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Compatibility of rural roads for achieving the targets of the sustainable development goals 3.6, 9.1 and 11.2 in Bangladesh

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Abstract

Rural Roads are a proven prime factor for reduction of poverty and lowering the transport cost in Bangladesh. According to the classification of the road systems in Bangladesh, about 353,353 km rural roads belong to the Local Government Engineering Department (LGED) and about 38% of rural roads have improved for all weather connectivity without considering the geometrical standards as per road traffic demand in most cases. According to the Accident Research Institute (ARI) of the Bangladesh University of Engineering and Technology (BUET), about 10% accidents occur on rural roads. But these statistics seem not to be authentic due to the road traffic crash data collection system is limited to the roads belong to the Roads and Highways Department (RHD) only. However, in contrast, the SDGs comprise 17 goals and 169 targets and the major share of the achievement of the following 3 targets directly depend on the Road Transport Infrastructure (including Rural Roads) but other targets are also partially depending on road transport services. Target 3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents. Target 9.1. Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all. Target 11.2. By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons. This Paper highlights the lack of competency of the existing rural roads to achieve the above three targets due to the deficiencies of the geometric as well as safety features.

Keywords: Rural roads, road safety, road safety inspection, sustainable development goals.

1. Introduction

Every year more than 1.35 million people die and another 50 million become injured or permanently disabled due to road traffic crash around the world of which about 90% of road traffic crash occurs in low- and middle-income countries. It is thus not surprising that the road traffic injuries are the leading cause of death for people aged 15–29 years globally, and half of them are vulnerable road users. The economic loss due to road traffic accidents is about 1-3% of GDP, which is more than the economic assistance received by these countries. The rise in global road traffic deaths has largely driven by the escalating death toll on roads in low- and middle-income countries – particularly in emerging economies where urbanization and motorization accompany rapid economic growth. In many of these countries like Bangladesh, necessary infrastructural developments, policy changes and levels of enforcement have not kept pace with vehicle use. In contrast, many high-income countries have managed to sever the link between rising motorization and road traffic deaths. These achievements are the cumulative result of making safer infrastructure, improving the safety of vehicles, and implementing a number of other interventions known to be effective at reducing road traffic injuries. As per the World Bank (WB) report, present road traffic crash death rate is the 8th position of total death globally and if appropriate measures are not taken to reduce the road traffic crash than this rate would be the 5th position in 2030 (WHO 2018).

According to the ARI of the BUET, about 3,500 people die and another 5,000 are injured in each year by road traffic crash; but the World Health Organization (WHO) estimates the number of fatalities could well be more than 24,000 (World Bank Group 2020; ARI-BUET 2013; Ahsan, H. M., et al., 2012; Mahmud, S. M. S. et al., 2012). The average fatality rate in Bangladesh from road traffic crash is 13.60 per 100,000 people, which is the second lowest in the South-East Asia Region, and less than the global average rate of 17.60 which is higher than the European Union as 9.3. In terms of registered motor vehicles, the fatality rate for 10,000 motorized vehicles is about 102, about 50 times more than 2.00 in USA, 1.40 in UK and 3.30 in New Zealand. Although, Bangladesh has the low level of motorization, only 30 motor vehicles for 10,000 people as compared with 7,970 motor vehicles in USA, 4,260 motor vehicles in UK and 5,600 motor vehicles in New Zealand but fatality rate is significantly high (WHO 2016). According to the ARI of the BUET, the road accident rate on rural roads is not significant with respect to the national scenario (Table 1). However, this insignificant rate may be significant due to the rapid growth of motorization and unplanned urbanization with parallel to the growth of non-standard locally made vulnerable motor vehicles. Moreover, the presently road accident data collection is limited to the national road networks, leaving the uncared rural roads. Although, the volume of rural roads is about 16 times more than the RHD road networks, but no physical initiatives are shown to collect road traffic crash data of rural roads (LGED 2013; Ahsan, H. M., et al., 2011; Mahmud, S. M., et al., 2009; Ahsan, H. M., 2012). Good practices of road safety programs in high-income countries over the past five decades have convincingly demonstrated that road crash fatalities and injuries are preventable and their devastating burden substantially avoidable. These are compelling reasons to act on this urgent and achievable sustainable development priority. Table 1 shows the Road traffic accident on different types of roads in Bangladesh (2006-2013)

2. Development history of rural roads in Bangladesh

Over the last decades, more and huge investments have made in the construction of road transport infrastructure (including rural roads) all over the country. However, in the context of rural roads, there has been a long history of development as part of the “employment generation” and “famine relief” in lean periods by the Local Government Institutions. In that period, different government authorities constructed rural roads without considering any

engineering judgment; only for accessibility, and without following any standard. Later the Government has realized that there is a much more potential in a road infrastructure construction, and an access road can catalyze economic activity and create sustainable additional incomes; and in fact, that have impacts not only on poverty, but also potentially on many other socioeconomic and human development indicators (Abdullah 1995).

After 1984, as per 'Strategies of Rural Development" of Bangladesh, LGED (previous named "Rural Works Program Wing") has started improvement of rural roads initially targeted to connect 2100 Growth Centers to Upazila Headquarter or nearest Highways. These improvements were mainly by earthwork and then by bituminous concrete including other rural roads on priority basis or recommendation by the powerful political or allied persons without considering road safety features in major cases due to several reasons, especially lack of right-off-ways (LGED 2010).

3. Classification and ownership of the road systems in Bangladesh

In better planning, implementation and maintenance of the infrastructures, the Planning Commission has classified the road systems and fixed responsibility for planning, design, implementation and maintenance through Gazette notification in 2003 into six categories (Table 2) (Planning Commission 2004; LGED 2005). The prior three categories belong to the Department of Roads and Highways (RHD) and the later three categories belong to the LGED. These three categories of roads known as "Rural Roads" and the Table 3 shows the statistics of the road systems in Bangladesh (LGED 2020).

These rural roads are serving for improving the livelihoods of about 66 percent of the country's people as well as to achieve the vision 2041 and the targets of the SDGs (Planning Commission 2008; UNO 2015; Planning Commission 2020; General Economic Division 2020). Table 2 shows the Classification, Definition, Ownership and Responsibilities and Table 3 shows the statistics of the road systems in Bangladesh.

4. Compatibility of rural roads to achieve the targets of the Sustainable Development Goals (SDGs) 3.6, 9.1 and 11.2

To achieve the three targets of the SDGs, it needs to make safer rural roads which means to improve the road safety features. However, from the last decade LGED has taken several initiatives for reducing road traffic crash as well as to improve the road safety of rural roads. These roads are also providing a major contribution to alleviate the poverty reduction as well as to achieve the 8th Five Year Plan and the Vision 2041 (Ahsan, H. M., et al., 2014; Hoque, M. M. et al., 2001). The key initiatives for improving the road safety of rural roads are as follows:

- Formation of Community Road Safety Group and Union Road Safety Committee in 2006.
- Formation of Regional Road safety Unit in 2006.
- Assigning responsibility of Road Safety Activities to Executive Engineer in district level in 2006.
- Establishment of Central Road Safety Cell in LGED H/Q in 2008, designating Additional Chief Engineer (ACE) Implementation as the cell chief and 7 other members.
- Assigning additional responsibility of Road Safety Activities to an Executive Engineer in Central Road Safety Cell.
- Establishing collaboration with Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET) to build capacity of LGED officials and preparation of Road Safety Training Manual in road safety activities.

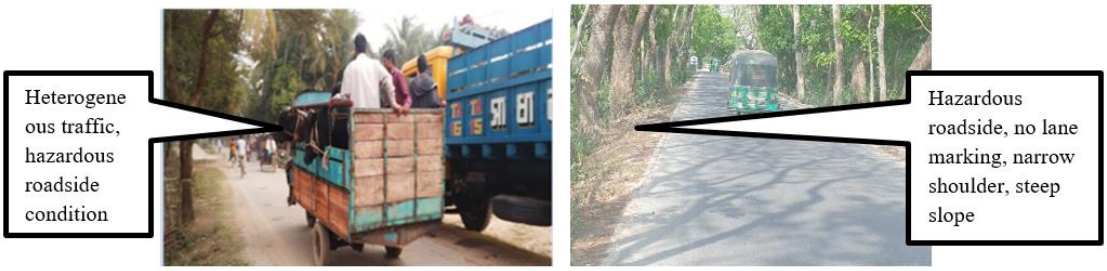

Fig. 1. & 2. Roadside hazardous, traffic characteristics, narrow shoulders of RRs

Fig. 3. & 4. Sharp curve, no super-elevation, drainage, negative shoulder slope, channelization, pedestrian facilities of common rural roads.

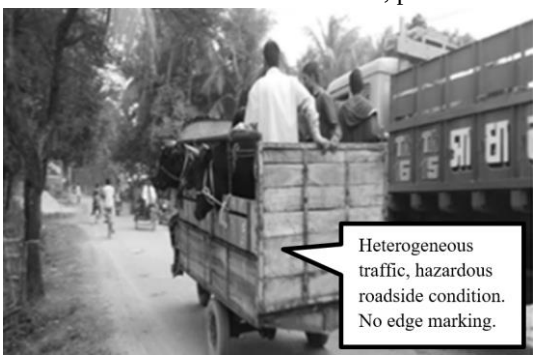

Fig. 5. Heterogeneous Traffic, Narrow Shoulder, Roadside Hazards

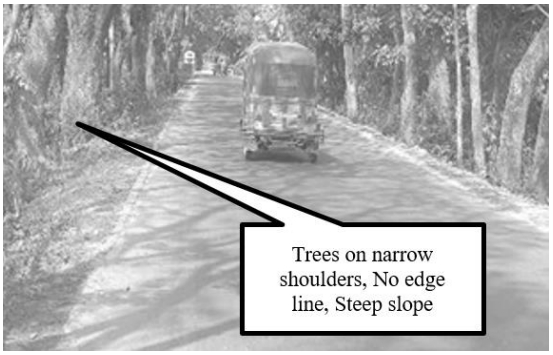

Fig. 6. Trees on narrow shoulders, No edge line, Steep

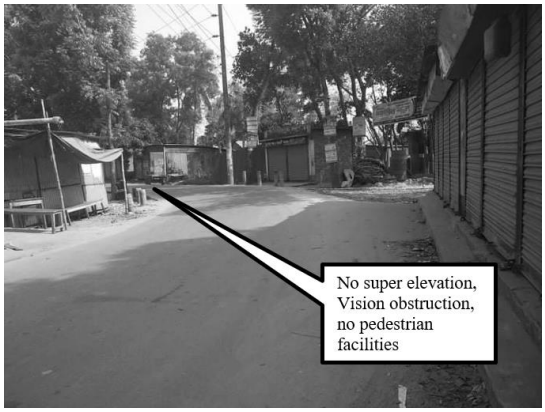

Fig. 7. No super elevation, Vision obstruction, and no pedestrian facilities

Fig. 8. Negative shoulder slopes, no super-elevation, no channelization at intersection, no drainage facilities.

On the other hand, LGED is performing a few activities for reducing road traffic crash through different rural development projects, especially donor assistance. The key road safety activities are as follows:

- Designing and implementation of a comprehensive Road Safety Action Plan.
- Promotion of proper road Safety Engineering by placing traffic signs and markings, speed control devices.
- Placing guide posts on sharp curve.
- Arrangement of road safety awareness campaign for different road user groups.
- Improvement of hazardous road locations.
- Strengthening and widening of carriage way width.

Moreover, the "the old Road Design Standards for Rural Roads" was upgraded as per traffic forecast and soil conditions by the technical assistance of the Bureau of Research, Testing & Consultation (BRTC) of BUET and approved by the Government in 2021 (LGED 2021). However, the road safety initiatives taken by LGED are not very significant, remarkable, meaningful and do not cover the whole country.

Table 1
Road traffic accidents on different types of roads in Bangladesh (2006-2013)

Road Class	Accident- Fatal		Casualty-Fatality		Accident-Non-Fatal		Casualty-Injury	
	Number	%	Number	%	Number	%	Number	%
National Highway	8106	47.8	10709	51.0	2161	41.3	7020	48.9
Regional Highway	2372	14.0	2959	14.1	636	12.2	2222	15.5
Feeder/District Road	2219	13.1	2604	12.4	641	12.3	1915	13.3
Rural	1688	9.9	1969	9.4	380	7.3	1255	8.7
City	2583	15.2	2777	13.2	1410	27.0	1951	13.6
Total	16968	100	21018	100	5228	100	14363	100

Table 2
Road network: Classification with definition, ownership and responsibilities

Sl. No.	Type	Definition	Ownership and Responsibility
1.	National Highway	Highways connecting National capital with Divisional HQs or sea ports or land ports or Asian Highway	RHD
2.	Regional Highway	Highways connecting District HQs or main river or land ports or with each other not connected by national Highways.	RHD
3.	Zila Road	Roads connecting District HQ/s with Upazila HQ/s or connecting one Upazila HQ to another Upazila HQ by a single main connection with National/Regional Highway, through shortest distance/ route.	RHD
4.	Upazila Road (UZR)	Roads connecting Upazila HQ/s with Growth Center/s or one Growth Center with another Growth Center by a single main connection or connecting Growth Center to Higher Road System through shortest distance/route.	LGED
5.	Union Road (UNR)	Roads connecting union HQ/s with Upazila HQs, Growth Centers or local markets or with each other.	LGED
6.	Village Road (VR)	Roads connecting Villages with Union HQs, local markets, farms and ghats or with each other. Roads within a Village>2.00km Roads within a Village<2.00km	LGED LGED LGI

5. Field study for evaluation of the compatibility of rural roads to achieve the three targets of the SDGs

For this study, 8 (Eight) high traffic rural roads were randomly selected, one from each division, to represent the demographic characteristics of the country. Then the Road Safety

Inspections had performed to identify the lack of geometrical dimensions as well as the deficiencies of the safety features of the roads (Table 4). For this purpose, a Road Safety Inspection (RSI) Checklist for rural roads was prepared based on Overseas Road Safety Audit Manuals (World Road Association 2012; ADB 2018). The findings from the RSIs have briefly described in the next paragraph. Table 4 shows the randomly selected rural roads for the studies and the Figures 1, 2, 3 and 4 represent the common scenario of the deficiencies of the road safety features of rural roads.

Table 3
The statistics of road systems in Bangladesh

Road Type	Road Length (km)				Responsible
	Total (km)	Paved (km)	(%) of Paved	Unpaved (km)	
National Highways	3521	3521	100	00	RHD
Regional Highways	4287	4287	100	00	
Zila Roads	13753	9626	70	4127	
Sub- Total RHD	21561	17,434	81	4127	
Upazila Road	36876	34022	92.26	2854	LGED/LGI
Union Road	41781	31060	74.34	10721	
Village Road-A	128541	43477	33.82	85064	
Village Road –B	146155	23292	15	122833	
Sub-Total LGED	353353	131851	37.31	221472	
Total RHD & LGED	374914	149285	39.81	225599	

(Source: LGED and RHD website, June 2021

6. Findings of the Study to evaluate the compatibility of Rural Roads for achieving the targets of SDGs 3.6, 9.1 and 11.2.

Bangladesh has experienced sustained economic growth and made progress on reducing poverty and boosting prosperity. However, these positive trends are being undermine due to high fatality and injury rates by road traffic accidents of this populous country. The performance of road safety of rural roads is not just poor but it is deteriorating. The roadside environmental hazards affect the poor road safety performance. However, improving road safety of rural roads is becoming a vital issue to national health, well-being, and economic growth. It is already clear that the SDG Target 3.6 date for halving global road deaths by 2020 in Bangladesh was not be met as insufficient resources and lack of actions. Achievement of other two targets 9.1 and 11.2 are also lagging behind road map due to the same reasons. Road safety audit procedures are neither well known nor recognized for improvement of rural roads in LGED. Consequently, the capacity to conduct effective road safety audits is limited to some hazardous locations of national highways only but not on any section of rural roads. However, the following major deficiencies of the road safety features are identified which are becoming significant constraints to achieve the targets of SDG 3.6, 9.1 and 11.2.

6.1 Deficiencies of the geometric features

- Narrow rural roads
- Narrow pavement width
- Lack of super elevation
- Lack of extra widening at curve sections
- Lack of shoulder/narrow/occupied shoulder
- Sudden Pavement edge drop on shoulder
- Uncontrolled access
- Steep side slope/ditch without guard rail
- Narrow Bridge or Culvert than pavement width

- Settlement at Bridge Approach/Abutment
- Lack of pedestrian facilities
- Improper speed hump without sign and marking
- Lack of drainage facilities
- Lack of overtaking/passing facility
- Lack of loading and unloading areas
- Lack of parking facilities

6.2 Road side environmental hazards

- Lack of optical vision
- Illegal use of road surface
- Illegal activities by vendors on shoulders
- Lack road edge or centerline marking
- Wrong/Lack of appropriate traffic sign
- No delineator or chevron sign
- Damaged or Rough surface
- Road side bill board
- Hat/Bazar or permanent shop at junction or corner point
- Open Drain on shoulders
- Large trees or electric pole on road side without sufficient setback
- Uncontrolled level crossing

6.3 Road user characteristics

- Shoulders are occupied by roadside inhabitants for household activities
- Sometimes local people use the carriageway to dry their crops
- Sudden entry of children from roadside house to road yards
- Lack of safety awareness of rural people
- Overtaking without proper signal
- Sudden walking and crossing of vendors, daily shopkeepers etc.

7. Conclusions and recommendations

- Rural roads are becoming a big road network for making all-weather connectivity of rural people with national highways. Moreover, this connectivity is one of a prime contributory factor to increase the economic activities of the rural people and to alleviate the poverty and illiteracy reduction.
- To achieve the targets of the SDGs 3.6, 9.1 and 11.2, these are depending not only road users and vehicle factors but also on the compatibility of rural roads avoiding traffic crash and mitigating the consequences of post-crash severity. The Government should take necessary action to make safer roads at least three Stars not only of highways but also of rural roads (iRAP 2018) (WRA, PIARC 2012).
- LGED should ensure to construct or improve safer rural roads with maintaining standard geometric dimensions including road safety features.
- Road Safety Audit/Inspection is a mandatory tool for both new and existing rural roads for assessing the deficiencies of road safety features.
- To make safer rural roads, in some cases it needs to land acquisition for maintaining standard geometrical features of the roads.
- Government should allocate sufficient fund to build safer rural roads.
- According to the chart, 84.8% of fatal road accidents occur in rural areas of Bangladesh. Among them National, Regional and District roads account for 74.8% and Rural roads

account for 9.9% of total fatal accidents. The rest 15.2% fatal accident occurs in urban streets.

- In case of total fatality, 9.4 % died on rural roads and for total injury, 8.7% occurs on rural roads.
- Regarding the accidents on rural roads, 81.6% are fatal.

Table 4
Lists of 8 rural roads, one from each division for field study

Sl. No	Division	District	Upazila	Road Name	Road Type	Road Length (km)
1	Rajshahi	Rajshahi	Charghat	Charghat UP (Paranpur)-Bonkeshore via Budirhat	UNR	5.00
2	Rangpur	Dinajpur	Kaharol	Kantanagar Bazar-Kaharol UZ H/Q road	UZR	8.50
3	Dhaka	Dhaka	Nawabganj	Nawabganj- Paragram GC Rd.	UZR	17.00
4	Mymensingh	Mymensingh	Nandail	Nandail H.Q-Dewanganj G.C Rd	UZR	17.00
5	Sylhet	Sylhet	Bishwanath, Jagannathpur	Bishwanath GC to Jagannathpur GC	UZR	26.00
6	Chattogram	Bandarban	Bandarban-Sadar & Lama	Soalock-Lama Road	UZR	67.00
7	Barisal	Barisal	Barisal Sadar	Charkawa-Karnakati to Ranirhat via Napter hat, Char Aicha Poler hat	UNR	8.00
8	Khulna	Jashore & Satkhira	Sadar, Monirampur, Keshabpur, Tala	Pulerhat-Rajgonj-Michael Madhusudan Datta Rd.	UZR	42.00

All figures represent the common scenario of the deficiencies of the road safety features of rural roads.

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