Journal of Bangladesh Institute of Planners ISSN 2075-9363
Vol. 11, 2018 (Printed in June 2020), pp. 77-87, © Bangladesh Institute of Planners

Impacts of Rural Road Development on Local Traffic: A Case Study of Tangail District

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Abstract

Construction and maintenance of rural roads bring multiple socio-economic benefits to the people of rural areas as well as significant change in the movement of local traffic. The aim of this study is to assess the impacts of rural roads development of the pattern of local traffic. The study area of this research is Tangail, which is a district of Bangladesh. For completing the study, data were collected from whole Tangail district by doing questionnaire surveys and holding focus group discussions with shopkeepers and officials of Local Government Engineering Department (LGED), which is the responsible authority for construction and maintenance of rural roads. Besides, educational institutions were also surveyed and information regarding land use changes were collected. Before the development works, people were mainly dependent on non-motorized transport modes and most of the roads were not usable throughout the year. After the development works, the non-motorized modes have declined and volume of motorized modes has increased significantly. At present, 87.3% shopkeepers are getting more customers than before and average reduction in freight cost is 35.42 BDT. The number of semi-paved and paved residential buildings has also increased. Students, who are a major part of the local traffic, their attendance in schools has increased dramatically as a result of road development. However, development of rural roads has also created some problems to the local people such as heavy traffic and increased number of accidents because of high speed of motorized vehicles.

Introduction

In Bangladesh, most of the people (64.96%) live in rural areas and majority of them are poor who have very limited access to high quality inputs and to local markets because of infrastructure limitations (Trading Economics, 2016; World Bank, 2014). Improved roads and infrastructures can create opportunities for economic growth and poverty reduction through a range of mechanisms (Khandker, Bakht, & Koolwal, 2009). Roads reduce transportation costs, as well as the costs of consumption and production of goods and services (BIDS, 2004). On the contrary, inadequate roads and poor road access put high cost on transportation as well as put constraints on rural poor in terms of their access to social infrastructures, such as education and health facilities (Oraboune, 2008).

When transport sector is efficient, it provides various economic and social opportunities and benefits that result in positive multiplier effects such as better accessibility to

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markets, employment, education, health and additional investment (Ooterhaven & Knaap, 2000). Roads are viewed as a means of socio-economic development because they link regions, places, people and economic activities. The expansion and improvement of a given road network would contribute to increase in accessibility and mobility, while reducing the distance to destinations, travel costs and travel time; despite these social and economic benefits, road networks are also perceived as cultural artifacts that lead to negative ecological effects (Patarasuk, 2013).

Particularly rural roads are somewhat typical in terms of their capacity to literally pave the way for various investments in social infrastructure sectors such as schools, health services, and security services. In case of agriculture sector, better roads can significantly reduce the cost of inputs such as fertilizers, seeds, and extension services (Dercon et al., 2008). On the output side, better roads increase the scope of profitable trade, which in turn encourages on-farm investments to raising agricultural production (Binswanger et al., 1993). This in turn raises rural incomes, lower food prices, reduces spatial inequality in food prices, and reduces dependence on food imports. If road infrastructure in well managed, it transforms the quality of life of citizens through dynamic externalities that its development often generates (Sengupta et al., 2007). It is evident that improvement of rural roads has multiple socio-economic effects on the rural people as well as on the quantity and quality of traffic volume. However, the aim of this study is to assess the impacts of rural road development on local traffic, which is based on the case study of Tangail district.

Materials and Methods

Study Area Profile

Tangail, which is a district of Bangladesh is selected as the study area as several road improvement projects have recently been carried out in Tangail. Tangail is the largest district of Dhaka division by area which is composed of 12 Upazilas[1] and 109 Unions[2]. It lies between 24° 01′ and 24° 47′ North latitudes and between 89° 44′ and 90° 18′ east longitudes. There are three types of roads in the rural areas of Tangail, which are Union Road, Village Road A and Village Road B. According to LGED (2009), by definition,

Union roads are those which connect Union administrative headquarters with Upazila administrative headquarters, growth centers or local markets or with each other.

Village Roads A are those which connect villages with Union headquarters, local markets, farms and inland village ports or with each other. Village Roads B are those roads which connect the areas within a village.

According to LGED databases (2017), the sum of total road network in Tangail district is 8249.25 km, out of which 1167.53 kilometers (km) are Union Road, 3391.78 km are Village Road A and 2749.57 km are Village Road B.

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1 Upazila is a local administrative unit of Bangladesh. A district is divided into multiple Upazilas for administrative advantages.

2 Union is local administrative unit of Bangladesh. Several Unions comprise a Upazila.

Literature Review

Asian Development Bank (2011) conducted a study in Chhattisgarh, India and found that there has been a significant increase in the number of trucks, mini buses, cars and taxies in the roads which have undergone road improvement works than the roads on which no improvement works were carried out. Again, Asian Development Bank (2014) in the validation report of one of their projects mentioned that there has been a significant increase in average vehicle speed in some of the roads of Philippines after the improvement works. ADB found that vehicles now run at an average speed of 61.9 km/h in those roads compared to their pervious average speed of 12.5 to 17.5 km/h.

Islam et al. (2008) showed that traffic condition in Afghanistan changed drastically after the redevelopment of several roads. They found that traffic volume has increased by 58 percent than before, after the Kabul-Kandahar-Herat road was improved.

According to Adejedi et al. (2014), in Osun State of Nigeria, roads were initially unpaved which were not usable throughout the year and the traffic volume was mainly consisted of pedestrians and non-motorized vehicles; however, after the road development works, the number of motorized vehicles has increased significantly and the roads have become usable throughout the year.

As a result of reconstruction of a highway from two-lane to four-lane in New Mexico, the average travel time reduced on the rural portion of the highway; also the vehicle operating costs reduced mainly due to less fuel consumption although the accident rates increase by 36 percent than before (Tarefder, 2015). Sloman et al. (2017) found that road improvement works have various short term and long term effects on traffic and travel behavior of people, which include shift of transportation mode, change in destination and generation of more trips. According to Goodwin (1996), an average road improvement, for which traffic growth due to all other factors is forecast correctly, will see an additional (i.e. induced) 10% of base traffic in the short term and 20% in the long run.

World Bank (1996) in its impact evaluation report of Morocco, studied four roads onto which development works were carried out and they found the most direct impact was the elimination of frequent road closures during rainy periods, as the improved roads are open to traffic year-round. Other impacts were: reduction in the vehicle operating cost, lower prices for freight and passenger services than in roads that were not improved, increased volume of traffic with a high portion of motorized vehicles, change in the ownership of motorized vehicles and drastic change in travel time.

Data Collection and Analysis

The objective of this study has been to identify the impacts of rural roads development on local traffic. To fulfill the objective, a survey was conducted in 12 Upazilas of Tangail district. Three kinds of roads were selected for survey from each Upazila.

a) A road having improvement works done. Here improvement is defined as changing the surface of the road from Earthen to Herring-Bone-Bond (HBB) or Bituminous Carpeting (BC).
b) A road having further improvement works done. Further improvement means changing the road surface from HBB to BC.
c) A road having maintenance works done, which means repairing the old BC surface.

From every Upazila 3, roads were selected onto which development works were recently been carried out and a total of 36 roads have been selected from whole Tangail district. Information regarding change in traffic volume and transportation mode as well as annual average daily traffic (AADT) were collected from LGED for the selected roads for both before and after improvement works. However, to verify the collected data, present traffic volume on the selected roads was counted manually on hourly basis for a time period of three days.

Separate questionnaires were prepared for holding focus group discussions with local peoples, shopkeepers, drivers and educational institutions; checklists were also prepared for observation survey. Questions were asked only to the people who use the roads regularly. Total sample is consisted of responses from 240 local peoples, 45 drivers, 79 shopkeepers, 103 students and teachers.

Results and Discussion

Variations in Transportation Modes

From Figure 1, it can be seen that in case of Union Road, there is a significant reduction in the number of people who used to go to their destinations by walking. Also there is a significant reduction in the percentage usage of rickshaw and van. On the other hand, the use of Auto-rickshaw and Auto-van has increased a lot after the development works. Before the development works, the roads were not suitable for motorized vehicles. But after the development works the number of motorized vehicles has tremendously increased and people are also eager to use them because of speed and convenience. In case of Village Road A, same situation is seen as Union Road.

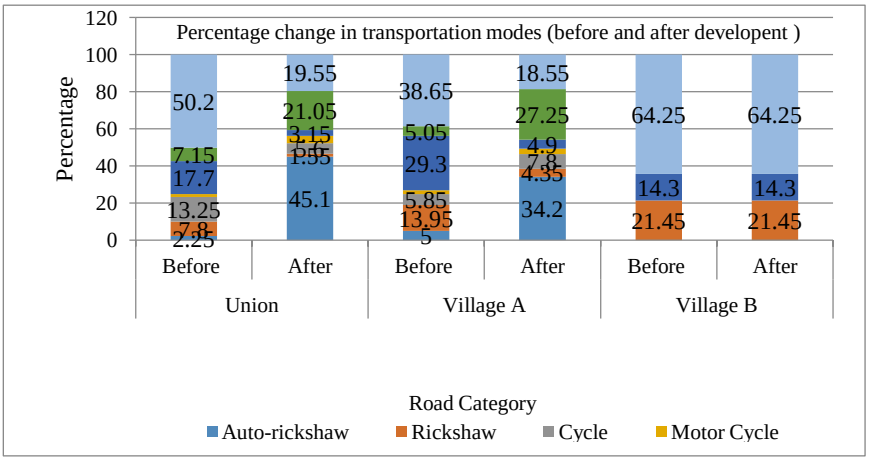

Figure 1: Change in transportation modes according to road category

People living in the villages connected by Village Road B were habituated to go to their destinations mainly by walking and using rickshaw. After the development works, there is no change in their transportation modes usage. New motorized vehicles have not been introduced in Village Road B even after the development works. So people have no other choice but using the old modes.

Diverted Traffic

Figure 2 shows that in case of Union Road and Village Road A, the maximum diverted traffic consist of rickshaw, Auto-rickshaw, van and car.

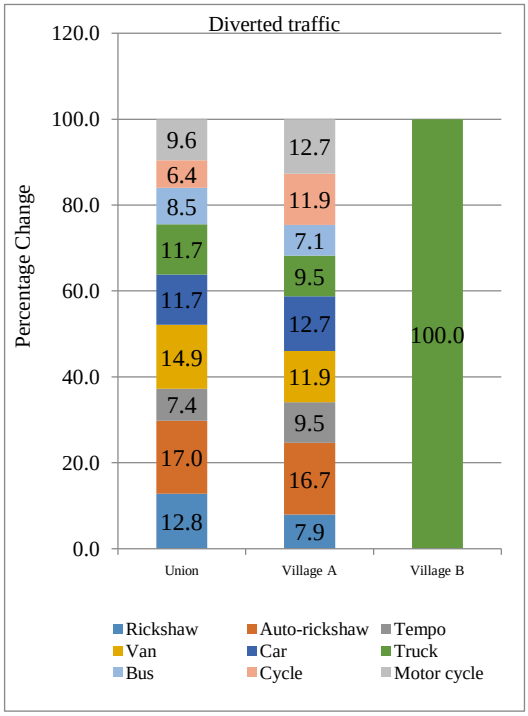

Figure 2: Percentage change in diverted traffic according to road category

In case of Village Road B, the only diverted traffic is truck. The reason is that people living in the villages connected by Village Road B show no changes in their transportation mode usage (Figure 1). As there is no demand for new transportation modes in Village Road B, there is no variety in diverted traffic on these roads.

Average Change in Traffic Volume

In case of improvement and further improvement (Figures 3 and 4) in Union Road, there has been a reduction in the average volume of Rickshaw and Van. On the other hand, average volume of Auto-rickshaw and CNG has increased.

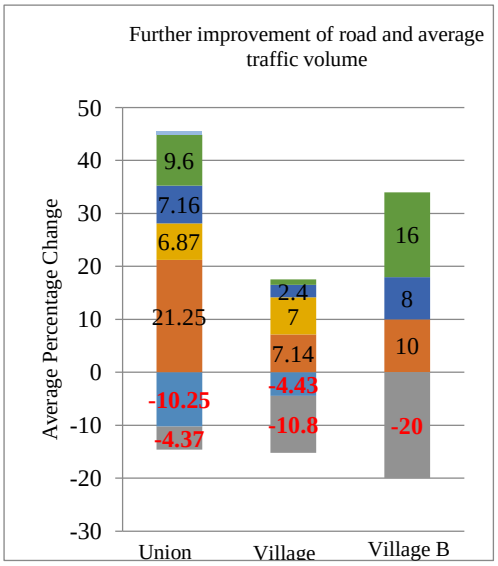

Figure 3: Average change in traffic volume and further improvement of road

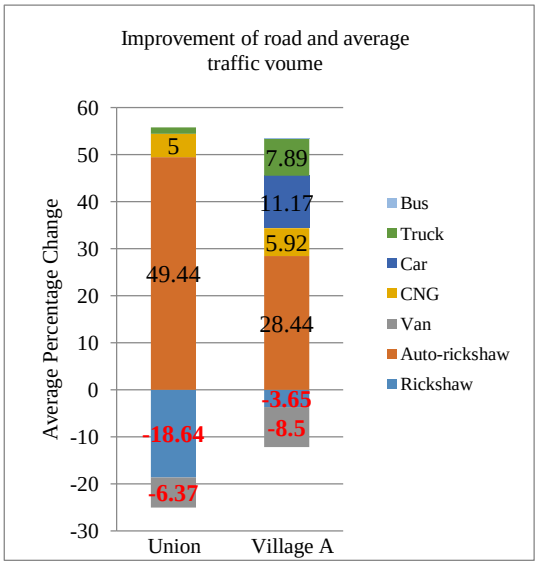

Figure 4: Average change in traffic volume and improvement of road

Similar situation is seen in case of improvement and further improvement of Village Road A and further improvement of Village Road B. In addition, average volume of car and truck has increased in Village Road A and Village Road B. Before development works, Village Road A and Village Road B had limited accessibility for heavy vehicles like truck. So after the development works the average volume of truck has increased because of good accessibility (Figure 5).

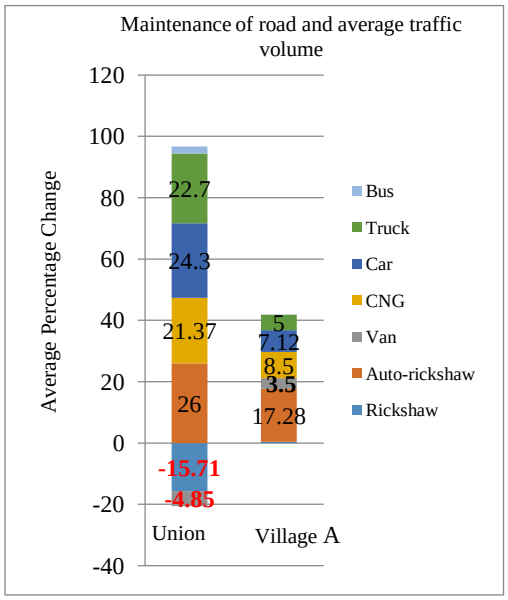

Figure 5: Average change in traffic volume and maintenance of road

In case of maintenance (Figure 3) in Union Road, the average volume of Rickshaw and Van has decreased. At the same time, the average volume of Auto-rickshaw, CNG, car and truck has increased tremendously.

Road Usability

Even after the development works, 19% roads in the villages of Tangail are not usable throughout the year. During rainy season many roads go under water. Among the unusable roads, 6.7% is Union Road and 63.7% is Village Road A and 29.4% is Village Road B.

As a result of road development, 87.3% shopkeepers are getting more customers than before. All the additional customers use the roads which have been developed. After the development works, 78.5% roads have new transportation modes those were not previously available due to poor condition of roads. Table 1 shows the new transportation modes in the three kinds of roads according to the intervention types; however, there is no significant relation between intervention type and new modes introduced.

Table 1: New modes according to intervention type

Intervention Type	Road Type	New Modes
Improvement	Union Road	Truck, Auto-rickshaw, Auto-van
	Village Road A	Truck, Auto-rickshaw, Auto-van, Car, CNG
	Village Road B	No new mode
Further Improvement	Union Road	Truck, Auto-rickshaw, Auto-van, CNG
	Village Road A	Truck, Auto-rickshaw, Auto-van
	Village Road B	Auto-van
Maintenance	Union Road	Bus, Auto-rickshaw, Auto-van, CNG
	Village Road A	Truck, Auto-rickshaw, Auto-van, CNG
	Village Road B	No new mode

Source: Shopkeepers' survey

Changes in Land Use

Road development works cause land use changes in surrounding areas and these new land uses cause significant impact on local traffic including increased traffic volume and change in transportation modes. Figure 6 shows that after the development works, the maximum level of increase is seen in the number of local shops for all three categories. The new shops have been constructed mainly alongside the road. Good accessibility has increased demand for consumer goods which has paved the way of new local shops construction. The number of semi-paved and paved residential buildings has increased. Because of the widening of the roads and change in surfacing it has now become easy to bring construction materials to village areas which was previously troublesome.

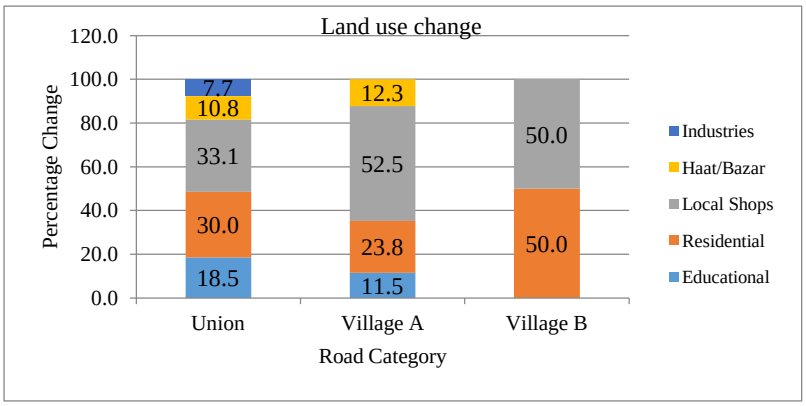

Figure 6: Percentage change in land use after the development works.

Some educational institutions and Haats/Bazars (village markets) have been constructed in case of Union Road and Village Road A. In case of Union Road, 7.7% vacant land has been converted into industrial use.

School Attendance

Students constitute a major portion of local traffic, particularly during the morning times, when schools start. Again students generate a lot of motorized and non-motorized trips which is also subject to change because of road development works. From Figure 7, it can be seen that attendance in primary schools has increased for all three types of intervention. Maximum attendance increase is seen in case of Improvement. Before the improvement works, the surface of the roads was earthen and only a few motorized vehicles used to run on them. After the improvement works, most of the road surfaces have been converted from earthen to bituminous carpeting. As a result, the number of motorized vehicles has increased rapidly. It has become more convenient for the children to reach primary schools by using these motorized modes which were not previously available.

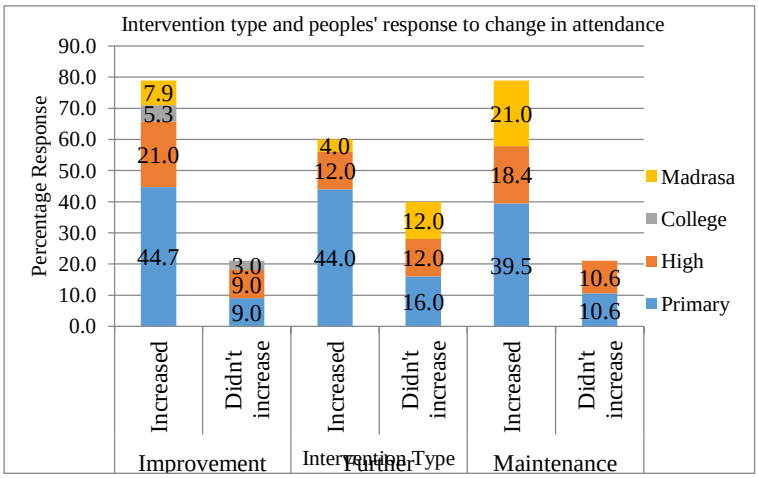

Figure 7: Intervention type and change in attendance in various educational institutions.

Again before the improvement works, the earthen roads could not be used in rainy reason. Many of the roads got submerged during heavy rainfall. But after the improvement works, students face no such kind of problem which increased their attendance (Table 2). Good accessibility and motorized modes have reduced transportation time and cost.

Table 2: Total attendance increase and girls' attendance

Intervention Type	Peoples' Response to Change in Attendance		Percentage of Girls' Attendance in Increased Attendance
	Increase	Did not Increase	
Improvement	78.9%	21.1%	93.3%
Further Improvement	60%	40%	92.9%
Maintenance	78.9%	21.1%	92.6%

Source: Authors' calculation based on Educational Institutions' Survey

Negative Impacts of Village Roads Development

All construction works have some positive and negative impacts. Similarly, developments of rural roads not only do only benefit to rural people but also creates some problems to them (Table 3).

Table 3: Problems after road development according to the perception of local people

New Problems	Percentage of the problem compared to other problems	Rank of the problem
Congestion	20	3rd
Heavy Traffic	24	1st
Noise	14	4th
Crime	6	5th
Air Pollution	14	4th
Accidents	22	2nd

Source: Author's calculation based on local peoples' survey

Heavy traffic is the most severe problem that the people are facing. Before the development works, the surface condition of roads was not suitable and roads were not wide enough to support large vehicles like trucks. After the development works many new local shops and residential buildings have been constructed alongside the roads. For carrying construction materials, the number of trucks using Union Road and Village Road has been increased which is creating problems to rural people.

The second problem is the increased number of accidents. Before development works, people mainly use non-motorized modes such as Rickshaw and Van. The non-motorized vehicles did not create any major accidents. But after the development works, the use of motorized modes such as Auto-rickshaw, Auto-van etc. has been increased. As the motorized modes have increased, the number of accidents has also increased.

Congestion is the third problem. Increased number of motorized vehicles is the main reason behind this problem. Again after the development works, land use alongside the roads has changed to some extent. Many new local shops and residential buildings have been constructed which is creating congestion.

Conclusion and Recommendations

This study shows the impact of rural roads development on local traffic in Tangail district. This was done by comparing the conditions of traffic before and after the development works. After the development of roads, a significant change can be seen in traffic volume and peoples' choice of transportation modes in Tangail. Also the standard of living of rural people has increased although they are facing some problems for increased volume of traffic. To ensure sustainable development of rural areas, there is need for integrated development which seeks to develop all sectors of the rural economy and link them up effectively with their urban counterpart. However, rural roads are not maintained properly. The authority in charge should take necessary steps to ensure proper maintenance of roads after development works.

Acknowledgement: *We are grateful to our honorable teachers Dr. Md. Musleh Uddin Hasan, Mr. Rafsun Mashraky, and Ms. Uttama Barua, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET) for their kind advices towards successful completion of this research.*

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