Achieving Economies in Construction of Rural Roads under PMGSY

By

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Unanimous View

- Positive scope of cost reduction and still maintain quality and safety
- Need to resist temptation
  - To over specify
  - To over design
- All rural roads to be well engineered
Challenges

- Preparation of quality DPR
  - Location specific
  - Maximise use of marginal materials
  - Maximise use of industrial wastes
  - Proper surveys and investigations
  - Guard against misreporting on data
    - Soil/subgrade strength
  - Traffic
- Realistic provision of culverts and bridges
- Advance planning so that reasonable time available to PIUs for proper surveys and investigations and preparing estimates.
- Realistic schedule of rates by states

- Strengthening of NRRDA
  - to exercise additional scrutiny of sample DPRs
  - to monitor implementation of technology initiatives.
  - to track progress on R&D Studies sponsored to CRRI, PTAs, STAs etc.

- Training of PIUs, contractors personnel for use of non-conventional materials and new technologies.

- Evolving resource efficiency strategies.

- Social acceptance for gravel roads and causeways.

- Convergence with other schemes such as MGNREGA, NRLM, skills for entrepreneurs and youth.
Measures Proposed

Pavement Design

- Limit the length for cement concrete roads
- Promote use of gravel roads with ultra thin bituminous seal
- Link roads – limit design traffic to 0.1 MSA and road carriageway to 3 m, formation width may be upto 7.5 m based on land use and expected traffic growth to enhance safety.
- Site audit for assessment of subgrade strength, traffic, CD Structures and protection works.
Promoting Use of Marginal Materials and Industrial Wastes

- Build up on recent effort on technology initiatives under PMGSY guidelines of May 2013
- Expedite mapping of strength characteristics of local materials (CRRI and STAs plus PIUs)
- Use of modified proctor compaction for higher strength.
- Embargo on use of aggregates beyond 50km lead
- Booklets in local language on guiding supervisory staff on use of local materials with stabilisation techniques
- Similar booklets on use of plastic waste, fly-ash, zinc slag, copper slag, marble dust, etc.
- Dialogue with equipment industry, low cost tractor based construction equipment (small contractors)
Hill Roads

- Balancing cut and fill
- Use excavated material and reduce dumping volume
- Promote use of gabions for retaining walls and breast walls
- Bio-engineering and bamboo reinforcement on hill side slopes for reducing land slides.
- Dumping yards are required to be provided for roads passing through forest areas as per instructions/guidelines of Ministry of Env. & Forest. Such dumping yards should be planned and provided across motorable roads and can be used as slip disposal places, resulting in cost reduction.
General Components of Gabion Retaining walls

Permeability through Gabion structure
Use of Gabion in Rural Roads

Typical Gabion box and Mesh details

Typical details of Mesh wire, Selvedge wire and edge wire
Photo depicts Gabion wall as crash Barrier on Sharp Curve on Hilly Road
Photograph of Gabion mattress for slope protection on River & Road
Flood Prone Areas

- Interlocked CC Block pavement
- Brick paved shoulders
- Balancing culverts
- Maximising use of cause ways and submersible bridges.
- Protection of side slopes of high embankments

Flood prone stretches to be identified by PIU but need to be approved at Chief Engineer level
Bridges and Culverts

- Follow IRC codes for causeways and submersible bridges
- Revive system of arch bridges and culverts
- Splayed wing walls in place of headwalls
- Need based cross-section of drain
- Bridges with length more than 50 m:
  - Though Routes – width to be 7.5 m
  - Link Routes – width 5.5 m (if projected traffic is more than T 7 category in 15 years or more width may be 7.5 m).
- Bridge-cum-bandhara as per site situation
Splayed Wing Wall
Abutment as per IRC SP-20

Plan of Abutment and wing wall

Elevation of abutment and splayed wing wall

Cross Section of Splayed Wing Wall
(near abutment at a-a)

\[ x = (\text{Height of embankment in meters} - 0.6) \times \text{Slope of embankment (Horizontal/Vertical)} \]
Semicircle Arch Culvert

• Need to design optimum cost effective structure to cover 3m water flow
• For 80% streams flood depth less than 3m
• 2m semicircle arch supported on raft foundation having dwarf pier of 1.5m.
• Arch ideal as superstructure, raft as foundation element.
• Special technology for construction - centering element
• Fast constructions easy to execute
• Large number of rivers having different flood depth, water velocity covered
• Thin Elements. Cost as low as Rs.35000 per running meter
Semicircle Arch Culvert
Bridge Cum Bandhara
Invest in Research and Knowledge Development

- Centre of Excellence for Rural Roads
  - Either in one of the STAs/Universities/Academia or a New Centre
  - To nurture and handhold
  - Provide low cost Accelerated Pavement Testing Facility for quick performance evaluation

- Actually such centres in 4-5 places in the country in the medium term

- Monitor performance of innovative materials

- R&D budget of 0.2 percent of total rural road investment
Thrust Areas of Research

- Guidelines for effective drainage of pavement
- Warm Mix Asphalt, Porous Pavements
- Recycling of pavements
- Fast construction technologies
  - Roads
  - Bridges
- Menu of subgrade/subbase treatments
  - Non conventional materials
  - Industrial wastes
- Pavement Performance Prediction Models – optimal timing of road renewal
- Effective safety measures on rural roads
Other important features

- Creating hygienic conditions and achieving sustained performance at entry to villages

- Timely and adequate maintenance.

- Knowledge and technology development to enhance resource efficiency.
Awareness Raising

- Quarry owners
  - Segregating useful waste material and non-useful waste material
- Community
  - Acceptance of Gravel Roads/ Thin sealed roads
  - Safe driving
  - Road safety awareness camps need to be organized involving Panchayats, SHGs, school and road users.
  - Respect for traffic signs and traffic rules
  - Awareness among the community for appropriate disposal of solid waste, cattle dung, waste water from houses for creating hygienic conditions along the roads.
  - Tractors having attachments like metallic rims (called cage wheels) should not be operated on black top roads, so as to avoid damage to pavements. These can be provided in fields and removed after work is over.
Capacity Building and Training

- NRRDA has taken an exemplary lead
- Need to continue
- Focus on:
  - Junior Engineers and Assistant Engineers
  - Supervisors
  - Construction Workers
  - Equipment Operators
  - Personnel of consultants
- SRRDAs may depute their selected officers to visit projects undertaken under R&D to promote such technologies and engineering measures.
- Handbooks, pocket books on various aspects of project – planning, design, construction, maintenance.
Additional Support from STAs

- Site checks in case of misreporting suspected regarding soil strength, traffic and HFL.

- Site visit if box culverts or abnormal provision proposed for CD works

- Site visit where costly protection structures proposed in estimates.

- STAs may be mandated for certain percentage of samples to be tested in their own laboratory for cross verification of material properties and to have a check on tendency of under reporting and over designing.
## Summary of Item-wise possible cost reduction

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Item(s)</th>
<th>Possible percentage cost reduction w.r.t cost of relevant item used traditionally (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of gravel roads for lower traffic volume as per IRC SP:72-2015 and Gravel Roads Manual.</td>
<td>30-40</td>
</tr>
<tr>
<td>2</td>
<td>Use of stabilized base and sub-base courses in place of traditional WBM layers as per IRC SP:72-2015.</td>
<td>20-40</td>
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<tr>
<td>3</td>
<td>Use of thin bituminous surfacing like surface dressing / mix seal surfacing for lower traffic volume as per IRC SP:72-2015.</td>
<td>15-25</td>
</tr>
<tr>
<td>4</td>
<td>Use of improved sub-grade strength as per IRC SP:72-2015.</td>
<td>5-15</td>
</tr>
<tr>
<td>5</td>
<td>Using low cost cement concrete road as suggested in Annexure ‘D’</td>
<td>20-30</td>
</tr>
<tr>
<td>6</td>
<td>Use of low cost marginal and local materials including industrial wastes such as fly ash and slag, wherever available.</td>
<td>10-25</td>
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<tr>
<td>7</td>
<td>Use of hill cut material with appropriate processing</td>
<td>10-30</td>
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<tr>
<td>8</td>
<td>Use of Gabions as protection structures in place of PCC wall.</td>
<td>30-40</td>
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<td>9</td>
<td>Use of Splayed wing wall in place of straight head wall.</td>
<td>25-30</td>
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<td>10</td>
<td>Using concrete block and semi circular arches</td>
<td>20-30</td>
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<tr>
<td>11</td>
<td>General Measures as suggested in Para 11</td>
<td>5-10</td>
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<tr>
<td>12</td>
<td>With additional support of ground verification through STAs, NQMs by NRRDA</td>
<td>2-15</td>
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Expectation from SRRDAs

- Efforts towards use of Locally Available Materials
- Not to make changes in DPR after STA scrutiny and clearance of proposals from the Empowered Committee.
- Continued effort in good implementation of rural road projects with stress on technology initiatives
- Ownership of maintenance.
- Schedule of rates for all roads should be based on the IRC Standard Data Book for analysis of rates.
Expectation from NRRDA

- Standard setting and enforcing institution
- Think Tank and Repository of Technical and Managerial wisdom
Forward Path

- MORD to accept report with refinements as considered appropriate
- Report to be sent to states for necessary implementation
- Highlight measures required at every RRM until impact is seen
- MORD to support establishment of a centre of excellence for rural roads
- MORD to support:
  - Strengthening of NRRDA
  - Preparation of booklets and handbooks
  - Reimbursement of expenses for site audit by STAs
- Continue momentum of training of PIUs, contractors, consultants
Thank You