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## ANALYSIS OF TRAFFIC INTENSITY VARIATION IN MAJOR INTERSECTIONS OF A SECONDARY CITY IN BANGLADESH: A CASE STUDY ON PABNA MUNICIPALITY

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### ABSTRACT

Intensive traffic flow has become a common scenario in almost every city of Bangladesh which creates severe traffic congestion that brings speechless woe for citizens. This situation challenges transportation planners and engineers to cope with providing sustainable traffic management strategies. From this realization, this study is conducted to analyze traffic intensity variation in major intersections of a secondary city in Bangladesh. Traffic volume Survey, Spot Speed study and Landuse pattern analysis were the main methodological approaches to conduct the study. The data collected were analyzed through the use of ArcGIS 10.3 and statistical computer packages. The study reveals that the flow of vehicles increases on roads during the summer season and normally vehicle's speed tends to decrease significantly at noon and evening indicating serious traffic jam. It also explores that land-use pattern has a great impact on the variation of traffic intensity within the city. This study tries to express the effects of these variables on traffic intensity variation to support the future planning of sustainable traffic management strategies for municipalities with similar profiles.

Keywords: Traffic intensity, Traffic Volume, Spot Speed, Landuse Pattern, Pabna Municipality.

### INTRODUCTION

In developing countries, urban migration is increasing so rapidly which creates intensive traffic resulting traffic congestion. According to Gwillian (2011), per year about 3 to 5 percent population growth has occurred over the past decade in African cities due to urban migration. This is huge for exceeding road network capacity.

Recently, transport activities have increased for demographic, economic, land use and international development which is essential for the economic and social growth of a country (MinVenW, 2004). On the other hand, transport has many negative effects such as traffic congestion and environmental pollution (Osoba and Samson, 2012). In Bangladesh, for the year 1997 country wise annual economic loss became \$79 million due to traffic congestion (Osman, 2010). In addition, annually \$3 billion and daily over 8 million works hour is wasted due to traffic congestion resulting from intensive traffic flow in Bangladesh (Gilbert & Perl, 2013 as cited in Chowdhury et al., 2016).

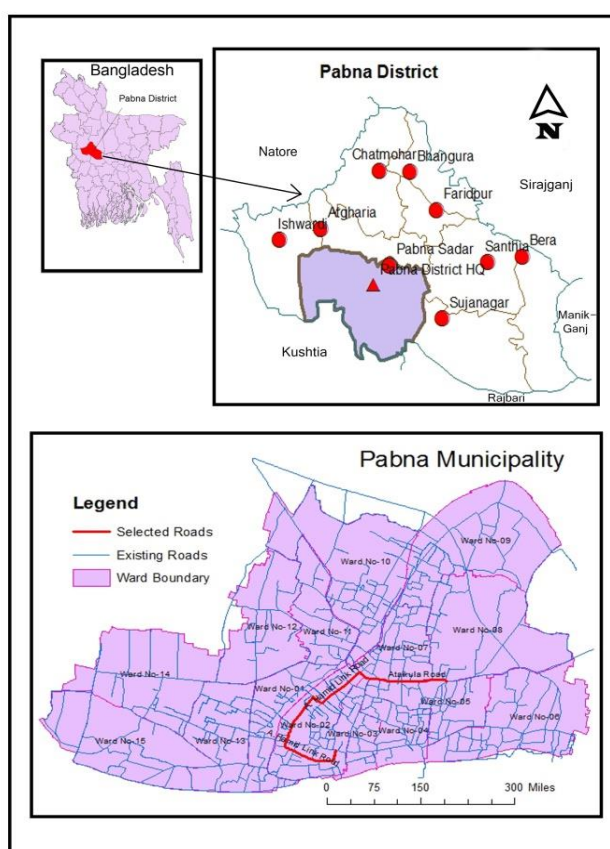
However, severe traffic congestion that brings speechless woe for citizens and this situation challenges transportation planners and engineers to cope peace with providing sustainable traffic management strategies.

Traffic intensity variation analysis provides information about temporal variations of traffic flow, speed distribution with respect to time and economic, social and cultural impact on traffic. This information is necessary to provide steps to reduce traffic congestion of a city.

Thus, this study is conducted to analyze traffic intensity variation in major intersections of a secondary city in Bangladesh i.e. Pabna municipality. It also tries to provide a better understanding insight the functioning of traffic system with temporal variation that may help decision makers in taking necessary strategies to provide fluent transport system within the city.

## METHODOLOGY

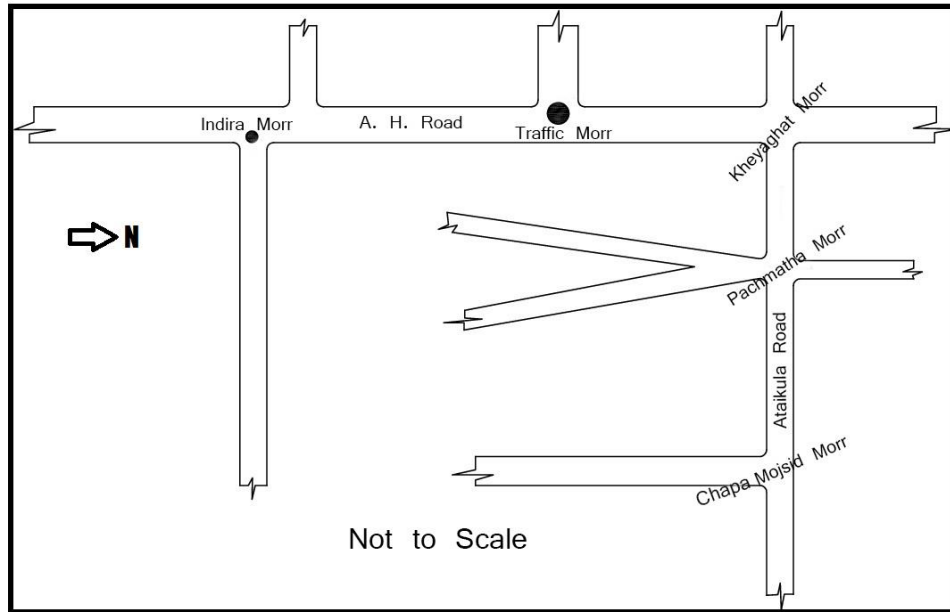
The study analyzes traffic intensity variation of traffic morr, indira morr along Abdul Hamid road and Chapa-Mosjid morr, pach-matha morr and Kheyaghat morr along Ataikula road under Pabna municipality which is selected as study area. To obtain study objectives temporal variation of traffic intensity and spot speed of vehicles are critically observed. At first, Abdul Hamid road and Ataikula road are selected as the major roads in the city. The five intersections along two roads are seriously affected by traffic congestion which has become a daily scenario. Almost all vehicles passing through the city using the two roads and facing traffic congestion in these intersections.



[Fig. 1]: Location of the Selected Roads

The study is conducted based on primary and secondary data. Primary data sources are:

- i) Reconnaissance survey: Field visit has been done for observation and selecting study area.
- ii) Traffic volume survey: Counting of vehicles has been done manually using passenger car units (PCU) value where one car is considered as a single unit; the cycle and the motorcycle are considered as half car unit; the bus and the truck are equivalent to 3 cars or 3 PCU.
- iii) Spot Speed Survey: Spot speeds of vehicles have been surveyed through the direct-timing procedure.
- iv) Landuse Pattern Survey: The analysis of existing land uses around the selected roads has been done through a physical survey.



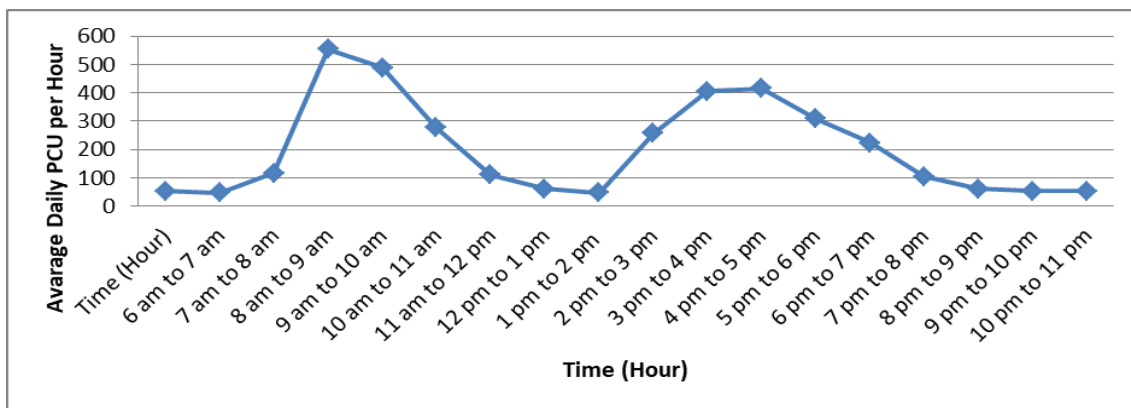
[Fig. 2]: Selected Intersections within the Roads

The secondary data have been collected from journals, books, Pabna municipality etc. The collected data have been analyzed through the use of ArcGIS 10.3 and statistical computer packages.

## RESULTS AND DISCUSSIONS

### Traffic Intensity Variation With Respect To Time

The five most important sections (e.g. Chapa-Mosjid morr, Pach-matha morr, Kheyaghat morr, Traffic morr, and Indira morr) of Pabna city have been surveyed to show the variation of traffic intensity with respect to time. The temporal variation of traffic has been illustrated in figure 3.

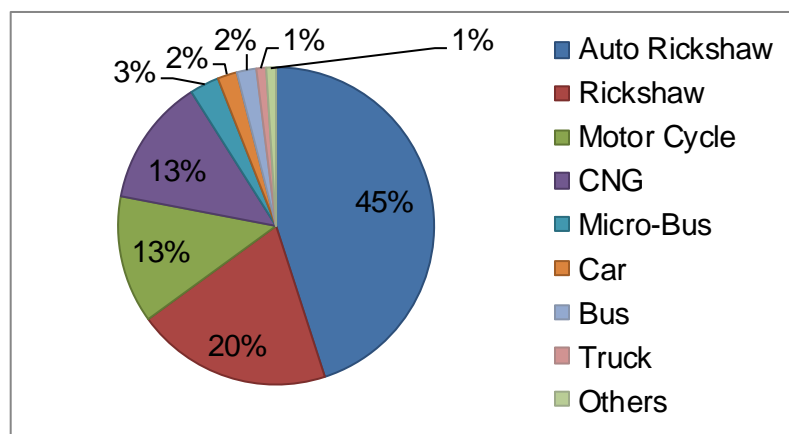


[Fig. 3]: Variation of Traffic Intensity With Respect To Time

[Fig. 3] shows that traffic volume becomes high from 8 am to 10 am in the morning and 4 pm to 6 pm in the afternoon. Intensive traffic flow occurs in the morning for peak hours of office, shopping, school and college as the starting time. Again, the intensive flow becomes high in the afternoon due to the peak hours as the ending time of offices, schools and colleges and also for shopping. In addition, it has been found that intensive traffic congestion occurs during peak hours. Besides the peak hour fact, some other causes have been identified for traffic congestion in intersection points such as due to the lack of regulations, insufficient parking space and footpath, multiple origin and destination points from auto rickshaw trips, moving of both rickshaws and auto rickshaws through access roads.

### Traffic Mode Choice analysis during Peak Hours

From traffic volume survey in the five intersections, it has been observed that auto rickshaw is the most preferable mode of traffic (45%) in the city. People prefer auto-rickshaws for fixed routes in short distance within municipality area, multiple origin and destination points, low fare and availability. The following modes are respectively rickshaw (20%), motorcycle (13%), CNG (13%), micro-bus (3%), car (2%), bus (2%), truck (1%) and others (1%).

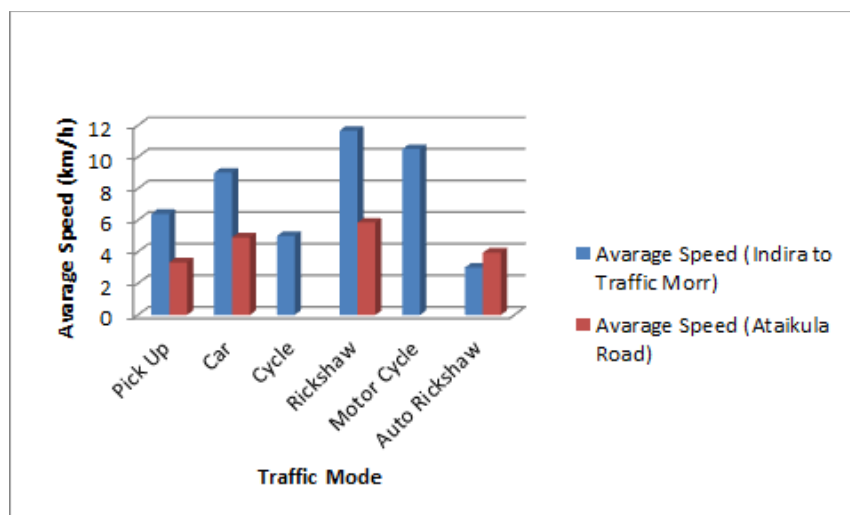


[Fig. 4]: Preferable Mode of Traffic during Peak Hours

General people prefer rickshaws for traveling as the fare is respectively low, destination based trip facility and availability in Pabna municipality.

### Spot Speed Variations

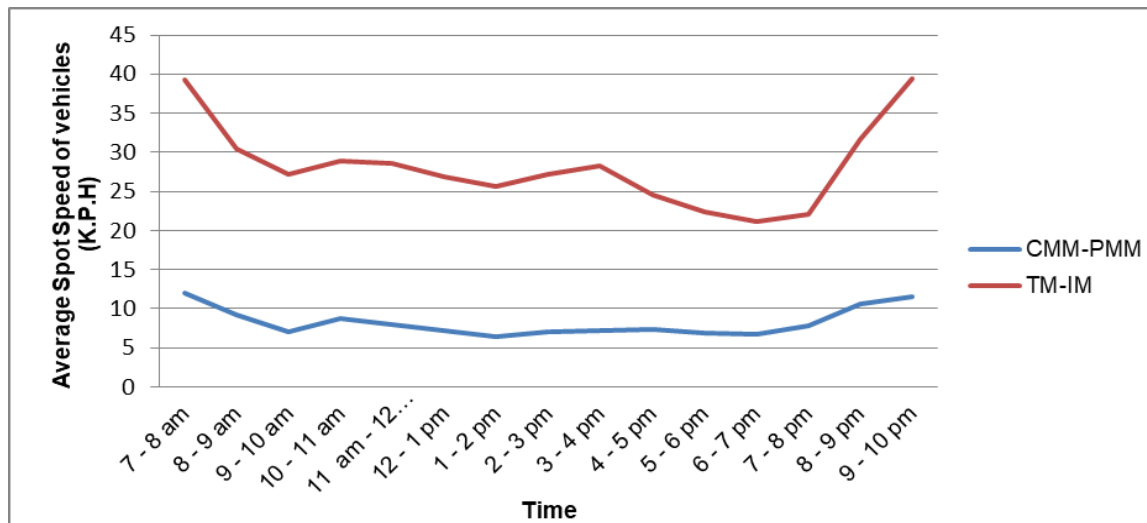
A survey conducted in 2008 revealed that average journey time within the city was around 20 minutes (MIDP, 2008). In this study spot speed variations of different vehicles during peak hours are analyzed. The spot speed survey has been done through Traffic morr to Indira morr (TM-IM) portion of A. H. road and Chapa-Mosjid morr to Pach-Matha morr (CMM-PMM) portion of Ataikula road.



[Fig. 5]: Spot Speed Variations On The Basis Of Traffic Mode during Peak Hours

[Fig. 5] shows that the average spot speed of rickshaw and motorcycle is higher than other vehicles. Rickshaws are one way trip generated vehicles that have a fixed origin and destination. In addition, rickshaws are able to bear only one or two passengers in a single trip and due to available passengers during peak hour their average spot speed goes higher. On the other hand, as auto rickshaw can bear at

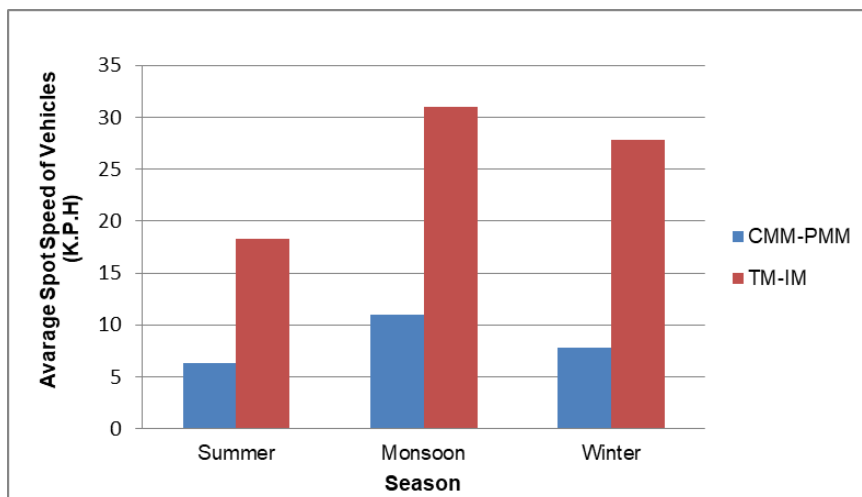
least 6 passengers in single journey drivers try to pick passengers from multiple origin points that create congestion. And hence the average speed of auto rickshaw becomes low.



[Fig. 6]: Average Spot Speed Variation throughout a Single Day

[Fig. 6] exposes the average spot speed of vehicles passing through the selected portion of the two roads in a single day. It reveals that the lowest average spot speed of vehicles is 6.44 K.P.H at 1 pm to 2 pm for Chapa-Mosjid morr to Pach-Matha morr (CMM-PMM) portion and 21.13 K.P.H at 6 pm to 7 pm for Traffic morr to Indira morr (TM-IM) portion. Unavailable frontal space for commercial activities of roadside shops and lack of footpath for pedestrians of CMM-PMM portion decrease the carriage way for vehicles which results in the lowest average spot speed during noon. On the other hand, several banks, offices, service centres, and markets are situated alongside the TM-IM portion of A. H road. These generate numerous trips within TM-IM portion. Again, illegal occupancy of the footpath by hawkers and parking decrease the carriage way area which results in the lowest average spot speed in TM-IM portion during the evening. The study also exposed that the mean spot speeds for CMM-PMM and TM-IM portion are respectively 8.25 and 28.24 K.P.H.

Again, Variation of average spot speed of vehicles is illustrated in figure 7 below.



[Fig. 7]: Average Spot Speed Variation throughout Seasons

[Fig. 7] marks that average spot speed is found low during the summer season for both portions of roads (6.34 K.P.H for CMM-PMM and 18.25 K.P. H for TM-IM). The study shows that the number of vehicles becomes high on roads during the summer season which results in high flow of vehicle and

creates traffic jam that decreases the spot speed. On the other hand, the number of vehicles on roads decreases during the monsoon season which results in low flow of vehicles that ensures the highest spot speed for both portions of the roads as well as intersections.

### Land Use Pattern Analysis

Table-1 shows the trip attractive landuse alongside the roads.

Table 1: Landuse types that attract trips alongside the Portion of the Roads

Name of Portion of Road	Name of the Road	Landuse types that Attract Trips
Chapa-Mosjid morr to Pach-Matha morr (CMM-PMM)	Ataikula Road	Bulbul College, Bookshops, Vegetable market, Hardware & Electronics shops, Banks, Jublitank, Mosque, jewelry shops
Traffic morr to Indira morr (TM-IM)	A.H Road	Two supermarkets, Banks, Medicine stores, Mobile markets, Band shops, training centers, Pabna College, Printing shops

Again table-2 shows that the surrounding area of selected roads is mainly used for commercial purposes (45%). Besides major land use types are services (20%), education (15%) and industrial (7%).

Table 2: Landuse Pattern in the Selected Area

Sl No	Landuse Type	Percentages
1	Residential	3%
2	Commercial	45%
3	Industrial	7%
4	Educational	15%
5	Religious	3%
6	Service	20%
8	Recreational	2%
9	Mixed use	4%
16	Others	1%
	<b>Total</b>	<b>100%</b>

According to a recent study, in Pabna city 25.1% of the total trip is generated for housework purposes, 25% is for education, 16.7% for service, 12.2% for business, 8.5% for personal work, 4.7% for recreation, 4.2% for shopping and 3.6% for other purposes (Rana, Hosssain & Sadat, 2017). The traffic intensity is high on the selected roads as major portions of the surroundings of roads are used for commercial, service and educational purposes. Hence, during office time intensive traffic flow is observed every day. Besides, acute trips are generated during different social, cultural and religious festival.

### THE SCOPE OF THE STUDY

According to Adedimila in 1981, "Traffic congestion or traffic jam is the byproduct of using motorized vehicles. Traffic jam is created when the vehicles do not move for a long time which causes huge time wastage and monetary loses". To protect this loses of country's economy, at first it is necessary to

analyse present traffic congestion and its characteristics. This study may help to perform these purposes as it has analysed the variation in traffic intensity of Pabna town, one of the most ancient towns in Bangladesh. In addition, this study tries to provide a better understanding insight the functioning of traffic system with temporal variation that may help decision makers in taking necessary strategies.

## **Recommendation**

One-way traffic flow can be a possible solution of congestion for the town. But it can be predicted that alternative roadway would be demanded in the nearest future especially for buses, trucks, and microbus. Controlling of traffic flow at intersections can be also a possible way to reduce congestion rate.

However, it has been observed that most of the commercial activities of the town take place within a very narrow space comparing to its total area. Therefore, growth centres should be developed at different important locations of the town to reduce trip generation towards the downtown of the town.

## **CONCLUSION**

Like other cities in Bangladesh, traffic congestion has become a common scenario in Pabna city. Regulating traffic and setting up planned office time may be a temporary solution in reducing the present daily congestion. But expanding of commercial area and constructing alternative road networks will be demanded in near future for the long lasting solution of the problem.

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