.5	91.6
	with animal	4	.6	.6	92.2
	face to face	1	.2	.2	92.4
	burning	5	.8	.8	93.1
	pedestrian	4	.6	.6	93.7
	one side	25	3.8	3.8	97.6
	deviation	10	1.5	1.5	99.1
	crash stop car	2	.3	.3	99.4
	crash place	1	.2	.2	99.5
	Fall into a hole	2	.3	.3	99.8
	broken glass	1	.2	.2	100.0
	Total	655	100.0	100.0	

Fig (1): Distribution of accidents according to the type

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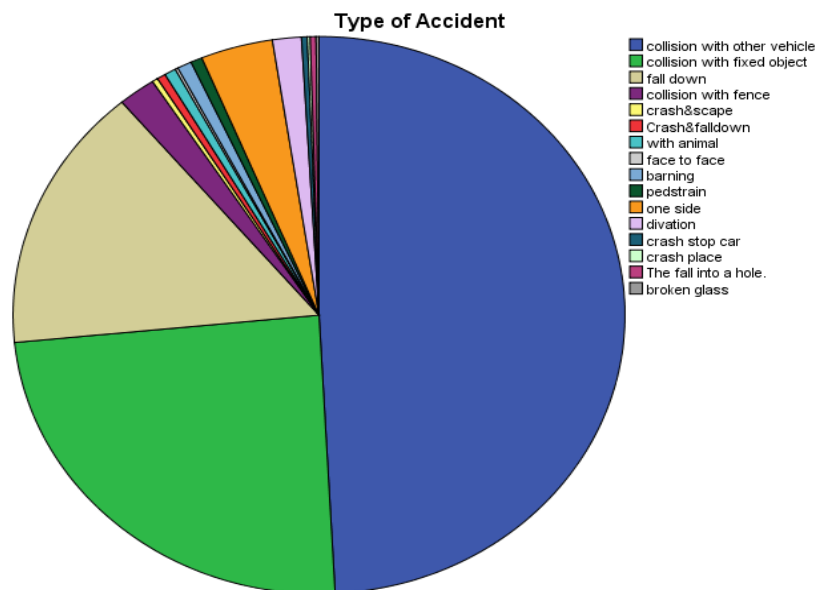
Table (5) show that 319(48.7%) of accidents happened on the highway without determining specific location, 31(4.7%) at ALTALAA, 117(17.9%) at ALNAKHEEL and 31(5.3%) in the province. The finding show that most of accidents 419 (63.9%) caused by driving on the highway.

Table (5): Distribution of accidents according to the location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	hill	31	4.7	4.7	4.7
	Highway	319	48.7	48.9	53.6
	Highway18	16	2.4	2.5	56.0
	Highway20	3	.5	.5	56.5
	Highway21	5	.8	.8	57.3
	Highway22	11	1.7	1.7	59.0
	Highway23	10	1.5	1.5	60.5
	Highway Sama station	13	2.0	2.0	97.9
	Highway Araniya station	5	.8	.8	98.6
	Highway Sacco station	1	.2	.2	99.2
	Highway Camels pathway	5	.8	.8	100.0
	Nakheel	117	17.9	17.9	78.4
	in the province	31			79.9
	moleeh&Zulfy	16	2.4	2.5	82.4
	mesa'dia	21	3.2	3.2	85.6
	Shagra st	4	.6	.6	86.2
	Hamadah mazareh	4	.6	.6	86.8
	Salabeekh st	7	1.1	1.1	87.9
	Majmaah Old st	12			
	Agrculure street	21			

The driver variable show that both sides were Saudi represent 237(36.2%), both were residents, Saudi with resident 136(20.8%). Recorded data did not specify responsibility and the error rate. Although the importance of the license information, the driver age, driver health situation, TD was not registered it in the form, so the responsibility was undetermined. The sample shows that only 16.9% of RTAs causes injuries, and 3.7% causes deaths.

Table (6) show the distribution of accidents on the age's categories, the finding showed that 63.3% of participants had an accident where 53.4% of overall total from whom 20-less than 30 years old, which represent 71.2% within them Preceding by 30-less than 40 years old category 22.7% of overall total, which represent 64.5% within the group. These Results agreed with results of (Whose age between 18-40 amounting to 78%).

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Table (6): Distribution of whom had a T.A. according to age categories

| AGE * Have you had a traffic accident Cross tabulation					
			Have you had a T.R.		Total
			yes	No	
AGE	$\prec 20$	Count	6	8	14
		% within AGE	42.9%	57.1%	100.0%
		% within T.R.	6.8%	15.7%	10.1%
		% of Total	4.3%	5.8%	10.1%
	20 less than 30	Count	47	19	66
		% within AGE	71.2%	28.8%	100.0%
		% within T.R.	53.4%	37.3%	47.5%
		% of Total	33.8%	13.7%	47.5%
	30 less than 40	Count	20	11	31
		% within AGE	64.5%	35.5%	100.0%
		% within T.R.	22.7%	21.6%	22.3%
		% of Total	14.4%	7.9%	22.3%
	40 and above	Count	15	13	28
		% within AGE	53.6%	46.4%	100.0%
		% within T.R.	17.0%	25.5%	20.1%
		% of Total	10.8%	9.4%	20.1%
Total		Count	88	51	139
		% within AGE	63.3%	36.7%	100.0%
		% within T.R.	100.0%	100.0%	100.0%
		% of Total	63.3%	36.7%	100.0%
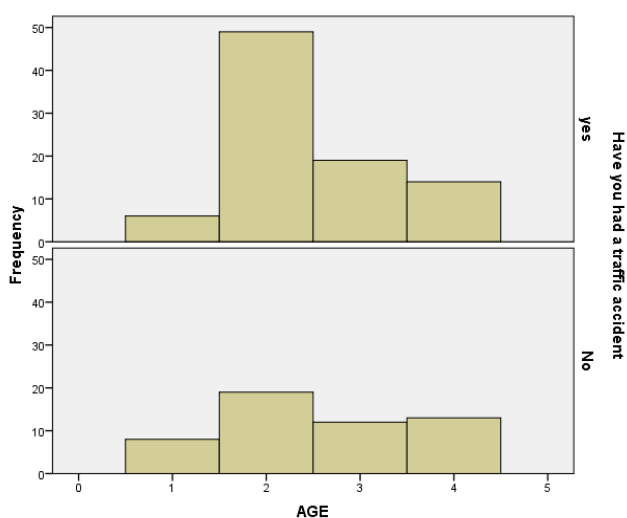
Fig (2): Distribution of who had a T.A. according to age Categories

Table (7) presents the distribution of who had a traffic accident on the nationality, the finding show that 62(70.5%) were Saudi, 26 (29.5%) were resident, which represent 68.1% with Saudi's VS 53.1% within resident's.

Table (7): **The distribution of whom had an accident vs. nationality**

		Have you had a traffic accident		
		yes	No	Total
Nationality	Saudi	62	29	91
	Non Saudi	26	23	49
Total		88	52	140

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Table (8): The distribution of whom had an accident vs. Educational level

		Have you had a traffic accident		
		yes	*No*	*Total*
Education	Primary	1	5	6
	secondary	7	10	17
	University graduate	66	28	94
	High Educated	14	9	23
Total		88	52	140

Table(9) present the distribution of whom had a traffic accident on marital status, the finding show that 34(38.6%)were marred,54 (61.4%) were single, which represent 57.6% within marred vs. 66.7% within single , which show that marital status affect the cause of accident.

Table (9): The distribution of whom had an accident vs. marital status

Count				
		Have you had a traffic accident		
		yes	*No*	*Total*
Marital Status	Marred	34	25	59
	Single	54	27	81
Total		88	52	140

Table (10) show the result of traffic accident distribution on occupation categories where 59.1% of them were students which was 3 times the nearest category (gov. employee 19.3%).

Table (10): The distribution of whom had an accident vs. Occupation

		Have you had a traffic accident		
		yes	*No*	*Total*
Occupation	Student	52	24	76
	gov. Employee	17	11	28
	Private sec. Employee	13	12	25
	driver	3	2	5
	Worker	2	1	3
	Other	1	2	3
Total		88	52	140

Fig (3b): The distribution of insurance type with the sample

The behavior of road users limited in over speed and using mobile while driving. The finding show that only 6.8% of participants committed with the speed determine by the government, 24.3% decrease speed when saw the camera and 22.9% drove with more than 140km/h. which represents (5.7%), (26.1%),(23.9%) of whom had an accidents within the past two years respectively, only 7.9% was not captured with radar camera because they were complying with legal process speed, 30 % were 4 to 6 time captured, while 30.7% of participants were not captured by radar because they decrement speed when they saw radar camera.

These results illustrate the wrong behavior of road users

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Table (11) shows how many times you have been to capture radar cameras in the last six months.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	11	7.9	7.9	7.9
	never I slow when camera	43	30.7	30.7	38.6
	1 to 3	33	23.6	23.6	62.1
	4 to 6	42	30.0	30.0	92.1
	7 or more	11	7.9	7.9	100.0
	Total	140	100.0	100.0	

V.   Conclusion

The aim of this study was to show the applications of data mining techniques in the field of accident investigation .We conclude from the above that the traffic accidents in the problem in the Kingdom of Saudi Arabia General and the province ALGhat under study need serious stance so as to curb the escalation and that the road to improve traffic safety level requires the development of a national strategy with specific targets to be implemented according to plan specific time to address the phenomenon of traffic accidents.

From the present study, the following could be concluded:

1. There is no coordination between the concerned authorities to register traffic accident which results in a lack of follow-up to the accident well through records
2. Most of accidents (64.1%) of overall happened on the highway form bridge 18 to bridge 23 where this distance not exceed than (140km), the rest of accidents (35.9%) distributed on the other points in the province. (Table (5)).
3. Road user behaviour was the most important factor causes accident, where only 6.8% of respondents were committed with the rolls.
4. Registration of traffic accident form needs to be revised as there is no license data and it's the proportion of responsibility in causing the traffic accident

VI.   Recommendations

1. The development of recording traffic accident form (incident report) and the unification of use between departments (traffic, the hospital, the Red Crescent and the security of the roads) in Ghat province to be simplified and contain the necessary information that the traffic safety plans.
2. Training fills the accident report and qualifying.
3. The necessity to add incomplete data (age, driving license, health status).
4. Determine the percentage of responsibility of both sides of accident.
5. Hide the radar cameras on the highways.
6. Coordination between the security apparatuses that records of traffic accidents and those responsible for road construction and maintenance in order to be clear who fills out a report of traffic accident.
7. More traffic awareness to citizens and residents about traffic rules.
8. We recommend members of society to abide by traffic laws and regulations.
9. The application of sanctions on violators of traffic regulations and accounting of repeated violation of it.

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