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Comparative analysis of level of service between Muradpur - Dewanhat & Agrabad - CEPZ links with identification of the contributing factors

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Abstract:

   Level of service of a road is a prime measuring scale regarding the standard and service of a road. But for better service it is necessary to maintain a uniform LOS level on a single road. But sometimes it differs from link to link due to various factors which ultimately decrease the functionality of the road. This paper discusses about such a road, port connecting Bahaddarhat to CEPZ road which maintain quite a different LOS level in two separate links. Not only that it discusses the level of difference and also the factors which are responsible for such LOS difference between two links. All the data that are used for this paper are collected through field survey.

Key words: Capacity, Average journey speed, LOS, Differential Factors.

Introduction

In urban area, road is a fundamental factor for the overall economic development, transections and mass transportation of a city [1]. As a business hub of Bangladesh and also as the tourist hub of Bangladesh, Chittagong has a strong economic role to play where the major weapon is the Port of this city. But the efficiency of the port largely depends on its connection with

the city commercial areas. Bahaddarhat to Patenga road which connects the port with the city is also known as the vein of Chittagong metropolitan city. But there is a big difference in level of service of this road in two different parts. For developing a solution it is necessary to know the level of differences and also the factors which affects behind this [2]. In this paper these objectives have been dealt with.

Study area profile

For this study we consider the vein of Chittagong city bahaddarhat to Patenga road where we divide our survey into 2 parts.
1. from Muradpur to Dewanhat.
2. Agrabad to CEPZ.

Muradpur to Dewanhat road has two major intersections within the road segment .This road connects the city people to the major port of the country and also with Patenga beach. The intersection points are Muradpur, Gate no.2, GEC, WASA, Lalkhan bazaar, Tiger pass. Bahaddarhat to Patenga road is very important for travelling in the city. In the south side of this place there is the Patenga Airport Road, in the north the road approaches to Bahaddarhat, in the east side there is O . R Nizam Road and in the west side there is Zakir Hossain Road[3].

Agrabad to CEPZ road also has two major intersections in the segment. One Port connecting road and the other one is on the custom house circle double mooring road. In the north, south, east, west direction the locations are as same as the Muradpur to tiger pass road. [3]

Methodology

For this project both primary and secondary source data were used. At first data was collected about the present volume and

speed of the routes through manual volume survey and moving observation method speed survey .From these surveys we collect data for calculating capacity & average journey speed of the routes. For calculation, all the vehicles are converted into U.K. standard P.C.Unit.Collection of data is conducted both in the week and weekend where we consider Friday as a weekend and Monday as a weekly day.

Speed Calculation

Here, the calculation method which is used to calculate average journey speed of Agrabad to CEPZ is shown which is used in the same way for Muradpur to Dewanhat road also.

Average speed, $V = \frac{d}{t}$.[4]

Where d = total distance and t = Average journey time

$$\overline{t} = t - \frac{y}{q} .[4]$$

Where, t = Journey time,   q = Flow rate, y = No. of overtaking vehicles – No. of overtake vehicles when test vehicle is moving.

Flow rate from Agrabad to CEPZ

$$q_{a-c} = \frac{x_{c-a} + y_{a-c}}{t_{a-c} + t_{c-a}} .[4]$$

Where, x_{c-a}= Opposing traffic counts when the test vehicle travelling Agrabad to CEPZ.

y_{a-c} = Overtaking − overtaken.

t_{a-c} = Journey time of Agrabad to CEPZ.

t_{c-a} = Journey time of CEPZ toAgrabad

Average journey time,

$$\overline{t_{a-c}} = t_{a-c} - \frac{y_{a-c}}{q_{a-c}}..[4]$$

Average speed from Agrabad to CEPZ,

$$V_{a-c} = \frac{d_{a-c}}{t_{a-c}}$$

here, d_{a-c} = distance of the link.[4]

In the same way the average speed of CEPZ to Agrabad and rest of the routes are calculated.

Capacity Calculation-

For capacity Calculation we use the following equation.

$$C = \frac{1000\,V}{S}[4]$$

Where, V=Average journey speed.
S=Average spacing between vehicles.
S=L+0.278vt.
L=length of the PCU vehicle.
V=Average journey speed.
t=Average journey time.

For evaluating LOS we consider the urban arterial road standard, kadiyali (2003) as a standard [4]-

Level of Service	Overall Speed (K.P.H.)	V/C ratio
A	≥ 80	0.6-0.7
B	$40 \leq$ Speed < 80	0.7-0.8
C	$30\leq$ Speed < 40	0.8-0.85
D	$25\leq$ Speed < 30	0.9
E	About 25	0.95
F	< 15	1.0 or more than 1.0

Analysis & Results

LOS of Muradpur to Dewanhat road-

As our study area is about 4.54 km in length so we divide it into three links to determine the level of services because of the over congestion level in this road. The links are Dewanhat to GEC, GEC to Gate no 2 and Gate no 2 to Muradpur.

Capacity of Dewanhat to Muradpur direction is calculated = 1465.81 PCU per hour.

Capacity of Muradpur to Dewanhat direction is calculated = 1415.5 PCU per hour.

Table 1:LOS calculation of Muradpur to Dewnhat road

Name of the direction	Volume	Journey speed(Km/Hour)	V/C ratio	LOS
GEC to Dewanhat direction	2055.27 PCU per hour	15.48	1.41	F
Dewanhat to GEC direction	2010.1 PCU per hour	13.85	1.37	F
GEC to Gate No. 2 direction	1749.37 PCU per hour	13.85	1.19	F
Gate No. 2 to GEC direction	1999.27 PCU per hour	15.48	1.41	F
Gate No. 2 to Muradpur	1636.35 PCU per hour	13.85	1.11	F
Muradpur to Gate No.2	1298.2 PCU per hour	15.48	0.91	E

Source-Field survey,2013.

From the result it is quite evident that the overall service of this road is F. This describes a forced flow operation at low speeds, where volumes are below capacity. In the extreme, both speed and volume can drop to zero. These conditions usually result from queues of vehicles backing up for a restriction downstream. [5]

LOS of Agrabad to CEPZ-

Here our study area is about 6.4 k.m long.But here we consider single link because of the less congestion point in this link. Here the busiest two points are the Agrabad commercial area and CEPZ circle. The rest is not congested at all and a perfect example of arterial road with minimum access road.

The capacity of Agrabad to CEPZ is calculated 2252 PCU per hour

The capacity of CEPZ of Agrabad is calculated 2534.33 PCU per hour.

Table 2-LOS calculation of CEPZ to Agrabad road

Name of the direction	Volume	Journey speed(Km/Hour)	V/C ratio	LOS
Agrabad to CEPZ	1842 PCU per hour	44.35	0.82	C
CEPZ to Agrabad	1938 PCU per hour	45.59	0.76	B

Source-Field survey,2013

On the Agrabad to CEPZ route the LOS is measured C. This is in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. Most of the drivers are restricted in their freedom to select their own speed, change lanes, or pass. [4]

But in the route CEPZ to Agrabad the condition is better than this one. Here it is found B. This occurs in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation [4].

Discussion

Factors affecting LOS
### 1. Roadside Land-use

On Muradpur to Dewanhat road most of the land is used for commercial purposes. So this is a very active place for

people to visit. It creates hazardous situation for the road. The amount of residential land is very little. Number of busy intersections is high here which create more congestion and the commercial purposes keep the road all day busy.

But in comparison Muradpur to Dewanhat road, the Agrabad to CEPZ roadside areas are mainly industrial and residential areas. Here only the Agrabad circle can be considered as a busy commercial area. The rest is mainly light and middle industrial areas and residential. The number of residential buildings is also high in respect of Muradpur to Dewanhat link road. The LOS of road mainly decreases in the morning and evening period and rest of the day maintain a better situation.
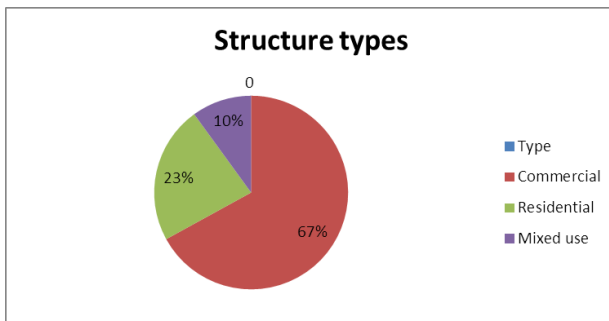
Figure 1-Structure type of Muradpur to Dewanhat (source-field survey)
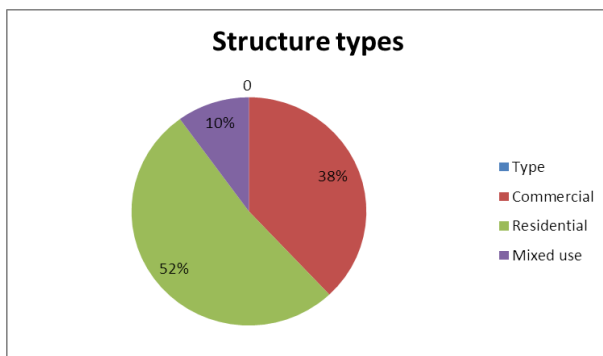
Fig 2- Structure type of Agrabad to CEPZ. (Source-Field survey)

2. Roundabout radius in Intersection

For an intersection a roundabout should have 19.95m – 26.6m [5]. In Gate No. 2 roundabout radius is only 1.51m, in GEC it is 1.21m and in Tiger Pass it is 2.75m which is insufficient for safe moving. This radius affects LOS in this road.

But in Agrabad to CEPZ we found three roundabouts, one on the Agrabad point, one on the custom house point and other on the CEPZ point .And their roundabout radius is 1.7m, 4.2 m and 2.7m respectively which ensure less bad impact on this route than Muradpur to Dewanhat route.

3. Channelization

In GEC intersection a traffic island,   a   roundabout;   a roundabout in gate no. 2; three traffic islands and a roundabout in tiger pass are used for channelization. These conflicting points cannot be solved by these islands.

But on Agrabad to CEPZ route, proper channelization is available on the Agrabad and also on the CEPZ point also. In fact these points are the intersection of 4 routes and have channelization for each one of them. It is also another important factor for being high LOS than the first route.

4. Carriage way, Lane and Shoulder

The carriageway from muradpur to Dewanhat is divided into two lane with no shoulder at all .Moreover most of the point like muradpur,2 no.gate,GEC,WASA or tiger pass is congested due to the off street parking which reduce the LOS of this route. But from Agrabad to CEPZ the route is divided into 3 lanes with shoulders. Though the shoulders are mostly occupied by the off street parked trucks and buses.
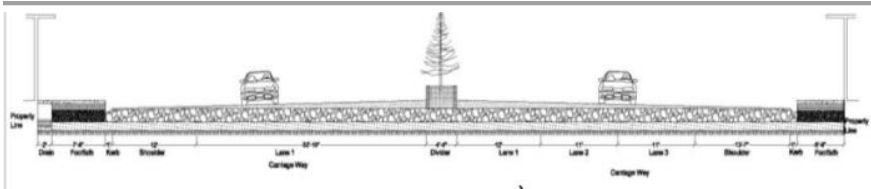
Fig- 3 Lane at each carriage way (Agrabad to CEPZ) road intersection.
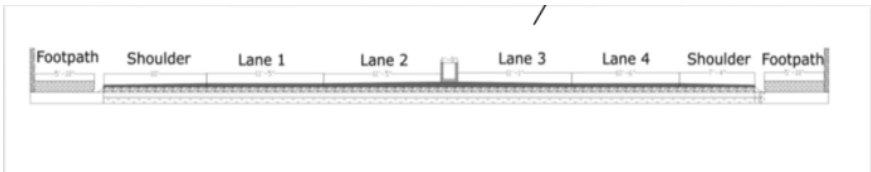

Fig 4 - 2 lane each carriageway (Muradpur to Dewanhat) road intersection.

5. Access road

For safe moving in a road there should have minimum number of access road. But from Dewanhat to Muradpur there is too many access roads which are linked with the main road which creates many conflict points. For this reason vehicles can't move with a regular speed and make congestion, which decreases LOS.
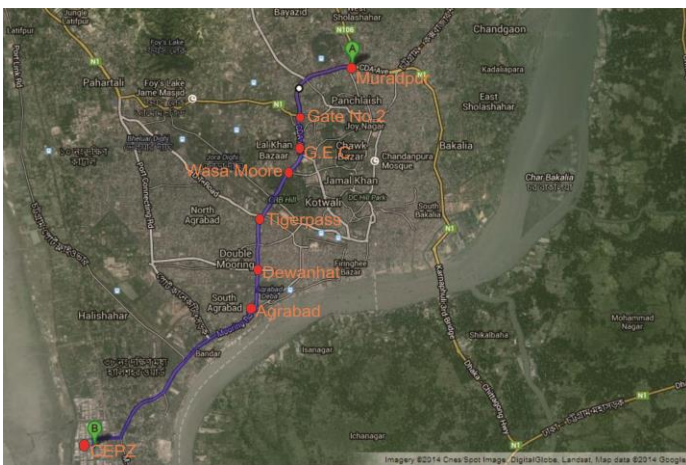

Fig 5- Access roads of the Links

But from the map it is quite evident that the number of access road is minimum in the Agrabad to CEPZ route. For that reason here the vehicles can maintain a moderate speed.

6. Signal Device

Muradpur e to Dewanhat road has three important intersections .At the three intersections along this road there is no signal devices which is very important for free flow of traffic and it plays an important role for the safety of people who cross the road. There is traffic police at every intersection but without signal devices they face problem and sometimes they do not do their duty properly.

But in case of Agrabad to CEPZ road on the 3 intersections there are both traffic polices and signal lights. But the lights are not properly maintained. Though it serve better than the signal system of Muradpur to dewanhat.

7. Low speed vehicles and Private Cars

Dewanhat to Muradpur is the main Arterial road of Chittagong city. But in this road it is seen that most of the flow of vehicles is CNG, rickshaws & Auto rickshaws which are slow moving vehicles. Besides increasing number of private car in respect of public transports like bus is also a major concern which is responsible for the decrease of LOS.

But in the Agrabad to CEPZ route the situation is much better than this route. As it is the main connecting road with port mainly container Lorries and other motorized vehicles are the main user of this road. The number of non-motorized slow vehicle is also low in respect of Dewanhat to muradpur. Moreover the numbers of Public transports are found higher also in this route than the previous one.

8. Illegal Parking

As the commercial activities in the muradpur to Dewanhat road are high, the numbers of commercial buildings are also very

high which lead them to a high number of on street parking. Most of the commercial buildings and shopping malls on this this road do not have adequate parking facilities. In fact some commercial buildings have no parking facilities at all. As a result the on street illegal parking creates congestion and as a result the LOS decreases.

But in the Agrabad to CEPZ road only the Agrabad circle is functionalized as a commercial area. The rest is mainly for light industries and residential areas. There are also adequate shoulders beside the road. So on street parking can't create vast impact on the LOS level of this road.

9. Management Problem

Sometimes management problems create congestion on roads and reduce LOS. Uncovered drainage in road and closed road reduce Los. Beside this illegal roadside use for commercial purpose is also responsible for reducing LOS.

But in the Agrabad to CEPZ route this type of problem is also minimum.

10. Grade separation

Grade separations like fly over can also play a vital factor for the development of LOS of a road [2]. In past the port connecting road means the Agrabad to CEPZ road was also as congested as the muradpur to Dewanhat route due to the pressure of the container lorries. But now a port connecting fly over have built which carry the maximum pressure of the port related trucks and Lorries. As a result the pressure reduces a lot.

But in case of Muradpur to Tiger pass route there is no grade separation .So the main road has to carry the whole pressure of vehicle.

11. Lane width:

A lane width of 3.65m is considered as the defined ideal lane [5]. Agrabad to CEPZ lane has average width of 3.67m. So, it is an ideal lane.

But in respect of Muradpur to Dewanhat the lane width is found 2.88m which is not also up to the standard to carry the traffic.

12. Lateral Clearance:

Lateral obstruction such as retaining walls, abutments, signposts, light, poles and parked cars, located closer than .9 ft. from the edge of a traffic lane reduce the capacity [5].
But in Muradpur to Dewanhat route it is found almost .7 feet and sometimes less than .5 ft.

In Agrabad to CEPZ the measurement is almost .8 ft. and sometimes 1-1.5 ft. also. It also plays an important factor.

Findings:

From the above analysis it is quite evident that the overall situation of the level of service in the Muradpur to Dewanhat is pretty much worse than the Agrabad to CEPZ link road. The main reasons are also discussed above. So in comparison we can easily identify that the LOS of Agrabad to CEPZ link is much better in respect of Muradpur to Dewanhat link.

Conclusion

For the overall development of Chittagong city, this Bahaddarhat to Patenga road is one of the chief factors which can play the vital role as it is the port connecting road with the city center. But from the comparison it is quite evident that the difference in the level of service is pretty much higher in different links of this road. But for the overall development uniform LOS of this road is a pre-condition [2]. In this paper I

try to find out the level of difference between the links and also the factors which are responsible for this difference. Hopefully it will help for further study about this road.

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