Development of a National Design Manual, Standard Specifications and Bidding Documents for Low Volume Roads in Ethiopia

Abdo Mohammed
Deputy Director General For Engineering Operation
Ethiopian Roads Authority
I. Background Information.
II. Organization of the Road Sector in Ethiopia
III. Ethiopian Road and Bridge Manuals and their Use
IV. The Reasons For LVR Documentation & Pre-requisite
V. Scope of Content and LVR Documentation.
VI. Principles and Approach For LVR Documentation.
VII. Conclusion
### I. BACKGROUND INFORMATION

<table>
<thead>
<tr>
<th>Location</th>
<th>North Eastern Part of Africa/Horn of Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>North Eastern Part of Africa/Horn of Africa</td>
</tr>
<tr>
<td>Area of Country</td>
<td>- Above 1.1 Million sq km. (the world’s 27(^{th}) largest country)</td>
</tr>
<tr>
<td><strong>Terrain condition can be classified</strong></td>
<td>- Flat and rolling</td>
</tr>
<tr>
<td></td>
<td>- High Plateau and mountainous ranging between (2000-4000) meters above sea level (Ras Dashen 4620)</td>
</tr>
<tr>
<td></td>
<td>- There is also extensive low land area (Dallol Depression) i.e.110 m below sea level</td>
</tr>
<tr>
<td><strong>Climatic Condition</strong></td>
<td>- Arid, tropical and Temperate rainy varies from 35 to 10 °C</td>
</tr>
<tr>
<td>Rainfall</td>
<td>- From 0 up to 2000mm+</td>
</tr>
<tr>
<td>Population</td>
<td>- The second-most populous in Africa (80 million)</td>
</tr>
<tr>
<td>Nation/Nationality</td>
<td>- More than 70 ethnic group</td>
</tr>
<tr>
<td>Language</td>
<td>- More than 70 Languages</td>
</tr>
</tbody>
</table>
### II. ORGANIZATION OF THE ROAD SECTOR

#### 1. Management of Low Volume Roads

<table>
<thead>
<tr>
<th>Period</th>
<th>Responsible Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951-1974</td>
<td>Imperial highway Authority (IHA)</td>
</tr>
<tr>
<td>1974-1977</td>
<td>Ethiopian Roads Authority ERA, Rural Roads Coordinating Division of ERA</td>
</tr>
<tr>
<td></td>
<td>The Agricultural sector (&lt; 100 v pd)</td>
</tr>
<tr>
<td>1977-1993</td>
<td>Ethiopian Transport Construction Authority (ETCA), Rural Roads Coordinating Division of ERA</td>
</tr>
<tr>
<td></td>
<td>The Agricultural sector (&lt; 100 v pd)</td>
</tr>
<tr>
<td>1993-Present</td>
<td>Ethiopian Roads Authority (ERA), Regional Roads Authority (&lt; 100 v pd)</td>
</tr>
<tr>
<td></td>
<td>Wereda Road Desks (&lt; 100 v pd)</td>
</tr>
</tbody>
</table>
### 2. THE ROAD SECTOR PROGRAM OF ETHIOPIA (RSDP) (1997-2010) Road Network

<table>
<thead>
<tr>
<th>RSDP</th>
<th>Year</th>
<th>Road Network in km.</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Asphalt</td>
<td>Gravel</td>
<td>Rural</td>
<td></td>
</tr>
<tr>
<td>RSDP - I</td>
<td>1997-2002</td>
<td>3708-4053</td>
<td>12162-12564</td>
<td>10680-16680</td>
<td></td>
</tr>
<tr>
<td>RSDP - II</td>
<td>2002-2007</td>
<td>4053-5452</td>
<td>12564-14628</td>
<td>16680-22349</td>
<td></td>
</tr>
<tr>
<td>RSDP – III</td>
<td>2007-2010</td>
<td>5452-7476</td>
<td>14628-14373</td>
<td>22349-26944</td>
<td></td>
</tr>
</tbody>
</table>

Percentage of Rural = $\frac{26944}{48793} = 55.2\%$; Unpaved = $\frac{41317}{48793} = 84.7\%$
<table>
<thead>
<tr>
<th>Indicators</th>
<th>1997 Start RSDP - I</th>
<th>2007 End RSDP - II</th>
<th>2010 End RSDP - III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Density 1/1000sq. km</td>
<td>24km.</td>
<td>38.6km.</td>
<td>44.4km.</td>
</tr>
<tr>
<td>Road Density 1/1000 population</td>
<td>0.46km</td>
<td>0.55km.</td>
<td>0.58km.</td>
</tr>
<tr>
<td>Prop. area more than 5km from all weather road</td>
<td>79%</td>
<td>68%</td>
<td>64.2%</td>
</tr>
<tr>
<td>Average Distance to all weather road</td>
<td>21km.</td>
<td>13km.</td>
<td>11.3km.</td>
</tr>
</tbody>
</table>
III. ETHIOPIAN ROAD AND BRIDGE MANUALS AND THEIR USE

- Standard Specifications 1968
- ERA 2002 Design Manuals

Other Documents
- Typical Cross sections recommended grades and drainage provision for rural roads (RR50, RR30 and RR10)
- Labor based manuals
2. Specific Opportunities Sought for efficiency

- Obtained from experience and research executed on low volume roads.
- Application of traditional design approaches to LVR prove conservative, inappropriate and costly

**Opportunities included:**
- Application of appropriate design standards (Geometry, Drainage, pavement,..)
- Alternative options for road surfacing
- Options to extend the performance of earth roads
- Application of innovative construction techniques and methods.
- Greater Use of local labour
IV. The Reasons for LVR Documentation & PRE-REQUISITE

1. Reasons

- Traditional engineering/road engineering is challenging in the face geographical and climate diversity
- **Network:** Majority LVR.
- **Accessibility:** only 37% of the sub-districts (Kebeles) are accessible; only 27% of the total population live within 2km from all section roads.
- Governments Strategic Growth and Transformation Plan (GTP) priority given for access
The existing manuals are appropriate for much of main trunk and link roads hence costly
LVR roads should be responsive to the influence end of environment rather than traffic related deterioration.
Opportunities that would provide lower cost engineering solutions are missed.
Previous recommendation and techniques cannot be implemented due to absence of design and manual standards and specification
3. Pre-request to develop a LVR manual

- Supportive government Policy growth and transformation plan(2010-2015)
- Awareness on the need for change in approach and introduction of new and innovative technologies
- Operational Environment (public sector agencies and private sector towards commercialization, technology options)
- Maintenance Environment (modification to existing maintenance specification, documents and practices)
V. Scope and Content of Low volume Roads Manual

1. Scope

- Caters for paved Before the Implementation of Road Sector and unpaved roads carrying up to 300 vpd.
- Adaptable to roads administered by different levels (ERA, Regions, weredas)
- Spot improvement to total rural road design
- Emphasis on Complementary Interventions
2. Structure /content of low volume Roads

- Part-A (Purpose, Scope and structure of manual, philosophy and approach to LVR Design, preparation of tender/contract/engineers estimate)
- Part - B introduction, application and use of the National Standards (geometric, drainage, materials and pavement Design Standards)
- Part - C complementary interventions (separately emphasized)
- Part - D explanatory Notes road Standards (detailed information to Part - B)
- Part - E explanatory Notes Drainage structures (detailed information to Part - B)
3. Complementary interventions (C)

- Close attention to maximize road provision benefits to the community (e.g. increase participation, minimize resettlement)
- It's not just building roads but adding value to the community.
- Concepts and practices summarized (Planning, Design and implementation under different categories)
- To be implemented through road projects or road works contract.
- Targeted communities within the road corridor and are affected by the road users and works.
- To take into account socio-cultural/environmental impacts.
- Generally it includes almost anything that contributes to the community.
VI. Principles and Approach for LVR Manuals

- Institutional framework (easy application and adaptation by clients concerned)
- End user Requirements (a manual in itself will not change anything) (Needs equivalent specification, engineering detail and bidding document)
- Consultation (involvement of the local industry Workshops, peer groups)
- Complementary interventions
- Mechanisms for future updating
- Promoting implementation (production of documents alone cannot solve all challenges it represents about ten percent of the challenge)
- To make sure that industry is ready/trained to use correctly.
- AFCAP/DFID to continue their role.
VII. Conclusion

- Appropriate and cost effective low volume road technology needed (Manuals, specifications, bidding documents)
- Critical elements are identified (policy, appetite for change, operational environment and desire for maintenance)
- Approaches and principles (framework, end user-manual preparation alone will not be a solution the balance of effort should insure using the manuals correctly, Consultation, uptake)
- ERA extends the benefit of its experience and lessons leaned to other similar authorities
Thank You