



Government of the People's Republic of Bangladesh
Ministry of Communications
Roads and Railways Division

Roads and Highways Department
Towards Effective Asset Management
of Roads & Bridges

June 2001

Foreword

“The Major Road Network of Bangladesh is now substantially complete. The work carried out during the last 25 years to construct this network represents a major investment for Bangladesh and the road network is now one of the Country’s major assets.

We must protect the value of this asset and the Ministry of Communications and its Departments must now pay particular attention to the maintenance of the road and bridge network.”


(Anwar Hossain, MP)
Minister for Communications.
June 2001

“During the last few years the Roads and Highways Department has developed comprehensive systems for planning maintenance activities based on HDM output to maximise economic returns to the Country. We must now use this planning tool to help implement a practical programme of effective maintenance in order to protect the Nation’s Road and Bridge Assets.

Preventive Maintenance is probably the most economically effective expenditure that can be made on the Highway Network and we must ensure that sufficient resources are allocated to this essential operation.”


(Syed Rezaul Hayat)
Secretary, RRD
Ministry of Communications
June 2001

SUMMARY

- Roads and Highways Department is responsible for providing a “safe, cost effective well maintained road network”
- RHD have Roads and Bridges assets valued in excess of Taka 37,000 crore (US\$7,400 million)
- Engineering Maintenance is not just cosmetic in nature. Road Maintenance is directed to preserving the value of the roads assets by preserving the durability of the roads and bridges. This process is known as Asset Management
- Without maintenance the value of these Assets will rapidly deteriorate. A single rehabilitation is estimated to cost 3 to 4 times the amount that should have been spent on Routine and Periodic maintenance
- Well maintained roads increase speeds and reduce the quantity of fuel, spare parts and tyres consumed. Potential savings of scarce foreign currency now expended on importing fuel and spare parts would be significant.
- Not maintaining roads has a cost to the economy. National Economic Growth is probably slowed by about 1% of GDP each year.
- Road maintenance provides very high returns on invested capital. Typically Periodic maintenance has an EIRR of between 40 and 100% compared to 8 to 15% and new construction. This means that Periodic Maintenance can pay for itself inside 1 to 3 years.
- 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.
- The analysis has shown that there is a huge backlog resulting from lack of appropriate Asset Management in the past. Investment of Taka 2,400 crore is needed in the short term to arrest the deterioration in the condition of the roads. This sum is rising each year at an accelerating rate whilst maintenance continues to be underfunded
- Long term maintenance needs are for Taka 500 crore per annum. This is a commitment that will never disappear.
- MoC and RHD have taken the initiative to direct about Taka 150 crore to Periodic Maintenance from the Revenue Budget.
- World Bank and ADB have committed funds to Periodic Maintenance over the next 4 to 5 years. Other agencies are interested in investing in this work.
- Development Projects (supported by the Development Partners) could be used to address this need:
 - Backlog Mitigation of Taka 2,400 crore (US\$ 480 million) over 10 years
 - Rolling Annual Major Road & Bridge Asset Management fund of Taka 500 crore (US\$100 million) of which Taka 220 crore (US\$ 44 million) will come from existing fund sources
- Implementation of the Asset Management programme will involve appropriate changes to RHD organisation and introduction of new contract procedures.

Why Maintain Roads?

The Goal

1.1 The goal of the Ministry of Communications and its Departments is: *“The Ministry of Communications will provide the People of Bangladesh with a safe, cost effective well maintained road network”*. The purpose of this document is to outline how the Country can be provided with a well maintained road network and how this can be achieved cost effectively.

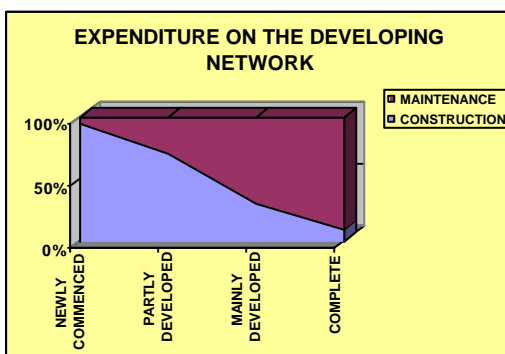
Maintenance of Roads and Bridges?

1.2 Engineers use the term Maintenance to describe the activities aimed at "Preserving the value of an Asset". Such works are major in nature and cannot be compared with the more cosmetic activities, such as painting and cleaning, normally considered to be maintenance.

Spending Priorities

1.3 Since Independence the main road and bridge network of Bangladesh has been developed and this network is now close to completion.

1.4 Spending must transfer from new construction to maintenance. In developed countries the vast majority of expenditure is

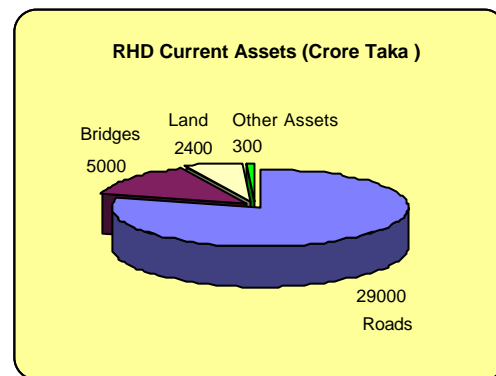


spent on maintenance. However to date insufficient attention has been given to maintaining these newly developed roads and many are showing signs of deterioration.

1.5 Vast amounts of money have been invested in roads that have been improved and rehabilitated with our Development Partners. Unfortunately these roads are not receiving the required maintenance.

Maintaining the Asset

1.6 RHD assets include the value of roads, bridges, land, ferries, equipment and buildings. The largest component is the value of the roads and bridges. The value of all RHD's assets are shown in the figure below to be conservatively estimated at Taka 37,000 crore (US\$7,400 million).



1.7 Maintaining the value of these assets places a great responsibility on the Ministry of Communications and the RHD.

1.8 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.

ASSET MANAGEMENT
RHD has the responsibility to maintain one of the largest assets in Bangladesh. Serious economic consequences will result from a lack of effective Asset Management.

The Benefits of Asset Management

Beneficial Spending

2.1 Of all the possible types of spending on the road network **Preventive Maintenance** is the most beneficial. This is because a small amount of money on timely maintenance can preserve the massive initial expenditure which was made at the time of construction.

2.2 Maintenance expenditure saves money in two ways. Firstly it reduces the overall costs to the roads agency (in this case the RHD). Secondly it reduces the costs to the road users.

Saving Costs to the Road Agency

2.3 Preventive maintenance is usually classed as either **Routine** or **Periodic**. Routine maintenance activities are minor works which must be carried out at frequent intervals, usually several times a year. Periodic maintenance consists of major actions which must be carried out every few years

2.4 Typical **routine maintenance** actions would be clearing culverts, repairing shoulders and embankment slopes, repairing potholes etc. These are small-scale items that can be carried out using labour-based methods.



2.5 Typical **periodic maintenance** actions are re-sealing, carpeting and

overlays using bituminous materials. Some periodic maintenance works may be carried out using labour intensive methods but machine based methods are generally required particularly on major highways.

2.6 Timely expenditure on preventive routine and periodic maintenance minimises the need for expenditure on costly re-construction or rehabilitation. In time this will lead to lower overall spending on the road network.



Saving Costs to the Road Users

2.7 Road user costs consist of time lost travelling, vehicle operating costs and the costs of accidents.

2.8 Well maintained road surfaces will increase speeds, thereby reducing travel times and making journeys more economical leading to lower fares and freight charges.

2.9 Operating vehicles on well maintained roads is cheaper than on poor quality roads as vehicles use less fuel and spare parts and require less maintenance. At present these costs are about Taka 10,000 crore (US\$ 2,000m), equivalent to 6% of GDP. Hence, the potential savings to road users from well maintained roads are very large and generally several times larger than the Road Agency costs.

The Disadvantages of not Maintaining

A Problem That Won't Go Away

3.1 Neglecting periodic maintenance leads to both higher agency costs and higher road user costs and loss of consumer satisfaction.

3.2 Unfortunately this lack of maintenance may not make itself fully apparent for some time but by then the damage has been done and far greater amounts of money will be required to rectify the situation than if preventive maintenance had been carried out in the first instance.

Effect on the National Economy

3.3 Every sector of the economy and the overall social conditions of the country are dependent on transport. Poorly maintained roads will cost 100's or 1000's of crore Taka each year to users. Given that the majority of fuel, spare parts and vehicles are imported the Balance of Payments is particularly affected by poor maintenance policies.

3.4 There is little doubt that poorly maintained roads have a significant adverse effect on National Economic Growth, probably reducing GDP growth by around 1% per annum.

The Expanding Network

3.5 In a developing country such as Bangladesh there is always a need to provide a basic level of access to all rural areas. This expansion of the road network also leads to an increased level of maintenance expenditure.

3.6 It is axiomatic that if a road is worth building in the first place then it must be worth maintaining. However rural roads

are generally built with little thought to the future maintenance needs and costs.

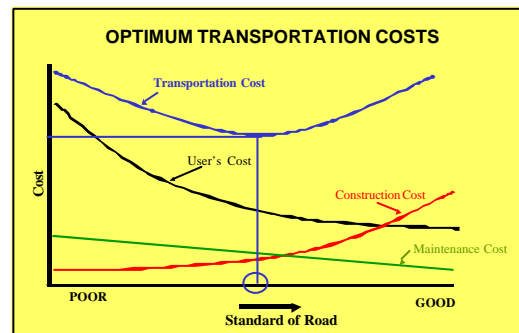
3.7 Maintenance savings are directly related to traffic levels and hence high user costs. Heavier trafficked roads should receive priority in maintenance funding over lightly used poor condition roads.

Striking a Balance

3.8 Funds are scarce and there are many conflicting demands. However there are few expenditures in any sector of the economy which have higher economic returns than preventive road maintenance.

Typical Economic Returns from Road Works	
	EIRR %
New Construction	8 – 15%
Reconstruct/Rehab.	15 – 20%
Preventive Maintenance	40 – 100%

3.9 The optimum funding level for maintenance must strike a balance between initial construction costs, the costs of maintenance and the costs to road users. Construction costs play a part because more expensive well constructed roads generally require less maintenance. However better quality can often be achieved without major increases in costs.



Establishing Maintenance Priorities

The Need for Maintenance Planning

4.1 A road network is a complex thing and to optimise spending over the total network is a major task. It is certainly beyond the power of an individual or group of people but modern computers and systems have made it possible to analyse complex road maintenance operations.

4.2 Any road planning exercise whether manual or computerised requires information. Information on the construction, location and condition of the roads and bridges, information on traffic and information on existing and planned projects.

4.3 The information must be up to date and because of the sheer volume it requires storage on a computer database. To be fully effective it also needs a system of analysis.

The RHD System

4.4 The RHD has established a system of annual road and bridge surveys, has sophisticated computer database filing systems and is using the latest versions of the International HDM analysis system.

RHD ANNUAL DATA COLLECTION

- ◆ Road & Bridge Conditions
- ◆ Road roughness,
- ◆ Traffic volumes
- ◆ Deflections
- ◆ Road user costs

4.5 The current system rivals any currently in existence Worldwide and has received international acclaim.

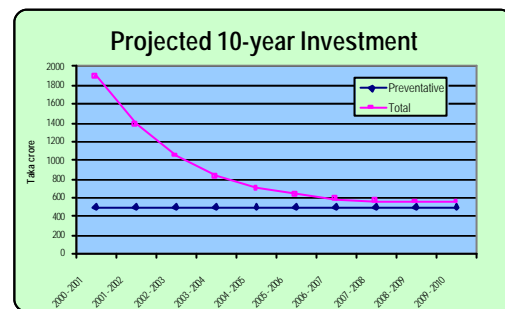
4.6 The HDM 4 model, which is being used in Bangladesh, is able to optimise maintenance expenditure over the whole network taking into consideration all the

various factors and requirements including the effects of non motorised traffic.

4.7 The HDM system provides an economic assessment of all possible maintenance treatments on each of the 1200 links of the Bangladesh road network and then places these in priority order. The system can also analyse the most economically effective means of carrying out maintenance when funds are limited.

The HDM Results

4.8 The HDM analyses carried out in 1999 and 2000 showed that to satisfy the optimum demand for road maintenance very high maintenance expenditures will be required in the early years of the programme. However if these expenditures are achieved the requirement will quickly diminish to give a more or less steady annual expenditure at around Taka 500 crore (US\$ 100 million) as shown in the figure:



4.9 The figure shows an idealised situation; in practice price escalation and the extension of the road network lead to gradually increasing expenditure with time.

4.10 When compared to existing levels of spending on maintenance it is clear that the current levels of maintenance being carried out on the RHD road network are inadequate to maintain the roads in a satisfactory condition.

Current and Future Spending

The Current Budgets

5.1 The current RHD budgets consist of the Revenue and the Development (ADP) budgets.

5.2 The Revenue Budget is often referred to as the maintenance budget. This is an incorrect interpretation, as only a small proportion of the Revenue budget is available for road and bridge maintenance.

5.3 The Revenue Budget in addition to Routine and Periodic Maintenance of roads, bridges and buildings is also used to fund the operation and maintenance of equipment and ferries. The RHD annual Revenue Budget is currently of the order of Taka 290 crore per annum (US\$ 58 million). A breakdown of the 2000/2001 revenue budget is shown in the following:

REVENUE BUDGET 2000-2001 (Repairs and maintenance of Roads, Bridges & Ferries)	
(Taka crore)	
Salaries for Staff	40
Materials for Department works	11
Maint. of Transport & Equip.	33
Maint. of Ferries & Ghats	34
Contracted works	146
Maint. of offices/housing	7
Petty purchase	4
Reserve for Emergency works, CDST and VAT	15
TOTAL ALLOCATION	290

5.4 Of the Taka 146 (US\$ 29 million) crore allocated for contracted works Taka 107 crore (US\$ 21 million) is for periodic maintenance in accordance with HDM priorities.

5.5 The Annual Development Budget is project based and is largely focused on upgrading, rehabilitation and new works.

Some of these items may be considered as periodic maintenance. The ADP budget is currently of the order of Taka 1,670 crore (US\$ 330 million). Hence, the Development Budget is currently about 6 times the size of the Revenue budget.

Future Budget Proposals

5.6 At the present time the various budget heads in both the Revenue and Development budget do not clearly identify the various types of maintenance being carried out. This results in an understatement of maintenance activities. It would be better if future budget allocations reflected the different types of maintenance activity being carried out.

5.7 The 2000/2001 Revenue budget continued the revised maintenance allocations introduced in 1999/2000. Periodic maintenance is being allocated in accordance with the HDM priorities with large scale works at the zone level and small scale works under divisions being undertaken by contract.



5.8 To obtain the maximum economic benefits a future maintenance programme would increase expenditure on routine and periodic maintenance whilst the spending on capital works should decrease with time as will the need for rehabilitation. Capacity expansion (improvement) projects will still be required as the economy grows.

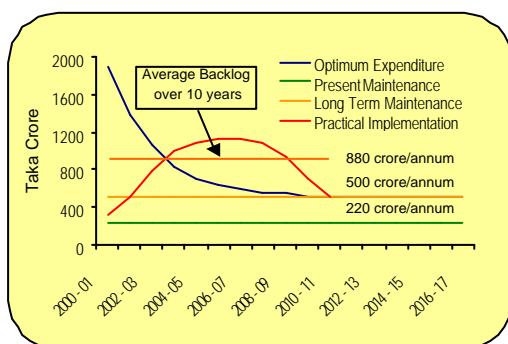
Bridging the Funding Gap

Funding Requirements

6.1 The HDM results show an ongoing need for around Taka 500 crore (US\$ 100 million) per annum once the level of maintenance stabilises. At the present time expenditure on maintenance activities is estimated at Taka 220 crore (US\$ 44 million) per annum: an annual shortfall of Taka 280 crore (US\$ 56 million). However, a large part of this is small scale work that does not provide the expected durability of larger scale well controlled maintenance works.

6.2 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. 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.

6.3 This backlog currently stands at around Taka 2,400 crore (US\$ 480 million). A great deal of work has been achieved in clearing the backlog over the past decade through a number of development projects. As it will not be viable to clear the remaining backlog immediately, it will be necessary to continue this effort over the next decade in co-ordination with RHD's maintenance planning. This is shown below:



Additional Resources

6.4 It is clear that unless funding for maintenance is increased significantly in the near future the situation will deteriorate further with a resultant effect on the National Economy.

6.5 Enhanced spending on preventive maintenance will require increased funding for roads in the short term but within a few years the level of funding should decrease as less roads require rehabilitation. The increased allocations for preventive maintenance will be spent in accordance with the HDM priority listings.

6.6 Those roads which have recently been improved and rehabilitated under major foreign aided schemes will require large scale equipment intensive maintenance, whereas smaller roads may be maintained by more traditional labour based methods.

6.7 It is therefore proposed that the large scale works will best be funded through a long term project in the Development budget. More traditional works may be carried out through the Revenue Budget allocations.

6.8 A Development project, or projects, will also be required to catch up on the backlog of maintenance and this should be of interest to the Development Partners. This work should be co-ordinated with the maintenance plan. It is vital that the objectives of future development projects are clearly stated to avoid ambiguity over what are development and maintenance activities.

Implementation

Current Activities

7.1 In the past road maintenance was currently carried out with little planning. Generally the field officers decided their maintenance priorities and spent the allocation as best they could. As funds for maintenance were generally inadequate this was usually a case of repairing badly damaged roads and bridges with little preventive action to avoid occurrence of serious damage.

7.2 Small scale routine maintenance works are being carried out by Department staff, and by labour-only contract with equipment and materials being provided at a sub-divisional level. Larger periodic maintenance works are only carried out by contract.

Maintenance Quantities

7.3 The RHD Network extends to 20,000 kms of road of which 2,850 kms are National Highways, 1,550 kms are Regional Highways and the remaining 15,600 kms are Feeder Roads.

7.4 The whole 20,000 kms should receive Routine Maintenance. However in practice about 14,000 kms will require Routine Maintenance as about 6,000 kms of Feeder roads are still under construction.

7.5 Periodic Maintenance will be required on all paved roads. As a general rule paved roads require a bituminous overlay or seal about every 5 - 6 years. If we only consider the 12,000 kms of bitumen surfaced road, between 2,000 to 2,400 kms of overlay or bituminous seal are required **every year**.

7.6 These general maintenance quantities equate to an annual ongoing budget of around Taka 500 crore per annum once the backlog has been cleared.

PERIODIC MAINTENANCE

Between 285 - 340 kms each of overlay or bitumen surface treatment will be required each year in each of the 7 RHD Zones. Over a 26 week works period each Zone would have to complete over 10 km of treatment a week!

Implementation Systems

7.7 The existing RHD operations are being changed to deal with this additional work. Periodic Maintenance works, which have been selected using HDM-4, are already being undertaken under Revenue Account funding. At present this represents only 20% of the total annual work required.

7.8 Routine Maintenance should be managed through the existing field office structure using Term Contractors. To carry out the work effectively appropriate contract forms must be developed.

7.9 Normal Periodic Maintenance. For the lower trafficked roads the traditional methods of seal coating and carpeting may be used with some improvements. These operations are to be executed by local contractors engaged through the relevant field offices.

7.10 Large Scale Periodic Maintenance. Heavier trafficked roads, particularly those which have recently been rehabilitated need high quality mechanised maintenance treatments. These works must be organised and supervised centrally. Modifications must be made to the organisation of RHD to improve maintenance management. In particular the Maintenance Circle must be significantly strengthened.

7.11 The Periodic Maintenance Programme on the scale required presents a welcome challenge to the larger local contractors.

Towards Sustainable Funding

Sustainable Funding

8.1 In common with many countries, Bangladesh is short of revenue for maintaining roads. Improving the utilisation of existing revenue (as proposed in this document) and introducing tolls can generate extra revenues, but will not be sufficient to eliminate the financing gap. Given that budget allocations from central Government funds are likely to remain well below requirements, what are the alternatives?

Bringing Roads Into the Market Place

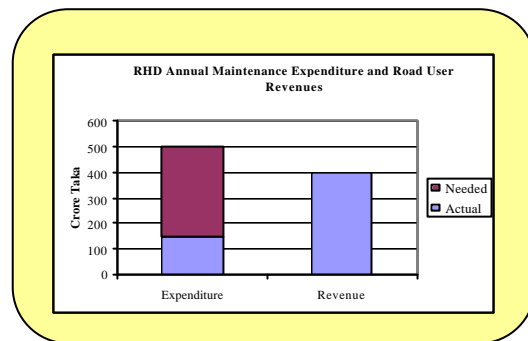
8.2 One of the most widespread ways of raising additional revenues is to restructure road financing along private sector lines. The most common way is the “**fee-for-service**” concept under which road users pay directly for the services they consume. This is achieved by paying road user revenues (such as fuel levies) directly into a **commercially managed road fund**.

8.3 Interest in road funds was generated in the early 1990’s by the African Road Initiative and the PROVIAL roads programme in Latin America. Unlike earlier road funds which simply earmarked road user revenues for road expenditure the new funds aim to ensure the public get value for money from any increased spending. The idea was to **bring roads into the market place, put them on a fee for service basis and manage them like a business**.

Planned and Operational Road Funds	
India	Pakistan
Nepal	New Zealand
Honduras	Guatemala
Lesotho	Namibia
South Africa	Yemen
Zambia	Ghana
Mozambique	South Africa

The Benefit for Bangladesh

8.4 Less than 40% of the Taka 400 crore (US\$80 million) now collected from users of the RHD road network (through fuel duties, tolls etc.) is spent on the maintenance of RHD Roads. If all this was allocated to a Road Fund it would be sufficient to cover 80% of RHD’s annual maintenance needs. A recent study has assessed that a substantial amount of revenue is not collected. Hence, the annual maintenance requirement could be comfortably funded by road user revenues.



The Way Forward

8.5 A Bangladesh Road Fund could be utilised to fund all road maintenance in the Country. The establishment of this fund would require co-operation across existing boundaries of responsibility and would need strong support from the Government.

8.6 A road fund will require either new legislation, or executive orders, to ensure the fund has sole access to road user revenues. The fund would be operated by an autonomous agency with an independent chairman and board directing the allocation of funds. The board would focus on Asset Management of the road network and use modern management systems and procedures to ensure that maintenance funds are properly allocated and expended.

RHD ROAD MAP OF BANGLADESH

