Experience Sharing Workshop for State Road Agencies

GIS based Road Maintenance Management System in Kerala PWD

2nd November, 2006
Kerala – God’s own country

- Located on the south western tip of India
- Narrow Strip of Land; 600 km long, 100 kms wide.
- Area – 38,863 sq km (1.27% of India’s land area)
- Climate – Tropical with 3 main seasons
- Geography
  - a mountainous western ghats towering 500-2700 m
  - midland region with sprawling plantations & paddy fields
  - coastal plains with stretches of backwaters
- Population – 31.838 million
- Population density – 819 per km2
- 74% living in villages
Kerala Road Network

- Kerala has a wide network of roads though poorly developed and congested
- Total length of road - 1,54,679 km
- Length of PWD Road network – 27,704 km
- Balance roads with Panchayat, Municipality, Corporation, Forest, Irrigation, and Others
- Road Density 398 km/100 sq.km
PWD Road Length

Length of PWD road

- **NH**  – 1,524km
- **SH**  – 3,928 km
- **MDR**  – 22,252 km
- **Total PWD**  – 27,704 km
Road Maintenance Problems

- **Faster deterioration of roads due to**
  - Heavy seasonal rainfall
  - Insufficient pavement strength
  - Increase in traffic (8-10% every year)
  - Inadequate drainage system

- **Issues with Road Pavements**
  - Pavement condition shows severe distress e.g. cracks, large potholes, edge breaks
  - Shoulders are damaged with high edge drops
Inadequate Road Maintenance Funding

Expenditure for Road Maintenance (Plan & Non-Plan)

- Non Plan
- Plan
- Total

Base Year: 1993-94
“For optimum utilization of the meager funds and prioritization of the development and maintenance works, it is of urgent necessity to introduce the Maintenance Management System both for pavement and bridges. This system has to be computer based and using Highway Design Model developed by WB updated to HDM-4.”

Report of the Committee on norms for maintenance of Roads in India, IRC-2001
Government decided to develop “GIS based Road Maintenance Management System” through Technical Assistance

Included in the Institutional Strengthening Action Plan (ISAP) of WB funded Kerala State Transport Project (KSTP)

Developed through two different consultancies

- Road Maintenance Management System (RMMS)
- GIS based Road Information Management System (RIMS)

Integrated to function as GIS based RMMS
Objective
- To develop a HDM-4 based Road Maintenance Management Systems for PWD linked to GIS system

Project Details
- Consultant - Wilbur Smith Associates
- Project Cost - 67 Million(INR)
- Project Duration (24 Months)

Project Status
- Project Completed on Sept 2006
- Central GIS Cell and RMMS Unit formed in PWD
- HDM-4 based system implemented
- Arc GIS solutions implemented
GIS – RMMS linkage

Selected Spatial Operations

RIMS Spatial Database

Road Network and Bridges

Other Spatial Data Layers

Attribute Data

RMMS Software

Final Output RMMS

Maintenance Programs etc.

Traffic Analytical Routines

Public Works Department, GoK
GIS based RIMS Process

Satellite Image

Digitized topo sheets

RMMS data

GIS based Road Maintenance Management System

Input

Processing

Output

Public Works Department, GoK
Outcome of GIS based RMMS

- Developed RMMS Software with HDM-4 as core for managing Road Information Database
- Complete Data collection for 6000 km of PWD road network
- Maintenance Intervention Strategy for PWD road networks was evolved.
- Central RMMS & GIS unit formed with in PWD
- Data collection manual prepared
- RMMS Training was given to 200 engineers
Out come of the GIS based RMMS

- Base Map of Kerala covering 27904 km of PWD roads prepared
- About 3000 Bridges identified and marked.
- Fully functional Central GIS unit with necessary hardware and software was established.
- Arc GIS at Central unit and Customized GIS at Divisions
- GIS awareness and training to around 300 PWD engineers
- Linked with RMMS data for visualization and analysis
Accidents plotted on GIS map
Roads Categorized by Roughness

Road Network
Neyyattinkara Sub-Division:

**Roughness**

- Map shows roads, categorized by the surface roughness.
- Red indicates highest roughness (roughness parameter more than 4) and requires maintenance priority.
Challenges faced…

- Quality of Existing data
  - Absence of updated Road and Bridge Registers
  - Absence of Quantitative data required for HDM-4
- Issues with Road Numbering and Road Code
- Road Jurisdiction and Overlapping Problems
- Calibration of Axle mount bump integrator
- Calibration of HDM-4 to suit Kerala conditions
- Integration with GIS system
Lessons Learned

Current Maintenance Strategy is not improving road network quality
Lessons Learned

Average Roughness (IRIav) for each Project
(weighted by section length)

Responsive Strategy improves road network quality

Year

Responsive Strategy improves road network quality

Responsive Strategy improves road network quality

Responsive Strategy improves road network quality
Lessons Learned

- Asset Preservation Concept
- Maintenance should be a regular process not a random event (PBMC..?)
- Maintenance shall be preferably preventative
- Improvement of pavement strength by rehabilitation should be included in the maintenance strategy.
- Fund allocation should be based on ‘Higher Economic Return’ (Benefit Cost Ratio)
Enhance road network quality through
- Enhance budget allocation for ‘Annual Maintenance’
- Maintenance shall be based on RMMS prioritization
- Specific maintenance programs using RMMS may be prepared to attract Central/external funding

Ensure Sustainability
- Institutionalizing RMMS in PWD
- Technical Assistance for during roll out and implementation.
- Continuous data collection.
One of the key objectives in implementing an RMMS is to provide justification for budget, and to help direct limited funds towards those areas where the return on investment will be greatest.

Success Factors for Road Management Systems
World Bank Report – October 2005
THANK YOU

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