THE POLICY IMPLICATIONS OF BANNING NON-MOTORIZED VEHICLES (NMVS) FROM THE ARTERIAL ROAD OF DHAKA CITY

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Introduction

The aim of sustainable transportation policy is to ensure mobility and accessibility to different income groups in a safe and environmentally friendly way (Guillen & Lidasan, n.d.). The non-motorized vehicles (NMVs), such as: bicycles and cycle-rickshaws play significant role to ensure accessibility and mobility for urban commuters in Asian cities. In many Asian cities, NMVs account for 25 to 80 percent of daily urban trips (Replogle, 2009).

Asian cities are experiencing increasing population growth and economic activities resulting in rapid growth of transportation problems such as congestion, poor level of services, safety and environmental degradation (Rahman, et al., 2009). The very familiar policies adopted by Asian transportation authorities to deal with these transportation problems are to initiate traffic control measures and mass-transit systems and to restrict NMVs on the major urban arterial roads. The authorities perceive NMVs, especially the three wheeler cycle-rickshaws, as the inefficient and backward transport modes, impediment to transport progress, and inconsistent with a modern urban image (Rahman, et al., 2009). The cycle-rickshaws are characterized as the 'slow moving', 'congestion creators' and 'inhuman' non-motorized public transport (Rahman, et al., 2009). Noticeably, the cycle-rickshaws are banned on the major arterial roads of Asian cities as a policy measure to offset the transportation problems.

Like many Asian cities, the Dhaka City Corporation decided to ban cycle-rickshaws on ten major arterial roads of Dhaka City. This was the part of World Bank-funded Dhaka Urban Transport Project that was initiated on 1999.

One of the major reasons for failure of urban transportation policies is the inability to understand the underlying factors causing the problem and consequences of the policy implications. For example, Manila (Philippines) banned NMVs initially in 1950's but some of the NMVs re-emerged in 1990's. Bangkok (Thailand) banned the NMVs in 1960 and Karachi (Pakistan) in 1962. Jakarta (Indonesia) followed the trend in 1988, but withdrew the interdict briefly in 1998 before reversal. New Delhi (India) applied this policy during the early 1980's and restricted total number of registration and licensing of cycle-rickshaws. After the long-time of banning the NMVs, about 70 percent residents in the low income neighbourhoods of New Delhi and Jakarta favour reinstatement of NMVs (Rahman, et al., 2008). The interdiction of NMVs didn't solve the transportation problems in these cities rather in some cases worsen the situations.

The objectives of this study are to evaluate the existing performance of the urban arterial road after banning the NMVs and to perform the before-and-after analyses of the transportation system. This study considers Mirpur arterial road of Dhaka City as a case study. The Mirpur road was considered as a demonstration project to ban the NMVs on the major arterial roads of Dhaka City by the Dhaka Transport Coordination Board (DTCB). This demonstration project was implemented in two phases – NMVs were banned from Amin Bazar to Asad Gate in December 2002 and from Asad Gate to Azimpur in December 2004.

Cycle-Rickshaw – an Important Mode of Transport in Dhaka City

In Dhaka City, about 2.5 million people are pulling or indirectly depending on an estimated 500,000 cycle-rickshaws (Wipperman and Sowula 2007). The cycle-rickshaws have significant share to total trip and contribute 40% of non-walk trips in Dhaka City (Strategic Transport Plan, 2005). This sector also has significant economic share to transport sector and national Gross Domestic Product (GDP). Cycle-rickshaws contribute 34% of the value added from the transport sector to GDP and 6% to the GDP of Bangladesh (Gallagher, 1992; Ali and Islam, 2005). The cycle-rickshaws have

social and cultural significance and are preferred by the significant social groups (e.g. women, elderly and office goers) because of their qualities of security, comfort and reliability. The commuters also prefer this fuel-free transport mode because it can operate on very narrow streets and has reduced road space occupancy compared to private automobiles (Human Development Research Centre 2004; Rahman, et al., 2009).

Methodology

This study collected traffic data on traffic volume, speed, and travelers, and land use data during the period of 2006. The traffic data on Technical Crossing were collected during the peak and off-peak periods of the working day at thirty-minute intervals (Figure 1). The peak periods were 8:00-8:30, 9:30-10:00, 17:30-18:00, while the off-peak periods were 12:00-12:30, and 15:00-15:30. The traffic data on the New Market crossing were counted during the peak and off-peak periods of both the weekday and weekend as the market area and shopping complexes are located in the close proximity of this intersection. The peak periods during the weekday were identified as 8:00-8:30, 13:00-13:30, 17:00-17:30, 19:00-19:30 and during the weekend as 10:00-10:30, 15:00-15:30, 18:00-18:30, 20:00-20:30.

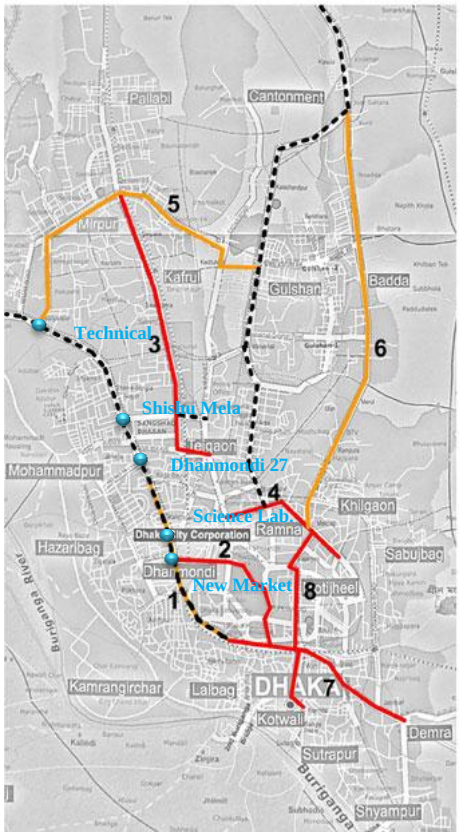
The traffic speed survey was conducted during the peak and off-peak periods of the weekend and weekday at the road sections of Azimpur –Nilkhat, Nilkhat – Science lab, Science lab – Dhanmondi 27, Dhanmondi 27 – Shishumela, and Shishumela- Mirpur technical intersection (Figure 1).

Existing Traffic Conditions

Under the prevailing transport policy, in 70% cases the commuters require intermodal shifts that consist of 25% rickshaw- public mass transit shift, 13% rickshaw-auto rickshaw shift, 12% walking-rickshaw shift, 10% public mass transit -auto rickshaw shift and 10% rickshaw-human hauler shift. The survey reveals that NMVs were associated with 70% commuters' trips after the banning of cycle-rickshaw on the studied road.

The traffic volumes at the North-South (N-S) and South-North (S-N) directions of the studied road sections are converted to Passenger Car unit per hour (PCU/hr) to define the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car. In general, the N-S bound traffic is higher than that of S-N bound during peak and off-peak hours at all intersections except Dhanmondi 27 (Figure 2).

Rickshaw-Free Corridors in Dhaka
(existing and proposed)



No.	Name of the corridor	NMT Phase out time (Target time)
1.	Mirpur Road(Kalabagan-Azimpur)	31-8-2004
2.	New Elephant Road/Bhasani road(Science Lab-Shahabagh-Matshabhaban- Press Club-College road)	31-8-2004
3.	Rokeya Saroni(Mirpur 10-Taltala-Agaraon-Farmgate)	31-5-2005
4.	New Eskaton Road/Circular Road (Bangla motor-Moghbazar-Mouchak-Malibagh-Rajarbagh)	31-7-2005
5.	Technical(Technical-Mirpur 1-Mirpur 2-Kachukhet-Banani)	30-9-2005
6.	Progati Sharani DIT Road (Kuril-Baridhara-Badda-Rampura-Malibagh-Mouchak)	30-11-2005
7.	Zohir Raihan Sharani/Hatkhola road (Azimpur-Fulbari-Taketali-Saidabad)	30-12-2005
8.	North-South Road/English road (Malibagh-Kakrail-Purana Palton-Zero point-Fulbaria)	31-7-2006

Figure 1: Mirpur arterial road and the study area

Mirpur area, at the north of the studied arterial road, is a periphery area of Dhaka city; and the residents at this area frequently commute to commercial areas such as Shahbag, Motijheel, Gulistan, Paltan etc. The commercial areas e.g. New Market, Nilkhet, Gausia and other shopping centers on the both-sides of the Mirpur road attract a huge number of traffics which also use Mirpur Road. The adjacent area of Azimpur, located at the south side of the studied road, is an educational and commercial area. This area also attracts trips for educational purposes from Mirpur and surrounding areas.

The N-S bound traffic flows are highest at the Science Lab section (Figure 2) because the commuters and bus routes use this section for commuting Jigatola, Mohammadpur, Shahbag, Paltan, Motijheel, New Market and Nilkhet (Figure 1). In case of S-N bound traffic, the traffic flows are increasing gradually from New Market to Shishu Mela section.

The composition of different modes is analyzed to understand the proportion of public and private motorized vehicles (MVs) on the Mirpur arterial roads. The private MVs (car, micro-bus, motorcycle etc.) contribute the major share of traffic flows during both peak and off-peak hours at all road section except at Shishu Mela section (Figure 3 and 4). At Shishu Mela section, public MVs (small) such as auto rickshaws, taxi, and human haulers contribute the major share of traffic flows (Figure 3 and 4). During both peak and off-peak hours, the public mass transits contribute the lowest traffic flows at the studied road sections. These statistical analyses reveal that the studied arterial road is not free from congestion; the private and small public MVs replaced the NMVs after interdicting the NMVs on that road.

This study also investigated the total number of cycle-rickshaws destined to the different sections of the Mirpur arterial road. Figure 5 shows that the NMVs reached the access roads of Mirpur arterial road at the rate of 532 – 588 PCU/ Hr on the N-S side of the road and 636 – 664 PCU/ Hr on the S-N side of the road during the peak periods. During the off-peak periods, these rates increased to 500 – 748 PCU/Hr on the N-S side and 550 – 752 on the S-N side, respectively (Figure 5). The volumes of cycle-rickshaws are high at the access

roads of the S-N bound of arterial road because of the separate NMV lane connecting the New Market post office and Science Lab Police box. The commuters reached at these points of the arterial road from the access road either terminated their trips or looked for intermodal shift. The integration of multimodal transport is required at these points of the arterial road.

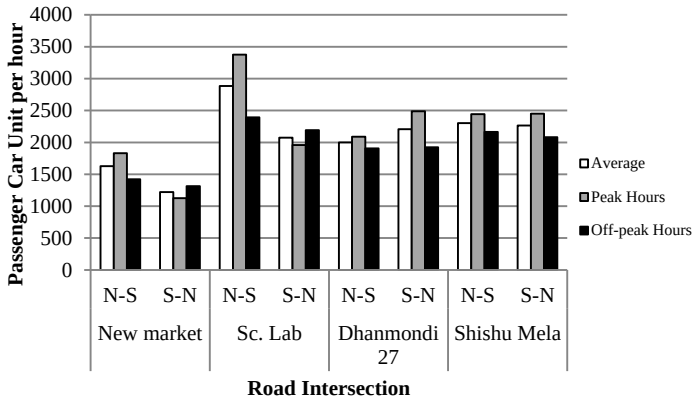


Figure 2: Passenger Car Unit (PCU) at different road sections

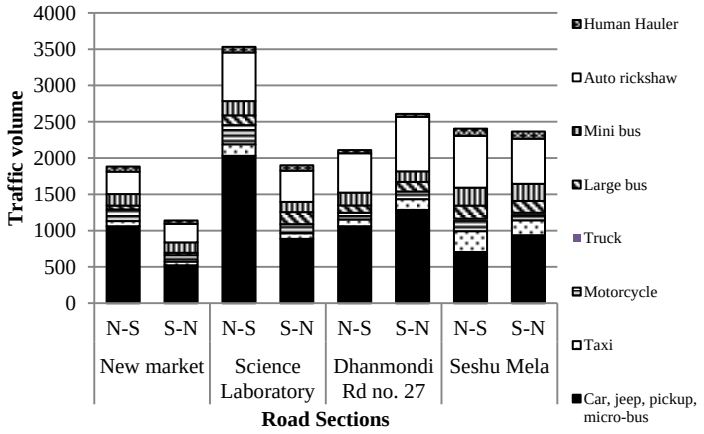


Figure 3: Traffic volume of different modes during peak hours

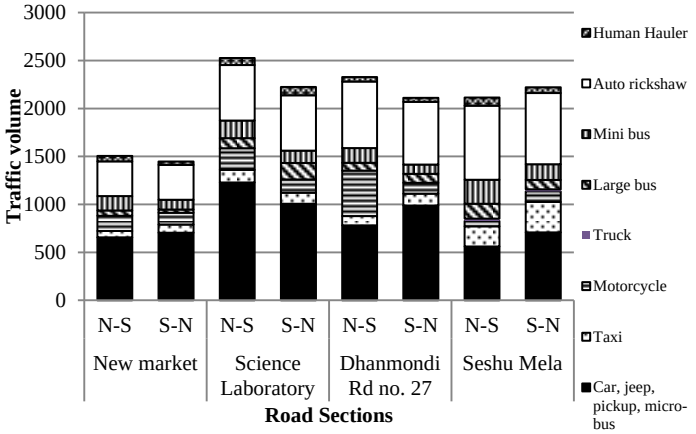


Figure 4: Traffic volume of different modes during off-peak hours

The study observed that the volumes of cycle-rickshaw at the access roads of arterial road on both directions were almost equal during the morning of weekend. The volume of cycle-rickshaw was higher at the access roads on the N-S bound than that on the access roads of S-N bound during the period of 15.00-16.00 o'clock in the weekend because the shoppers trip to the shopping centers at New Market and Gausia during this period.

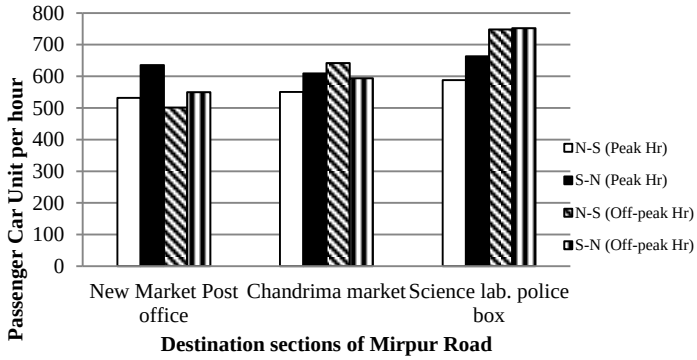


Figure 5: Passenger Car Unit of cycle-rickshaws at the access roads

The journey speed (km/hr) and delay time (min.) are estimated during the peak and off-peak hours at the road sections of Azimpur -Nilkhet (A.-N.), Nilkhet - Science Lab. (N.-S.L.), Science Lab. - Dhanmondi 27 (S.L. - D. 27), Dhanmondi 27 –Shishu Mela (D. 27 - S. M.) and Shishu Mela - Technical (S.M. - T.). The maximum peak hour journey speed of the traffic flow is observed at S.M. - T. road section on the S-N bound and at D. 27 - S. M. section on the N-S bound. The minimum peak hour journey speed of the traffic flow is found at A. – N. section on the S-N bound and at N. – S. L. section on the N-S bound (Figure 6).

Figure 6 shows that the average journey speed of private MVs is obviously high during the off-peak periods because of low traffic flow. During the peak periods, the journey speeds of public mass transit and private MVs are always high at the road sections of D. 27 - S. M. and S.M. - T. in both directions comparing to other road sections. The journey speeds for both public mass transit and private MVs are comparatively low at A.-N. section during both peak and off-peak hours because of the traffic congestion at the intersection of Nilkhet – New Market.

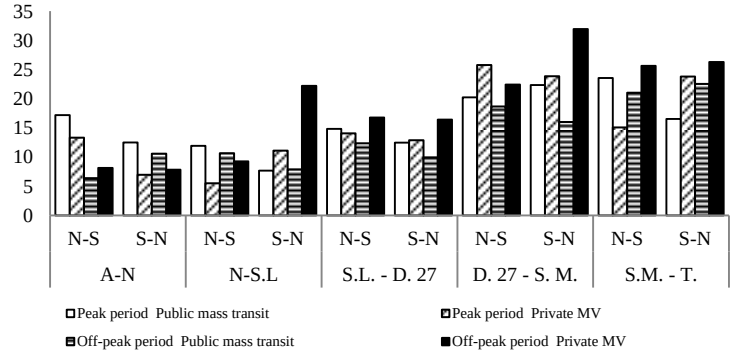


Figure 6: Journey speed (km/hr) of private MV and public mass transit during peak and off-peak hours

The delay time on each of the road segment of the Mirpur arterial road is estimated to determine the level of service of this arterial road under the prevailing transport policy. It is interesting to observe that the difference between the delay times during the peak and off-peak

hours is extensively high on the N-S direction of A. – N. and S. L. – D. 27 road sections (Figure 7). The difference between the delay times is also high on the S-N direction of A. – N., N. – S. L., and S. L. – D. 27 road sections (Figure 7).

Figure 7 also shows that the maximum peak and off-peak hour delay time is at S. L. – D. 27 and D. 27 – S. M. road sections on the S-N direction, respectively. This reveals that the traffic congestion is high on these road segments because of the returning traffics especially after evening. On the N-S direction, the maximum peak and off-peak hour delay time is at A. – N. and D. 27 – S. M. road sections, respectively (Figure 7). On these road sections, the traffic congestion is high during morning and afternoon as the commuters are traveling to educational institutions and commercial centers during these periods. The minimum peak and off-peak hour delay time is at S. M. – T. and N. – S. L. road sections on the S-N direction, respectively (Figure 7). On the N-S direction, the minimum peak and off-peak hour delay time is at N. – S. L. and A. – N. road sections, respectively (Figure 7). The traffic traveling on the S-N bound were directing towards the connecting roads of the arterial road reducing the traffic flow on the S. M. – T. road section during the peak hours. On the other hand, major share of traffic flows that originated from the Mirpur and its surrounding areas with a destination target to educational and commercial areas reached the destination before reaching the N. – S. L. and A. – N. road sections on the N-S bound.

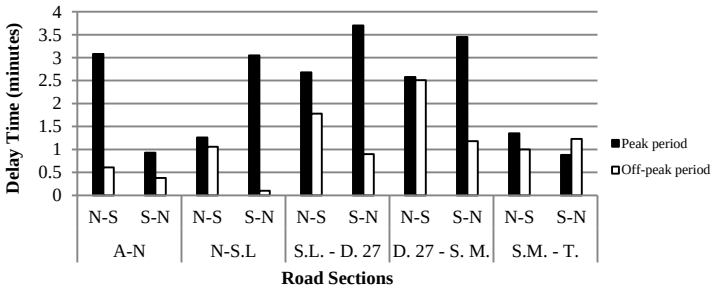


Figure 7: Delay time (minutes) on the road sections during peak and off-peak hours

Before and After Comparative Evaluation

The before-and-after analysis reveals that a significant number of commuters previously used the cycle-rickshaw commuting on public mass transit after the interdiction of the NMVs on the Mirpur arterial road. This transport policy also caused a significant change on the distribution of transport modes used by the commuters. For example, around 19% commuters shifted from cycle-rickshaw to auto-rickshaw, 14% travelers shifted from public mass transit to auto-rickshaw and 14% travelers shifted from cycle-rickshaw to human hauler.

The Dhaka City Corporation (DCC) constructed a separate NMV lane connecting New Market post office and Science Lab. Police box. The traffic volumes on the studied road sections of the arterial road are compared before and after the implementation of banning NMVs (Figure 8). The total number of traffic flows were reduced at all the studied road sections of Mirpur arterial road, but the motorized traffic flows were increased (Figure 8).

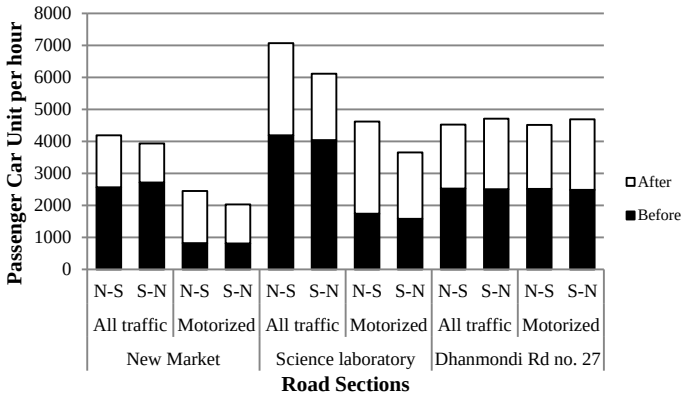


Figure 8: Before-and-after comparison of traffic volumes (PCU/Hr)

The journey and running speeds were compared before and after the implementation of banning NMVs. Table 1 shows that the journey

speed was significantly increased on the S-N bound after banning NMVs; however, there is no significant increase in the running speed.

Interestingly, the journey and running speeds were decreased on the N-S direction causing more traffic congestion and delay time (Table 1). The banning of NMVs attracted more private MVs on the Mirpur arterial roads caused additional traffic flow. During the off-peak periods, both the journey and running speeds were increased significantly (Table 1).

The level of service (LOS) of the Mirpur arterial road is also examined before and after the implementation of banning NMVs. The LOS is calculated based on the traffic speed, travel time, roadway geometric features, safety and convenience of travel, and the delay time. The LOS of the Mirpur arterial road remains as **E** after the implementation of the transport policy. The LOS **E** is defined as the traffic flow is unstable, and the road is operating at maximum capacity. The traffic flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to maneuver in the traffic stream and speeds rarely reach the posted limit. The comfort level of drivers and commuters is poor. This reveals that the policy didn't improve the transportation system on the Mirpur arterial road.

Table 1: Journey and running speed before-and-after scenario

Speed (km/h)	Direction	Peak period		Off-peak period	
		After	Before	After	Before
Journey speed	N-S	16.58	17.71	21.69	13.63
	S-N	20.90	9.52	20.77	17.66
Running speed	N-S	26.32	28.36	31.36	23.92
	S-N	28.37	23.79	24.30	27.96

The traffic study reveals that the transportation system on the Mirpur arterial road didn't drastically improved because of banning NMVs. This study needs to understand the surrounding land uses of the Mirpur arterial road in order to identify the reason because the performance of transportation system is greatly dependent on land uses. The comparative analysis of the surrounding land uses (e.g. 50 meter buffer zone of the studied road) reveals that the residential,

open space, and mixed land uses were decreased after banning NMVs (Figure 9).

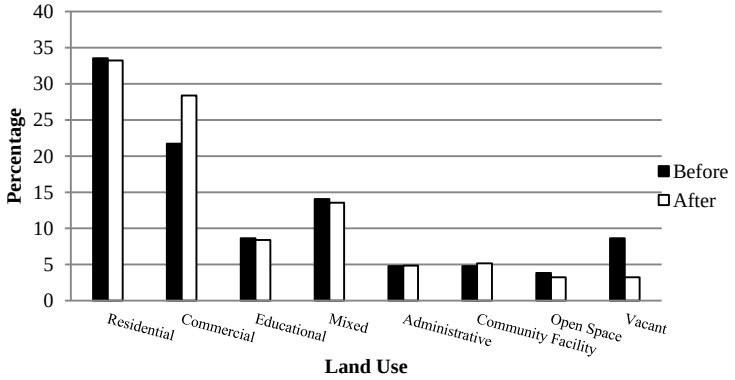


Figure 9: Comparative analysis of land use pattern

On the other hand, the commercial land use sharply increased after that policy (Figure 9). The vacant plots have also decreased from the previous scenario. Most of the vacant plots have been converted into commercial plots. The commercial activities and commercial trips were increased because of the increased commercial land use within the close proximity of Mirpur arterial road. This results in increased motorized traffic flows on the Mirpur arterial road.

Findings and Discussion

This study reveals that the policy of banning NMVs did not yield any major improvement to the transportation system on Mirpur arterial road; and in some aspects it caused huge economic burdens to a major portion of commuters. The private MVs such as passenger cars and auto-rickshaws are the dominant transport modes after banning NMVs. The policy of banning NMVs encouraged the commuters, especially the higher-middle class income groups, to buy private cars. This is observed in the study as the Science Lab. and Dhanmondi 27 intersections are the most congested intersections after the implementation of the transport policy. The surrounding areas of these road intersections are resided by the high and higher-middle class income groups. The implemented policy increases the travel

costs to the low and middle income groups for whom cycle-rickshaws were the cost-effective transport mode. This policy also increases the sufferings of the most vulnerable road users, such as, women, children and disables by depriving them from having their most suitable mode of transport (Rahman, et al., 2009).

The study also reveals that there is no improvement on the travel time for the MVs. In some cases, commuting becomes complicated and difficult because of lack of integrated multimodal transportation system. The taxis and auto-rickshaws that replaced NMVs are reluctant to make short trips causing significant increase of waiting time for commuters. The banning of NMVs has deteriorated accessibility of the majority of road users by cutting accessibility to access roads, and destroying the connectivity of the transport system. The economic impact of banning NMVs has been devastating that is as high as Tk 1.52 billion (€10 millions) per year in the area (Rahman, et al., 2009).

In summary, it can be said that the noble intentions to reduce the traffic congestion and increase the road safety by banning NMVs on the Mirpur road are not achieved; rather this policy encourages the ownership of more private MVs. The policy didn't study carefully the economic and social losses of the low income groups and rickshaw pullers because of banning NMVs (Rahman, et al., 2009).

The transport authorities should focus on the efficient public transport system by implementing a comprehensive public transport policy including overall improvement of public transport through coordinated traffic signalling system, effective route plan, regular timing, removing road side encroachments, and increasing service quality etc.

Conclusion

Dhaka City, the Capital of Bangladesh and one of the mega cities in South Asia, is facing growing traffic congestions on the major arterial roads for which the government and urban transportation planners have been initiating different strategies to reduce the traffic

congestions. As a part of these initiatives, the Dhaka City Corporation banned NMVs from the ten major arterial roads of Dhaka City. The objectives of this study are to evaluate the existing performance of the Mirpur arterial road after banning NMVs and to perform the before-and-after performance analyses. This study collected traffic data on traffic volume, speed, and travelers, and land use data during the period of 2006.

This study identifies that private MVs (car, micro-bus, motorcycle etc.) contribute the major share of traffic flows during both peak and off-peak hours at all road section except at Shishu Mela section after banning NMVs. At Shishu Mela section, public MVs (small) such as auto rickshaws, taxi, and human haulers contribute the major share of traffic flows.

The before-and-after analysis reveals that a significant change on the distribution of transport modes used by the commuters after the interdiction of the NMVs. For example, around 19% commuters shifted from cycle-rickshaw to auto-rickshaw, 14% travelers shifted from public mass transit to auto-rickshaw and 14% travelers shifted from cycle-rickshaw to human hauler. The level of service (LOS) of the Mirpur arterial road remains same even after banning NMVs. This study identifies the increment of commercial activities and the commercial trips as one of the reasons for not improving the transportation system of Mirpur arterial road.

This study concludes that the noble intentions to reduce the traffic congestion and increase the road safety by banning NMVs on the Mirpur road are not achieved; rather this policy encourages the ownership of more private MVs. The transport authorities should focus on the efficient public transport system by implementing a comprehensive public transport policy including overall improvement of public transport through coordinated traffic signalling system, effective route plan, regular timing, removing road side encroachment, and increment of service quality etc.

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