Better Road Asset Management Through *Performance-Based Maintenance (PBM)* in Nepal

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http://www.performance-based-road-contracts.com
• What is a Good Road Asset Management System?

• Overview of the PBM concept
  – Characteristics
  – Risks
  – Performance or Service Levels
  – Performance monitoring
  – Payment and Incentive Systems

• Main Reasons for Implementing PBM

• Brief History of Implementation of PBM
Overview of Presentation (2)

• Implementation experiences
  – Argentina
  – Uruguay
  – Canada
  – New Zealand
  – Estonia
  – India
  – Latin America
  – South Africa
  – Other Selected Asian Countries
  – Lessons Learned
Overview of Presentation (4)

- Implementation of PBM in Nepal
  - Problems with past implementation
  - Proposed new project
  - Required framework conditions
  - Main recommendations
From here

To this

No potholes
What is a Good Road Asset Management System?
Road Asset Management System

• A good Road Asset Management is a systematic process of maintaining, upgrading, expanding and operating road, bridge and road side assets, using engineering principles with sound business practice to effectively and efficiently allocate and utilize resources for the provision of well defined levels of service to satisfy public expectations.

• To implement good road asset management it needs the right environment.
Main Elements of RAM(S)

- Stakeholders Expectations
- Road Traffic Volume and Composition
- External Risks

Road Sector Policies
- Institutional Reform
- Legal Framework

Road Sector Funding
- Over extension of Road Network
- Overloading of Vehicles

Road Organizations
- Policies
- Leadership
- People
- Information
- Planning
- Operations
- Performance
- Communication
- Improvements

Asset Management System

1. Asset Management Policy
2. Asset Management Plan
3. Network Referencing
4. Asset inventory
5. Asset Condition
6. Traffic Demand
7. Levels of Service
8. Asset Deterioration
9. Asset Valuation
10. Works and Services
11. Funding Scenarios
12. Program Optimization
13. Work Program
14. Program Implementation

Procurement
- In-house, Unit Price Contract, PBMC

Scope of Road Asset Management (RAM)
Benefits of RAMS

• Consistent good level of service
• Reduced life-cycle cost
• Reduced road user cost
• Ability to monitor and track performance
• Improve transparency in decision making
• **Ability to predict consequences of funding decisions and future funding needs**
• Decreased financial, operational and legal risk
The best way of effectively and efficiently manage road related assets is through Long Term Performance Based Road Maintenance Contracts, which can guarantee roads in permanently good condition.
Overview of PBM Concept
Performance Based Road Maintenance Contracts

- Performance Contract (Western Australia)
- Asset Management Contract (USA)
- Performance-Specified Maintenance Contract (Australia, New Zealand)
- Contract for Rehabilitation and Maintenance (Argentina, Brazil)
- Area Maintenance Contract (Finland, Ontario/Canada)
- Managing Agent Contract (UK)
- Output and Performance Road Contract (World Bank)
Maintenance Delivery

- Inhouse with own staff
- Unit price contracts
  - Unit rates for work items
  - Payments are based on quantity of completed and measured work
- Performance based maintenance contracts (PBMC)
  - Pure (mainly OPRC)
    - Performance Standards defined for all works and services
    - Fixed monthly payments if performance standards are complied with
  - Hybrid
    - Unit rates for work items and performance based works and services
Characteristics of PBMC (1)

- **Performance or Service Levels** define the **minimum conditions** of road, bridge and traffic assets as well as the management and operation of the assets during the **entire contract period**, leaving it mainly to the contractor as to how to achieve them.

- **The contractor is fairly free to decide**
  - What to do, when to do, how to do, where to do
  - To do the physical works himself or subcontract as long as he meets the performance or service levels and other conditions defined in the contract, including technical norms and regulations during the **entire contract period**
Characteristics of PBMC (2)

- **Lump sum payments** are made periodically (mainly monthly) and might be adjusted in accordance with the change of certain factors, like inflation or unexpected increases of traffic volume.

- **Major emergency, rehabilitation and improvement works** might be paid based on unit prices for works agreed case by case.
• **Deductions** are being made for non-compliance with terms and conditions of contract, especially with respect to the service levels.

• **Duration of contracts** should at least include one periodic maintenance cycle (4-5 years for gravel roads and 8-12 years for bituminous roads). Pure routine maintenance contracts are normally between 1-3 years. *Pilot contracts may be of shorter duration.*
Characteristics of PBMC (4)

- **Complexity**
  - Routine maintenance
  - Routine and periodic maintenance
  - Construction, periodic and routine maintenance

- **Contract duration in years**
  - Up to 30 years
Characteristics of PBMC (5) Potential Scope of Services and Works

Road Network Management and Operation

Routine/ Recurrent Maintenance

Periodic Maintenance

Emergencies

Rehabilitation

Improvements

PBMC potential
Distribution of Risk

In-house Maintenance

Outsourcing Specific Maintenance Works

Performance-Based Road Management and Maintenance Contracts

Long-term Road Concessions (BFOT)

- Short-term
- Medium-term
- Long-term

Road Agency risk decreases

Contractor risk increases
Risk Identification

There are three fundamental risks:

• **background risk**
  – Political, legal and regulatory risks
  – Monetary and macro-economic risks
  – Force majeure including extreme weather conditions

• **cost risk**, a risk of exceeding initial cost estimates for the construction or operation of the project

• **revenue risk** if the client does not pay on time

• **social acceptability risk**
Risk Sharing

- PBCs require the principle acceptance of sharing risk between the client and the contractor.
- Private contractors are willing to take some of the project risks, provided that the nature of the risks relates to their expertise so that they will be able to properly assess the consequences. The expected remuneration is proportionate to the level of risk they will bear.
- Asking the private sector to bear risks that could best be handled by the public sector will usually result in either withdrawal of the private partners who refuse to take the risk, or premature termination by the contractor, with the possibility of him going bankrupt.
Risk Mitigation

- **Background risks**
  - Born by client

- **Cost risks**
  - Proper prediction of asset deterioration !!!
  - Prediction of weather conditions
  - Payment adjustment formula to cope with inflation and unexpected traffic growth
  - Compensation for overloading
  - Reduction of risk by changing partially to re-measured work

- **Revenue risks**
  - Payment guarantee

- **Social acceptability**
  - Involvement of the road agency’s staff
  - Involvement of the public
Performance / Service Levels

Objectives

– To satisfy the road user
  • accessibility
  • comfort
  • travel speed
  • safety

– To minimize total system cost (cost to road users and agency – *life-cycle cost of assets*)

– To minimize environmental impacts
Service Levels

- Fulfil objective
- Clearly defined
- Objectively measurable
- Affordable
- In compliance with the law (law of public roads, ordinance on maintenance and protection of roads)
Relationship between Objectives and Service Levels

- **Improve road safety**: Potholes not bigger than 15cm in diameter, ruts <15mm deep, friction coefficient >0.4, etc.
- **Preserve road asset value**: Cracks not wider than 3mm, potholes not bigger than 15cm, obstruction of drainage channels <15% of flow area, etc.
- **Reduce vehicle operating cost**: Roughness IRI < 3
- **Travel time**: Average travel speed > 50 km/hr
- ............
Performance Monitoring

• Contractor’s self-control system
• Inspections by client
• Road user complaints
• External Audits
Contractor Self-Control System with Joint Monthly Control by Client (1)

• Continuous control by Contractor (daily patrol)
• Daily reports to client of defects and works performed
• Non-compliances recorded for all or part of the road network and submitted to monitoring engineer towards the end of each month
• If non-compliances will be recorded for only part of road network, the sections may be chosen (a) at random or (b) defined by the client
• At the beginning of the following month contractor and the client jointly check of records for completeness
• Contractor will receive payment reductions for any non-compliances with service levels
Self-monitoring by Contractor with joint monthly Control (2)

- For those non-compliances detected by the client (monitoring engineer) during the joint inspection, additional payment reductions might be imposed to give the contractor an incentive to record ALL non-compliances in time.
- For those non-compliances which might have occurred in the time between, the contractor might be granted a certain amount of payment reductions to be subtracted from the ones that the monitoring engineer has detected during the joint inspection.
- If only part of the road network is controlled jointly the payment reductions will be applied to the remaining roads proportionally. For example if only 10% had been controlled the payment reductions points will by multiplied by a factor of 10.
Self-monitoring by Contractor with joint monthly Control (3)

- Contractor to receive additional payment reductions if he does not repair non-compliances within a certain time period (defect repair period)
  - For dangerous non-compliances set short defect repair times (needs special monitoring)
  - For other non-compliances set individual or common (monthly) defect repair periods.
  - For longer periodic / cyclic compliance requirements set longer defect repair periods.

- If contractor fails to repair non-compliances within the defect repair period he will receive additional payment reduction points which may escalate for additional periods the defect has not been repaired, alternatively the monitoring engineer might contract a third party to repair the defect at the expense of the contractor.
Self-monitoring by Contractor without Monthly Joint Control (1)

- Continuous control by Contractor (daily patrol)
- Web based Management Information System
- Contractor to record any non-compliance with type of non-compliance, date, time, location, photo when detected and when repaired. For some repairs like pavement defects photos need to be made and recorded during repair works.
- When Contractor detects a non-compliance a defect repair time allowance will start
- If Contractor repairs the defect within this time no payment reductions will apply
- If Contractor does not repairs the defect in time payments reductions are automatically calculated.
Self-monitoring by Contractor without Monthly Joint Control (2)

- Monitoring Engineer has real-time access to the web based system
- When Engineer detects any non-compliance which is not recorded in the system, the Engineer records the non-compliance and the contractor receives payment reductions for not having recorded or detected the non-compliance
- If the contractor falsely records a repair as completed, he receives additional payment reductions for cheating
- Since the system is web based the information can be made public for road users to check if the system works correctly and may alert the monitoring engineer or contractor for non-recorded defects
Payment and Incentive Systems

- **Fixed** periodic payments for scope of works and services contracted under performance or service levels, mainly for routine maintenance works.
- Payments based on unit prices and quantities of work performed typically for “risky” work items such as Emergency and Unforeseen Works and often for periodic maintenance and rehabilitation works as well.
- Periodic fixed payments to be reduced if contractor does not comply with the performance service levels.
• Gradual increase of payment reduction might be considered over the contract period
• Repeated non-compliance of the same item may increase the payment reductions by an escalation factor or formula.
• Contract to be terminated prematurely for underperformance and / or works to be performed by others on the expense of the contractor
• Payment and incentive systems vary widely from one country to another
### Example for Payment Reductions

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Service Level</th>
<th>Payment reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pothole</td>
<td>&lt; 30 cm in diameter or equivalent surface area</td>
<td>500 USD and each day it is not repaired</td>
</tr>
<tr>
<td>Roughness (IRI)</td>
<td>&lt; 3.5, measured once a year</td>
<td>1000 USD per 100 meter of lane km and per month after a 2-months grace period</td>
</tr>
</tbody>
</table>

Payment reductions shall be reasonable but high enough to incentivise the contractor to comply in the first place.
Example of Payment Schedule

- Avoid Pre-Financing
- Disperse Profits to Maintenance Phase

![Diagram showing payment schedule with phases of rehabilitation, maintenance, and cost curve.]
Example of Bidding Documents

• Sample Bidding Document: Procurement of Works and Services under Output- and Performance-Based Road Contracts (World Bank 2006)
• State Highway Maintenance Contract Proforma Manual SM032 (Transit New Zealand 2008)
• Bidding Documents for Procurement of Contract under Performance Based Road Contract (OPRC) for Improvement, Rehabilitation, Resurfacing & Routine Maintenance Works of Roads of Sangru-Mansa-Bathinda Contract Area (PUNJAB), 2011
Contractual Relationship with Hybrid Type PBMC

- **Client/Road Administration**
- **Audit by Client or External Auditor**
- **Performance or Conventional Contract**
- **Hybrid type PBMC**
- **New Type Contractor**
- **Project Manager Engineer**
- **Inspection of Compliance with Service Levels**
- **Supervision for Admeasured Work**
Main Reasons for Implementing PBM
Main Reasons for Implementing PBC

• Developed Countries
  
  *Increase efficiency* *(least cost at a defined service level)*

• Transitional and Developing Countries
  
  *Increase* **effectiveness**, *which means to keep roads in good or fair condition permanently* to avoid rehabilitation
Potential Cost Savings

- Shifting from in-house maintenance with own staff to contracts with the private sector can save between 20% and 50% of maintenance cost.
- Implementing PBMC can save another 10% to 30% compared with traditional unit price contracts.
- Keeping roads in good condition permanently can save expensive rehabilitation cost, 1 NPR not spent in time on maintenance will result in rehabilitation cost 4 to 10 NPR later on.
- Keeping roads in good condition can save road substantial user costs (time delays, vehicle operating cost, road accident cost, etc.).
Reported Savings by Introducing Performance Based Road Maintenance Contracts

- New Zealand: 15-22%
- Australia: 10-35%
- Brazil: 15%
- USA: 10-18%
- Finland: 18%
- Alberta, Canada: 20%

Savings are reported against traditional unit price contracts.

In addition, quality improvements were reported.
Development of Road Maintenance Cost in Sydney, Australia

Performance Specified Road Maintenance Contract

(Target of the Roads and Traffic Authority of New South Wales)

Private contractor

Time (months from June 1991)

% 1991 Rates
Some Reasons for Reduction in Road Maintenance Cost

Drivers of savings: **Incentives / competition / long-term management**

- Modern management and work procedures
- Increased labour productivity
- Total life cycle costing
- Just-in-time maintenance
- Better use of latest technologies
Timely Maintenance Saves Expensive Rehabilitation Cost

Source: National Center for Pavement Preservation.
RELATIONSHIP BETWEEN ANNUAL ROAD MAINTENANCE COST, REHABILITATION COST AND ADDITIONAL ROAD USER COST FOR A ROAD SECTION OVER A PERIOD OF 20 YEARS.

Declared policy of DOR since 1995

Cost in Millions of USD

Lowest overall cost for road agency and road users
Other Benefits of PBMC (1)

• Road Agency
  • Reduces workload of staff
  • Avoids frequent claims and contract amendments to increase quantities of works by contractor
  • Improves quality of rehabilitation and improvement works, if needed
  • Improves control and enforcement of effective road quality service levels
Other Benefits of PBMC (2)

• **Road Users**
  • Provides better and safer roads with consistent conditions

• **Consultants and Contractors**
  • Guarantees workload over longer period
  • Provides potential for increased margins
  • Opens excellent opportunities for business growth
Brief History of PBM
Brief History of PBMC

- 1988 British Columbia, Canada
- 1990 Argentina
- 1994-98 Colombia, Uruguay, Chile, Brazil, Peru
- 1995 Sydney, Australia, Estonia
- 1996 Virginia, USA
- 1998 New Zealand, Finland
- 2001 Chad, Zambia, England, Spain

**Drivers: efficiency and effectiveness**
APPLICATION OF PERFORMANCE-BASED CONTRACTING TO MANAGE AND MAINTAIN ROADS ACROSS THE WORLD

- Countries that have established PBC programs
- Countries that are at early stages of PBC program implementation
- Countries that are preparing to launch PBC's
- Countries that do not use PBC's or countries for which not related data was located

NOTE: This does not imply that every province/region/state has PBC's: the data pertains to the national level only, not sub-national ones.

Source: World Bank, 2006
Complexity of PBMCs

Complexity

Estonia 1995

Micro enterprises
Latin America
China
Bangladesh

US 1997
MAC UK 2004

Ukraine 2014

New Zealand 1998

Finland 2008

Punjab India 2012

Estonia 2008

Argentina 1994 (RMC)

Finland 1998

Serbia 2004

US 1997

Croatia 2015

Contract duration in years

Source: G. Zietlow
Implementation Experiences
• 1990 toll roads PBM
• 1995 first PBCs in 1995
  CREMA (Road Rehabilitation and Maintenance Contracts)
• 2012
• 100% of national roads
  (32000 km out of which 10000 km toll concessions)
• 2100 km of provincial roads
Overloading
Weigh Station
Caminos del Río Uruguay
Uruguay

- 1995: 4-year area contracts
- 2+2-year contracts for employees to start a business, right to return to the road administration after one year
First PBMCs in Canada in 1988
Started with 3-year contracts, 10 years term since 2003 and cover 100% of network
Most of the road administration staff joint contractors or formed own companies
Gradual increase in scope of performance based items – still hybrid type contracts
Until 2005 contracts did not include upgrading/replacing roads or structures, resurfacing, rehabilitation, engineering and geo-technical work, centreline painting, electrical maintenance, corridor management, and avalanche control
• First performance contract covering 406 km of national roads was let for 10 years in 12/98
• Contract cost was 15% below comparable cost of traditional contracting
• Performance standards are very well elaborated
• System of quality control by the contractor (quality manual, quality plan, quality system procedures) in place
In 2000 a similar contract was concluded
Two years later a third contract covering 1040 km of local roads and 122 km of state highways
While the first contract resulted in 15% savings the latest one came in 22% below the cost estimate for comparable conventional contracts
Now more than 40% of the national roads are maintained under performance contracts (Hybrid, PSMC and Alliance Model)
• 1995 – the Estonian Road Administration (ERA) launched two pilot performance-based contracts for road management and maintenance (assisted by Finnish Road Administration)
• 1995 to 2000 - ERA tested several **one-year and two-year** PBMCs
• Since 2000 –2005- Several **5-year** PBMCs have been awarded.
• Since 2006 – **7 year** PBMCs
• **2008 - 100%** of ERA’s network (16500 km) is being maintained under hybrid type PBMCs
Estonia, Reduction of ENRA Staff

**Number of Staff at ENRA and Road State Agencies**

- **Admin. staff**
- **Road workers**

- **1999**:
  - Admin. staff: 1500
  - Road workers: 900

- **2000**:
  - Admin. staff: 1100
  - Road workers: 1000

- **2001**:
  - Admin. staff: 600
  - Road workers: 1400

- **2002**:
  - Admin. staff: 600
  - Road workers: 900

- **2003**:
  - Admin. staff: 500
  - Road workers: 600
India, Punjab

- Since 2012 **Output and Performance Based Contract (OPRC)** for ten years (WB)
- Improvement, rehabilitation, resurfacing & routine maintenance works in the Sangru-Mansa-Bathinda Area for a total of **203 km**
- Lump sums except for emergency works
- 1000 to 4000 VPD
- Significant overloading
- Pavement design for 22 years (min 15 expected)
Blue roads are all to be widened in first 3 years
India, Punjab
India, Punjab

- Compensation for overloading, contractor has to prove the resulting damages and costs
- Contractor has to allow for 7.5% of traffic growth per year
Other Selected Asian Countries (1)

• Malaysia
  – 2000, 6 area-wide 15-year PMBCs covering all national roads (hybrid), in the process of prolongation and converted to full PBC.
  – On the peninsular 3 contracts with 3075 km, 4006 km and 7489 km
Other Selected Asian Countries (2)

• **India**
  – 2009, Andhra Pradesh, WB, 3 OPRCs active, 34 OPRCs implemented or under preparation (10000 km)
  – 2013, Tamil Nadu, WB, 5-year PBCs with a total of 640 km

• **Sri Lanka**
  – 2009, eight 1-year routine maintenance PBCs
  – 2010, two 2-year routine maintenance PBCs

• **Vietnam**
  – 2009, WB, one 3-year PBC, 300 km of national highway
Selected Asian Countries (3)

• China
  – 2009, ADB, 4-year simple PBCs on 1300 km of rural roads with local community groups (Yunnan Province)

• Indonesia
  – 2010, two 3-year PBCs, 21 and 11 km, basically rehabilitation contracts
Small and Micro-Enterprises (SME) in Latin America

<table>
<thead>
<tr>
<th>Road Management Enterprise (200 km)</th>
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<tbody>
<tr>
<td>Cooperative ME 40 km</td>
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<td>Cooperative ME 35km</td>
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<td>Cooperative ME 45 km</td>
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<td>Cooperative ME 50 km</td>
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<td>Cooperative ME 20 km</td>
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<tr>
<th>Supervision Engineer (200 km)</th>
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<tr>
<td>Single owner ME</td>
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<th>Supervision Engineer</th>
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<tbody>
<tr>
<td>Small Road Maintenance Enterprises (150 - 300 km)</td>
</tr>
<tr>
<td>Contracts include more sophisticated equipment and supply of materials</td>
</tr>
</tbody>
</table>
Municipality of Popayan, Colombia

- 15 micro-enterprises (173 persons)
  - 9 urban and 6 rural
  - 1 nursery (22 women)
- 580 km with 300 km in urban areas
- Cost: US$ 1034 per km and year (2001)
- 6 supervisory/management firms
- Cost: US$ 600 per km and year (2001)
- Extensive training program
Colombia
SME in Latin America

- Cover unpaved as well as paved roads
- Contract duration between 1 and 4 years
- Simple performance levels
- Simple payment reduction scheme
- Monthly inspections
- Monthly payments
- Training programme by road agency and supervisory enterprise
South Africa (1)

- SANRAL is responsible for about 16000 km of national roads out of which 1374 are concessioned to the private sector
- Traditionally SANRAL used ad-measured-based routine road maintenance (RRM) contracts
- Development of sustainable small, medium and microenterprises along its network
• The main contractor operates as management contractor, while 80% or more of the work is executed by small contractors (Historically Disadvantaged Enterprises and SMMEs) with at least 90% of work going to Black Enterprises from local areas
  – Ownership of roads close to their homes
  – Empowerment opportunities through new skills
• Main contractor bears responsibility of **training and mentoring of subcontractors**
  – In 2007 > 12600 people received training by SANRAL

• RRM s are hybrid type contracts, cover 200 km with a duration of 3 + 2 years on national roads and 5 + 3 years on SANRAL toll roads

• Performance based items are
  – Vegetation control
  – Cleaning of culverts, drains, channels, and waterways
  – Road sign cleaning
Still high risk aversion of contractors results in excessively high cost of pavement repairs
  – Payment repairs are paid on unit prices but need to be finished within defined time limits

Gradually SANRAL intends to introduce more performance based items when contractors will be able to better cost their perceived risks

Project Management Team comprises of a representative of (Contractor, SANRAL, Local community) meets regularly
• Design and supervision of RRM is contracted to **private sector**
• RRM contracts ensure that the entire network has contractors responsible for the upkeep, maintenance and emergency assistance all year round
Lessons Learned (1)

• Implementation experiences are highly positive in developed countries and mainly positive in developing countries with few teething problems.

• Progress depends on the attitude of the road administration, the ability of consultants and contractors to implement PBMC as well as the political backing of PBMC.

• Substantial cost reductions have been realized with few exceptions.

• Road conditions have improved.
Lessons Learned (2)

• PBMC have attributed to a stable and sufficient flow of funds for road maintenance.
• Pilot projects are the best way to implement performance contracts.
• Performance Contracts have to be tailored to each specific situation.
• A gradual approach slowly increasing the duration and complexity of the PMBC have produced the best results in terms of sustainability.
• Preferably roads should be in “maintainable” conditions.
Specific Lessons Learned (3)

• The history of the road condition and interventions as well as the road condition survey is essential to be able to predict future pavement deterioration

• Qualification of contractors and supervisory staff of the client is key to success

• For long-term contracts road agencies and contractors need to operate an asset management system

• Risks shall be assigned to the party that can best bear and manage the risk
Specific Lessons Learned (4)

- Project preparations requires consultants which have experiences in implementing PBMCs in similar environments
  - Mix of unit price items and performance items
  - Monitoring system
  - Penalty system
- Training and coaching of client and contractors during the initial implementation phase helps to adjust to the new contracting system
- Once a road under PMBC shall ALWAYS continue to be maintained under PMBC!
Implementation of PBMC in Nepal
Problems with Implementing PBMC in Nepal

Note: Most of the problems and solutions have been identified in the Study „Review of Performance Based Maintenance Contracts“ of the World Bank, November 2015 by Greenwood and Joshi
# PBMC in Nepal

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<tbody>
<tr>
<td>2.</td>
<td>Pathlaiya-Fuljore</td>
<td>74 Km ICB</td>
<td>Hetauda</td>
<td>75.15 With 37% discount</td>
<td>April 2005 – April 2010</td>
<td>Kalika-Sapana-Himdung JV</td>
<td>Satisfactory</td>
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<tr>
<td>3.</td>
<td>Fuljore-Chaurhwa</td>
<td>75 Km ICB</td>
<td>Lahan Dhanusha</td>
<td>75.65 With 40% discount</td>
<td>April 2005 – April 2010</td>
<td>SwachhandaNirmanSewa</td>
<td>Satisfactory</td>
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<td>4.</td>
<td>Narayani Bridge-Hetauda</td>
<td>77 Km ICB</td>
<td>Hetauda</td>
<td>175.68</td>
<td>23 April, 2007-22 April, 2012</td>
<td>CTCE-Kalika JV</td>
<td>Satisfactory</td>
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<td>5.</td>
<td>Kohlpur-Chisapani</td>
<td>56 Km LCB</td>
<td>Nepalgunj</td>
<td>53.95</td>
<td>24 October, 2005-23 October, 2010</td>
<td>MK-ANK JV</td>
<td>PMBC concept not well understood. [note 1]</td>
</tr>
<tr>
<td>6-8</td>
<td>Chisapani-Gaddachowki</td>
<td>52 Km LCB</td>
<td>Mahendranagar</td>
<td>53.44</td>
<td>24 October, 2005-23 October, 2010</td>
<td>MK-ANK JV</td>
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<tr>
<td></td>
<td></td>
<td>50 Km LCB</td>
<td></td>
<td>55.9</td>
<td>18 September, 2005-17 September, 2010</td>
<td>Lumbini-Chandra &amp;Basanta JV Arniko/Hiranchan Mahadev - JV</td>
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<td></td>
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<td>46.48 Km LCB</td>
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<td>56.48</td>
<td>18 September, 2005-17 September, 2010</td>
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PBMC in Nepal

<table>
<thead>
<tr>
<th>Development Partner</th>
<th>Location</th>
<th>Start Date</th>
<th>Duration (years)</th>
<th>Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 World Bank</td>
<td>Narayani bridge-Butwal</td>
<td>May 2003</td>
<td>3</td>
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<tr>
<td>2 World Bank</td>
<td>Pathalaiya-Fuljore</td>
<td>April 2005</td>
<td>5</td>
<td>74</td>
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<tr>
<td>3 World Bank</td>
<td>Hetauda and Fuljore-Chaurahawa</td>
<td>April 2005</td>
<td>5</td>
<td>75</td>
</tr>
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<td>4 ADB</td>
<td>Kohalpur-Gadden Chauki</td>
<td>Oct. 2005</td>
<td>5</td>
<td>56</td>
</tr>
<tr>
<td>5 ADB</td>
<td></td>
<td>Oct. 2005</td>
<td>5</td>
<td>52</td>
</tr>
<tr>
<td>6 ADB</td>
<td></td>
<td>Oct. 2005</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>7 ADB</td>
<td></td>
<td>Oct. 2005</td>
<td>5</td>
<td>47</td>
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<tr>
<td>8 ADB</td>
<td>Hetauda-Narayani</td>
<td>April 2007</td>
<td>5</td>
<td>77</td>
</tr>
</tbody>
</table>
Key Findings (1)

- There was no long term policy or strategy for the implementation of PBMC within DoR. Associated with this there was no support structure to develop PBMC. By contrast the SMD implementation in the early 1990s was associated with a team of ‘champions’ who supported implementation;
- The PBMC pilot trials had a complex set of performance measures that were hard to monitor in the field and were subsequently open to challenge. Additionally the performance measures did not cover the full range of activities the contractor was to undertake – for instance routine inspection, data management and reporting activities;
• The use of an input based Bill of Quantities meant that the risk for inputs had remained with DoR. Where the works specified couldn’t deliver the outcomes desired under the performance measures, this opened areas for dispute with up to a tenfold increase in works required;

• Enforcement of the contracts was not strong, and with DoR directly supervising these contracts there was not the normal separation of client-contractor-consultant that exists for other major projects
Key Findings (3)

• **Low bidding** with regard to the maintenance phase of the projects existed, which meant that there was little incentive for the contractor to retain an interest in the project. Additionally the resulting penalties were too small (or not sufficiently enforced) to drive the right outcomes;

• **Risk transfer** was not reasonable, especially with regard to overloaded vehicles – wherein the contractors were left to take all the risk, despite the fact that the ability to control overloading was not at all within their jurisdiction
### Key Findings (4)

#### Table 9. Cost efficiency analysis.

<table>
<thead>
<tr>
<th>Name of road</th>
<th>Length (Km)</th>
<th>Maintenance cost for five years</th>
<th>SMD practice</th>
<th>PBM</th>
<th>Cost saving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total cost (NRs)</td>
<td>Discounted cost (NRs)</td>
<td>Cost/Km</td>
<td>Total cost (NRs)</td>
</tr>
<tr>
<td>Chaurahawa-Phuljor</td>
<td>75</td>
<td>24,742,995</td>
<td>14,845,797.00</td>
<td>197,943.96</td>
<td>1,464,709.09</td>
</tr>
<tr>
<td>Phuljor-Pathalaiya</td>
<td>75</td>
<td>23,191,828</td>
<td>13,915,096.80</td>
<td>185,534.62</td>
<td>13,723,977.27</td>
</tr>
<tr>
<td>Kohalpur-Bhurigaon</td>
<td>56</td>
<td>15,160,909</td>
<td>9,096,545.40</td>
<td>162,438.31</td>
<td>2,938,000.00</td>
</tr>
<tr>
<td>Bhurigaon-Lamki</td>
<td>52</td>
<td>15,481,114</td>
<td>9,288,668.40</td>
<td>178,628.24</td>
<td>2,777,400.00</td>
</tr>
<tr>
<td>Lamki-Attariya</td>
<td>50</td>
<td>14,849,506</td>
<td>8,909,703.60</td>
<td>178,194.07</td>
<td>3,062,500.00</td>
</tr>
<tr>
<td>Attariya-Gaddachowki</td>
<td>46.48</td>
<td>12,989,031</td>
<td>7,793,418.60</td>
<td>167,672.52</td>
<td>3,688,500.00</td>
</tr>
</tbody>
</table>

Key Findings (5)

Roughness (IRI)

Optimizing Maintenance Interventions with PBMCs Based on Present Official Prices (IRR of 12%)

**Current situation:**
- periodic maintenance deferred
- poor quality pavement
- high long-term total transport costs

**PBC:**
- timely interventions
- good quality pavement
- low long-term total transport costs

Source: ADB Report by Tim Yates, Study for Kazakhstan
Cost Pattern of Past PBMC

• It was concluded that contractors had not performed well in any of the six components for analysing their performance. Likewise, it was found that road agency was weak in administrating the contracts. There was no improvement in the service quality of the road in term of road roughness of the road after the implementation of Performance Based Maintenance and Management Contract. Cost distribution patterns of the project road show that improvement works occupy the bigger proportion of the contract amount and that maintenance works constitute lesser proportion of contract amount.
Recommendations (1)

- The present contract modality of schedule of rate contract breaking into various improvements, emergencies and maintenances was not realistic instead. The contract should be made into lump sum output based contract like Design Build with more risk to the contractor. The more recent OPRC contract can be a good option.

- Proper discussion with time frame among all of the stakeholders to modify and develop the PBMC document compatible with Nepali Environment and its implementation. Service quality indicators, inspection format, penalty reduction provision specified in PBM contracts are not quite compatible to Nepali Environment and so it needs modification.
Recommendations (2)

• Role of the consultant should be sought for execution of the Performance Based Maintenance Contract.

• Proper capacity development in the form of extensive training among all stakeholders including contractor. Institutional strengthening component can be added in the PBM contracts. Separate PBM unit under Maintenance Branch of Department of Road can be established which will regularly monitor the PBM contracts.
Outline Strategy (WB Study)

- Enforcement of all DoR contracts (SMD and OPRC) including the use of Open Contracting methodologies to engage the public and other bodies in the supervision and delivery of contracted works;
- Controlling/reducing of overloading on the network, to reduce the risks that are being transferred to contractors;
- Develop a detailed implementation schedule (5-10 years) for OPRC across the entire DoR network of assets;
- Development a Master Bidding Document for DoR based on the World Bank Sample OPRC Bidding Document, and
- Develop and implement a comprehensive capacity development programme. This is to cover the period before, during and after OPRC contracts are let.
Proposed Project (1)

- Rehabilitation and upgrade to 4 lanes with median and shoulders of about 160 km of roads between Narayanghat and Butwal in two packages (about USD 108 mil for 65 km and USD 72.5 mil for 48.5 km) now (USD 135 mil and USD 104 mil)
- Improve road safety and maintenance
- Phase 1: Rehabilitation and upgrade for 3.5 years (+ 1 year warranty period)
- Phase 2: Performance based maintenance for 4 years (USD 7500 /year and km)
- International consultancy services to support the civil works
- Equipment to enhance road safety by establishing road accident emergency response system
- *(Coaching and training of contractors during the PBM phase, not included until now)*
Proposed Project (2)

- Monitoring / Supervision by DoR
- PBM expert (16 PM) will be engaged during phase 2
  - Act as team leader (advisor?)
  - Monitor progress and compliance with Specifications
  - Supervision of works and services
  - Review/approve Contractor’s Work Program, maintenance methodologies, key personnel
  - Verify completed works
  - Certify Interim Payment Certificates
  - Knowledge transfer to DoR
  - Reviewing and finalizing the PBM Manual
  - Preparing templates for monitoring maintenance works
Proposed Project (3)

- PBM expert (4PM) will be engaged through ADB's ongoing TA to (i) design and agree with DOR a framework for PBM contracts, including the selection of roads, and assist in institutionalizing the new method within DOR; (ii) develop performance-based maintenance guideline, manual, contracts, performance monitoring system and modern road asset management system; and (iii) provide training to DOR staff and conduct a study tour to learn state-of-the-art PBM system.
Proposed Project (4)

- International Bidding
- Pre-bid site visit and workshop (including PBM?)
- Evaluation of bids (importance PBM?)
- PBM represents only 2% of estimated contract amount!
Proposed Project (5)

- **Performance Guarantees**
  - (10%) of total contract amount
  - Reduced by 30% after DNP and reduced further in 4 equal parts each year to 0 end of contract

- **Retention Money**
  - Max 5% of contract amount
  - 75% repaid after DNP and reduced further in 4 equal parts each year to 0 end of contract

- *Needs revision, since this will not guarantee that contractor will performe until end of contract*

- *Even if he complete the contract, there is no money left for outstanding issues*
Mitigation of Past Problems with new PBM (1)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>No long-term policy and strategy</td>
<td>Project might help to develop one (TA)</td>
</tr>
<tr>
<td>Design lacking – poor pavement structure and unpredictable behavior</td>
<td>New construction</td>
</tr>
<tr>
<td>Complex performance indicators and monitoring</td>
<td>Will be addressed</td>
</tr>
<tr>
<td>Lack of supervision</td>
<td>Supervision for civil works will be done by international consultant.</td>
</tr>
<tr>
<td></td>
<td>Monitoring / supervision during PBM will be done by DoR with assistance of a PBM expert</td>
</tr>
</tbody>
</table>
## Mitigation of Past Problems with new PBM (2)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusing specifications</td>
<td>Needs to be addressed</td>
</tr>
<tr>
<td>PBM support and guidance</td>
<td>PBM expert to prepare PBM manual, etc.</td>
</tr>
<tr>
<td></td>
<td>PBM expert to support DoR</td>
</tr>
<tr>
<td>Delay in budget release</td>
<td>Cannot be influenced by project design except for interest payments to be paid by client</td>
</tr>
<tr>
<td>Contractors claimed that government DoR and agencies did not accept</td>
<td>Cannot be influenced by project design</td>
</tr>
<tr>
<td>adjudication and arbitration decisions</td>
<td></td>
</tr>
<tr>
<td>PROBLEM</td>
<td>MITIGATION</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Low bidding</td>
<td>Needs to be addressed through adequate penal actions or minimum required amount</td>
</tr>
<tr>
<td>Front loading</td>
<td>Cannot be avoided</td>
</tr>
<tr>
<td>Breakdown of vehicles on the road</td>
<td>Daily safety patrol (not yet included)</td>
</tr>
<tr>
<td>Overloading</td>
<td>Contractor to be obliged to hinder overloaded vehicles to proceed. Clause was included in previous contract and seems unrealistic.</td>
</tr>
</tbody>
</table>
Required Framework

- **Political**
  - Stability of Government
- **Legal**
  - Multi-year contracting
  - Road maintenance rules, norms and regulations
- **Financial**
  - Multi-year financing
  - Dedicated and sufficient funds
- **Institutional**
  - Separation of client and contractor
  - Competition between well qualified contractors
  - Effective control of overloading
Main Recommendations

• General
  – Continue with the institutional reform
    • Creation of Road Agency
    • Contract ALL road maintenance
    • Enforce axle load controls
  – Improve financing of periodic road maintenance

• PBM
  – Implement gradual approach to PBM
  – Improve supervision and enforcement
  – Implement selective PBM in connection with total rehabilitation and improvements
  – Improve rules and regulations for maintenance
  – Introduce an Asset Management System
  – Institutionalize PBM in DoR
  – Develop long-term strategy for implementation of PBM
  – Institutionalize training in PBM
Other Ongoing Programmes

– Technical support by the Millennium Challenge Corporation in the transport sector with concentration on the road sector.

– Technical assistance by DIFID extended to the Roads Board of Nepal for instructional strengthening
The Sustainable Implementation of Performance Based Road Maintenance Contracts in Nepal is not a Question of YES or No; it is a question of WHEN and HOW.

But without proper control and enforcement of service levels, PBMCs or OPRCs will not produce the expected benefits.
“Roads are like babies: It’s often easier to produce them ....... than to maintain them”
„It is not the wealth that has created our roads, it is the roads that have created our wealth“. J.F. Kennedy

And I like to add:

„and even more so, if we maintain them effectively and efficiently“
Thank you for your attention