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BANGLADESH – NATIONAL REPORT

STRATEGIC DIRECTION ST4

**ASSET MANAGEMENT: TECHNICAL INPUTS TO
DECISION MAKING**

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Abstract

The road network of Bangladesh comprises National Highways (NH, major roads), Regional Highways (RH, secondary roads), Zilla Roads (ZR, district or tertiary roads), Upazilla roads, Union roads, Village roads and Urban roads. Major arterial roads (national, regional and zilla roads) are constructed, developed and maintained by the Roads and Highways Department (RHD). The Local Government Engineering Department (LGED) constructs and maintains the Upazilla, Union and Village roads, whereas, City Corporations deal with Urban roads.

Asset management requires efficient maintenance of roads pavement and bridges, this has to be considered as protecting a considerable national asset. Current government's maintenance funding is not sufficient for adequate management of roads and bridges. As a result, a maintenance backlog is increasing every year.

RHD has a Road and Bridge Asset Management System (RAMS), designed to assist with the maintenance of its large assets. RAMS incorporates the Road Maintenance and Management System (RMMS) database and the Highway Development and Management Tool (HDM-4), backed up by regular annual surveys for traffic and road condition data.

LGED pavement management system is mainly based on data collection and engineering judgment. LGED is now in the process of introducing HDM to assist with its maintenance management. City Corporations do not have any formal pavement management system.

Analysis shows unless the asset is protected by maintaining the network, the whole investment may be jeopardized. Enhanced spending on preventive maintenance will require increased funding for roads.

As in many other countries, Bangladesh is now in the process of developing a Road Maintenance Fund, as an alternative means of meeting ongoing maintenance costs. A Road Fund Board is going to be established soon. Bangladesh is considering the introduction of Performance Based Maintenance contracts, as an essential component of its road asset management.

The Government is encouraging Private Public Partnership (PPP) in the transport sector of Bangladesh, particularly on highways and expressways, including mass-transit, bridges, tunnels, flyovers, interchanges, city roads, bus terminals, commercial car parking, etc. Bangladesh Private Sector Infrastructure Guidelines have been prepared and recently accepted by Government. The Government is planning to implement an expressway project, of 2nd Dhaka Chittagong National Highway on a Built Own Operate and Transfer (BOOT) basis.

1. INTRODUCTION

An adequate and efficient transport system is a pre-requisite for both initiating and sustaining economic development. The transport system of Bangladesh consists of road, railways, waterways, two seaports, maritime shipping and civil aviation, catering for both domestic and international traffic. During the last 20 years there has been a significant shift from water and rail transport to road transport. The road transport plays a major role in the transportation system of the country, which had shares for passenger and freight of 73% and 63% respectively in 1996 (TSC, 2006). The paved roads in Bangladesh increased from 3600 km in 1971 to 50,000 km in 2005 (RFEO, 2006).

The road network of Bangladesh comprises National Highway (NH, major roads), Regional Highway (RH, secondary roads), Zilla Roads (ZR, tertiary roads), Upazilla Roads, Union Roads, Village Roads and City Roads. Major arterial roads, e.g., NH, RH and ZR are constructed, developed and maintained by the Roads and Highways Department (RHD) (RHD, 2006). The Local Government Engineering Department (LGED) constructs the Upazilla, Union and Village roads. City Corporation deal with urban roads in metropolitan cities. Sometimes District Boards do manage a minor part of the network in their jurisdiction. Details of the road classes and responsibilities in Bangladesh can be seen in Figure 1 and facts of the road network are in Table 1.

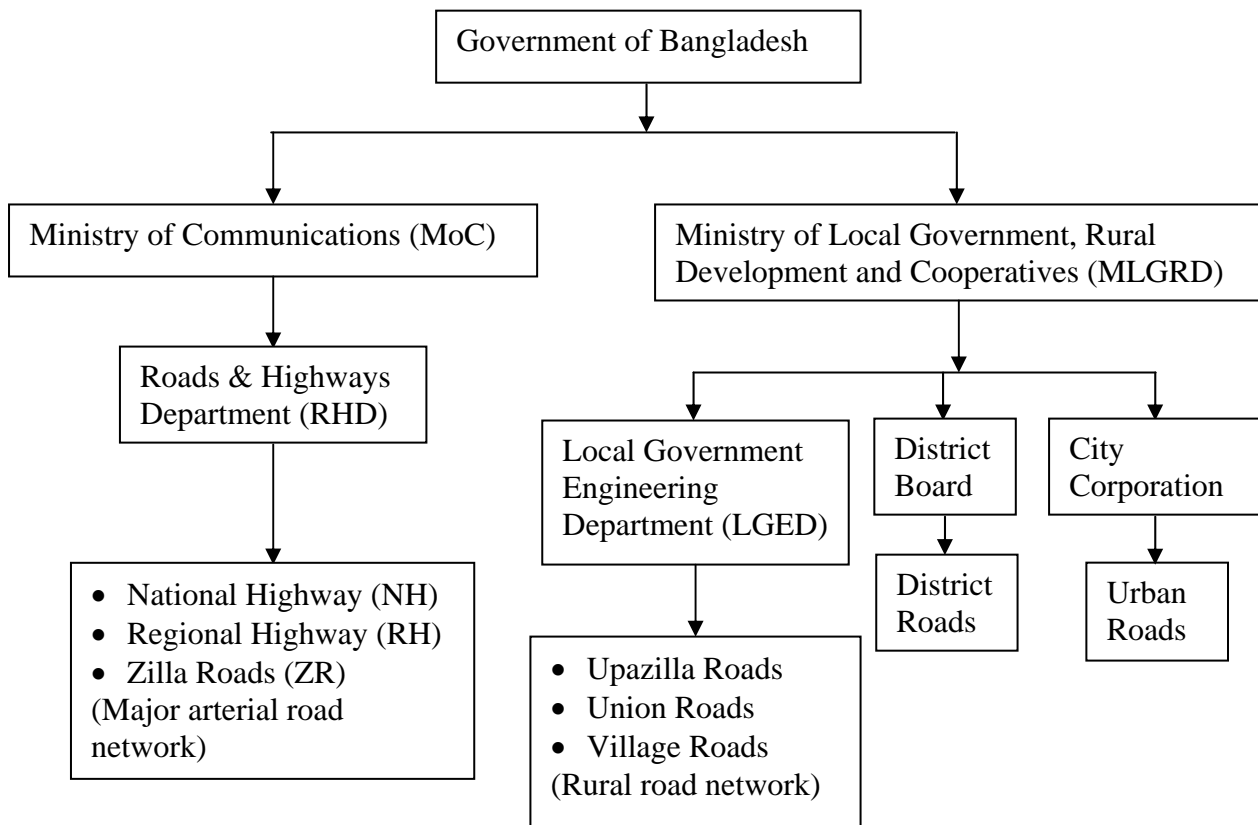


Figure 1: Details of the road classes and responsibilities in Bangladesh

RHD deals with the major roads in Bangladesh. Its vision is to provide a safe, cost effective and well-maintained road network. RHD has roads and bridges assets valued in excess of US\$7,400 million. These can be seen in Figure 2 (MoC, 2000). RHD road network covers over 20,782 km of roads and there are approximately 14,800 bridges and culverts of span of more than 3.0 meter on these roads. That means there is one structure per 1.40 km of road and 12.47m of bridging per km of road (RHD, 2005).

Table 1: Road network in Bangladesh (RHD, 2006; RFEO, 2006 and LGED, 2005)

Road type	Description	Length (km)	Responsibility	Comments
NH	Roads connecting capital to districts and ports	3,529	RHD	RHD network is of 20,782 km of which about 17,434 km are paved. These are major roads in the country.
RH	Roads connecting district to districts	4,127	RHD	
ZR	Roads connecting district to upazilla and upazilla to upazilla (shortest distance)	13,126	RHD	
Upazilla road	Roads connecting upazilla to upazilla and upazilla to union (shortest distance)	36,166 (17,889 km are paved)	LGED	LGED network is of 249,830 km of which about 33,987 km are paved. These are rural roads in the country.
Union road	Roads connecting union to union	42,329 (8,515 km are paved)	LGED	
Village road	Roads connecting union to village and village roads	171,335 (7,583 km are paved)	LGED	
City road	Urban roads in the metropolitan cities	3,200	City Corporation	These are urban roads.

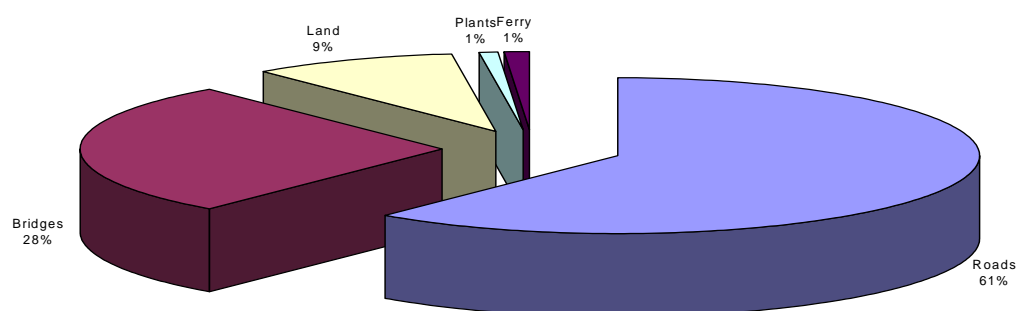


Figure 2: Different categories of RHD's assets (MoC, 2000)

LGED has about 249,830 km of roads and 7.46 m/km, 4.85 m/km and 1.85 m/km of structures for Upazilla, Union and Village roads respectively (LGED, 2005). City Corporations have about 3,200 km roads (RFEO, 2006).

The value of the paved roads network is about US\$ 8 billion in Bangladesh (RFEO, 2006). It was observed that about 65.5% of the traffic is on RHD's roads, 7.5% runs on LGED roads and city roads have about 27% of the traffic (RFEO, 2006).

Recent surveys show that vast majority of RHD and LGED roads are good or fair. This is shown in Figure 3. However, RHD's surveys were more complete than LGED surveys.

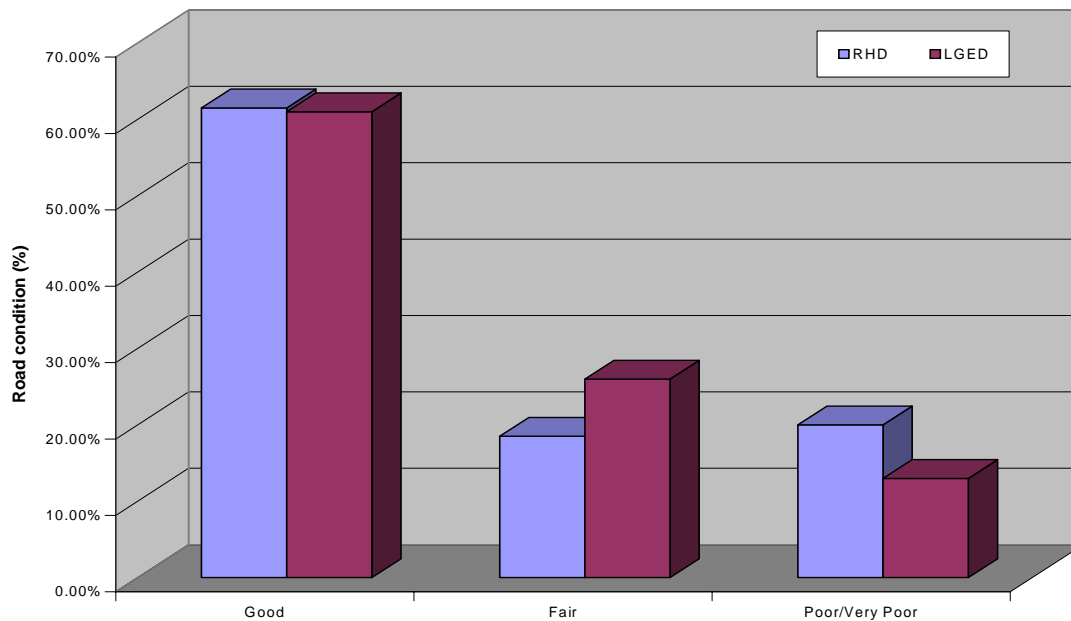


Figure 3: RHD and LGED recent road condition (RFEO, 2006)

This figure shows that roads in Bangladesh are huge assets and particular attention is required to manage these assets.

Asset management also means to manage road assets appropriately. Serious economic consequences will result from a lack of effective asset management. Road Maintenance is directed to preserving the value of the roads asset by maintaining the durability of the roads and bridges. Without maintenance, these assets will rapidly deteriorate. Not maintaining roads has a cost to the economy. National economic growth is probably slowed by about 1% of Gross Domestic Product (GDP) each year because of lack of maintenance (MoC, 2000). Road maintenance provides very high returns on invested capital. Typically periodic maintenance has an Economic Internal Rate of Return (EIRR) of between 40 and 100% compared with 8 to 15% for new construction (MoC, 2000).

It was estimated that there is a loss of asset value of US\$ 400 million/year due to lack of maintenance, as a result, if no action is taken, after 20 years the road network will be unusable (RFEO, 2006).

2. CONCEPT OF ASSET MANAGEMENT

Road networks are physical assets and powerful generators of economic growth and social equity. Road asset management has to be considered as a large business, which has the following components.

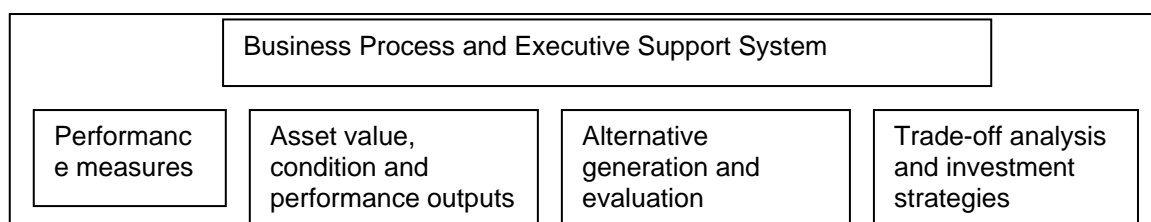


Figure 4: Asset management components (PIARC, 2005)

Asset management can be defined as “A systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organized and flexible approach to making the decisions necessary to achieve the public's expectations” (PIARC, 2005). Generally, asset management is a business-like approach to managing infrastructure, which may touch organization, partners, stakeholders and customers in the following way (PIARC, 2005):

- strategic planning,
- performance assessment and analysis,
- alternative generation and evaluation,
- investment strategies and programming,
- business planning and funding acquisition,
- engineering and design phase,
- construction and implementation,
- operation and maintenance, and
- monitoring and marketing.

Asset management is these activities given as a service or product for a client. Efficient management of roads is required for the satisfaction of the road users.

Road assets are normally, roads, bridges, land, unfinished road projects and structures (PIARC, 2005). The ultimate benefits of asset management should be, improved understanding of asset performance, better organizational integration, and more strategic, effective and efficient management of the infrastructure (PIARC, 2005).

3. ROAD ASSET MANAGEMENT IN BANGLADESH

There are many examples of massive road assets being lost due to inadequate maintenance. A World Bank study of maintenance of countries in Sub-Saharan Africa concluded that US\$150 billions had been lost in the asset value of roads and bridges over a 20 year period due to a lack of maintenance (MoC, 2000). Efficient asset management can be achieved through proper and timely road maintenance.

Maintenance expenditure saves money by reducing overall costs to the roads agency and costs to the road users. In developed countries, the vast majority of expenditure is spent on maintenance. However, to date insufficient attention has been given in Bangladesh to maintaining newly developed roads and many are showing signs of deterioration. It is clear that the current levels of maintenance being carried out on the road network are inadequate to maintain the roads in a satisfactory condition (MoC, 2000). Maintenance funding for different agencies in 2003-04 can be seen in Figure 5.

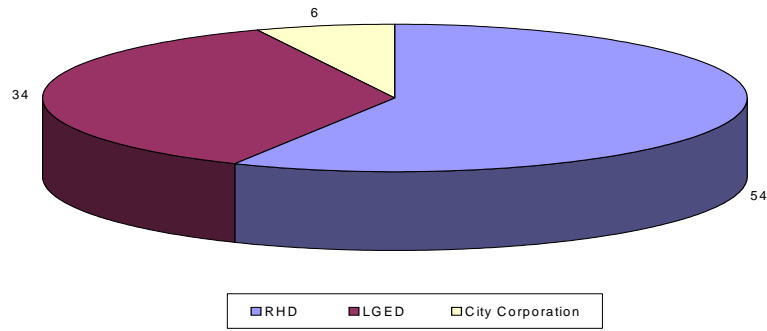


Figure 5: Total estimated roads and bridges maintenance allocation in US\$ million for 2003-04 (RFE0, 2006)

This funding is not sufficient enough to maintain the assets properly. The current RHD funding and backlog situation can be seen in Figures 6(a) and (b). Backlog means rehabilitation and reconstruction are required due to not maintaining roads on time. Revenue is maintenance spending and development is capital spending.

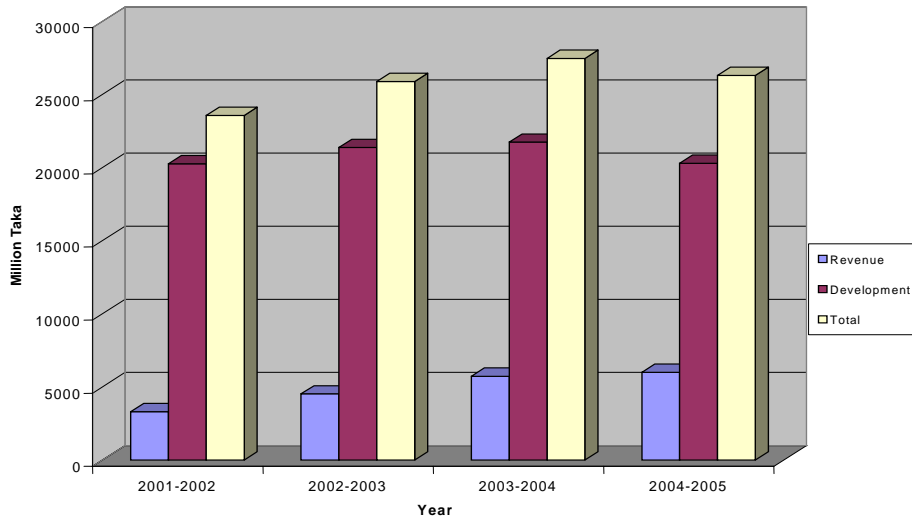


Figure 6(a): Current funding situation in RHD (1US\$ million = 65 million taka)

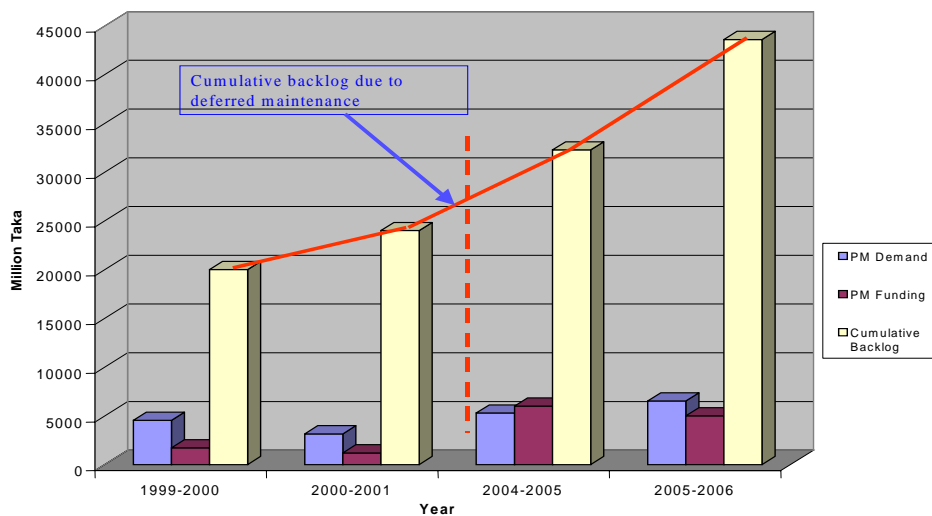


Figure 6(b): Current backlog situation in RHD (1US\$ million = 65 million taka)

Previously, fund allocation for maintenance was done on the basis of visual inspection and scattered information. There was no systematic data collection, storing activity, logical prioritization criteria, and rational distribution of maintenance fund or scientific process for the identification of new projects (MoC, 2000). To utilize the allocated fund efficiently, a Pavement Management System (PMS) was required.

RHD has now developed a very efficient PMS and road database based on a system of annual survey of road data. Survey data is stored in the RMMS database. Economic analysis for prioritization has been done using the HDM-4 model for decision-making. This gives a practically justified maintenance program (Khan, 2005a). However, LGED has a simple PMS based on survey and engineering judgment. City Corporations do not have a system yet.

4. ROAD ASSET MANAGEMENT SYSTEM IN BANGLADESH

It was discussed earlier that different agencies have different PMS to maintain their assets. These are discussed below.

4.1 RHD-PMS

RHD has a world-class road management system. This is being used with state-of-the-art analysis software to identify where it is best to spend the limited budget. RHD has established the Road Maintenance Management System (RMMS) and the Bridge Maintenance Management System (BMMS) databases to feed into the Highway Development and Management Model (HDM-4) model. These outputs are shown in the Road Asset Management System (RAMS) maps using Geographical Information System (GIS). Details of the RHD-PMS can be seen in Figure 7.

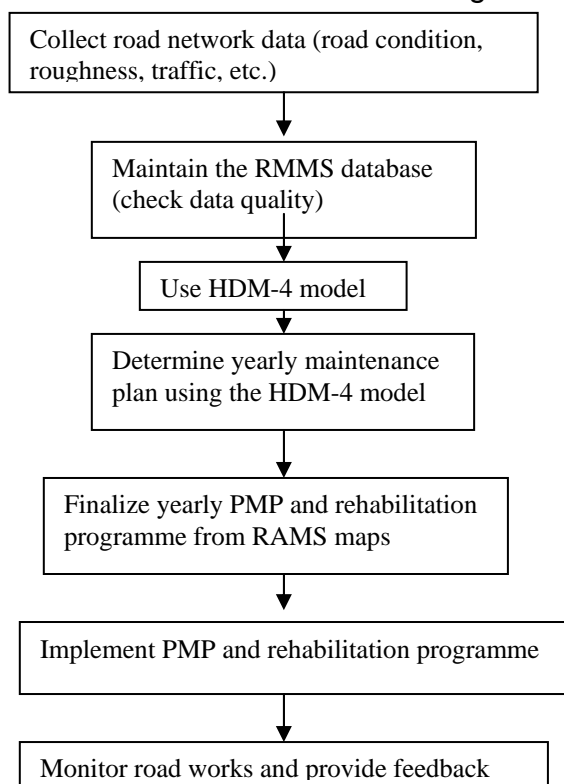


Figure 7: Current RHD-PMS (Source: Khan, et al. 2005b)

Normally, road condition, traffic and roughness surveys are conducted each year in RHD. Pavement inventory data is collected once every 3 years (RHD, 2003). The field staff collect road condition and traffic data by visual inspection methods. Every field division is responsible for the collection of data under its jurisdiction. It has been observed that field staff that collect these data are often not properly trained (Khan, 2005).

“48-hours” traffic data are collected for each road. The traffic data is then averaged to achieve Annual Average Daily Traffic (AADT). In addition, The HDM Circle's assistant engineers collect roughness data. This data is generally considered reliable. Roughness data is collected by Road Data Measurement Acquisition System (ROMDAS), which is calibrated before collecting field roughness data (RHD, 2005). In 2004, road condition, traffic and pavement inventory data were collected by outsourcing to achieve better quality data.

It is observed that data collection is delayed in Bangladesh due to bureaucracy and lack of appropriate budget. Another important drawback of data collection is lack of appropriate training among different field staff. Regular training is a necessity to reduce data variability (Khan, 2005).

The RMMS database of RHD has records of about 13,560 km of roads data (RHD, 2005). This consists of road condition (cracking, ravelling, potholes and edge-break), structural condition (depression and rutting), roughness, pavement inventory, traffic volume and composition and treatment (Khan, 2005). The main purpose of the RMMS database is to develop the Annual Maintenance Plan (AMP) using the HDM-4 model. The database is also used for GIS mapping and to determine Road User Charges (RUC) for decision-making purposes.

Previous studies pointed out about inconsistencies and incompleteness of the RMMS database (Khan, 2004; ARRB, 2003). Khan showed that only 5% of the whole database is reliable using the 1996-2002 data. A road database should be assessed for reliability before use for decision-making purposes. This check must be done using statistical and range check methods, such as those utilized by Khan.

PMS implementation requires a valid model to measure total life-cycle performance, costs and benefits for several road maintenance and rehabilitation alternatives for a road network (Watanatada, et al. 1987). The HDM-4 model can be utilized for these purposes, and RHD has been using the HDM-4 model since 1999-2000. HDM-4 requires data on the road network, vehicle fleet, road works and configuration for analysis.

The HDM system provides an economic assessment of the possible maintenance treatments of all paved roads of RHD road network and then places these in priority order. The system can also determine the most economically effective means of carrying out maintenance when funds are limited. It was shown in Figure 7 that HDM-4 outputs are generally used for the yearly maintenance and rehabilitation programme. Recently, RAMS has been developed by RHD to present the annual maintenance programme in a more understandable manner allowing the preparation of contract packages in a manageable way. Maps prepared under RAMS from HDM-4 results identify the ongoing, critical or priority maintenance projects. An example of the RAMS map of Comilla Division prepared by the HDM unit in RHD using the HDM-4 results of 2006 can be seen in Figure 8.

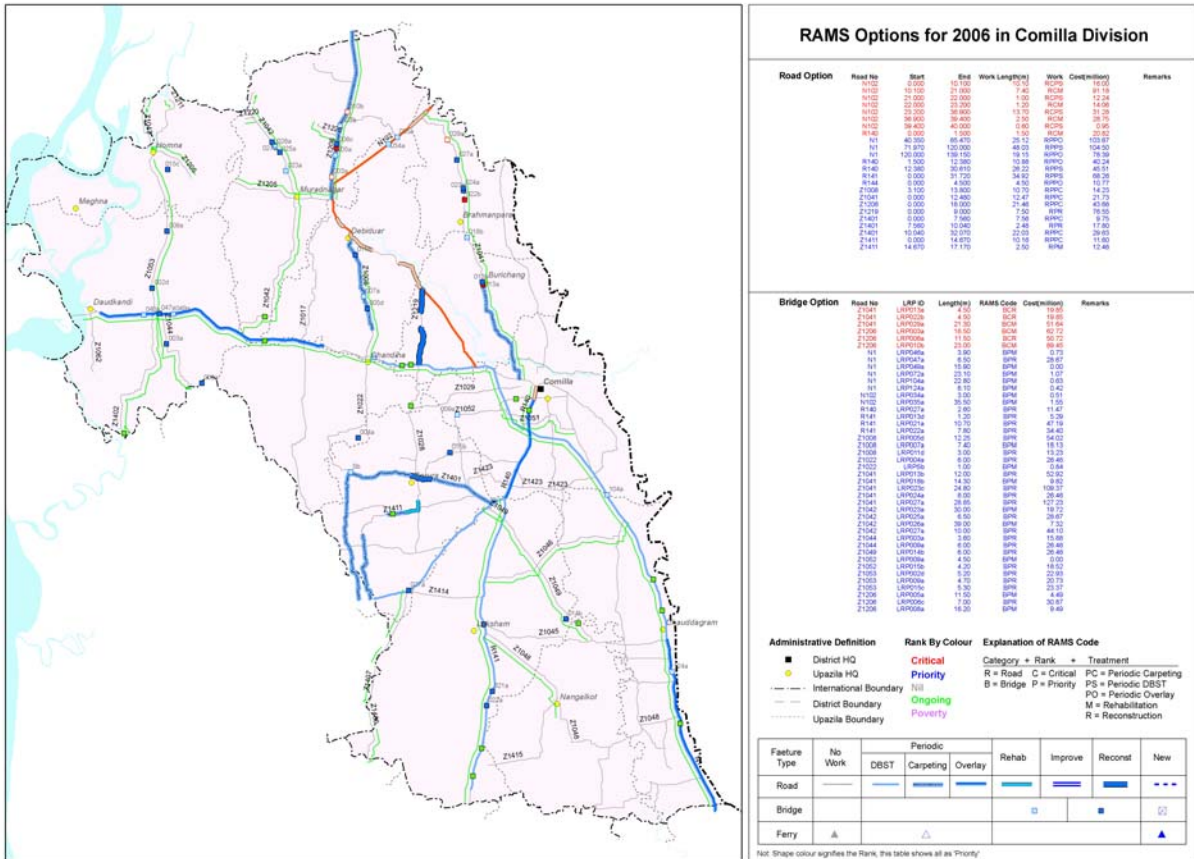


Figure 8: RAMS maps to undertake efficient decisions

The Maintenance Circle of RHD uses the HDM-4 outputs to determine a yearly Periodic Maintenance Programme (PMP). Rehabilitation, reconstruction and widening works are normally conducted through the Annual Development Programme (ADP), funded by the Donors and Government. Maintenance works are generally implemented by the field divisions and by the foreign aided projects. Tenders are invited by the Maintenance Circle to implement these projects. To implement periodic PMP efficiently, Quality Assurance (QA) of road works has been made mandatory. The newly introduced Central Management System (CMS) records the financial and physical progress of a project. Post evaluation of maintenance works can be done through several tests. All these ensure efficient implementation of the PMP programme and ultimately sound management of RHD's assets.

However, RHD is lacking some expertise in QA, and monitoring at the moment. This needs to be improved. The new Technical Assistance project funded by the U.K. Department for International Development (DFID) will place emphasis on these areas.

4.2 LGED-PMS

It was mentioned earlier that LGED-PMS is simpler compared to RHD-PMS, which can be seen in Figure 9.

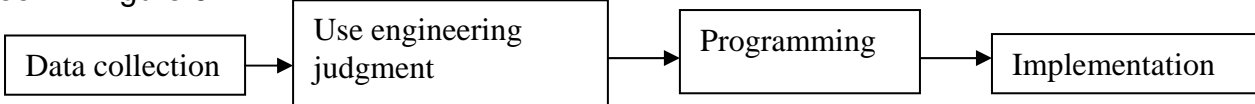


Figure 9: Components of LGED-PMS

LGED does not have a complete road database at the moment. No economic tool is utilized to obtain a rational yearly programme to manage assets. Engineering judgment is used to evaluate collected data, which might impact on project selection.

4.3 City Corporation-PMS

In Bangladesh City Corporations manage urban roads. However, their PMS is very weak, e.g., data collection is rare. This affects the overall asset management system. They lack economic tools and efficient project implementation.

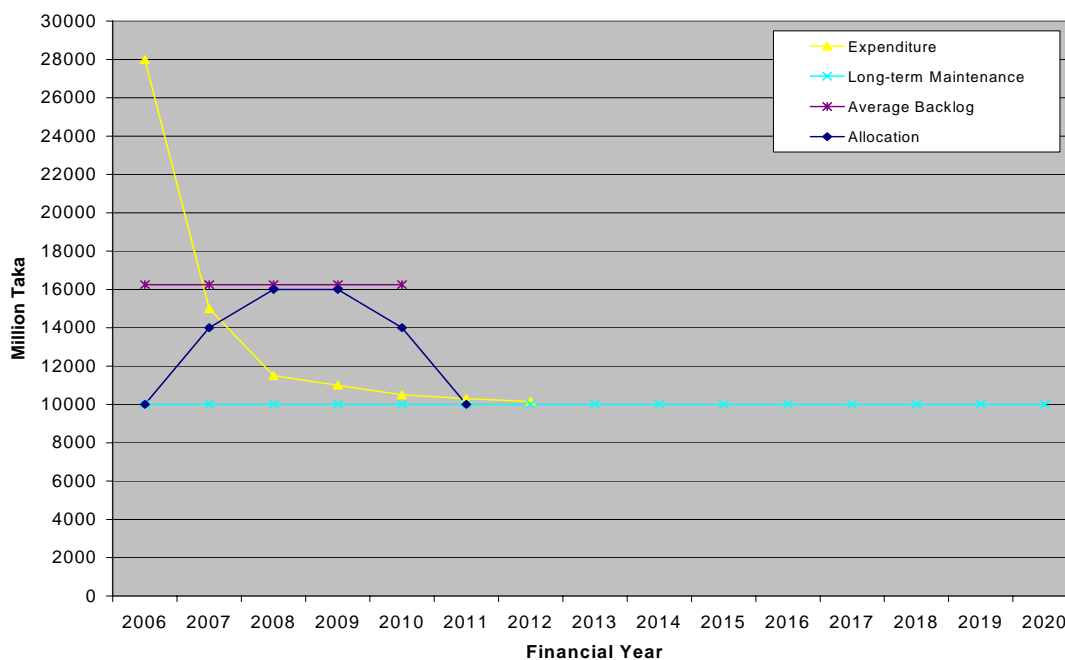
It should be mentioned here that political interference has a large impact in Bangladesh in managing assets. RHD tries to overcome this problem by using RAMS maps.

5. CURRENT ANALYSIS OF THE ASSETS

Some results for road assets in Bangladesh were shown earlier. Recent analysis results are given below.

5.1 Results for RHD

The HDM analysis for RHD network shows that backlog mitigation requires US \$ 250 million over 5 years. About US \$ 153 million per annum will be required once the level of maintenance stabilizes. At the present time, expenditure on maintenance activities is estimated at US \$ 100 million per annum; an annual shortfall of US \$ 53 million (RHD, 2006); this can be seen in Figure 10. RHD has received US\$ 67 million for PMP (Periodic Maintenance Programme) in 2006-07 from Government, DFID and Japan Bank for International Cooperation (JBIC). The World Bank and Asian Development Bank have committed funds to periodic maintenance over the next 4 to 5 years.



(1 US\$ million = 65 million taka)

Figure 10: Current backlog and funding requirement to maintain assets (RHD, 2006)

However, a large part of this money is for small-scale work that does not provide the durability of larger-scale well-controlled maintenance works. In addition to the above long-term maintenance needs, the immediate problem is to deal with the very high levels of maintenance required during the next few years (see Figure 11). These high levels of maintenance are a result of current levels being well below the requirement so that a backlog of deferred maintenance has developed. The unconstrained cost needed for periodic maintenance and rehabilitation for the first 5 years of the analysis period is shown in Table 2. Figure 12 shows the first year (2006-07) unconstrained works from the HDM-4 analysis.

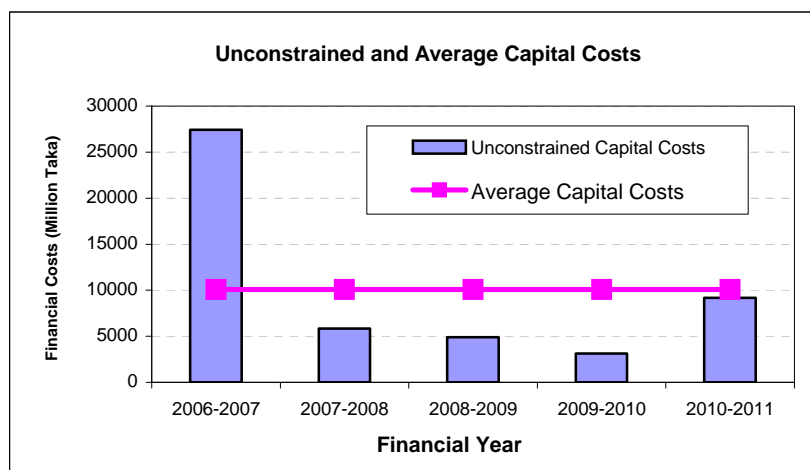


Figure 11: Yearly unconstrained maintenance demand (RHD, 2006) (1US\$ million = 65 million taka)

Table 2: Unconstrained periodic and rehabilitation costs (US\$ million) (RHD, 2006)

Work name	Year					Total
	2006	2007	2008	2009	2010	
Periodic maintenance	263.71	53.17	66.38	44.36	135.05	562.67
Rehabilitation	158.30	36.65	9.23	3.61	6.27	214.06
Total	422.01	89.82	75.61	47.97	141.32	776.73

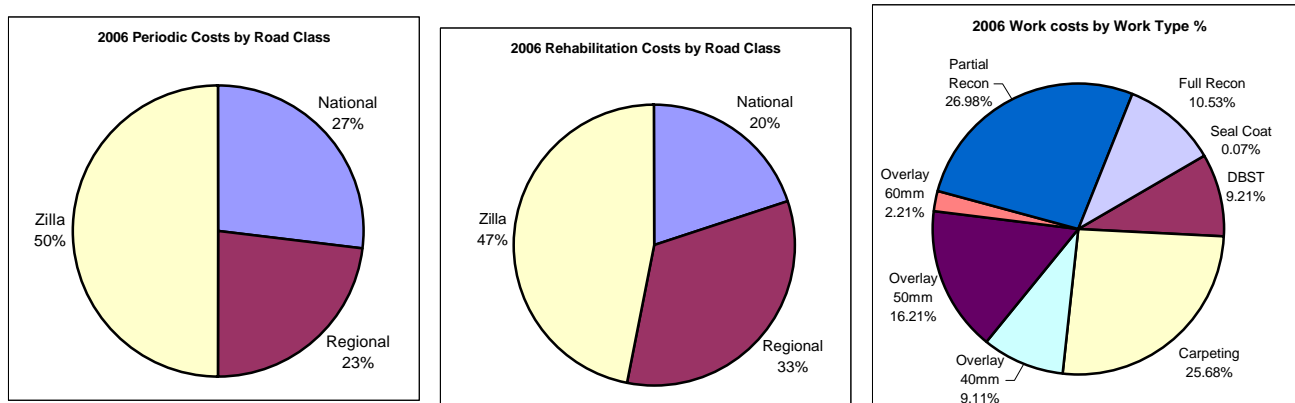


Figure 12: First years (2006-07) unconstrained works for RHD (RHD, 2006)

A great deal of work has been achieved in clearing the backlog over the past few years through a number of development projects. It is not viable to clear the remaining backlog

immediately, it will be necessary to continue this effort over the next decade in coordination with RHD's maintenance planning unit.

5.2 Results for LGED

Details of LGED assets are in the Rural Road Master Plan. It was stated that LGED requires US\$ 8,660 million for the next 5 years (LGED, 2005). For 2005-06, LGED; total maintenance and rehabilitation needs can be seen in Table 3.

Table 3: Summary of maintenance and rehabilitation need for 2005-06 (LGED, 2005)

Type of works	Requirement (US\$ million)
Routine maintenance	15
Periodic maintenance	71
Rehabilitation	74
Total	160

LGED actually received US\$ 59 million for maintenance, which was 69% of the total maintenance need of 2005-06 (LGED, 2005). The rehabilitation need was met from development funding from Government and foreign donor agencies. It was estimated that LGED has current maintenance backlog of US\$ 125 million (LGED, 2005).

Year-wise resource requirement for the LGED roads can be seen in Figure 13.

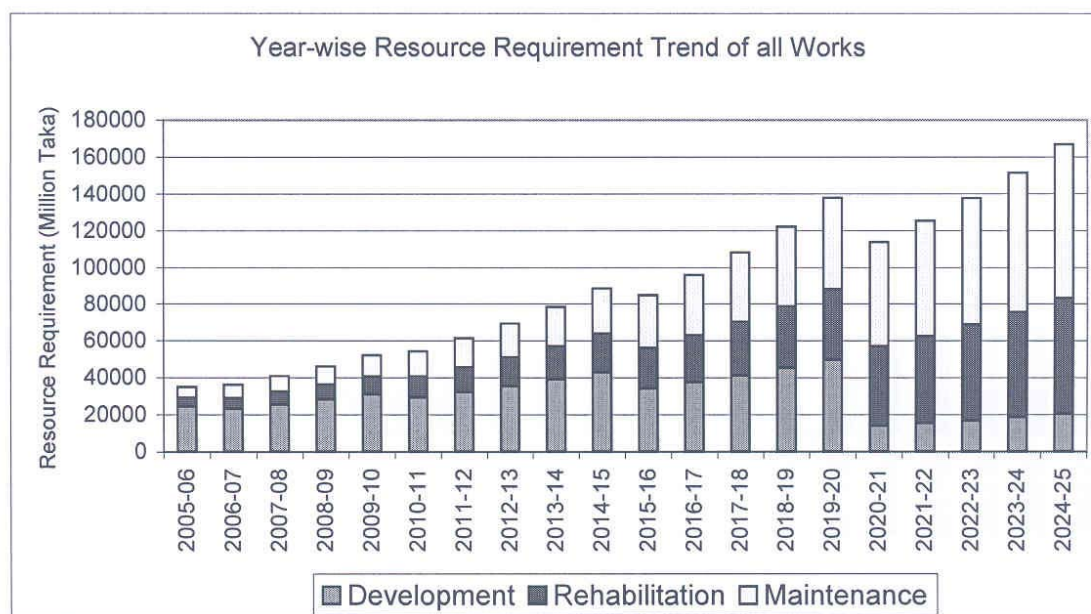


Figure 13: Year-wise resource requirement for LGED (LGED, 2005)
(1 US\$ million = 65 million taka)

5.3 Results for City Corporation

It was estimated that City Corporations require US\$ 4.50 million for routine maintenance and US\$ 21.50 million for periodic maintenance (RFEO, 2006).

Finally, it was estimated that total maintenance demand in Bangladesh is about US\$ 215 million (see Table 4), of which Government funding is around 50%. Again, current backlog is US\$ 385 million (RFE0, 2006).

Table 4: Estimated optimum maintenance expenditure in US\$ million (RFE0, 2006)

Agency name	Type of road	Routine maintenance	Periodic maintenance	Total demand	Percentage of demand (%)
RHD	NH	2.30	37.70	40.00	RHD requires 56% of the total demand.
	RH	1.54	18.46	20.00	
	ZR	4.62	55.38	60.00	
LGED	Upazilla road	6.15	46.15	52.30	LGED requires 32% of the total demand.
	Union road	3.08	13.85	16.93	
City Corp.	City roads	4.46	21.38	25.84	City Corporations require 12% of the total demand.
Total		22.15	192.92	214.63	

6. IMPROVEMENT IN THE CURRENT ASSET MANAGEMENT SYSTEM

The above discussions show that road assets cannot be maintained properly due to a lack of funding, political pressure and poor QA. As a result, improvements are necessary to enhance the current systems, which are discussed below.

6.1 Road Fund Board (RFB)

It is observed that current maintenance backlog and effective maintenance require more funding to achieve road users' satisfaction. However, the Government is not capable to give further fund. Inadequate maintenance may be due to:

- insufficient funding,
- money is allocated but not spent,
- money is not spent efficiently, and
- money is not spent effectively.

All these point to the requirement to establish a Road Fund Board (RFB) in Bangladesh. This is under process. Legislations for the Road Fund are now under consideration in Parliament. It was observed from the recent RUC study that road users are willing to pay for better roads, which can ultimately ensure efficient asset management. The most common method of road funding is the "fee-for-service" concept under which road users' pay directly for the services they consume. This is achieved by paying road user revenues (such as fuel levies) directly into a commercially managed road fund. The new Road Fund aim to ensure the public gets value for money from any spending.

It is obvious that road users have to be involved in road management through RFB. It is a common saying that "user pay, user say". Generally, the road fund will be used to maintain NHs and to eliminate the maintenance backlog. Sources of road fund may be fuel levy,

license fees for heavy vehicle, mass-distance charges, tolls and permit-based change. A suggested Phasing in road user charges for the next 6/7 years is shown in Figure 14. The Percentages of demand as shown in Table 4 above suggest the allocation of maintenance funds for different road agencies from the Road Fund.

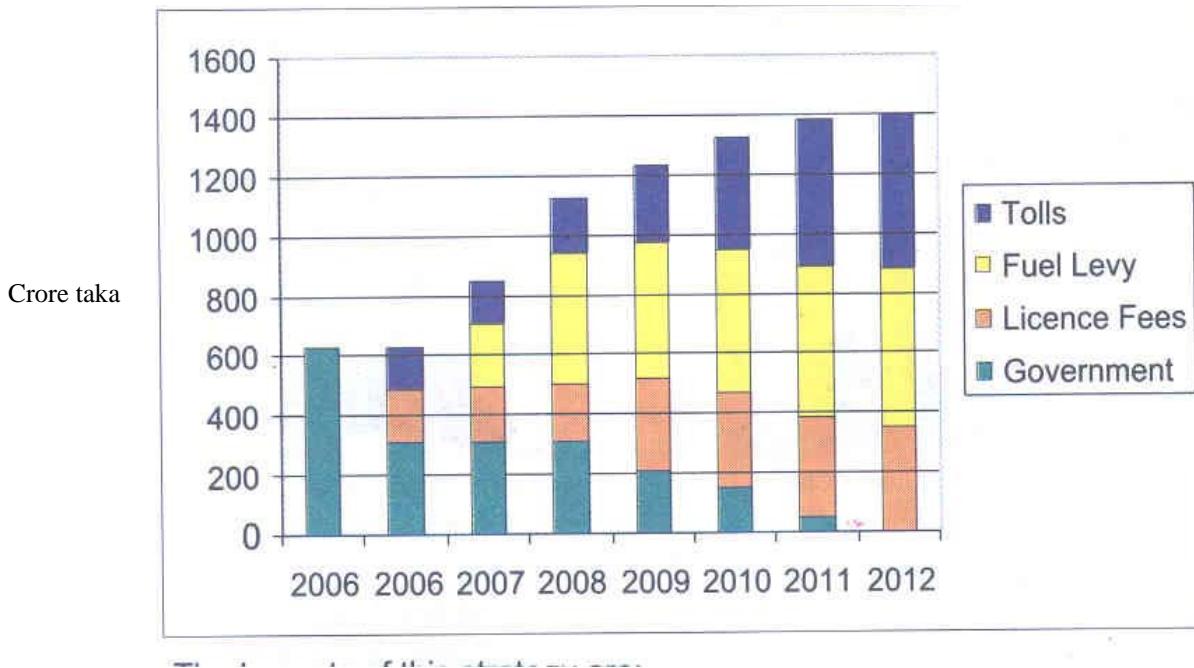


Figure 14: Financial strategy for the Road Maintenance Fund (RFEF, 2006)
(1 US\$ million = 65 million taka = 6.5 crore taka)

6.2 Public Private Partnership (PPP)

It is observed that Public Private Partnership (PPP) can better maintain assets by improving quality of service, better management and technical innovation. Moreover, PPP has also the following benefits (Gavilanes, 2005):

- time saving,
- more infrastructure earlier,
- optimization of public administration costs,
- introducing pricing policy, and
- introducing criteria to decide which quality level is to be offered.

The, PPP has already been introduced and it provides an efficient management of assets. Government of Bangladesh recently accepted and circulated Bangladesh Private Sector Infrastructure Guidelines (PSIG), which emphasize the land transport sector, highways and expressways including mass-transit, bridges, tunnels, flyovers, interchanges, city roads, bus terminals, commercial car parking etc. (PSIG, 2004). Details of private sector partnership are discussed in the guidelines and this is encouraged in the road sector. As a result, the Government has accepted implementing of the 2nd Dhaka Chittagong National Highway as Built Own Operate and Transfer (BOOT) basis.

6.3 Performance Based Maintenance (PBM)

Performance Based Maintenance (PBM) is a form of maintenance conducted by contractors where their performance is continuously evaluated. PBM contracts can be given for short period (5 years) or for long period (25+ 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. Discussions in the previous sections clarify that PBM could be a better solution for asset management in Bangladesh.

7. CONCLUSIONS

Road maintenance has to be considered as protecting a massive national asset. Road management must be treated as a business – it is a very large business indeed. In the short term, the development budget needs to be used to overcome funding deficits and to clear the backlog with assistance from development partners. In the longer term, new ways of asset management probably using a 'Road Fund' can be considered. Road users should be treated as customers who will pay a fee for improved services. Utilizing these fees to constitute a dedicated Road Fund. Establishing a RFB (with public and private participation) for management of the Road Fund formulating policies for stable and adequate funds for management of the nation's road assets is essential for the growth of the economy.

PPP has to be introduced in Bangladesh for highway construction and maintenance as it can ensure better management and quality of service. Government expressed interest in the 2nd Dhaka Chittagong National Highway as BOOT basis, as a first initiative of PPP. It is expected that in future, private investment would improve asset management.

PBM is well accepted in the developed countries can be introduced in Bangladesh for sound road asset management. It is expected that to ensure efficient pavement maintenance, PBM would be a practical solution for Bangladesh.

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