

MAINTENANCE FINANCING STRATEGY

A. Introduction

1. The purpose of this analysis is to (i) analyze the existing funding arrangements for road maintenance, (ii) derive the funding for road maintenance require to reduce backlog of roads in poor condition over the next ten years, (iii) develop and recommend a maintenance financing strategy to implement the reduction of backlog over the next ten years.

2. The scope of this analysis covers National, Regional and Zilla roads. The two main budgetary sources reviewed are the Non-development Revenue and the Annual Development Budget (ADP). This document will first discuss the assumptions used, followed by description of the analysis conducted, and finally conclude with findings and recommendations on a feasible maintenance financing strategy.

B. Assumptions

3. **Road network.** The RHD is currently responsible for the management of National, Regional and Zilla roads. A survey of current road conditions that was conducted in 2010-11, the detailed findings are attached in Table 1.

Table 1: Overall RHD Road Network condition survey in 2010/11 (data in km)

Road	Good	Fair	Poor	Bad	Very Bad	Total Surveyed
National	755.62	1441.12	742.83	344.7	77.97	3362.24
Regional	260.53	1403.06	1357.04	475.07	106.78	3602.48
Zilla Road	422.19	1503.27	3233.51	2216.27	312.95	7688.19
Total	1438.34	4347.45	5333.38	3036.04	497.7	14652.91

Source: Needs document (RHD).

4. **Backlog.** The survey revealed that the proportion of roads in the Good-Fair condition for National, Regional and Zilla category are 65%, 46% and 25% respectively. The remaining roads are in Poor to Very Bad condition, forming the backlog of roads requiring rehabilitation. The backlog for National, Regional and Zilla roads are 35%, 54% and 75% respectively. This is summarized in Table 2 below.

Table 2: RHD network – proportion of roads in Good-Fair and Poor-Very Bad condition

Road Class	Total Length	Paved Length	Roads in Good-Fair condition	Roads in Poor-Very Bad condition
National	3,537 km	3,437 km	2,311 km (65%)	1,226 km (35%)
Regional	4,275 km	4,105 km	1,974 km (46%)	2,301 km (54%)
Zilla	13,458 km	10,659 km	3,377 km (25%)	10,081 km (75%)
Total	21,271	18,202		

Source: Needs document (RHD).

5. **Road Maintenance.** To ensure continued safety and level of service, roads categorized as Good or Fair require routine and periodic maintenance. Routine maintenance comprises small scale works conducted regularly – assumed annually in this analysis – to ensure safety of

existing roads in the short run to prevent premature deterioration. For the purpose of this analysis, routine maintenance is assumed to be undertaken for all Good-Fair roads, as well as backlog roads that have not yet been rehabilitated. Periodic maintenance is larger scale activities conducted over longer periods, this is assumed to occur every 6 years. Such activities preserve the structural integrity of the road by resurfacing and overlaying, and are largely preventive measures. This analysis assumes periodic maintenance is undertaken periodically on all Good-Fair roads. Roads categorized from Poor to Very Bad require repair. Rehabilitation is required, typically involving reconstruction to bring the road back to acceptable standards.

6. The unit costs per kilometer for maintenance in each road category were estimated based on average geometric road profiles and unit rates for typical maintenance works (Table 3).

Table 3: Unit cost of maintenance for each road category.

Road Class	Routine (mil Taka/km)	Periodic (mil Taka/km)	Rehabilitation (mil Taka/km)
National	0.1	4.1	41.5
Regional	0.07	3.1	31.1
Zilla	0.05	2.4	20.8

7. **Maintenance Budget.** The Ministry of Finance publishes¹ the annual budget allocation across the various government agencies. From these annual publications, RHD's budget allocations for Annual Development Program (ADP) and Revenue budget have been analyzed.

C. Analysis

8. The analysis consists of two parts. The first is to understand past trends in budget allocation and utilization. The second is to derive the funding requirement to reduce backlog of roads over ten years. This two-stage analysis enables the assessment of whether the current funding allocation for road maintenance is sufficiently secured and efficiently utilized, and ensures that recommendations are feasible.

1. Past trends in budget allocation and utilization

9. **Annual Development Program (ADP).** The ADP sets out an annual development program of construction of new roads, which also includes widening, rehabilitating and strengthening of existing roads. Since the latter category of schemes in the ADP enhances existing roads, they can be considered as rehabilitation works.

10. Actual expenditure on the ADP is compared against MOF's original budget allocation (Table 4). Fluctuations are observed in both the expenditure and budget allocations, with larger variations in expenditure. This is mainly due to the political environment, i.e., care taker government, the disaster-prone natural environment, and the tedious procedures for the government to approve and release the fund in general. The expenditure is observed to increase on average by 9% per annum, and the allocated budget reduces only slightly by 2% per annum. This implies improvement in RHD's capacity over the observed period.

¹ Ministry of Finance, "Supplementary Grant and Allocation". The original budget is set beginning of the financial year, in July. The revised budget is produced in March/April of the second half of the financial year.

Table 4: ADP – comparison of expenditure versus budget allocation

Year	Total expenditure (million Taka)	Annual increase in expenditure	Budget (million Taka)	Annual increase in budget	Utilization of Budget
2006-7	17,453.2	-3%	23,403.4	4%	75%
2007-8	15,270.8	-13%	25,642.9	10%	60%
2008-9	12,131.4	-21%	18,694.9	-27%	65%
2009-10	19,665.7	62%	17,141.5	-8%	115%
2010-11	18,425.9	-6%	17,260.6	1%	107%
2011-12	24,309.0	32%	18,358.6	6%	132%

11. The individual projects within the FY2010/11 and FY2011/12 ADP were analyzed to determine the proportion of ADP allocated to constructing new roads and rehabilitating existing roads (Table 5). In the absence of actual expenditure for the individual projects, the revised ADP budget was used as a proxy for analyzing expenditure. The trends show that a significant portion of ADP is allocated to rehabilitation and emergency road works. In FY2010/11, 13.9 billion Taka (69% of ADP allocation) was spent on rehabilitation and 0.5 billion Taka (2% of ADP) spent on unplanned emergency works. This brings the total spend on rehabilitation to about 71% of ADP. In FY2011/12, the expenditure on rehabilitation was 11.6 billion Taka (52% of ADP), while the unplanned emergency works rose to 5.5 billion Taka (25% of ADP). This brings the total spend on rehabilitation to about 77% in FY2011/12. Overall, the total expenditure on planned and unplanned rehabilitation increased by 19% from FY2010/11 to FY2011/12.

Table 5: ADP expenditure – allocation between construction of new roads and rehabilitation

Description	FY2010/11 (million Taka)	FY2011/12 (million Taka)	% change
New roads	5,604 (29%)	4,967 (22%)	-11%
Rehabilitation and emergency works	13,883 (69%)	11,627 (52%)	+19%
Emergency works	500 (2%)	5,500 (25%)	
Others	-	130 (1%)	-
Total	19,987	22,224	+11%

Note: (1) This table uses revised budget as a proxy for estimating ADB expenditure for new roads and rehabilitation.
(2) "Others" includes feasibility studies for new roads in FY2011/12.

12. A further detailed breakdown of the ADP allocation for rehabilitation works is described in Table 6 below. It illustrates increased emphasis on enhancing National roads in FY2011/12, but reduced emphasis towards enhancing Regional and Zilla roads.

Table 6: ADP estimated rehabilitation expenditure – allocation across road categories

Description	FY2010/11 (million Taka)	FY2011/12 (million Taka)	% change
National	2,830	4,359	54%
Regional	4,284	2,046	-52%
Zilla	6,771	5,220	-23%
Total	13,882	11,627	+16%

Note: (1) This table uses revised budget as a proxy for estimating ADB expenditure for new roads and rehabilitation.

13. **Revenue budget.** The Revenue budget is mainly utilized for routine and periodic maintenance. Table 7 below summarizes RHD's actual expenditure on routine and periodic spending since FY2006/7. In addition to routine and maintenance, the table illustrates additional spending on 'other payment', which includes ad-hoc backlog payment and emergency works etc. It is worth highlighting that emergency works have been subsumed within different categories at different times. For example, the routine maintenance spent in FY2007/8 includes emergency repairs following floods; the 'other payment' in FY2008/9 includes special maintenance of Dhaka bypass in FY2008/9. Overall, albeit significant fluctuation of the in the earlier years, there is still an average 9% annual increase in total expenditure between FY2006/7 to FY2011/12.

Table 7: Revenue budget - Actual expenditure on routine and periodic maintenance

Year	Expenditure on Routine maintenance	Expenditure on Periodic maintenance	Other payment (including backlog)	Total Expenditure	Annual increase in expenditure
2006-7	74.08	170.16	49.98	294.22	-66%
2007-8	316.33	233.29	34.88	584.50	99%
2008-9	337.68	143.23	-	480.91	-18%
2009-10	310.00	250.00	50.00	610.00	27%
2010-11	276.74	325.00	66.06	667.80	9%
2011-12	446.00	245.00	-	691.00	3%

2. Funding requirement to reduce backlog

14. The total estimated expenditure on maintaining and rehabilitating roads in FY2011/12 was about 24 billion Taka. The breakdown of expenditure is shown in Table 8. To assess whether the current funding allocation for road maintenance is sufficient, the funding requirement for maintaining the roads was analyzed.

Table 8: FY2011/12 Expenditure on maintenance and rehabilitation works (billion Taka)

Revenue budget	
Routine and Periodic maintenance	6.9
Annual Development Budget	
Rehabilitation	11.6
Emergency rehabilitation works	5.5
Total:	24.01

15. **Base case maintenance financing strategy.** In the base case strategy, the objective was to eliminate all backlog over ten years. It was assumed that the backlog would be cleared at a constant rate across the ten years i.e., clearance of 122km of National, 230km of Regional, and 1,008km of Zilla backlog roads each year. To do this, the funding requirement for rehabilitation for National, Regional and Zilla roads was found to be 5.1 billion Taka, 7.2 billion Taka and 20.9 billion Taka, respectively.

16. It is assumed that routine maintenance is applied to all Good-Fair roads and un-rehabilitated backlog. In addition, periodic maintenance of Good-Fair roads is undertaken every 6 years. The annual funding for this strategy was calculated and tabulated in Table 9. Taking into account the funding requirement for routine and periodic maintenance, as well as rehabilitation, the total funding requirement in the first year is 36.6 billion Taka. This is a 59% nominal increase from RHD's funding allocation in FY2011/12. As the backlog is being cleared each year, the length of Good to Fair roads increases. This requires a small increase in routine

and periodic maintenance, contributing towards small increment in annual funding requirement of less than 2%. Accounting for 8.5% of inflation, the current price increases per annum have also been computed and summarized in the table below.

Table 9: Base case maintenance financing strategy – annual funding requirement

year	Routine maintenance	Periodic maintenance	Rehabilitation	Total requirement	Constant price increase p.a (%)	Current price increase p.a (%)
1	1179	3939	33186	38304	59%	73%
2	1179	4547	33186	38911	1.6%	10%
3	1179	5154	33186	39519	1.6%	10%
4	1179	5762	33186	40127	1.5%	10%
5	1179	6370	33186	40735	1.5%	10%
6	1179	6978	33186	41343	1.5%	10%
7	1179	7586	33186	41951	1.5%	10%
8	1179	8194	33186	42559	1.4%	10%
9	1179	8801	33186	43166	1.4%	10%
10	1179	9409	33186	43774	1.4%	10%

17. In FY2011/12, the expenditure on routine and periodic maintenance for the Good-Fair roads is 6,910million Taka. However, the derived requirement for routine and periodic maintenance is about 1,179million Taka and 3,939million Taka for routine and periodic maintenance, respectively, totaling about 5,118million Taka. The expenditure is 34% higher than the estimated requirement mainly because (i) some poor roads may be maintainable with overlay (periodic maintenance), (ii) it is often technically difficult to split sections between fair and poor conditions, and (iii) sometimes there requires even emergency works for certain sections to address emergency needs due to floods, etc. This is also because of the tedious government process for project approval and fund release. From the perspective of the funding level, the current funding allocation is considered sufficient to meet the current maintenance requirements of the road network.

The issue is to ensure appropriate maintenance prioritization and budget allocation, and the expenditure as planned, to sustain the road network. At the same time, sufficient contingency budget would be secured to address emergency works so that such works could be appropriately undertaken without hampering routine and periodic maintenance works.

18. **Alternative maintenance financing strategy (A).** As a 59% increase in budget for road maintenance could prove challenging, an alternative strategy was explored. To reduce funding requirement, it was assumed that backlog in National and Regional roads are eliminated completely over ten years; and 35% of Zilla roads would be eliminated over ten years. The calculations demonstrate that this can be achieved the current FY2011/12 levels of funding (24 billion Taka) increases modestly by 3%, with small increases of about 1% in subsequent years to provide periodic maintenance to the growing proportion of Good-Fair roads. Accounting for 8.5% of inflation, the current price increases per annum have also been computed. The annual funding requirement is detailed in Table 11 below.

Table 11: Alternative strategy (A: constant elimination) – annual funding requirement

year	Routine maintenance	Periodic maintenance	Rehabilitation	Total requirement	Constant price increase p.a (%)	Current price increase p.a (%)
1	1210	3939	19571	24720	3%	12%
2	1210	4282	19571	25063	1%	10%
3	1210	4625	19571	25406	1%	10%
4	1210	4968	19571	25749	1%	10%
5	1210	5312	19571	26092	1%	10%
6	1210	5655	19571	26436	1%	10%
7	1210	5998	19571	26779	1%	10%
8	1210	6341	19571	27122	1%	10%
9	1210	6684	19571	27465	1%	10%
10	1210	7028	19571	27808	1%	10%

19. **Alternative maintenance financing strategy (B).** Another alternative strategy is developed to assume constant growth in budget from the existing levels of funding for each National, Regional and Zilla road category (refer to Table 6, column on FY2011/12 expenditure). Assuming the same unit maintenance costs as before, it was found that the annual growth rate of funding required to eliminate all back log in ten years is 6.4%, 32% and 35% for National, Regional and Zilla roads respectively. As before, the requirement in the first year is compared to the estimated total maintenance expenditure in FY2011/12. Note, however, that there is a sharp decrease in requirement in the first year. This is because the FY2011/12 budget includes 5.5 billion of emergency rehabilitation, and as discussed before, the expenditure is about 1 billion more than derived requirement.

Table 12: Alternative strategy (B: gradual elimination) – annual funding requirement

Year	Routine maintenance	Periodic maintenance	Rehabilitation	Total requirement	Constant price increase (%)
1	1228	3939	11627	16793	-30%
2	1221	4145	14388	19755	18%
3	1213	4403	18018	23634	20%
4	1202	4727	22810	28740	22%
5	1188	5140	29157	35485	23%
6	1169	5671	37586	44427	25%
7	1144	6359	48808	56311	27%
8	1111	7255	63775	72141	28%
9	1066	8431	83768	93264	29%
10	1006	9980	110505	121492	30%

20. The rehabilitation budget was adjusted upwards to (a) absorb the emergency budget and excess routine and periodic maintenance, and (b) to maintain the same total level of expenditure as in FY2011/12. The optimized level of funding in the first year is shown in Table 13. Since the backlog across different road categories vary, the funding allocations should be adjusted according to the maintenance needs. Hence, it was found that given the smaller proportion of backlog in National roads, a small decrease (-8% p.a) in funding can be supported, whilst reallocating resources to eliminating more significant backlogs in Regional (16% p.a) and Zilla (19% p.a) roads. The strategy as described in Table 14 indicates a gradual growth in funding requirement of up to 15% is required to eliminate all backlog. Accounting for 8.5% of inflation, the current price increases per annum have also been computed. As the year on year increase are larger than previous strategies, this strategy is also most vulnerable to inflationary risks.

Table 13: Allocation of maintenance funding – actual expenditure in FY2011/12 and adjusted allocation in first year of strategy

Road category	Actual expenditure in FY2011/12	Adjusted allocation in first year of strategy	% increase in annual allocation to eliminate backlog
National	4,359	7,096	-8%
Regional	2,046	3,331	16%
Zilla	5,220	8,498	19%
Total	11,625	18,925	-

Table 14: Alternative strategy (B: adjusted gradual elimination) – annual funding requirement

year	Routine maintenance	Periodic maintenance	Rehabilitation	Total requirement	Constant price increase p.a (%)	Current price increase p.a (%)
1	1211	3939	18925	24075	0%	9%
2	1208	4275	20547	26029	8%	17%
3	1203	4643	22603	28449	9%	19%
4	1197	5050	25163	31410	10%	20%
5	1190	5506	28309	35005	11%	21%
6	1182	6022	32141	39344	12%	22%
7	1171	6611	36777	44558	13%	23%
8	1159	7287	42357	50802	14%	24%
9	1144	8069	49048	58261	15%	24%
10	1126	8977	57049	67152	15%	25%

D. Findings

21. In FY2011/12, an estimated total of 24.0 billion Taka was spent on road maintenance in FY2011/12. This is contributed from the Revenue budget (6.9 billion Taka) and a significant proportion of rehabilitation projects from the ADP (17.5 billion Taka). The expenditures in maintenance and rehabilitation have increased on average by 6% and 9%, respectively. The current provision of the maintenance financing at 6.9 billion Taka is assessed at the same or exceeded level of the requirement for routine and periodic maintenance to sustain maintainable roads, i.e., roads in good to fair conditions. These demonstrate government's commitment to priority on maintenance and RHD's increasing capacity to maintain its road assets.

22. However, a mismatch between expenditure and the funding requirement is observed for routine and periodic maintenance. Appropriate maintenance prioritization and budget allocation, and the expenditure as planned, needs to be ensured together with the increase to the budget. At the same time, sufficient contingency budget would be secured to address emergency works so that such works could be appropriately undertaken without hampering routine and periodic maintenance works.

23. There is currently 13,608km of backlog roads requiring rehabilitation. The ADP, with more than 70% of funding (17 billion Taka) allocated to rehabilitation works, demonstrates strong commitment to reducing this backlog. To ensure long-term maintenance of road assets can be sustained, different strategies have been developed to reduce this backlog. There are pros and cons in each strategy.

24. **Base case strategy.** Backlog is eliminated by a constant length over ten years. The advantage is the constant elimination strategy makes it simpler for monitoring progress, and annual increases from the first year onwards is small (less than 2%). The disadvantage is the requirement for upfront increase of 59% of funding requirement from FY2011/12 levels.

25. **Alternative strategy (A).** To reduce the upfront funding commitment, prioritization is made: (i) eliminate all backlog of national and regional highways, and (ii) reduce the backlog of Zilla road as much as possible. All National and Regional backlog roads are eliminated. Other advantages include small annual increases in funding requirement from the first year onwards (about 1%). The disadvantage is that there is still 65% of the current backlog remained or about 50% of the total Zilla roads after 10 years.

26. **Alternative strategy (B).** Rather than eliminating a constant length of backlog over ten years, this alternative strategy builds up the funding requirement from FY2011/12 levels. Like in base case strategy, all backlog is eliminated. The advantage is that the funding requirement is increased gradually over ten years. This gradual increase can be accommodated if there is efficient allocation of funding adjusted according to maintenance requirements, as the lengths of rehabilitation in different road categories change over the ten-year period, which requires a strong planning capacity and budget discipline for all government agencies. Another main disadvantage is that this strategy is more vulnerable to inflation risks and since the annual increase is higher than the base case strategy.

E. Recommendations

27. Alternative A Option is considered most realistic and appropriate, taking into account (i) the budget constraint and the past trend of budgetary and expenditure increase, and (ii) institutional weaknesses for budgetary allocation and use. It is not only RHD but also other agencies approving and releasing the fund as required.

28. The key issue is to ensure appropriate maintenance prioritization and budget allocation, and the expenditure as planned, in parallel with the increase to the budget. At the RHD level, actual works undertaken should be recorded in the relevant budget/expenditure headings. This is the first step towards enabling monitoring expenditure and results. At the same time, sufficient contingency budget would be secured to address emergency works to provide certain flexibility for emergency works so that such works could be appropriately undertaken without hampering routine and periodic maintenance works. Such contingency budget will also help streamline the fund release.

29. Further improvement to maintenance efficiency will also help reduce the maintenance costs through (i) introduction of more efficient maintenance scheme and (ii) efficiency improvement to RHD maintenance operations. To ensure efficient execution of maintenance, innovative approaches would be pursued such as third-party technical audit and contract arrangements to include a long-term performance-based maintenance in the works contract.

30. A proposed TA for RHD institutional strengthening associated with the proposed project will provide capacity development support to these areas.