Proceedings of the 4th International Conference on Civil Engineering for Sustainable Development (ICCESD 2018), 9~11 February 2018, KUET, Khulna, Bangladesh (ISBN-978-984-34-3502-6)

ANALYZE THE EFFECT OF DRIVER BEHAVIOR AND SOCIOECONOMIC CONDITION ON TRAFFIC FlOW: A CASE STUDY OF PABNA MUNICIPALITY IN BANGLADESH

Mital Chakma

Student, Department of Urban and Regional Planning at Pabna University of Science and Technology, Bangladesh. e-mail: mitalchakmamit@gmail.com

ABSTRACT

The numbers of "Three-wheeler" (locally known as "Auto") are increasing quickly and has turned into the most prevailing urban transport mode in the districts and developing town focal point of Bangladesh. In any case, an excess of import of this vehicle represents a huge weight on the power supply and urban traffic management system of this country. The purpose of this study is to investigate the interaction of socioeconomic condition and driving behavior of Auto drivers toward the design of a safe and efficient traffic and transportation management system. The main objective of this study is to to present the effect of different driving behaviors and socioeconomic condition of Auto drivers on traffic flow system for the town center of Pabna municipality. To achieve the objectives of this study, a direct interview survey was conducted from 50 Auto drivers to determine how individual differences and individual responses to driving conditions cheap driving behavior. This study reveals that in this municipality the number (3500) of Auto vehicles is increasing day by day for low price, less noise, and safety.62% driver response that the competition between them in making more trips to support their family are the main causes of traffic rules violation and traffic congestion. Finally, it was shown through correlation analysis between the socioeconomic condition and with the different driving behaviors of Auto drivers. The results of correlation analysis are in good agreement with the general views of respondents and it shows that the socio-economic condition and driving behaviors of Auto drivers are interdependent to ensure safe and efficient traffic flow for an urban area.

Keywords: *Auto, Traffic congestion, Passenger attraction, Correlation, Driving behaviors*

1. INTRODUCTION

Traffic congestion is a typical event and occurs almost in all the cities of Bangladesh. Among the major urban areas like Dhaka, Chittagong, Khulna, Rajshahi and some district town like Pabna, Jessore, Bagura and so on are additionally confronting this issue (Shamsher & Abdullah, 2013). Shamsher and Abdullah (2013), likewise contend that traffic research still can't completely anticipate under which conditions a "traffic congestion" suddenly occur. Traffic congestion happen when the street limit is doused inferable from a high number of vehicles passing a similar point in the meantime and due to road works, accidents, extreme climate conditions, and so on (Matin et al., 2012; Remi et al., 2009; Salman & Qureshi, 2009). On the other hand (Parker & Senserrick, 2017; Parker & Senserrick, 2012) carry out that emotions, moods, driving experience, are perceived as powerful factors in their driving behaviour, and importantly as compelling variables in their road safety outcomes, congestion, and a mediation. Parker and Senserrick (2017), likewise contended that the emotions which emerge from driver-particular or context specific triggers which result in changes in their driving decision-making (intentionally or unknowingly) and at last changes in their driving behavior. In addition, the quality of traffic roads and behaviors of drivers are additionally critical components causing traffic congestion (Araina et al., 2017). Aggressive driving behavior is one of the aggressive behavior forms which is regularly found right now

(Lajunen & Parker, 2004; Shinar & Compton, 2004; Galovski et ai., 2005; Hohn, 2006). It might cause different issues in the public arena, for example, traffic congestion, a mishap that influences the properties and life of individuals, sickness and demise (Chomeya, 2010). As per (Shamsher & Abdullah, 2013; and Mamun 2015) Rickshaws and Auto are regularly blamed for the traffic bedlam in Bangladesh. The rickshaw and Auto driver stopped their vehicles at the road side by ignoring traffic rules and regulation resulting traffic congestion and road accident are common in our country. Subsequently, to reduce car influx Bangladesh Government has effectively prohibited rickshaws utilizing on the primary streets of Dhaka city (capital) because of huge weight on movement (Shamsher and Abdullah, 2013). But in other urban and municipal areas rickshaw and Auto or three electric wheels banning procedure has not yet implemented. And these vehicles are increasing with jumping up (see in figure 1). This situation can be easily observed in the few urban territories where vehicles growing faster and exceed the capacity of the transportation system.

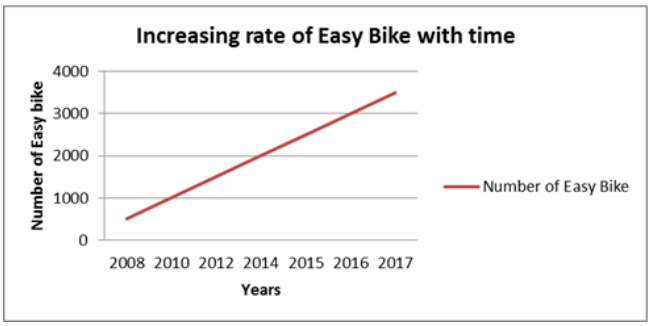

Figure 1: Increasing rate of Auto in the study area

In resultant, slow traffic creates issues for people and leave an antagonistic effect on the business economy in light of the fact that the reaction rate of people towards their allot assignment turn out to be low (Matin et al., 2012). Concerning this issue, it is very important to observe the Auto or three electric wheel drivers behavior and socioeconomic condition, to investigate the appropriateness of this vehicle as a local public transport mode in the municipality.

2. STUDY AREA

Absolute location of the Pabna municipality is 24.99^{o} north latitude and 89.23^{o} east longitude, in figure 2 (Mamun, 2015; UGIIP, 2007). Pabna district is described as an imperative economic center point of Bangladesh for its location and simple transportation linkages with different parts of the nation (Chakma & Chakrabartty, 2017; Saha et al., 2013; & Mamun, 2015). Regular individuals from the encompassing country zone, go to the Pabna CBD area for office work, business, treatment and for different purposes by usinging battery operated auto (Saha et al., 2013). Mamun (2015), carry out that about 2637 Autos employ throughout the roads in this municipality and the number is increasing because of its zero contamination (exhaust), less noise and safety. From field survey it was found that nearly 3,500 battery operated auto were running for 181939 people in18.64 sq. km area. The Municipal authority officially claimed that they gave license upto 1200 auto and 530 rickshaws. But there are also so many others battery driven vehicles (auto bike and auto rickshaw) which are roaming around the Pabna municipal area without any license. For this reason, this city is fully jammed packed with these vehicles. From these perspectives, the study tries to investigate the interactions between socio-economic condition and driving behavior of Auto drivers toward the design of a safe and efficient traffic and transportation management plan of the study area. The main objectives of this study are to set up several scenarios in the driving simulator to test the Auto drivers behavior. The scenarios are divided into different categories including the socio- demographic, work load pressure and traffic

rules violation of Auto drivers & to explore how the socio economic condition and driving behaviors of Auto drivers are interdependent to ensure safe and efficient traffic flow in the study area.

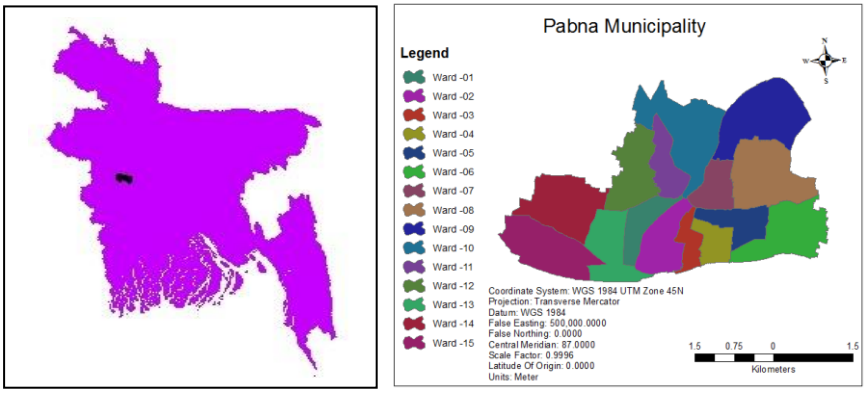

Figure 2: Location of study area with the context of Bangladesh

3. LITERATURE RWVIEW OF THE STUDY

"Three-wheelers" (locally known as "Auto") is a notable travel mode in the urban transportation system in Bangladesh (Mamun, 2015). It is a generally utilized tiny three-wheeled vehicle for transport of individuals, goods and services all over in this country and in numerous Asian countries. Santucci et al (2016), argue that if 10% of car drivers start moving on an electric bike than reduced traffic congestion by 40% in Europe (Brussels). But increase in excess number may create a negative impact on the urban environment. Mandal et al (2015), carry out that Auto vehicles annual growth rate of traffic is about 6.1% in the Rajshahi City Corporation (RCC) area of Bangladesh. Mandal et al (2015), also point out that these batteries cause numerous environmental damages on short scale. Lead batteries in some cases releases hydrogen gas. Gas can cause numerous health issues in terms of long-term exposure. Mamun (2015), in his research paper said that this Auto or Electric three wheelers are responsible for daily 1.53 hours of load shedding per a day in Pabna municipality. Municipal authority said that huge number of illegal Auto is responsible for traffic congestion in CBD area specially bul bul college more and this traffic congestion rate is growing from 2% to 5% in 2016. On the other hand Government republic of Bangladesh has already claimed that the Auto and other battery operated vehicles consume more than 300 Megawatts of electricity every day to recharge their batteries (The Daily Star, 2011).
The introduction of Auto can be indicated as a quiet insurgency in the transport sector of Bangladesh. A huge number of such vehicles are now playing all over the country, largely in the municipalities and suburban area. Some gauge the figures of a million. There are no legitimate insights accessible, as these vehicles are not enlisted with the administrative transport office. These vehicles are advanced in Pabna by some enthusiastic business organization. Around 3500 vehicles ply throughout the streets in this municipality and the number is expanding because of its zero contamination (exhaust), less noise and safety.

Figure 3: Electrict three wheel or Auto

The picture (Table 1) demonstrates the gigantic pressure of Auto on municipal traffic and transportation management system. The investigation assumed that traveler's appreciation for this vehicle is the main reason behind the increasing of Auto and substitution of human hauler.

Table 1: Average number of Easy bike at 6 main points of CBD area in the Pabna municipality during peak hour (9.30am to 10.30am)

Points	Vehicle Number
Edward College	376
In front of Judge court	602
In front General Hospital	421
Pasmatha more	289
Doyel chottor (toward mental hospital)	172
In front of Pabna Zilla school	613

4. MATERIALS AND METHODS

The study carried out on the Pabna municipality of Bangladesh on the basis of the increasing rate of plying easy bikes, nastiest traffic situation and researcher's own interest. To understand the traffic and transportation problem of the town center as a whole and to arrive at a planning solution to alleviate the problem, the following methods were mainly utilized in completing the case study:

4.1 Secondary data collection

Secondary data were obtained from various government offices and concerned departments. Besides consulting different journals, research reports, internet and some newspapers were also used to extract the required information.

4.2 Reconnaissance Survey

During the collection of primary data, the study area of Pabna Municipality has been visited many times, to know the existing situation; a reconnaissance survey had been done to acquire an overall site. So it was decided to run a questionnaire survey to generate primary data.

4.3 Questionnaire Survey & Interview

Questionnaire survey and interview was conducted with the most numerous (50 drivers) auto drivers or three electric wheel drivers from 27th September to 9th October 2017; with the purpose of collecting information about the volume, composition and pattern movements of traffic entering the Municipal boundary, known as external trips, thereby, counting vehicles and interviewing a sample of drivers at cordon points in their journey into the study area. Several discussions were conducted regarding Traffic congestion issues in CBD area with the pedestrian, Transportation engineer, Urban Planner, professional experts in different sectors, from October 2017 to November 2017. The data obtained was analyzed and shown in the graphs.

4.4 Traffic volume survey

The Traffic volume survey was conducted for Easy bikes at different intersections of CBD area in the Pabna municipality by hiring some assistant and set them some important location in the Pabna municipal CBD area, like- Edward College**;** In front of Judge court; In front General Hospital; Pasmatha more; Doi bazar more; Doyel chottor (toward mental hospital); In front of the Pabna zilla school.

5. RESULT AND DISCUSSION

5.1 Trip Characteristics of Different Auto drivers

The planning, design and management of the road traffic and transportation system greatly depends on the availability of relevant, reliable and recent travel data, and the ability to analyze and interpret these data (Rawas, 1989). To know the trip characteristics of auto driver, road side field interview survey was conducted. The main purpose of this survey was to collect the information of auto driver about their movement (origin and destination) and it is found that most of the auto originated from outside of Central Business District (CBD) area and their destination is a CBD area of the municipality. The commercial and administrative zone of Pabna municipality are mostly covered by ward no 2 and 3 with the area of 341.473 acres land (Rahman et al, 2017). Table 02 shows the distribution of vehicle movements.

Table 2: Trip characteristics of different auto drivers

		Destination in different Zones															**Total Trip Generation**
		Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8	Ward 9	Ward 10	Ward 11	Ward 12	Ward 13	Ward 14	Ward 15	
Origin in different Zone	Ward 1	-	15	19	-	-	5	-	3	8	-	2	-	-	5	-	57
	Ward 2	15	-	56	12	28	9	51	15	9	7	45	6	7	6	5	271
	Ward 3	19	56	45	21	33	-	-	9	3	-	15	9	12	8	2	232
	Ward 4	-	12	21	-	15	-	1	3	-	9	-	-	2	-	-	63
	Ward 5	-	28	33	15	5	6	13	4	2	4	3	4	1	4	-	122
	Ward 6	5	9	-	-	6	-	-	2	-	4	-	7	-	-	-	33
	Ward 7	-	51	-	1	13	-	19	5	14	7	15	1	3	5	-	134
	Ward 8	3	15	9	3	4	2	5	-	-	-	14	-	-	-	9	64
	Ward 9	8	9	3	-	2	-	14	-	-	4	-	-	-	2	-	42
	Ward 10	-	7	-	9	4	4	7	-	4	-	16	-	3	-	1	55
		2	45	15	-	3	-	15	14	-	16	2	4	1	-	3	120

Ward 11																
Ward 12	-	6	9	-	4	7	1	-	-	-	4	-	-	7	-	38
Ward 13	-	7	12	2	1	-	3	-	-	3	1	-	-	-	3	32
Ward 14	5	6	8	-	4	-	5	-	2	-	-	7	-	1	3	41
Ward 15	-	5	2	-	-	-	-	9	-	1	3	-	3	3	-	26
Total Trips Attraction	57	271	232	63	122	33	134	64	42	55	120	38	32	41	26	

In the survey found that 271 numbers of trips are attracted to the ward no-02, 232 in ward no-03. 134, 122 and 120 trips are attracted into the word no 07, 05 and 11 respectively (Figure 4). The study also tried to find out the reason behind this huge trip attraction on that word. It was found that ward no 02 and 03 are the town center of Pabna municipality, people are congest here for their daily purpose. The other attraction zone are 07,05 and 11 no ward because many institution like- Christian grave yard, Shahid Fazlul Haque Poura High School, Bulbul College and Pabna sadar grave yard in ward no-05; Sadar Thana, Central girls school, Ichamoti Clinic, PTC hospital, Food storehouse, Pathfinder KG school, Blue bird KG school, Jalal Memorial Hospital, Square Company in ward no-07; and DPHE office, BADC office, Petrobangla gas company, District forest office, Power Development Board office, BRDB office in ward no-11.

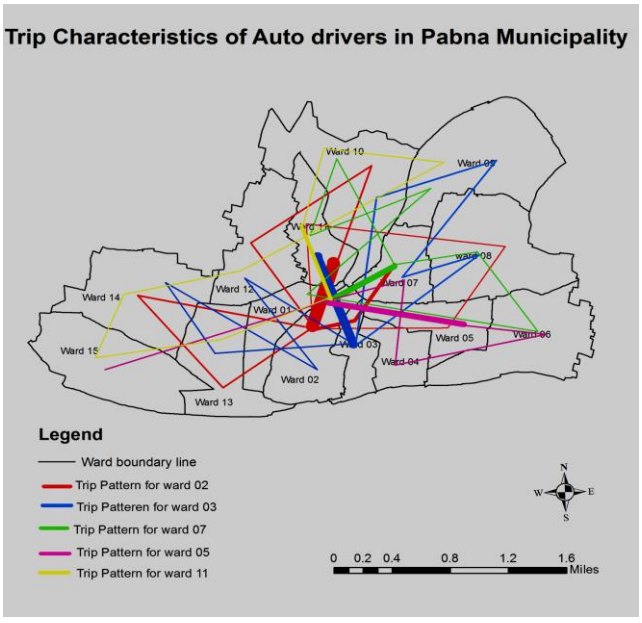

Figure 4: Trip Characteristics of Auto drivers

5.2 Driving Behavior Analysis of Different Auto Drivers

Platten et al (2013), said that besides driving behaviors, operating behavior is an importance secondary task to understand the performance of mechanism while driving. Rauch (2009), was identified hesitations during the secondary task operation occurring in difficult situations. In order to know the best about traffic congestion issues, driving behaviors and quality of roads, we surveyed different regions of the Pabna municipal area. Regarding these issues and based on recommendations from professional and traffic officers a short open-ended questionnaire was designed to get responses from the Auto driver. The collected data were analyzed using ArcGIS 10.3, SPSS software and proper correlation results were obtained. Following questions were asked and responses were obtained to study the driving behavioral effect on traffic flow condition in Pabna municipality.

Table 3: Responses from the respondents about various aspects

Questionnaires	Total Respondents	Frequency (%)
Socio-demographic variables		
Age of the respondent		
1. 18-21	10	20
2. 21-24	7	14
3. 24-30	12	24
4. 30-35	9	18
5. Up to 35	11	22
Education qualification		
1. Read and write	22	44
2. Primary education	13	26
3. Secondary	10	20
4. Higher secondary & Diploma	05	10
What is your marital status?		
1. Single	15	30
2. Married	32	64
3. Divorced	03	6
How many family members do you support?		
1. No family member	05	10
2. 2-3	12	24
3. 3-4	11	22
4. 5 and above	22	44
Who is your vehicle's owner?		
1. Myself	31	62
2. My employer	19	38
Have you got first aid training?		
1. Yes	50	100
2. No	-	
Do you have any driving license?		
1. Yes	08	16
2. No	42	84
Monthly income the owner of the vehicle while driving is around 19000 TK		
Monthly income the employer of the vehicle while driving is around 13000 TK		
The minimum driving experience of the drivers is around 6 months		
Traffic violations		
Reasons of traffic rules (light, speed, no stopping etc.) violation		
1. For short queue	11	22
2. To increase income	23	46
3. Racing with another driver	03	06

4. No fine on violence	02	04
5. Drunk driving	01	02
6. Disregard	05	10
7. Poor traffic management	05	10
8. Others	-	
Safe attitude towards traffic rules violation		
1. Strongly disagree	-	
2. Disagree and	02	04
3. Slightly disagree	-	
4. Neither agree or disagree	06	12
5. Strongly agree	12	24
6. Agree and	29	58
7. Slightly agree	01	02
If your cell phone rang while driving, how you received your call?		
1. Reduce speed and receive calls	07	14
2. Received call at normal speed	39	78
3. Stop driving and receive calls	03	06
4. I disconnect ringing	01	02
Frequency of per day mobile phone usage while driving (general use)		
1. Never use	05	
2. At least 1 or 5 times	19	10
3. At least 5 or 10 times	22	38
4. At least 10 or 15 times	04	44
5. At least 15 or 20 times	-	08
6. More time	-	
Safe attitude towards mobile phone usage		
1. Strongly disagree,	-	
2. Disagree and	03	06
3. Slightly disagree	07	14
4. Neither agree or disagree	10	20
5. Strongly agree,	02	04
6. Agree and	28	56
7. Slightly agree	-	
Do you drive after knowing your Easy bike has a mechanical problem?		
1. Yes	23	46
2. No	27	58
What are the reasons for driving, after having a mechanical problem?		
1. No alternative to support my family	32	64
2. For own income	11	22
3. Foe more income	07	14
4. Others	-	
Causes of driving in the wrong direction		
1. Disregard traffic rules	01	02
2. Time saving	21	42
3. Competition/Racing with another driver	05	10
4. To get more passenger	23	46
Causes of parking violation		
1. Lack of parking place for three electric wheels	25	50
2. Poor traffic management system	07	14

3. Poor parking management system	13	26
4. No parking pricing	05	10
Workload of the driver		
How many hours do you drive per a day?		
a) 5 to 8	15	30
b) 8 to 10	11	22
c) 10 to 15	15	30
d) Above15 hours	09	18
Why you work so long (for 10 to 15 & above 15 hours' work)?		
a) To support my family	31	62
b) For my personal expenses	15	30
c) Others	04	08
Do you do any rough behave with passengers during pressure on work load?		
a) Yes	07	14
b) No	43	86
Do you violence the traffic rules during pressure on work load?		
a) Yes	37	74
b) No	13	26
How many times do you violence the traffic rules?		
a) Always	06	12
b) Sometime	23	46
c) Most of the time	21	42
Have you ever had road traffic accident during the pressure of workload?		
a) Yes	30	60
b) No	20	40
What were the causes of this accident?		
a) Pedestrian carelessness	11	22
b) Failure to follow the right hand rules	10	20
c) Failure to give way for pedestrian	13	26
d) Phone use while driving	08	16
e) Quality of road	01	02
f) Vehicle mechanical problem	04	08
g) Others	02	04
When workload pressures become high?		
a) 8am to 10am	16	32
b) 10am to 12pm	02	04
c) 12pm to 2pm	01	02
d) 2pm to 4pm	04	08
e) 4pm to 6pm	12	26
f) 6pm to 9pm	14	28

*Survey, 2017

5.3 Correlation Analysis of Different Driving behaviors

One of the main objectives of this study is to find the extent to which different driving behaviors are correlated with socioeconomic condition of Auto dirvers. For this, the study introduced four driving behaviors from upper Table 03 as follows:

$Group_1$ (i) Independent variable
X_1 = Age of the drivers

$Group_2$ (j) Dependent variable
X_6 = Reasons of traffic rules violation

X_2 = Education qualification
X_3 = Family member support
X_4 = Cell phone receiving pattern
X_5 = Work hours
X_7 = Driving in the wrong direction
X_8= Parking violation
X_9= Causes of road accident

The coefficient of correlation using the 50 sample responses to see the association between the group1 and group2 may be defined as:

$$rij = \frac{50\sum xixj - \sum xi.\sum xj}{\sqrt{[50\sum xi2 - (\sum xi)2].[50\sum xj2 - (\sum xj)2]}}$$

Where i and j are not same,

Using the upper formula on each possible pair of 50 responses on driving behaviors, the acquired correlation coefficients and significance levels are attested in Table 4.

Table 4: Analysis of different Auto drivers driving behaviors

Case	i	j	R_{ij}	Significance Level	Confidence Level (95%)	
					Lower	Upper
1	X_1	X_6	-o.138	0.340	-.596	.210
	X_1	X_7	-0.101	0.486	-.269	.130
	X_1	X_8	-0.283	0.047	-.342	-.003
	X_1	X_9	0.331	0.019	.067	.709
2	X_2	X_6	0.057	0.695	-.454	.676
	X_2	X_7	0.080	0.580	-.201	.355
	X_2	X_8	-0.129	0.371	-.353	.134
	X_2	X_9	0.284	0.046	.009	.916
3	X_3	X_6	-0.019	0.894	-.592	.518
	X_3	X_7	-0.020	0.892	-.292	.255
	X_3	X_8	0.045	0.758	-.204	.278
	X_3	X_9	-0.070	0.631	-.574	.352
4	X_4	X_6	0.222	0.121	-.179	1.483
	X_4	X_7	0.151	0.296	-.197	.634
	X_4	X_8	0.015	0.917	-.351	.389
	X_4	X_9	0.000	1.000	-.713	.713
5	X_5	X_6	0.016	0.911	-.532	.595
	X_5	X_7	-0.040	0.783	-.316	.240
	X_5	X_8	-0.284	0.046	-.474	-.005
	X_5	X_9	0.035	0.808	-.414	.528

This correlation conducted by using Pearson's correlation. The Pearson's "r" ranges in value from -1 to +1. According to Pearson's ranges we can say; if r≤0. 30 is a weak correlation, if 0.30<r<0.70 moderate correlation and again if r≥0. 70 is a strong correlation between two variables.

Case-1: After the comparison of "age" of the drivers with those who traffic rules violence; who drive on wrong direction; who disregard parking rules shows weak negative correlation with lower confidence level and with the significance level of 38%, 48% and 4.7%, respectively, with this result we can say that the age of the drivers does not effect on traffic rules violation; driving on wrong direction and disregard parking rules. Again, when a comparison of age of the drivers and who make road accident was conducted shows moderate positive correlation with lower significance level of 1.9% and with high level of

confidence 70.9%, with this result, we can say that the age of the drivers is directly affected by making road accident, according to sample data.

Case-2: After the comparison of "education qualification" of the drivers with those who traffic rules violence; who drive on wrong direction; who make road accident shows weak positive correlation with 67.6%, 35.5% and 91.6% confidence and with high level of significance 69.5%, 58.0% and 4.6%, respectively, with this result we can say that lower educated drivers can significantly effect on traffic rules violence; drive on wrong direction; and making road accident. On the other hand, education, quality of the driver does not effect on the parking rules violation, according to sample data.

Case-3: After the comparison of "family member support" of the drivers with those who traffic rules violence; who drive on wrong direction; who make road accident shows weak negative correlation with 51.8%, 25.5% and 35.2% confidence and with high level of significance 89.4%, 89.2% and 63.1%, respectively, with this result we can say that family member support of the drivers does not effect on traffic rules violence; drive on wrong direction; and road accident making. On the other hand a weak positive correlation was found between the number of family member supports of the drivers and who parking violation. In that case we can say that family member supports of the drivers have an effect on who parking rules violence but not significant, according to sample data.

Case-4: After the comparison of "cell phone receiving pattern" of the drivers with those who traffic rules violence; who drive on wrong direction; who parking violation and who make road accident shows weak positive correlation with high level of significance 12.2%, 29.6%, 91. 7% and 100%, respectively, with this result, we can say that, those who received cell phone during driving, he has a significant effect on traffic rules violence; drive on wrong direction; parking violation and occurring road accident, according to sample data.

Case-5: After the comparison of "workload pressure" of the drivers with those who drive on wrong direction; and who disregard parking rules shows weak negative correlation with 78.3% and 4.6% significant level, with this result, we can say that, workload pressure does not effect on driving on wrong direction; and disregard parking rules. On the other hand a weak positive correlation was found with the workload pressure on the drivers and with whom traffic rules violence and who make road accident, with high level of significant 91.1% and 80.8%, respectively, with this result, we can say that those who drive more hour per day he has more potential to make road accident and traffic rules violence, according to sample data.

6. CONCLUSIONS

Pabna is an old town in Bangladesh. There is no "Master plan" for the municipal city as a result the town Centre was developed without concerning expert values. The roads in town Centre are narrow and traffic congestion becomes continuous problems with the increasing numbers of Auto. From past researchers are trying to alleviate traffic congestion problems in the Pabna town center. In this regard 50 Auto drivers were surveyed and their responses to different problems associated with traffic congestion and trip characteristics were discussed. Finally, it was shown through correlation analysis between socioeconomic condition and with the different driving behaviors of Auto drivers. The results of correlation analysis are in good agreement with the general views of respondents and it shows that the socio-economic condition and driving behaviors of Auto drivers are interdependent to ensure safe and efficient traffic flow of the study area. It was found that the competition between them in making more trips to support their family is the main causes of traffic rules violation and traffic congestion. For Town center Pabna, traffic congestion pressure can be improved by launch on various strategies such as improved road infrastructures, road capacity

expansion, building Auto parking space and financial penalty to the traffic law breakers. Most importantly, proper traffic and transportation management system along with the appropriate implementation of traffic rules is necessary to mitigate the problems of traffic congestion in town Centre.

REFERENCES

Araina, S., Shaikh, F., & Shaikh, M. (2017). Problem of Traffic Congestion and Correlation Analysis of Driving behaviors in Qasimabad, Hyderabad. *Mehran University Research Journal of Engineering & Technology, 36*, 139-148.[p-ISSN: 0254-7821, e-ISSN: 2413-7219].

Chakma, M., & Chakrabartty, P. (2017). Water Logging & Drainage Planning in Bangladesh: A Case Study of Pabna Municipality, Pabna. *International Conference on Planning, Architecture and Civil Engineering* (pp. 315-324). Rajshahi: Rajshahi University of Engineering Technology.

Chomeya, R. (2010). Aggressive Driving Behavior: Undergraduate Students Study. *Journal of Social Sciences, 6*(3), 411-415; ISSN 1549-3652.

Galovski, T., Malta, L., & Blanchard, E. (2005). *Road Rage: Assessment and Treatment of the Angry, Aggressive Driver.* (1st Edn., ed.). Washington DC: American Psychological Association, Washington DC.ISBN: 10: 1591473055.

Hohn, R. (2006). *Aggressive driving and road rage: they aren't the same.* PDE Publications Inc. http://www.drivers.com/article/462/.

Lajunen, T., & Parker, D. (2004). Are aggressive people aggressive drivers? A study of the relationship between self-reported general aggressiveness driver anger and aggressive driving. *Accid. Anal.Prev.*, 243-255. DOI: 10.1016/S0001-.

Mamun, A. H. (2015). Electric Three Wheelers and Municipal Transportation in Bangladesh. *International Journal of Innovative and Applied Research, 3*(2), 12-16.

Mandal, S., Ahmed, S., & Rabbi, F. (2015). Impact of battery driven vehicle on the electricity of Rajshahi city, Bangladesh. *International Conference on Mechanical, Industrial and Materials Engineering* (pp. 1-6). Rajshahi: RUET.

Matin, F., Herani, G. M., & Warraich, U. A. (2012). Factors Affecting Traffic Jam in Karachi and its Impact on Performance of Economy. *KASBIT Business Journal, 5*, 25-32; http://ideas.repec.org/s/ksb/journl.html.

Parker B, S. (2017, June 28). Emotions, behaviour, and the adolescent driver: A literature review. *Transportation Research Part F 50*, 1-37.

Parker S, B., & Senserrick, T. (2013). Methodology and broader implications of young driver research published in traffic injury prevention in the past five years. *Australasian college of road safety conference.* Adelaide: Australasian college of road safety.

Parker S, B., & Senserrick, T. (2017). Brief report: A call to improve sampling methodology and reporting in young novice driver research. *Injury Preventionhttp, 23*(1), 8-9.

Platten, F., Milicic, N., Schwalm, M., & Krems, J. (2013, September 15). Using an infotainment system while driving – A continuous analysis of behavior adaptations. *Transportation Research Part F, 21*, 103–112: http://dx.doi.org/10.1016/j.trf.2013.09.012.

Rahman, A., Prothan, J. I., Islam, M., & Pramanik, A. (2017). Parking Provision for CBD Area of Pabna Town in Bangladesh. *EJERS, European Journal of Engineering Research and Science, 02*(09), 27-30.DOI: http://dx.doi.org/10.24018/ejers.2017.2.9.453.

Rauch, N. (2009). Ein Verhaltensbasiertes Messmodell zur Erfassung von Situationsbewusstsein im Fahrkontext. *Julius-Maximilians-Universität Würzburg; www.psychologie.uni-wuerzburg.de/methoden/texte/2009_Rauch_Diss.pdf>.*

Rawas, M. A. (1989). Urban Transportation Problem in the Muscat Area, Sultanate of Oman. *Doctor of Philosophy in Urban transport planning, Department of Geography at University of Salford.*

Remi, A., Adegoke, A., & Oyerinde, A. (2009). A Study of the Causes, Effects and ameliorative Measures of Road Traffic Congestion in Lagos Metropolis. *European journal of Social Sciences, 11*(1), 119-128.

Saha, A. K., Haque, M. R., Nahar, T. T., & Rahman, M. M. (2013, December). Application of Traffic Management Plan a Sustainable Solution of Traffic Congestion in Pabna City, Bangladesh. *International Journal of Recent Development in Engineering and Technology, 1*(3), 11-15.

Salman, A., & Qureshi, S. (2009). Indicators of Urban Sustainable Development: A Geographical Review of Urban Regeneration Projects in Karachi, Pakistan In: Donert, K., Ari, Y., Attard, M., O'Reilly, G. andSchmeinck, D. (eds.) Geographical Diversity. *Proceedings of the HERODOT Conference*, (pp. 183-187). Ayvalik, Turkey.

Santucci, M., Pieve, M., & Pierini, M. (2016, April 18-21). Electric L-category vehicles for smart urban mobility. *Transport Research Arena. Elsevier B.V.ISSN: 2352-1465.doi: 10.1016/j.trpro.2016.05.433*(14).

Shamsher, R., & Abdullah, M. N. (2013, Numebr 1). Traffic Congestion in Bangladesh- Causes and Solutions: A study of Chittagong Metropolitan City. *Asian Business Review, 2*(3), 13-18.ISSN: 2305-8730.

Shinar, D., & Compton, R. (2004). Aggressive driving:an observational study of driver, vehicle and situational variables. *Accid. Anal. Prev., 36:*, 429-437.

The Daily Star. (2011). *Electric Rickshaws Run out of Steam.* Dhaka.

UGIIP. (2007). *Urban Governance and Infrastructure Improvement Project (UGIIP) for Pabna Pourashava.* Dhaka: Local Government and Engineering Department of Bangladesh.