PAVEMENT PRESERVATION AND ROAD ASSET MANAGEMENT SYSTEM
BACKGROUND

- Phased development of Roads in India
- Pavements in terminal condition stage
- Road pavements – nations highway assets
- Tremendous challenge in preserving & enhancing pavements assets
- Value of timely preventive maintenance
- Benefits and cost effectiveness of preventive maintenance of pavements
Pavement Preservation in Asset Management

- A program of activities aimed at preserving investment in the nation’s highway system, enhancing the pavement performance, extending pavement life, & meeting customers’ needs
- Excludes capacity improvements and new or reconstruction of pavements
- Change in philosophy from reactive to proactive maintenance
- Applying the right treatment to the right road at the right time
Asset Management

- Move to Asset Management
  - A systematic / strategic process of maintaining, upgrading and operating physical assets cost-effectively

- Highway Asset Management
  - Insight
  - Asset Management Planning
  - Benefits of Asset Planning
Asset Management Planning

CUSTOMER EXPECTATION
- Level of service
- Cost

LEGISLATIVE REQUIREMENTS
- Financial
- Environmental

ORGANISATIONAL VISION/MISSION

STRATEGIC PLANNING PROCESS

ASSET MANAGEMENT PROCESS

EXISTING ASSETS

NEW ASSETS

SURPLUS ASSETS

NON ASSET SOLUTIONS
- Failure management
- Insurance
- Demand management

MAINTAIN/RENEW/UPGRADE ASSETS

CREATE ASSETS

ASSET DISPOSAL

IMPROVED PERFORMANCE

Strategic planning

Tactical planning

Operational planning
Flexible Pavement Preservation Concept and Techniques

- Proactive approach of preventive maintenance
- Preventive maintenance to pavements in good condition
- Reduce the rate of deterioration
- Cost effective way of pavement maintenance
Implementing the Pavement-Preservation

- Dedicated funding
- Universal – Regionally dependent
• **Performance Based Prediction Models**
  - deflection,
  - riding quality - unevenness / roughness
  - distress modes - crack area (%) and rut depth (mm)

• **Influencing parameters such as**
  - traffic intensity and loading - cumulative standard axles
  - pavement age (years) since last renewal / strengthening
Structural Performance of Flexible Pavements

![Graph showing deflection over age/time](image-url)
Rutting Life Criteria – Allowable traffic

Allowable Traffic (millions)

Initial Deflection (mm)

RDc = 10mm
RDc = 12mm
RDc = 15mm
Cracking Life Criteria – Allowable traffic

![Graph showing the relationship between initial deflection and allowable traffic for different cracking criteria (Cc = 2.5%, Cc = 5.0%, Cc = 7.5%, Cc = 10%). The x-axis represents initial deflection (mm), and the y-axis represents allowable traffic (millions).]
Functional Performance of Flexible Pavements

![Graph showing the relationship between Riding Comfort Index (RCI) and Unevenness (mm/km). The graph illustrates a downward trend, indicating that as unevenness increases, the riding comfort index decreases.]
Graph showing the unevenness (m/m/km) over age/time (years) for different iDEF values: 0.5mm, 0.6mm, 0.75mm, 0.85mm, 0.9mm, 1.0mm, and 1.15mm.
### Definition of Flexible Pavement Condition Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Sound</td>
</tr>
<tr>
<td>2</td>
<td>Some deterioration</td>
</tr>
<tr>
<td>3</td>
<td>Moderate deterioration</td>
</tr>
<tr>
<td>4</td>
<td>Severe Deterioration</td>
</tr>
<tr>
<td>5</td>
<td>Failed</td>
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</table>
# Flexibles Pavement Performance Standards

<table>
<thead>
<tr>
<th>Category</th>
<th>Threshold Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Rut Depth (mm)</td>
<td>9</td>
</tr>
<tr>
<td>Cracking (% Area)</td>
<td>2.0</td>
</tr>
<tr>
<td>Riding Comfort Index (5 – 0)</td>
<td>4</td>
</tr>
<tr>
<td>Unevenness, mm/km (IRI)</td>
<td>2100 (2.89)</td>
</tr>
</tbody>
</table>
PAVEMENT PRESERVATION – ASSET MANAGEMENT FOR INDIA

- Pavement Preservation - Asset Management (PPAM)
  - Commitment of maintenance agency
  - Customer focused comprehensive training
  - Dedicated Funding
Pavement Preservation Program – Needed Approach

- Determination of Needs
- Framework for Treatment Selection
- Develop Analysis Procedures
- Feedback to Determine Effectiveness
- Research Studies
Available Tools for Development of PPAM

- Pavement performance / condition data collection
- Pavement performance / deterioration prediction models
- Pavement performance in terms of structural and functional condition
- Performance standards and maintenance trigger values
- Methodology to estimate remaining service life of pavements
- Prioritization methodology for maintenance
- Life cycle cost analysis
Crack area envelops with RCI
Rut depth envelopes with RCI

![Graph showing Rut depth envelopes with RCI](image-url)
Functional Life Criteria
The initial condition characteristics of pavement and traffic details are:
- Initial deflection (iDEF) = 0.6mm
- Initial Unevenness (iUI) = 1200 – 1300mm
- Pavement surface: Bituminous Concrete (Asphalt Concrete)
- Traffic (A) = 3000 cvpd
- Traffic growth factor = 0.075
- Vehicle Damage Factor (VDF) = 4
- Transverse Distribution Factor (TDF) = 0.2
Variation of RCI with the Ageing of Pavement
Performance based Pavement Preservation

![Graph showing Performance based Pavement Preservation](image)
Resulted Benefits

- **Better riding quality**: RCI of 3.5 against 2.0, thus better serviceability

- **Extended service life**: 8 msa (> 5 years) at 2.0 RCI for comparison at 40 msa

- **Savings in Total costs**: about 70 million Rs. Per two lane km, due to the preventive maintenance adopted in this case
DISCUSSIONS

- Highway pavement performance database and over ten-year-long experience in the deflection, rut depth, crack area, unevenness and other surface distress measurements

- Pavements with lower value of initial deflection - for longer life periods

- Functional condition deterioration - functional performance and life of in-service flexible pavements to establish the timing for maintenance so as to improve the riding quality of flexible pavements

- Pavement preventive maintenance is just one of pavement preservation concepts
Preventive maintenance programs emphasize cost effective treatments and understanding the life cycle cost implications of different strategies.

The treatment performance is greatly affected by the condition of the pavement when treatment is applied.

The benefits of preventive maintenance better known and accepted.

To study the successful countries experience and to share with other agencies.

A comprehensive training program in the area of pavement preservation policy, programming, and techniques is needed.
CONCLUSIONS

• Models to predict the pavement performance of the overlaid pavements developed

• Deflection life relationship is capable of predicting at any time, the life expectancy of pavement

• Deflection has significant effect on IRI growth

• Critical condition envelopes for structural condition - to estimate the timing for major strengthening / rehabilitation
- Functional condition envelops - to estimate the optimum timing for resurfacing/maintenance and vehicle operation costs

- Pavement Performance Standards

<table>
<thead>
<tr>
<th>Condition</th>
<th>RCI values</th>
<th>UI Range mm/km (IRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound</td>
<td>3</td>
<td>3000 – 4000 (4-5)</td>
</tr>
<tr>
<td>Critical</td>
<td>2.5</td>
<td>4000 – 5000 (5-6)</td>
</tr>
<tr>
<td>Failed</td>
<td>2.0</td>
<td>6000 – 6500 (7-8)</td>
</tr>
</tbody>
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- Pavement preservation by preventive maintenance treatments - restore pavement surface and extend its service life by 5 to 7 years - delay the need for the more costly pavement rehabilitation, allowing additional rehabilitation projects to be funded
• Proper implementation of a pavement-preservation program - other issues must be addressed

• The success of a pavement preservation program is based on selecting the right treatment for the right pavement at the right time

• Performance-related specifications and associated performance-level warrantees, the contractors may be required to guarantee the performance of a pavement for a specified service life

• To ensure this level of performance, the contractor will be responsible for performing maintenance or preservation activities on an elective basis.
Thank You All