

SUSTAINALBE DEVELOPMENT AND ROAD TRANSPORT IN BANGLADESH

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ABSTRACT:

Sustainable road development is an enormous challenge in the context of Bangladesh as its road system grows ever bigger, and that already constructed roads need increasingly more funding for maintenance. The road system is still in growth stage excepting major arterial roads, which require sustained adequate funding more than ever for protection of the created assets. Besides acute financial scarcity challenges for sustainable road development are selection of right project, implementation following proper design and quality, institutional capacity building, achieving value for money, good governess, frequent recurrences of flood, national policy reform etc. This paper deals with the challenges Bangladesh is currently facing in sustainable road development along with measures taken to overcome them. The paper focuses mainly on Roads and Highways Department (RHD) as it is the main road authority in Bangladesh. For better management of road assets, RHD has a Pavement Management System (PMS), which consists of data collection, database, Highway Development and Management Model (HDM-4), procurement and implementation. Example shows that right treatment on right time can sustain a road development in the long run. Again, experience in RHD reveals that proper construction quality can ensure well-maintained assets. Finally, Intelligent Transport System (ITS) needs to be introduced in Bangladesh to manage road infrastructure and traffic efficiently. This paper proposed a simple approach of ITS for RHD.

1. INTRODUCTION

Bangladesh has an area of 147,000 sq.m. with a population of about 130 million making it most densely populated in the world. Due to poor accessibility, especially in rural area, new road construction is of very high demand and very often constitutes crucial political agenda in respective constituency. Road is the ever increasing dominant transport option for passengers and freight, and dependency is increasing day by day. From 1974 to 1997 the percentage of passenger per kilometer for roads has increased from 54% to 73%, while the share of railways has declined from 30% to 13% [1]. The corresponding data for freight were 35% to 63% for roads and 28% to 7% for railways. There has been no significant change in the output/modal share of inland water transport. In the Fifth Five Year Plan (1997-2002), the allocation of funds for the development of different modes of transport is as follows:

Roads-53.00%, Railways-19.71%, Water Transport-11.12%, Air Transport-6.16% [1]. The motorized vehicle population has grown from 251,765 in 1989 to 435,311 in the year 1996. This trend is likely to continue at a faster rate with the construction of more roads and bridges. The transport demand for passengers and freight is likely to increase from 72 billion PKms (Passenger-Kilometer) and 10 billion TKms (Tons-Kilometer) respectively in 1996 to 196 billion PKms and 30 billion TKms respectively in the year 2015 [1].

Road as dominant transport mode will continue in the foreseeable future, but, this rapid development has to be sustainable.

2. ROAD SYSTEM IN BANGLADESH

Roads and Highways Departments (RHD) under Ministry of Communications (MoC), Local Government and Engineering Department (LGED) under Ministry of Local Government, Rural Development and Co-operative (MLGRD) are mainly responsible for construction and maintenance of road systems in Bangladesh. Besides, urban roads are constructed and maintained by the six City Corporations under MLGRD. Roads are functionally classified into following 6(six) categories (see Figure 1).

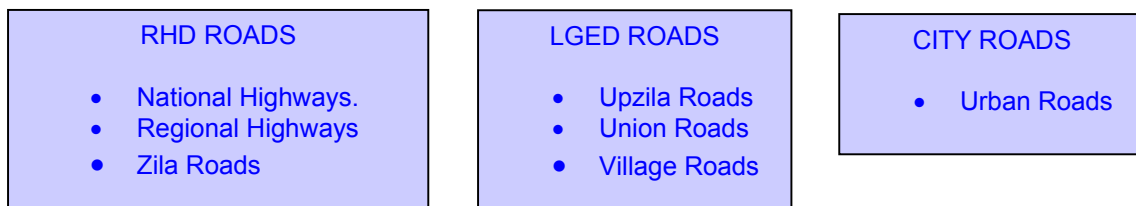


Figure 1 – Different types of roads in Bangladesh

National highways are the major/primary roads, regional highways are secondary roads and zilla roads are tertiary roads. LGED roads are mainly rural roads, while urban roads are of city roads. Definition of these roads can be seen elsewhere [2] [3].

The length of the paved road network rose from 600 km in 1947 to only 3,600 km in 1971. However, after that time there has been dramatic growth in road building so that at present there is around 50,000 km of paved roads in Bangladesh [4]. The total paved road asset value is about US\$ 8 billion [4]. The total length of the road network is 226,500 km, of which 21,600 belongs to RHD; 201,700 km under LGED and 3,200 km under City Corporations [4]. The majority of traffic 65.5% is on RHD roads with around 27.0% on city roads, while, only 7.5% of total traffic is on the LGED network [4].

3. NATIONAL POLICIES IN ROAD SECTOR

Government has recently adapted the following national policies for road sector, which can ensure sustainability.

3.1 National Land Transport Policy (NLTP)

The NLTP has been formulated in the light of the Government pledge to establish a transport system, which is a safe, cheap, modern, technologically dependable, environment friendly and acceptable in the light of globalization. It has been prepared for a long term vision of at least 30 years to make the role of transport in economic activities more significant and underpin continued economic and social development [5].

3.2 Integrated Multi-Modal Transport Policy (IMTP)

It is to develop transport sector combining road transport with railways, civil aviation and Inland Water Transport (IWT). It's vision is to provide safe, dependable, effective, efficient and fully integrated transport operations and infrastructure, which will best meet the needs of freight and passengers by improving levels of service and minimize cost in a effective manner. It supports government strategies for economic and social development whilst being environmentally and economically sustainable. In addition, it will make the transport system efficient in a regional context to allow Bangladesh to export its unique geographical position [6].

3.3 Road Master Plan for RHD and LGED

RHD is developing its Road Master Plan for the next 20 years under Asian Development Bank Project, which mainly highlights the importance maintenance for sustainability. It is believed that this plan would give emphasize on overloading, drainage and routine maintenance. LGED formulated its Road Master Plan and derived its maintenance demand [3].

4. BUDGET SCENARIO AND FUNDING

Financial resource crisis for developmental work is acute in developing countries, like Bangladesh posing threat to sustainable road development. The national budget has two distinct heads, namely the development and the revenue budgets heads. The development budget is meant for new projects, which includes rehabilitation and new road construction. Financial inputs to this head consist of internal resources and external funding from international, regional and bilateral development partners. On the other hand, the entire revenue budget is provided from the resource generated internally. Overall foreign fund flow has been decreasing, at present local contribution in Annual Development Programme (ADP) is about 60%. The following Box 1 shows the ADP allocation scenario.

Box 1 - Annual Development Programme (ADP) Allocation Scenario [7]

- The total allocation for 2002/3 represents only 8% of the total projects costs included - on average at this level, completion would take 12.5 years
- For new projects, included in the ADP for the 1st time, this under-funding situation is more acute - the allocation equates to 3.8% of cost, implying average timeframe of 26 years for completion
- The rate of project completion is totally disproportionate to the rate of new project commencement, and this situation is actually getting worse through time.
- The allocation of 2002/3 shows the major disparity between donor funded and GoB financed projects in terms of the pace of release of allocation to fund the total cost. For donor projects, the allocation is over 20% of total project cost

During financial year 2005-06 development fund allocated from National ADP for RHD and LGED are Tk. 2004 Crore (RHD Website) and Tk. 3069 Crore (LGED Office, 1 US\$ = Tk. 70.00 and 1 Crore = 10 million) respectively with about 10% year to year annual increase.

4.1 Road Maintenance Requirement and Funding

The absence of regular maintenance and the short term work often employed in the face of budgetary shortages has resulted in a considerable latent burden under Bangladeshi road surfaces. The ongoing requirement for maintenance is around double the current locally funded expenditures [2]. Maintenance allocations for different road agencies are given in the Figure 2.

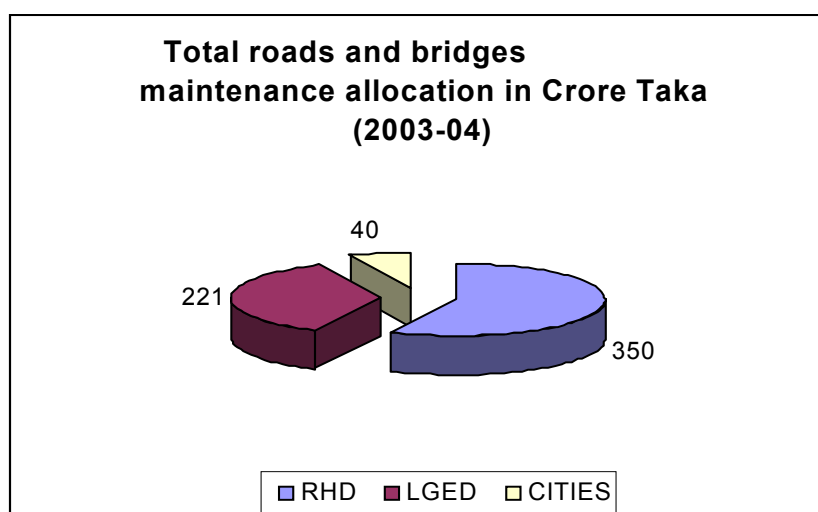


Figure 2 - The total roads and bridges maintenance allocation (2003/04)
(1 Crore Taka = US\$ 0.15 million) [2]

There was a significant increase in major periodic maintenance in 2004-05 provided by Department for International Development (DFID) (Sector Budget Support) and Japan Bank of International Cooperation (JBIC) (debt swap arrangement). Excluding this, externally finance expenditure and ferry costs, expenditure was reasonably constant at about US\$ 55 million per year. The total estimated expenditure on maintenance of full network is US\$ 215 million, which is around US\$ 70 million more than was spent in 2004-05 [2]. However, RHD expenditure includes US\$ 58 million from International aid agencies. Without this assistance the total expenditure would only be 40% of the total requirement. Current backlog for the whole RHD road network is US\$ 285 million [8]. Backlog means rehabilitation and reconstruction works that are required due to deferred maintenance for lack of funding.

The above discussions show that maintenance is neglected, which may not be able to manage the assets properly. Hence, the development would not be sustainable in the long run.

5. GOVERNMENT'S INITIATIVE ON SUSTAINABLE DEVELOPMENT

Government has undertaken some initiative for sound development in road sector, which are discussed below.

5.1 Financial and Quantitative Project Evaluation

Proper project evaluation/appraisal is vital for sustainable road development as it is the essential investment project prioritization tool and even more crucial in case of limited resources. Situation further worsens in Bangladesh where political priorities often govern especially in locally funded project. Recently to expedite project approval process it is made time bound. At present projects are evaluated using format known as Development Project Proposal (DPP). Project Appraisal Framework (PAF) is on the process of approval where more systematic details evaluation of all GoB and foreign aided projects will be done, e.g., benefit-cost ratio/Internal Rate of Return (IRR)/Net Present Value (NPV), thereby hopefully be able to offset to certain extent political selection of GoB funded project [9].

5.2 Project Appraisal Framework (PAF)

To meet the challenges of sustainable road development, the PAF is designed as a tool to allow consistent planning and prioritizing of transport sector projects in line with objectives of the national policies enumerated in Poverty Reduction Strategy (PRS), NLTP and IMTP etc. Reflecting the recent changes in appraisal techniques, the PAF offers a simplified multi-criteria appraisal mechanism for Bangladesh, which addresses the poverty alleviation and social development needs besides the economic viability. Adoption of PAF in the transport sector will help ensure comparability of projects both within and across modes. PAF will be applicable to both new construction and maintenance projects for surface transport modes [9].

The PAF has adopted two sets of indicators to ensure equity and efficiency. With given different quantitative outputs of each indicator, they are applied to rank each project with a view to help the decision-making process on a common basis. In case of the PAF, the social and economic development (includes economic condition of project area, gender issues, resettlement etc.) indicators take care of equity, whereas transport efficiency (Economic Internal Rate of Return, EIRR/ Financial Internal Rate of Return, FIRR), funding, multimode

integration and safety are considered as efficiency indicators [9]. Once the Project Appraisal Report is finalized and the appraisal summary is completed, the score can be interpreted from the following Table 1 [9].

Table 1 - Score of appraisal summary [9]

Score Ranges	Meaning
50 and above	Very Good
40-50	Fair
35-40	Poor
Below 35	Very Poor

The selection of projects will not depend on the score of any project itself. Rather how that particular project scores compared to other projects and how much resource is available to fund projects should also be the guiding factors. Priority of projects will depend on the relative scores of the projects. A project may be funded if the following conditions are fulfilled [9].

- The project scores better than all rejected projects,
- Adequate fund is available so that the project can be finished on time, and
- The project is at least fair as per the ranges provided in Table 1.

If none of the projects are found to be at least in the fair range, it means that more efforts have to be made in order to identify good projects so that these could contribute to the development process of the country.

5.3 Reform in Public Procurement

To achieve value for money, there is no alternative to efficient, effective and transparent unified procurement policy and standard and it posed as challenge for sustainable development since long. Bangladesh's constitution has no direct provision on public procurement nor does any nationally applicable procurement law exists previously to regulate approximately US\$3 billion per year of government procurement. Previously each department and public sector entity had its individual manuals and procedures. Inadequate procurement expertise, complex bureaucratic decision-making processes, lack of transparency, allegations of corruption in the procurement of goods, works and services have contributed considerably to slow down project implementation. Hence to improve governance in public sector procurement, it was felt that a permanent unit should be established to provide technical advice to all agencies of the government including ministries. The Central Procurement Technical Unit (CPTU) of the Implementation, Monitoring and Evaluation Department (IMED) under Ministry of Planning [10] is functioning on it considering the recommendations of the Country Procurement Assessment Report (CPAR).

Within the Government, the CPTU is responsible for policy formulation, co-ordination, monitoring and improvement of the public procurement in Bangladesh. For all departments involved in public procurement, unified standard formats and procedures have been implemented which includes documents like Standard Tender Documents, Standard Request for Quotations, Standard Pre-qualification Documents, etc [10].

6. RHD'S INITIATIVE ON SUSTAINABLE DEVELOPMENT

RHD has also taken several initiatives for sound development, which are discussed below.

6.1 Organizational Operating System

To meet the challenges of sustainable road development, organization and management plan of RHD have changed considerably over last decades to make it efficient, effective and modern. The management plan shows the hierarchy of management information required to define the organization and the procedures, which are required for effective operations.

The RHD's strategy is designed to satisfy the requirements of the MoC's policy in respect of those activities that are the remit of the RHD. Separate strategies have been prepared for each of the Wings and Zones within the department, e.g., Circle Operational Plans and Circle Management Manuals. The Circle Operational Plans contain details of the objectives, outputs and activities of each Circle within the Wings/Zones together with details of the personnel and other resources required. An Operational Budget supports each Circle Operational Plan, which is essential for the successful implementation of the plan. The Management Manuals contain operational procedures and regulations and job descriptions for the various grades of personnel and for specific posts [11]. These manuals will regularly be updated. LGED also has more or less similar organizational management plan.

6.2 Institutional Changes

Institutional Development Component project has been running for more than a decade for capacity building in RHD so that it can sustain and meet the challenges of the 21st century. Some notable changes are: establishment of modern Road Maintenance and Management System (RMMS) and Bridge Maintenance and Management System (BMMS) data bases, introduction of computerized Pavement Maintenance Management System (PMMS) linked to HDM-4 (Highway Development and Management Tool) used for economic appraisal of project. Based on maintenance needs report prepared by HDM-4, periodic maintenance programme is taken up. Road Asset Management System (RAMS) using computerized database is in place for long. A training centre has been established and regular training programmes have been carried out based on Training Needs Assessment for human resources development of the department.

6.3 Design and Quality

Road construction especially for small Government of Bangladesh (GoB) funded projects following proper design and quality is a challenge for sustainable road development in Bangladesh. Locally funded projects being smaller in sizes could not afford equipment intensive method of works resulting in lower quality roads. But foreign aided projects are properly designed and construction quality is good. There are manuals for road design, quality control guidelines, quality assurance manuals etc., but their efficient application in the locally funded smaller projects is very difficult. Moreover, these manuals need to be upgraded.

6.4 Decentralization

Proper decentralization is very important for effective and efficient running of a department. The country is administratively divided into 64 districts and 464 upzillas. RHD and LGED have procuring entity and work executing offices named Divisions up to district level and LGED has such offices in the name of Upzila Engineer up to Upzila level. Considerable financial power is vested upon those officers to expedite the implementation of programmed works. In RHD, Circles are above the Divisions headed by Superintending Engineer and Zone office headed by Additional Chief Engineer where increasingly higher financial powers have been delegated. Delegation of these powers is time to time revised by Ministry of Finance (MoF) as required. Besides financial powers, administrative powers have also been delegated to those levels.

6.5 E-Governance

E-governance is a vital for efficient, effective and transparent operation of any organization by meeting the national and global challenges. According to National Information Communications Technology (ICT) Policy 2002, MoC has finalized to preparation of Ministry's ICT policy and ICT Cell. All departments under the Ministry has hosted websites with necessary documents, information, data, major ongoing projects, active tenders, etc. Tender has to be published in the RHD website and tender value more than US\$ 0.15 million has to be published in the CPTU website. RHD has been at the forefront in Bangladesh to introduce E-governance. RHD had officially launched RHD website [12], which contains a wide variety of information on technical and managerial issues, roads and bridges data, personal data, financial project information, different manuals, standard test procedures, design standards for roads and bridges and management plans for each area [12].

RHD has introduced Central Management System (CMS), which is computerized management tool that addresses transparency, physical and financial progress. It consists of Contract Module and Financial Module. Progress is monitored using Earned Value Analysis (EVA). When each contract is monitored and managed, it is possible via the linkages in the contracts Module to view progress at any of a Divisions Circle, Zone Office or the entire budget heads. EVA can manage both physical and cost control of projects. Since the CMS system is used to provide estimates, contract documents and payment certificates and since there is a direct link between the physical measurement and the expenditure recorded in the cashbook, RHD management can be confident that the system records the actual condition.

6.6 Flood Management

Flood and its extent of damage to road system pose considerable threat to sustainable road development. Near past Floods in 1987, 1988, 1998 and 2004 caused extensive damage to the roads and bridges. Moderate floods occurred once in two years while sever floods occurred once in 6-7 years. Generally, about 38% to 68% of total area of Bangladesh goes under water. Effects of flood are (i) damage to the infrastructure (ii) cost and time overrun in the ongoing projects (iii) arranging capital fund for restoration work (iv) delay in planned urgent maintenance work. Flood damages in RHD and LGED road network are shown below in the Boxes 2 and 3 [13].

Box 2 - Flood Damage of RHD Road Network [13]

- Flood of 1988 damaged 8.35% of total network and % of total bridges and culverts.
- Flood of 1998 damaged 19.6% of total road network and % of total bridges and culverts.
- Flood of 2004 damaged 12.8% of total road network and % of total bridges and culverts. It costs about US\$ 150 million, e.g., 45% yearly RHD development budget.

Box 3 - Flood Damage of LGED Road Network [13]

- Flood of 1988 damaged 1.5% of total network and % of total bridges and culverts costing about US\$ 50 million.
- Flood of 1998 damaged 14.46% of total road network and % of total bridges and culverts costing about US\$ 130 million.
- Flood of 2004 damaged 9.86% of total road network and % of total bridges and culverts costing about US\$ 145 million.

Steps taken to deal with flood are (i) Raising formation level of roads during reconstruction and rehabilitation work (ii) Cause way construction in flood prone area (iii) Disaster management plan in cautionary and disaster stage, i.e. liaison officer, flood control room etc. (iv) Reconstruction/rehabilitation of bridges/culverts having history of being disruption or disconnection during flood on priority basis (v) Stocking bailey bridges for quick restoration of communications (vi) Construction of hard shoulder to minimize damage during overflow (vii) Natural slope protection by turfing, special vegetation like Kalmi (viii) Construction of sufficient drainage structure especially during construction/rehabilitation and in places required (ix) Develop attitude to live with flood rather seek protection from it (x) More awareness and planning in rural road construction under LGED to minimize hindrance in natural flow of water.

6.7 Overloading

It is observed that overloading is now very common in Bangladesh. In the current Road Master Plan study, axle-loading survey is being conducted. Overloading increases pavement deterioration rate to fail pavements earlier. Recently, RHD is introducing Weight Bridge at several locations to control higher loads. There will be higher charge for the owners based on loading.

7. RHD-PMS: SOME MAJOR DRAWBACKS

RHD has a Pavement Management System (PMS) to maintain its assets efficiently, which consists of data collection, database, HDM-4 model, programming, implementation and monitoring [14]. However, malpractice may be observed due to insufficient funding, delayed funding, non-effective and non-efficient utilization of funding.

An example derived from HDM-4 can be seen below to emphasize on timely funding and treatment works, which justifies the maintenance theory: right treatment in right time and in right place (see Table 2) [15].

Table 2 - Example on impact of timely maintenance [15]

Road No.	Link Name	Treatment	Year	Treatment Cost (million taka)	NPV (million taka)	NPV/Cost	IRR	Comment
N7	Rajbari	Overlay 50 mm	2006	1.62	3.944	1.352	106%	Overlay 50 mm should be done in 2006 for economic benefits. Deferred maintenance provides less economic benefits.
			2007	1.62	3.348	1.053	77%	
			2008	1.62	2.882	0.948	97%	
			2009	1.62	2.919	0.938	67%	
			2010	1.62				

It is observed that RHD's pavement construction quality is not always up to the mark, which affects sustainability. PMP consultants in RHD stated the following issues on construction quality after field visits.

- Material and construction quality are not always good,
- Drainage is not properly addressed, and
- Bleeding and undulation are common.

The impact of overloading on pavement performance can be seen in Figure 3, which shows that pavement cannot perform well due to overloading and economic benefits are also high for higher loading [15]. Figure 4 shows that good drainage and constructed road has the lowest deterioration rate and then pavement can perform well. It reveals that bad drainage can affect on pavement strength, and thereby deterioration rate is high. Bad construction also increases pavement deterioration, but at a lower rate compared to drainage [15]. Figure 5 reveals that economic benefits decrease due to improper drainage and bad construction [15].

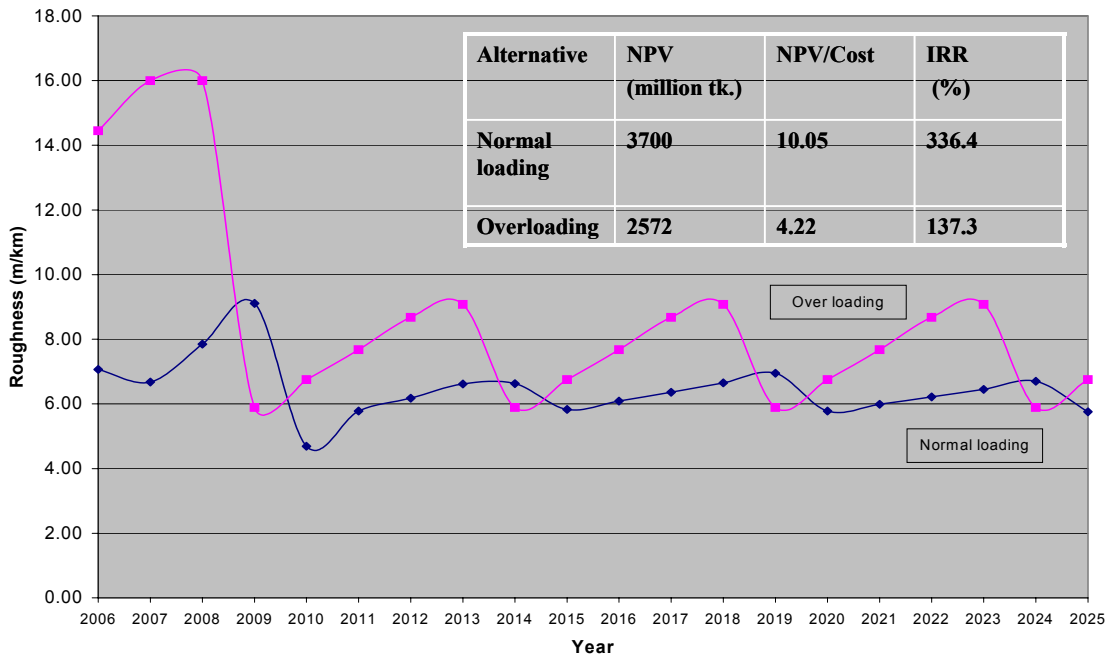


Figure 3: Impact of overloading on pavement performance [15]

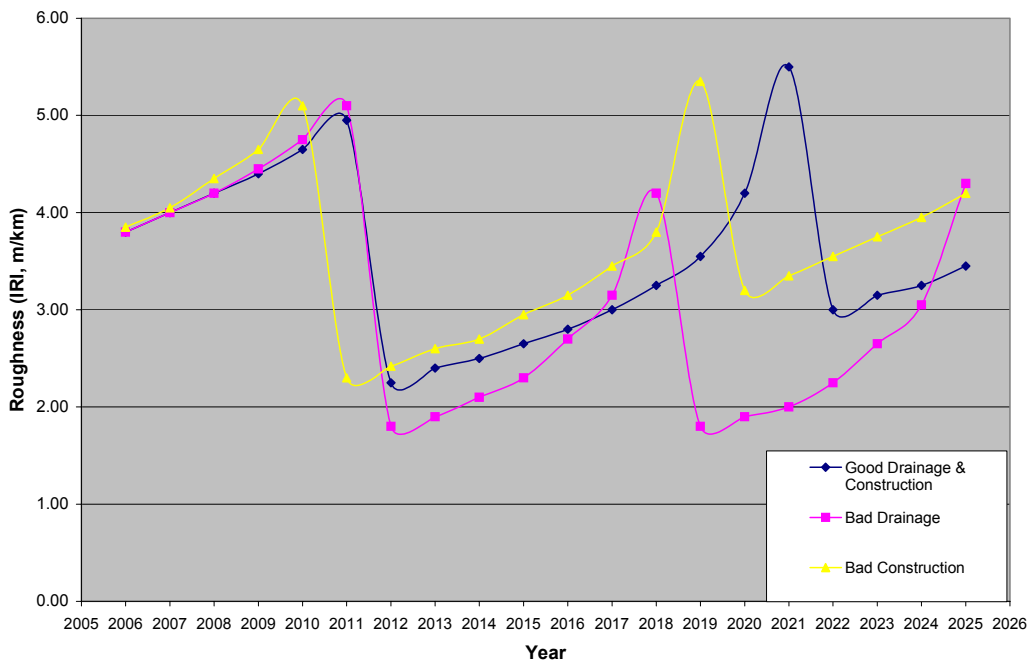


Figure 4: Impact of drainage and construction quality on pavement performance [15]

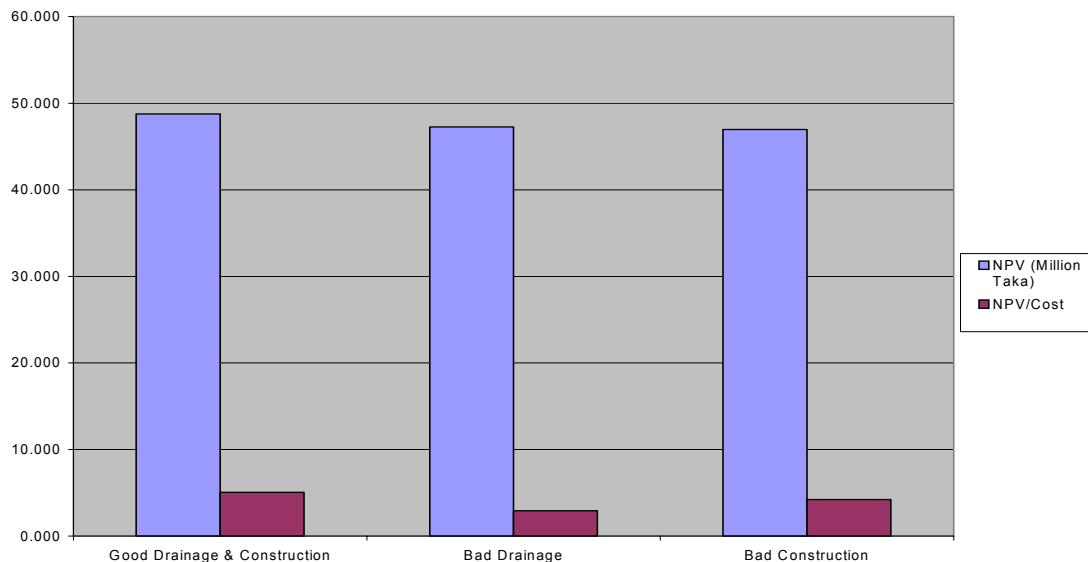


Figure 5: Economic impact of drainage and construction quality [15]

8. ROAD MAINTENANCE FUND

The Government's Poverty Reduction Strategy Paper (PRSP) stated that the Government will "explore various options for financing road maintenance and operation and consider establishing an autonomous road maintenance fund to ensure adequate stable financing of roads" [2]. Its main objective is gradual replacement of the government's contributions from the general budget to finance maintenance costs by the progressive implementation of the road user charge system to ensure sustained funding. It is believed that by 2012, road users will be able to pay for the full costs of road maintenance in Bangladesh. The draft Road Fund Act specifies a set of road user charges and other sources of revenue, major sources of road fund can be seen below.

Sources of Road Maintenance Fund [2]:

- A surcharge on the price of Petrol, Octane, Diesel and CNG fuel (fuel levy),
- International transit charges to be paid by foreign vehicles operators using the roads of Bangladesh,
- Charges imposed on vehicles according to their size and weight,
- Vehicle license fees,
- Road and bridges tolls, and
- Route permits charges.

Sufficient road maintenance budget through road fund can ensure sustainability in the long-run.

9. PRIVATE INVESTMENT IN ROAD SECTOR

Time has come for Bangladesh to open up its road system for private investment considering this as a business like many other countries to arrange additional fund flow to this sector. The board of Investment has setup Infrastructure Development Unit to provide support to privately finance projects. Guidelines for private investment in National Highways has been framed where project identification principles, legal framework, Government support, tax/fiscal concessions/other concessions, toll/fee, land handover procedures, project construction, termination of concession, procedures for applications and processing proposal, evaluation and award procedure etc are enumerated. In fact institutional and legal framework has been established [1].

There is considerable interest within Bangladesh in road sector private financing. But excepting some National Corridors current traffic levels are too low to pay even a small proportion of the revenue requirements of a commercially funded Built Operate and Transfer (BOT) project. Even then, Government support can make BOT project attractive to investors. RHD has already identified some road and bridge projects as BOT and some investment proposals have invited internationally through RHD website. Rapid increase of traffic indicates more BOT road projects will be viable within 6/7 years time [16].

Very recently Cabinet has approved the construction of second highway between capital city Dhaka and Chittagong with private investment. The 210 km highway will be constructed as first expressway and as first Built Own Operate and Transfer (BOOT) road project at a cost of Tk. \$900 million in three years time.

10. PERFORMANCE BASED MAINTENANCE (PBM)

Performance Based Maintenance (PBM) is a sort of maintenance conducted by contractors where their performance is continuously evaluated. PBM contract can be given for short period (may be for 5 years) or for long period (up to 10 years). It can ensure improved service and road users satisfaction; as a result, road assets may be maintained in an efficient way. There is no PBM contract in Bangladesh, though it is common in the developed countries of the world. PBM would be a better solution for asset management in Bangladesh.

11. INTELLIGENT TRANSPORT SYSTEM (ITS)

Intelligent Transport System (ITS) provides the ability to gather, organize, analyze, use and share information about transportation system. It helps in traffic management, pavement monitoring and more effectively and reliably managing public transport [17]. ITS can reduce travel uncertainty (better real time and predictive information to plan trips), can increase security and enhances reliability and business efficiency [18].

For society-wide benefits due to ITS are improved mobility for people and freight, less traffic congestion, greater capability of surface transportation, fewer traffic related deaths and

injuries and a better managed transportation system [17]. Detail benefits of using ITS are [17]:

- mobility
 - traffic management
 - demand management
 - commercial vehicle management
- traffic congestion
- environmental impact
 - optimize trips
 - reduce congestion and crashes
- reducing fatalities and crashes severity
- managing the transportation infrastructure
 - sensor in roads
 - sensor in vehicles
- reducing travel uncertainty
 - real time information (in vehicle navigation system)
 - predictive information
- increasing security
 - use of Global Positioning System (GPS)
 - wired
 - wireless
- increasing efficiency for operators
 - Electronic Toll Collection (ETC)
- increasing efficiency for users
 - use of smart card in ETC
 - real time traffic information and adapted rates

ITS is very suitable for developing countries as experience of developed countries can be used and these equipments and systems are now cheaper. It can be utilized for asset and traffic management efficiently [18]. The following innovative approaches have been proven successful in developing countries [18]:

- Affordable ITS is a strategy to deploy ITS inexpensively by leveraging the existence IT infrastructure,
- Step-by-Step approach is a methodology to develop ITS in a systematic and incremental manner,
- ITS Enhancing Reliability and Business Efficiency is the process of identifying and introducing ITS project based on the immediate benefits to users and operators of the transportation system, and
- Public-Private Partnerships is the process of leveraging the strengths of both public and private sector interests through cooperative arrangements.

The above approaches can be analyzed for Bangladesh to determine the suitable one. In RHD, ITS can be utilized in the following way (see Figure 6).

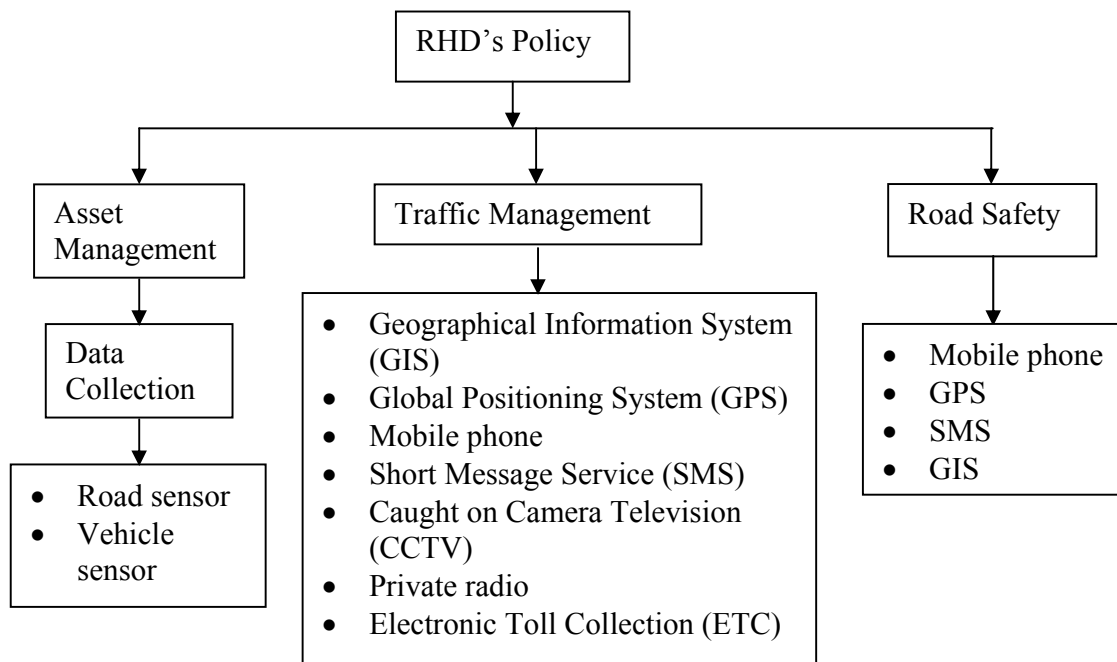


Figure 6 – Proposed ITS for RHD

12. CONCLUSIONS

In Bangladesh, due to scarcity of road maintenance resources challenges lie ahead is to preservation of these assets in a sustainable manner. NLTP, IMTP and the Road Master Plan emphasized on efficient road maintenance. Zilla roads, connecting lowest Government administrative unit to the country's main road system, requires huge development investment. Foreign aid is being available to develop part of these roads. Government has realized its importance; establishment of the Road Fund Board (RFB) is at final stage of approval to solve the maintenance fund problem in a sustainable way. PBM and PPP are the two important approaches to ensure the network in good condition.

Considerable policy reform in the national levels has been done specially by formulation of NLTP, IMTP, and reform in procurement to attain value for money along with capacity building of the road related organization like RHD, LGED, Planning Commission, MoC and MLGRD. Another challenge is concept, culture of quality and properly designed road construction especially in case of Government funded small and segregated works. So far, policy, organizational capacity building, guiding manual and standards all are in place satisfactorily but all these need full utilization on the ground in all works. Increasingly political interference in this sector is also a serious problem, hopefully which would be reduced in future using PAF.

It is observed that RHD's pavement design, maintenance and construction quality are not always up to the mark, which needs to be improved. Overloading can be controlled using Weight Bridge and imposing overloading charges.

Finally, ITS can be introduced in RHD for sustainability, which can ensure efficient road asset, traffic and road safety management. It is believed that the proposed ITS for RHD would easily be implemented and helpful in near future.

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