Rural Road Planning and Prioritisation Model (RPPM)

Prototype illustration: road with socio-economic facilities along a partly paved road for improvement

Abdul Quium
Acknowledgement:

RPPM was developed for Local Government Engineering Department (LGED) by a project under the ReCAP programme funded by UK AID.

The project was implemented by a multi-disciplinary team of Bangladesh University of Eng. and Tech. (BUET) in collaboration with LGED.
Purpose of the presentation

• Context of the study
• Objectives and overview of project
• RPPM Methodology - for planning and prioritisation of rural roads in Bangladesh
• RPPM – a web-based tool to implement the methodology
Types of rural road:
- Upazila road
- Union road
- Village road

- Upazila road: 37,400 km; 3% unpaved
- Union road: 41,600 km; 8% unpaved
- Village road: 202,000 km; > 50% unpaved
Some features of rural road network in Bangladesh

Present situation:
- Rural Road network length: about 321,000 km (2.18 km/sq km)
- Paved (BC/CC/RCC): about 74,000 km:
- Brick paved: about 20,000 km (to be paved in future)
- Maintenance – a major issue
- Not all villages connected by all-weather road

Further development should be selective:
- Network can be sustained and properly maintained
- Meets current transport needs – some roads need upgrading
- Enhance rural access/connectivity at all levels.
Context of the Study

LGED and LGIs manage all rural roads; about 3,21,462 km or about 93% of total roads

- Many earth or unpaved roads need improvement – about 25,000 km of upazila and union roads unpaved
- Partially paved roads need to be fully paved
- Volume and composition of traffic have changed, roads need better maintenance
- Roads built for low volume traffic - now inadequate and substandard
Unexpected type of traffic on many “rural” roads

Unexpected volume of commercial vehicles per day (> 300) on some roads

Courtesy: LGED
Planning and Prioritisation of Rural Roads

Objectives of the project include:

• A methodology on planning and prioritisation of rural roads for their development and maintenance

• A software to implement the methodology

• A user manual for the software and training of 15 professionals to apply the methodology and use the software.
Types of Road Development Work by LGED

**Improvement**
- Converting an earth road to a paved road
- Converting a partly paved road to fully paved road
- Converting a HBB (brick paved) road to fully paved road

**Further Improvement/Upgradation**
- Improvement of road geometric standards (raising of embankment height, road widening, higher pavement design standards)

**Maintenance**
- Maintenance of an already paved road (BC/CC or HBB).
The methodology considered the following:

- Government objectives, current policies and strategies
- Guidance and advice of the Working Group
- Comments and suggestions received at the First Stakeholders Workshop
- Outcome of consultation meetings with concerned LGED officials at the HQ and field offices
- Observations and conclusions distilled from the literature review
Overall approach to planning and prioritisation

Two components:
- Network Planning (Core network)
- Prioritisation

[Diagram showing planning and prioritisation process]
Core Network

The core network focuses on **connectivity and access**:

• upazila-wise access needs and connectivity with neighbouring greater region/rest of the country - meets intra- and inter-upazila connectivity needs

• union-wise access needs and connectivity with neighbouring unions – meets intra- and inter-union connectivity needs

• village-wise access needs – meets inter-village connectivity needs and access to facilities
Core Network Planning

Core Network composed of:

• given roads (roads of RHD within a upazila), if any
• upazila roads connecting zila and upazila HQs and national centres, RHD roads and highways, GCs, railway and steamer stations, etc.
• union roads connecting upazila and union HQs, zila roads, markets etc.
• important Village Roads (IVRs)
• village roads that serve as the only linkage of a village to a market centre, a union road or another village connected to the core network

Priority of roads in core network considers connectivity
Prioritisation of rural roads

Appraisal methodologies and tools used:

• Cost Benefit Analysis (CBA)
• Multi-Criteria Analysis (MCA)
• Analytical Hierarchy Process (AHP)
  (to determine relative weights of MCA criteria)
• GIS for mapping (using LGED’s current GIS database)
Cost Benefit Analysis (CBA)

Followed the standard procedures of CBA

- Standard construction and maintenance costs
- Savings in vehicle operating costs by types of vehicles
- Time savings to passengers (by types of vehicles)
- Normal traffic growth
- Generated traffic growth
- Shadow pricing for labour and material costs
- 20 years of economic life

Estimated EIRR values
Multi-criteria analysis (MCA)

1. Identified a list of potential criteria for MCA
2. Selected criteria for each type of road development
3. Established relative weights (AHP and Median Population Threshold Method)
4. Score of a road against each criteria
5. Standardized the score on a common scale
6. Calculated combined score
7. Ranking based on combined score
Multi-criteria analysis (MCA)

Criteria for MCA

• Traffic volume, Facilities (15 types of socio-economic) served, GC/Markets served, road type, surface type, connectivity, local priority, road safety, bus route, last maintenance year

Socio-economic facilities (15 types)

• Education (primary school, secondary, madrasa, college)
• Health (5 types of clinics, hospitals and health centres)
• Other (industry, cyclone shelter, other public centres etc.)
### Table 3.6: List of criteria and their weights determined by AHP analysis

<table>
<thead>
<tr>
<th>MCA criteria</th>
<th>Improvement of unpaved roads</th>
<th>Improvement of partly paved and HBB roads</th>
<th>Further improvement of roads</th>
<th>Maintenance of roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Volume</td>
<td>7.95</td>
<td>20.01</td>
<td>21.84</td>
<td>15.05</td>
</tr>
<tr>
<td>Facilities Served</td>
<td>18.65</td>
<td>15.02</td>
<td>9.54</td>
<td>14.85</td>
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<tr>
<td>Growth Centre/Market Served</td>
<td>29.20</td>
<td>13.58</td>
<td>17.91</td>
<td>12.70</td>
</tr>
<tr>
<td>Connectivity</td>
<td>35.80</td>
<td>21.04</td>
<td>20.07</td>
<td>19.65</td>
</tr>
<tr>
<td>Local Priority</td>
<td>8.40</td>
<td>5.97</td>
<td>14.93</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Type</td>
<td>N/A</td>
<td>5.86</td>
<td>N/A</td>
<td>7.80</td>
</tr>
<tr>
<td>Road Type</td>
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<td>11.83</td>
<td>7.86</td>
<td>14.15</td>
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<tr>
<td>Road Safety</td>
<td>N/A</td>
<td>6.69</td>
<td>7.84</td>
<td>N/A</td>
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<tr>
<td>Bus Route</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>11.50</td>
</tr>
<tr>
<td>Last maintenance year</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>4.30</td>
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<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Results of AHP application by the project team.
Important features of the methodology

• Reflects government policies and objectives in core network generation and prioritisation
• Network planning focuses on rural access and connectivity
• Combines top-down and bottom-up approaches
• Road development activities considered within a single planning framework based on a consistent approach
• Fulfils the demand of local leaders for their participation
• Has a strong research component
Rural Road Planning and Prioritisation Model (RPPM)

RPPM is a web-based tool; generate 4 types of outputs:

• Generates core networks at upazila and union level
• Priority lists of roads (8 types as requested)
• Priority score table with basic information, details of priority scores, and CBA and MCA results of a road, and
• Maps showing prioritised roads on an upazila map.

RPPM will enhance decision making capacity in LGED regarding selection of rural roads for development
Prioritisation outputs for eight types of conditions

**Unpaved roads: Improvement** - converting into paved roads
  • High traffic volume
  • Low traffic volume

**Partly paved roads**
  • Improvement (paving unpaved part)
  • Maintenance (roughness consideration)

**Fully HBB**
  • Improvement (converting into BC/CC/RCC)
  • Maintenance (roughness consideration)

**Fully paved roads**
  • Further improvement
  • Maintenance (roughness consideration)
<table>
<thead>
<tr>
<th>Ranking</th>
<th>Rd Code</th>
<th>Rd Name</th>
<th>Upazila</th>
<th>AADT</th>
<th>CVD</th>
<th>Length in km</th>
<th>EIRR %</th>
<th>MCA Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>393233004</td>
<td>Deuli UP office (Silimpur)-Bangrail</td>
<td>Delduar</td>
<td>1004</td>
<td>80</td>
<td>3.95</td>
<td>33.95</td>
<td>47.20</td>
</tr>
<tr>
<td>2</td>
<td>393473003</td>
<td>Bangra U.P.-Sahadebpur Bazar Road</td>
<td>Kalihati</td>
<td>892</td>
<td>47</td>
<td>2.10</td>
<td>24.09</td>
<td>43.44</td>
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<tr>
<td>3</td>
<td>393953011</td>
<td>Bashakanpur Bazar-Hagra UP via Beguntola Bazar</td>
<td>TangailSadar</td>
<td>811</td>
<td>50</td>
<td>9.00</td>
<td>20.93</td>
<td>33.87</td>
</tr>
<tr>
<td>4</td>
<td>393234029</td>
<td>Babupur-Bangrail</td>
<td>Delduar</td>
<td>492</td>
<td>70</td>
<td>2.45</td>
<td>19.34</td>
<td>11.66</td>
</tr>
<tr>
<td>5</td>
<td>393233008</td>
<td>Deoli Up Office-Elaasin GCC Road Via Shalpabati</td>
<td>Delduar</td>
<td>740</td>
<td>12</td>
<td>3.49</td>
<td>16.73</td>
<td>44.77</td>
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<tr>
<td>6</td>
<td>393093011</td>
<td>Kanchanpur UP Office-Patherghata hat via Tarabari Road.</td>
<td>Basail</td>
<td>434</td>
<td>48</td>
<td>8.70</td>
<td>14.63</td>
<td>28.61</td>
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<td>7</td>
<td>393092009</td>
<td>Ishorgonj GC-Sunna GC Road.</td>
<td>Basail</td>
<td>388</td>
<td>30</td>
<td>3.00</td>
<td>14.39</td>
<td>75.87</td>
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<td>8</td>
<td>393663015</td>
<td>Warshi R&amp;H road to Warshi UP road</td>
<td>Mirzapur</td>
<td>679</td>
<td>70</td>
<td>3.00</td>
<td>13.17</td>
<td>21.84</td>
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<tr>
<td>9</td>
<td>393953006</td>
<td>Baghil-Aynapur Road</td>
<td>TangailSadar</td>
<td>505</td>
<td>74</td>
<td>5.73</td>
<td>10.04</td>
<td>44.36</td>
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<td>10</td>
<td>393473014</td>
<td>Elanga U.P.-Nardhri Bazar road</td>
<td>Kalihati</td>
<td>540</td>
<td>11</td>
<td>5.00</td>
<td>8.97</td>
<td>60.87</td>
</tr>
<tr>
<td>11</td>
<td>393093008</td>
<td>Basail-Kanchanpur UP office Road.</td>
<td>Basail</td>
<td>344</td>
<td>48</td>
<td>3.92</td>
<td>8.07</td>
<td>41.30</td>
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<tr>
<td>12</td>
<td>393234001</td>
<td>Putiajani-Meruaghona Rd</td>
<td>Delduar</td>
<td>414</td>
<td>17</td>
<td>2.50</td>
<td>6.48</td>
<td>16.35</td>
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<tr>
<td>13</td>
<td>393853015</td>
<td>Mahanandapur Bazar-Baheeratul UP via HarangaChala Rd</td>
<td>Shakhipur</td>
<td>267</td>
<td>4</td>
<td>7.60</td>
<td>6.06</td>
<td>47.26</td>
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<tr>
<td>14</td>
<td>393093014</td>
<td>Fulkhat(Janjania)-Kawaljani UP via Badiajan.</td>
<td>Basail</td>
<td>238</td>
<td>10</td>
<td>4.00</td>
<td>5.76</td>
<td>28.74</td>
</tr>
<tr>
<td>15</td>
<td>393234026</td>
<td>Deoli hat to jhunkai hat Road</td>
<td>Delduar</td>
<td>293</td>
<td>14</td>
<td>1.00</td>
<td>4.91</td>
<td>8.89</td>
</tr>
</tbody>
</table>
Details of evaluation outcome and ranking of individual road

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Volume</td>
<td>AADT: 388</td>
<td>2.87</td>
</tr>
<tr>
<td>Socio-economic Facilities</td>
<td>Types</td>
<td>Number</td>
</tr>
<tr>
<td>Primary School</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Secondary School</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Madrasa</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Industries</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Health Center</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Community Clinic</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Non Government Clinic</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Upazila Health Complex</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other Centers</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Connectivity</td>
<td>35.80</td>
<td></td>
</tr>
<tr>
<td>Road Type</td>
<td>Upazila Road</td>
<td>0.00</td>
</tr>
<tr>
<td>Surface Type</td>
<td>% of paved segment: 0%</td>
<td>0.00</td>
</tr>
<tr>
<td>Road Safety</td>
<td>No</td>
<td>0.00</td>
</tr>
<tr>
<td>Local Priority</td>
<td>Medium Priority</td>
<td>4.20</td>
</tr>
<tr>
<td>Total MCA Score</td>
<td>75.87</td>
<td></td>
</tr>
<tr>
<td>EIRR</td>
<td>14.39</td>
<td></td>
</tr>
<tr>
<td>Ranking</td>
<td>2</td>
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</table>
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User Guide
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Analytical Map

Upazila Level % of Paved Road of Bangladesh

View Map >>
Core network – Basail upazila

List of roads in core network - Basail

RPPM Output
### Road Maintenance Priority List

**District:** TANGAIL  
**Upazilla:** BASAIL  
**Type of Development:** Maintenance  
**Surface Type:** Fully Paved Road

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Road Code</th>
<th>Road Name</th>
<th>Road Condition</th>
<th>AADT</th>
<th>CVD</th>
<th>Total Length</th>
<th>Score MCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>393092001</td>
<td>Basaul-Karchanpur GC Road.</td>
<td>Bad</td>
<td>502</td>
<td>79</td>
<td>3,700</td>
<td>87.969</td>
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<tr>
<td>2</td>
<td>393095005</td>
<td>Basaul Tangail re-Basaul Post Office.</td>
<td>Fair</td>
<td>304</td>
<td>17</td>
<td>0.200</td>
<td>36.815</td>
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<tr>
<td>3</td>
<td>393094054</td>
<td>Bilpara Hat-Gramminimum Dolchin Madrasa</td>
<td>Fair</td>
<td>603</td>
<td>63</td>
<td>1.300</td>
<td>36.767</td>
</tr>
<tr>
<td>4</td>
<td>393094003</td>
<td>Basaul Nukur Road-Godown.</td>
<td>Fair</td>
<td>186</td>
<td>39</td>
<td>0.210</td>
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<td>5</td>
<td>393094010</td>
<td>Kolka-Kavali Road.</td>
<td>Fair</td>
<td>368</td>
<td>79</td>
<td>0.600</td>
<td>33.810</td>
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<td>6</td>
<td>393094020</td>
<td>Pouli-Bangra Road.</td>
<td>Fair</td>
<td>146</td>
<td>15</td>
<td>2.322</td>
<td>20.701</td>
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</tbody>
</table>
Prototype illustration: road with socio-economic facilities along a partly paved road for improvement
Prototype illustration:
road with socio-economic facilities along a road selected for further improvement
Thank you

Courtesy: LGED