INTRODUCING STRATEGIC PLANNING MODEL (SPM) BASED MULTI CRITERIA ANALYSIS (MCA) TECHNIQUE FOR RURAL ROADS MANAGEMENT IN BANGLADESH

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Abstract

Roads and Highways Department (RHD) of Bangladesh uses the Highway Development and Management Model (HDM-4) to undertake efficient decisions on managing its road network including rural roads. However, it is observed that only economic analysis, using the HDM-4 model, sometimes under estimates rural roads. Hence, a Strategic Planning Model (SPM) based Multi Criteria Analysis (MCA) approach has been considered as example using political, social, environment, job creation, safety and economic factors to manage rural roads appropriately. A SPM basically considered HDM-4 economic results with political, social, job creation, safety and environment factors to finalize treatments priority. The results show that SPM based MCA can better address rural roads. A complete MCA can be introduced in RHD to manage its rural roads properly in future.

1. Introduction

Roads and Highways Department (RHD) of Bangladesh has the prime responsibility to construct and maintain major roads, bridges and ferries in the main road network of Bangladesh. RHD's vision is to provide safe, cost effective and well-maintained roads at the road users satisfaction. RHD has about 20,800 km of roads and about 15,000 bridges and culverts [1]. The RHD road network length can be seen in Table 1.

Table 1 - The road network of Bangladesh [1]

Type of roads	Description of roads	Classification	Total (km)
National Highway (NH)	That connects roads between capital city and districts headquarters	Primary roads	3,529
Regional Highway (RH)	That connects roads between one district and another	Secondary roads	4,127
Zilla Roads (ZR)	That connects roads between districts and thanas, and between thanas and thanas	Tertiary roads (rural roads)	13,126
Total			**20,782**

The replacement value of RHD road-related assets are valued at approximately US $7,400 million [2]. RHD paved roads assets have been estimated recently as US$ 3,700 million [1]. Maintaining this asset requires timely and efficient actions. To assist this, RHD uses the Highway Development and Management Model (HDM-4) to develop its Annual Maintenance

and Rehabilitation Needs from the Road Maintenance and Management System (RMMS) Database [3]. These outputs are used to identify the need for reconstruction, rehabilitation and periodic maintenance works with projects selected on the basis of technical and economic selection criteria [4]. More specifically, HDM-4 has been used to help prepare the Periodic Maintenance Program (PMP) component of the Annual Maintenance and Rehabilitation Needs; this comprising resurfacing and localised rehabilitation and reconstruction treatments [3]. RHD has been using the HDM model to manage its assets including rural roads since 1995 and the model has been calibrated for Bangladesh condition [3].

The overall current network condition can be seen in the following Table 2 [1], which is generally analysed and managed by the HDM-4 model in RHD.

Table 2 - Network condition of RHD roads based on roughness [1]

Zone	Road length < 4.0 IRI (% of survey)				Road length >9.0 IRI (% of survey)			
	National	Regional	Zilla	Total	National	Regional	Zilla	Total
Dhaka	17.6	5.6	2.3	25.4	0.7	5.7	14.5	21.0
Comilla	9.0	4.3	2.0	15.3	2.0	2.1	14.7	18.8
Chittagong	13.7	1.4	0.9	16.1	2.2	6.7	16.6	25.5
Rangpur	4.1	11.2	2.2	17.5	1.1	0.1	4.0	5.2
Rajshahi	15.3	7.8	3.7	28.4	0.3	4.6	7.5	12.3
Khulna	12.4	15.4	7.5	35.2	0.2	1.8	2.9	5.0
Barisal	7.5	11.0	7.6	26.1	0.4	5.1	11.6	17.1
Sylhet	26.2	1.8	2.2	30.2	1.5	8.4	8.7	18.6
Total	13.7	7.3	3.4	24.5	1.0	4.3	10.6	15.9

Table 2 shows that 25% of the road network is in good condition (< 4 IRI), while 16% roads are in bad condition (> 9 IRI). Good, fair, poor and bad condition of roads has been derived from roughness for different classes of roads [5]. Again, about 3%, 86% and 11% rural roads are in good, fair and bad condition respectively (see Table 2), which require proper intervention. It should be mentioned here that ZR in RHD are the tertiary roads and can be considered as rural roads.

2. Asset Management in RHD

RHD has a newly introduced Pavement Management System (PMS), which comprises of the following items [4]:

- Data collection,
- Database (the RMMS database),
- Decision making tool (the HDM-4 model),
- Programming,
- Implementation, and
- Monitoring.

In the RHD-PMS, HDM-4 plays a vital role. It contains a RMMS database at its core, and a Geographical Information System (GIS) [3]. The PMS is currently being upgraded in RHD and its scope extended. Details of the RHD-PMS can be seen elsewhere [3] [4].

Generally, to maintain the road network properly, road condition, pavement inventory, traffic and roughness data are collected each year for each paved road, and entered into the RMMS database [6]. In 2004, Road Measurement Data Acquisition System (ROMDAS) [7] was introduced for the first time in RHD to measure roughness data at different speeds using Z250 profile meter. Traffic, road condition and pavement inventory data have been collected periodically since 1995, and in 2004 this data was provided through out-sourced contracts [6]. However, in 2005 only the RHD engineers of Highway Data Management unit collected roughness data.

It was mentioned earlier that use of the HDM-4 model (key tool for asset management) commenced in 1995 in RHD using Highway Design and Maintenance Standards Model (HDM-III) and this was later followed by the introduction of HDM-4: Version 1 [8]. It is used to provide whole of life-cycle analysis of road pavement performance in response to user specified investment alternatives. Details characteristics of the HDM-4 model can be seen in the HDM-4 series [5] [9]. Appropriate inputs for the HDM-4 model are essential to obtain sound results, and it is observed that the following major inputs are required for a justifiable HDM-4 run [4]:

- Reliable data,
- Treatment intervention criteria, and
- Calibration parameters.

Data quality has to be ensured to obtain consistent HDM-4 results [3], which can be evaluated by field visits, statistical method and range checking. The RMMS database has 2004 outsourced data, which are quite good.

RHD considers routine, periodic and rehabilitation treatments, which details can be seen elsewhere [1] [4]. Treatment intervention criteria are the trigger levels of a treatment, based mainly on ranges of roughness, road condition and traffic volume [5]. Intervention levels are usually chosen in relation to road importance and road use on the basis of technical and economic criteria, which have been set for all treatments to use in the HDM-4 model through engineering judgment [1] [3] [4].

It was mentioned earlier that the HDM-4 model has been calibrated for Bangladesh condition through several studies [3].

The above discussions in Sections 1 and 2 reveal that rural roads in RHD are maintained by the HDM-4 model's analysis, e.g., economic analysis and engineering judgment.

3. Problem of the HDM-4 Results for Rural Roads

Generally, economic analysis is used to manage rural roads in Bangladesh. Optimisation objective considered in the HDM-4 programme analysis to derive Annual Maintenance and

Rehabilitation Needs is “Net Present Value (NPV)/Cost”, which is suitable when budget is constrained [1]. In the current HDM-4 analysis, 43% maintenance demand are shown to rural roads, whereas in reality RHD has 63% rural roads [1], which can be seen in Table 3. It reveals that ZR (rural roads) is not getting sufficient priority and fund for its network. Only economic analysis cannot satisfactorily highlight ZR. Stakeholders’ observation and political interference clarify that rural roads are not maintained and are not getting adequate fund according to the requirement in Bangladesh.

Table 3 - Maintenance demand for different roads in Bangladesh for 2006-07 [1]

Type of roads	**Percentage of network (%)**	**Maintenance demand (%)**
NH (primary roads)	17.00%	31.10%
RH (secondary roads)	19.85%	25.86%
ZR (tertiary/rural roads)	63.15%	43.04%

It is generally observed that NH and RH have more Annual Average Daily Traffic (AADT) compared to the ZR. As a result, NH and RH get more economic benefits in the HDM-4 analysis due to reduction of Vehicle Operating Costs (VOC). Normally ZR’s NPV/cost are lower, and they are getting less priority in the HDM-4 analysis. Therefore, country like Bangladesh, rural roads might not get proper consideration in the PMP programme if budget is limited. An example of this situation from the HDM-4 outputs can be seen below in Table 4. Social, political, job creation, safety and environment factors may be utilised for rural roads along with economic factors to address these roads appropriately [10] [11] [12]. Details of selecting these factors and their proposed weightage can be seen later on.

Table 4 - HDM-4 outputs for some roads [1]

Road no.	Type of road	Chainage (km)	AADT	Suggested treatments	Cost (US$ million)	NPV/Cost	Priority based on economic factor
N3	NH	0.00-10.00	86,993	DBST	0.60	23.82	1
N302	NH	0.00-5.70	11,403	OV50	0.48	12.48	2
N205	NH	0.00-2.48	10,157	Part Recon 110	0.57	7.98	3
R370	RH	0.00-14.00	6,478	OV50	0.98	6.84	4
Z7411	ZR	17.00-20.54	2,932	Carpeting 40	0.07	5.77	5
R310	RH	0.00-2.30	8,421	DBST	0.11	5.57	6
Z4011	ZR	22.54-26.57	3,115	Carpeting 40	0.09	5.26	7
N102	NH	40.00-50.00	5,442	Part Recon 110	1.77	5.00	8
Z1041	ZR	0.00-2.20	2,939	Carpeting 40	0.05	4.40	9
R160	RH	24.20-27.55	4,951	Full Recon 75	0.55	4.01	10
R111	RH	3.63-7.44	8,081	OV50	0.23	3.66	11
Z4025	ZR	0.00-16.23	2,978	OV60	1.44	3.37	12
N1	NH	427.45-430.45	3,058	OV50	0.14	2.75	13
Z1422	ZR	26.99-33.10	2,337	Carpeting 40	0.13	2.61	14
Z1012	ZR	12.96-15.20	2,564	Carpeting 40	0.05	2.54	15

Note: DBST = Double Bituminous Surface Treatment 25 mm, OV 50 = Overlay 50 mm, OV 60 = Overlay 60 mm, Part Recon 110 = Partial Reconstruction 110 mm, Full Recon 75 = Full Reconstruction 75 mm [1].

4. Objectives of the Study

A Strategic Planning Model (SPM) based Multi Criteria Analysis (MCA) technique considering environment, political, job creation, safety and social issues along with the HDM-4 outputs (after economic analysis) can provide much better solution and can address rural roads in Bangladesh properly [1] [10] [11] [12], which was the major aim of the paper.

The objectives of the analysis were:

- To set criteria and relative weightage in the SPM based MCA, and
- To observe impact of MCA for rural roads management in Bangladesh.

5. Methodology of the Study

In the current study the MCA was used to produce appropriate results in treatment selection to ensure the long-term integrity of the asset. Generally, MCA deals with different relevant criteria and provides consistent solution. It not only considers economic issue but also uses and gives weightage on social, political, job creation, safety and environment factors [10] [11] [12]. Normally, relative weightage are given for all the factors to obtain sound results.

It was mentioned earlier that social, political, job creation, safety and environment factors along with economic factor can be considered for SPM based MCA, which was also utilized in the current analysis. As, RHD gets priority results from the HDM-4 economic analysis that can be utilized with social, political, job creation, safety and environment factors for further prioritization to obtain better outputs. This approach is known as SPM based MCA, which is suitable for RHD's prioritization at the moment.

It should be mentioned here that in the ongoing RHD Road Master Plan Study, it was tried to analyze ZR separately, and a very simple approach based on engineering judgment was proposed. The approach was subjective and only social factors were considered for ZR treatment prioritization [13]. Therefore, the current approach of utilizing HDM-4 economic results along with social, political, environment, job creation and safety factors for MCA to obtain better prioritization is more appreciating.

It is observed that in the Govt.'s Project Appraisal Framework (PAF), equity and efficiency indicators are considered. Equity is based on socio-economic development, e.g., pro poor economic growth and gender equity [12]. It is observed that job creation among local people is an important issue for economic development and 6% weightage is given in total on it. Again, in the efficiency indicator, economic efficiency has been highly weighted (30% in total) [12]. Safety to reduce accidents has also been considered, but no weightage was given [12]. The other issues considered for project appraisal can be seen in the PAF [12].

For ZR, social and political issues are very important as politicians and rural people like these roads to be maintained. Again, efficiently maintained ZR help in economic growth of the rural people. The other important factor can be used in a MCA is environment, as it is relevant to road works. As a result, in the current analysis, political, social and environment factors were considered with economic outputs from HDM-4 to obtain better-prioritized results.

In the current study, for MCA the above mentioned factors, e.g., economic, social, political, job creation, safety and environment was chosen as they are important for pavement management, especially rural roads management.

All the factors considered in the MCA have to be given weightage according to their importance to undertake maintenance activities [10] [11] [12]. In the current analysis, these weightage were set from engineering judgment, which can be seen in Table 5.

Table 5 - Relative weightage for different factors in Bangladesh

Factors	Relative Weightage (Fw)
Economic	0.40
Social	0.20
Political	0.15
Environment	0.10
Job Creation	0.10
Safety	0.05
Total	**1.00**

Here, socio-economic factors, e.g., economic, social and job creation, have been given 70% weightage. Economic factors were weighted highly, which was 40%, as it is the outputs of HDM-4, which is consistent to the PAF. Social and political weightage were given 0.20 and 0.15 respectively as they are very crucial in Bangladesh. Environmental factor has been weighted as 0.10 as it is important for road works. Job creation weightage is consistent with the PAF.

At the moment, these weightage was given on engineering judgment, which are also consistent with the PAF. However, a comprehensive study is required in future to improve these weightage.

All the analyzed roads were required to be ranked and were given weightage for the chosen economic, social, political, job creation, safety and environment factors considering their importance and road classes in treatment selection (see Tale 6). An example for some roads is shown in Table 7.

Table 6: Engineering judgment used to finalize weightage in treatment selection for different factors

Factors	Priority	Comments
Economic	HDM-4 outputs and priority.	The only factor previously used by RHD.
Social	ZR, RH and NH respectively. Main priority is for ZR, then RH and less priority is for NH.	Consistent with the PAF.
Political	ZR, RH and NH respectively. Main priority is for ZR, then RH and less priority is for NH.	Politicians think of their constituency at first.
Environment	NH, RH and ZR respectively. Main priority is for NH.	Major roads have high impact on environment and importance.
Job Creation	ZR, RH and NH respectively. Main priority is for ZR, then RH and less priority is for NH.	Rural and poor people should get main priority. Consistent with the PAF.
Safety	NH, RH and ZR respectively. Main priority is for NH.	NH's accident rate is high and severe.

The ranking for sample of roads in treatment selection for these factors were based on engineering judgment. All the roads were tried to rank in a rational basis. For example, ZRs may get high priority for social, political and job creation factors, and NH/RH may get high preference for economic, environment and safety factors (see Table 6). However, in future, a comprehensive study is required to judge this sort of ranking.

These relative ranked roads are given final weightage considering all the factors and treatment priority (see Table 5 and Equations 1 and 2 below). Hence, all the roads of HDM-4 outputs may be analyzed for social, political, job creation, safety and environment factors along with economic issue to achieve better results.

The following relationships were used to achieve final weightage for any roads treatment priority.

$W = \sum (RW_f * F_w)$ ……(1)

Where, W = Final weightage

RW_f = Relative weightage for a road from priority ranking of a factor, e.g., environment, social, political, job creation, safety and economic

F_w = Weightage of each factor (see Table 5)

$RW_f = 1 – (m/n)$ ……(2)

Where, n = No. of roads considered

m = Priority to select specific treatment for a specific factor among 15 roads, e.g., 1 to 15

In MCA, a problem is structured in such a way that alternative may be ranked according to pre established preference in order to achieve pre-establish objectives. Hence, Analytical Hierarchical Process (AHP) may be used. AHP is based on multilevel hierarchy with a main goal, objectives, sub-objectives and alternatives [10]. A typical AHP approach used in the study can be seen in Figure 1.

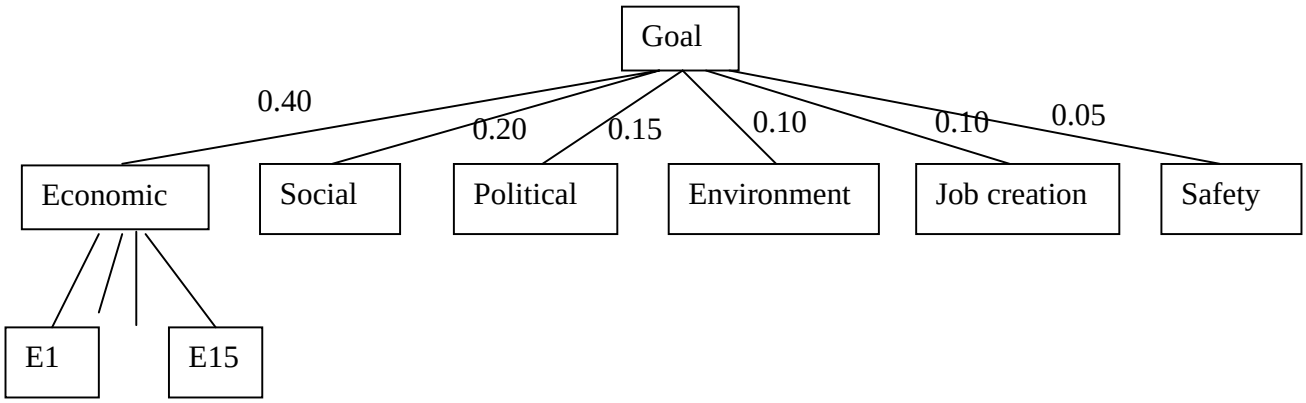

Figure 1: A typical AHP approach used in the study

Here, E1 = relative weightage of sample Road 1 for economic factor, E15 = relative weightage of sample Road 15 for economic factor, and so on. This is used for the other factors, e.g., social, political, environment, job creation and safety factors.

Table 7 - Relative ranking of some roads for different factors in Bangladesh

Road no.	Chaing. (km)	Proposed treatment	Econ. weight.	Social weight.	Political weight.	Environ. weight.	Job creation weight.	Safety weight.
N3	0.00-10.00	DBST	1.00	0.93	1.00	1.00	0.87	1.00
N302	0.00-5.70	OV50	0.93	0.33	0.13	0.80	0.67	0.87
N205	0.00-2.48	Part Recon 110	0.87	0.67	0.40	0.67	0.13	0.80
R370	0.00-14.00	OV50	0.80	0.07	0.33	0.73	0.33	0.73
Z7411	17.00-20.54	Carpeting 40	0.73	1.00	0.93	0.47	1.00	0.20
R310	0.00-2.30	DBST	0.67	0.40	0.47	0.53	0.07	0.60
Z4011	22.54-26.57	Carpeting 40	0.60	0.87	0.80	0.40	0.93	0.33
N102	40.00-50.00	Part Recon 110	0.53	0.13	0.27	0.60	0.40	0.67
Z1041	0.00-2.20	Carpeting 40	0.47	0.80	0.73	0.27	0.80	0.07
R160	24.20-27.55	Full Recon 75	0.40	0.20	0.07	0.33	0.27	0.47
R111	3.63-7.44	OV50	0.33	0.73	0.87	0.93	0.20	0.53
Z4025	0.00-16.23	OV60	0.27	0.60	0.67	0.20	0.60	0.40
N1	427.45-430.45	OV50	0.20	0.27	0.20	0.87	0.73	0.93
Z1422	26.99-33.10	Carpeting 40	0.13	0.53	0.60	0.13	0.53	0.27
Z1012	12.96-15.20	Carpeting 40	0.07	0.47	0.53	0.07	0.47	0.13

Note: weight. = weightage, chaing. = chainage, econ. = economic, environ. = environment

Table 7 shows that N3 (0.00-10.00 km) have high weighting for social (0.93) and political (1.00), which is not normal for a NH. It is one of the major corridors in Bangladesh and the road condition is very poor at the moment. Many people of different districts that use the road like this to be improved immediately. Same situation can be seen for R111 (3.63-7.44 km), as it is an important RH.

In RHD, the HDM-4 outputs can be utilized in the SPM based MCA to obtain better Annual Maintenance and Rehabilitation Needs. This type of analysis is being used by the Atkins in the UK to maintain Highway [11]. Initially, they use the HDM-4 outputs based on economic analysis, and then social, political and environment factors are considered from the HDM-4 results in the MCA to obtain better results [10] [11] [12], which was also considered in the current study. Moreover, job creation and safety factors were added in this study. It should be mentioned here that RHD is using HDM-4: Version 1.3, and there is no scope of using MCA. Hence, its outputs have to be utilized for further analysis (SPM). In future, HDM-4: Version 2 may be used for MCA.

However, treatments chosen for all these roads were set fixed in the current study. HDM-4 selects treatments from road condition, traffic and roughness data using economic analysis. The overall process of the study can be seen in Figure 2.

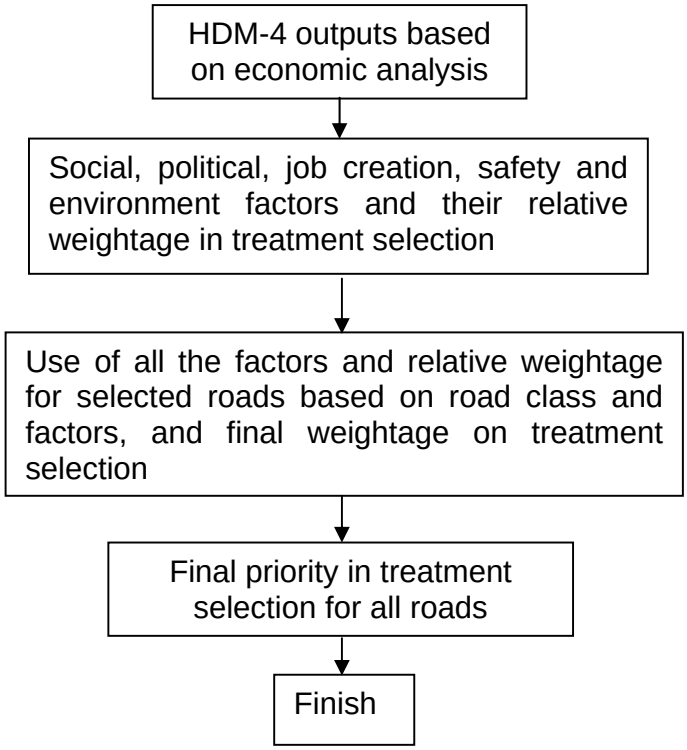

Figure 2 - Overall process of the study

6. Results of the Study

Some of the roads as example (see Table 4) were used in the analysis for the SPM based MCA technique. Weightage and relative ranking were given to these roads for social, political, environment, job creation, safety and economic factors (see Table 7). These relative ranked roads were then weighted finally using Table 5 values and Equations 1 and 2, which provided new results in treatment priority (see Table 8). An example of determination of final weightage in the current study has been given in Table 9 for the chosen ZRs.

Table 8 - SPM based MCA technique for some roads in Bangladesh

Road no.	Chaing. (km)	Proposed treatment	Eco. weight. (Table 7)	Social weight. Table 7)	Political weight. Table 7)	Environ weight. Table 7)	Job creation weight. Table 7)	Safety weight. Table 7)	Final weight. (Eq. 1 and 2)	Final priority
N3	0.00-10.00	DBST	1.00	0.93	1.00	1.00	0.87	1.00	0.97	1
N302	0.00-5.70	OV50	0.93	0.33	0.13	0.80	0.67	0.87	0.65	5
N205	0.00-2.48	Part Recon 110	0.87	0.67	0.40	0.67	0.13	0.80	0.66	4
R370	0.00-14.00	OV50	0.80	0.07	0.33	0.73	0.33	0.73	0.53	8
Z7411	17.00-20.54	Carpeting 40	0.73	1.00	0.93	0.47	1.00	0.20	0.79	2
R310	0.00-2.30	DBST	0.67	0.40	0.47	0.53	0.07	0.60	0.51	9
Z4011	22.54-26.57	Carpeting 40	0.60	0.87	0.80	0.40	0.93	0.33	0.68	3
N102	40.00-50.00	Part Recon 110	0.53	0.13	0.27	0.60	0.40	0.67	0.41	11
Z1041	0.00-2.20	Carpeting 40	0.47	0.80	0.73	0.27	0.80	0.07	0.57	6
R160	24.20-27.55	Full Recon 75	0.40	0.20	0.07	0.33	0.27	0.47	0.29	14
R111	3.63-7.44	OV50	0.33	0.73	0.87	0.93	0.20	0.53	0.55	7
Z4025	0.00-16.23	OV60	0.27	0.60	0.67	0.20	0.60	0.40	0.43	10
N1	427.45-430.45	OV50	0.20	0.27	0.20	0.87	0.73	0.93	0.37	12
Z1422	26.99-33.10	Carpeting 40	0.13	0.53	0.60	0.13	0.53	0.27	0.33	13
Z1012	12.96-15.20	Carpeting 40	0.07	0.47	0.53	0.07	0.47	0.13	0.26	15

Table 9 - An example of SPM based MCA technique

Road no.	Proposed treatment	Prevs. priority	Eco. weight. (Table 7)	Social weight. (Table 7)	Political weight. (Table 7)	Environ weight. (Table 7)	Job creation weight. (Table 7)	Safety weight. (Table 7)	Final weight. (Eq. 1 and 2 and Table 4)	Final priority ranking from 15 roads
Z7411	Carpeting 40 mm for 17.00-20.54 km	5	0.73	1.00	0.93	0.47	1.00	0.20	(0.73*0.40) + (1.00*0.20) + (0.93*0.15) + (0.47*0.10) + (1.00*0.10) + (0.20*0.05) = 0.79	2
Z4011	Carpeting 40 mm for 22.54-26.57 km	7	0.60	0.87	0.80	0.40	0.93	0.33	0.68	3
Z1041	Carpeting 40 mm for 0.00-2.20 km	9	0.47	0.80	0.73	0.27	0.80	0.07	0.57	6
Z4025	Overlay 60 mm for 0.00-16.23 km	12	0.27	0.60	0.67	0.20	0.60	0.40	0.43	10
Z1422	Carpeting 40 mm for 26.99-33.10 km	14	0.13	0.53	0.60	0.13	0.53	0.27	0.33	13
Z1012	Carpeting 40 mm for 12.96-15.20 km	15	0.07	0.47	0.53	0.07	0.47	0.13	0.26	15

The above Table 9 shows that ZRs are getting better priority in treatment selection for different roads using the SPM based MCA technique. For example, Z7411 and Z4011 were initially ranked as 5 and 7 from HDM-4 outputs (see Table 4); they were finally ranked 2 and 3 after MCA respectively (see Table 9). Though the analysis was done as example, but the results are appreciating. It concludes that MCA is a better approach to finalize treatment selection in Bangladesh.

7. Road Fund and Rural Roads

Government of Bangladesh is going to establish a Road Fund Board to allocate money to maintain the road network efficiently. Now, RHD uses the HDM-4 and the allocation of maintenance demand would be based on the HDM-4's outputs. If MCA is considered in the analysis, ZRs would get more priority in getting road maintenance fund in future, which was justified from the above example (see Tables 8 and 9).

8. Limitations of the Study

The analysis was done as an example using the SPM based MCA technique. The following limitations were observed:

- The complete HDM-4 outputs were not analyzed,
- The MCA was utilized after the HDM-4 results, which could be done initially,
- Weightage given were not based on any study and were not judged, and
- Only the selected treatments for some roads were analyzed to finalize priority.

9. Conclusions and Recommendations

It was mentioned earlier that the analysis was done as an example to observe whether MCA can be introduced in RHD to obtain better results for rural roads as they are getting less priority. The analysis shows that this approach is quite useful, which would help ZRs to get more priority in treatment selection.

In future, RHD should introduce MCA for the HDM-4 outputs to analyze its rural roads properly, which was also suggested earlier [1]. HDM-4: Version 2 needs to be incorporated to consider social, political, environment, job creation, safety and economic factors together at the beginning.

However, weightage given were not based on any study, which needs to be improved. Only the selected treatments from HDM-4 were analyzed to finalize priority. Factors and weightage should be determined from consultation with stakeholders and public bodies [11]. This will increase credibility and auditability. A comprehensive study is required for selecting factors, relative weightage and to assign relative weightage of different roads in treatment priority.

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