

Road Maintenance Strategy in India

by

Rahul Gupta

Superintending Engineer (Expressway Coordination)

**Ministry of Road Transport & Highways
Government of India
[4th September 2013]**

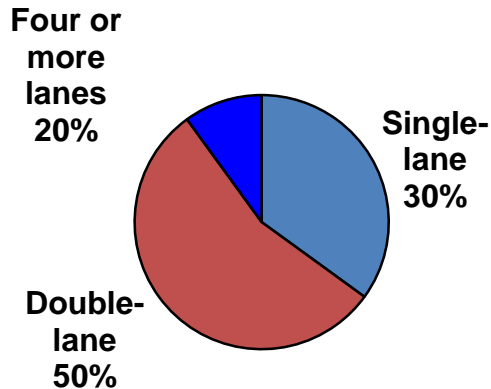
India's Road Network

| | (km) |
|--------------------------------------|------------------|
| National Highways | 82,803 |
| Expressways | 200 |
| State Highways | 156,181 |
| Other Roads (MDR,ODR &VR) | 4,455,510 |
| Total | 4,694,694 |

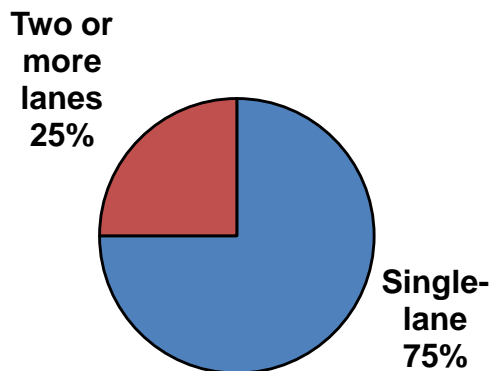
- Second largest road network in World, density 0.66 km per sq km of land;
- National Highways constitute only 1.7% of length, but carry 40% of the traffic on Indian Roads.

Present Status of Roads

Status of National Highways



Status of State Highways



Modal shift

- ≡ Composition of road traffic is currently 65% of total freight & 90% of total passenger traffic (as against 12% of total freight & 31.6% of total passenger traffic in the 1950s);
- ≡ The Compounded Annual Growth Rate (CAGR) of traffic on the roads during last two decades is at the rate of 9% per annum.

Issues

- ≡ Road maintenance throughout the network is low, leading to poor quality of roads;
- ≡ About 35% of the villages are not connected by all-weather roads.

Institutional Framework

- Indian Constitution assigns responsibility for the National Highway network to the Central Government, while State Governments are responsible for developing and maintaining State Highways, Major Districts Roads, Other Districts Roads and Village Roads;
- At the central level, responsibility for the National Highway system is of Ministry of Road Transport and Highways;
- At the State level, highways are developed and maintained by State Public Works Departments (PWDs), while rural roads are taken care of either by PWDs or by Local Government engineering departments.

Ministry of Road Transport & Highways

- **Responsible for Planning, Development and Maintenance of National Highways in the Country;**
- **Extends Technical and Financial support to State Governments for the development of State Roads and the roads of inter-state connectivity and economic importance;**
- **Evolves standards & specifications for roads and bridges in the country;**
- **Serves as a repository of technical knowledge on roads and bridges.**

National Highways Development Program

- National Highways Development Program (NHDP) is world's largest road development program;
- Comprises of seven phases for development of more than 55,000 km of NHs;
- Under NHDP,
 - Completed Length :21,042 km
 - Presently Under Implementation :19,365 km
 - Balance for award :15,956 km
- Other than NHDP, Government is also implementing major road development programs in North East (SARDP-NE) for 6418 km and in Left Wing Extremism (LWE) affected areas for 5477 km;
- National Highways are also being developed with loan assistance of JICA (220 km) and World Bank (1125 km).



**A NATIONAL HIGHWAY
DEVELOPED UNDER NHDP**

Rural Roads Development Programme -Pradhan Mantri Gram Sadak Yojana (PMGSY)-

- **Fully funded by Central Government, supplementing efforts of State Government in construction and maintenance rural road network;**
- **Primary objective to provide connectivity to all the eligible unconnected habitations of more than 500 persons in the rural areas (250 persons in the hilly and desert areas) by good quality all-weather roads;**
- **Action Plan for construction of 350,000 km of roads;**
- **Focuses on qualitative construction through a three tier process-**
 - **Technical assessment by local Divisional Engineers;**
 - **Quality approval by State and National Quality control wings;**
 - **5 years maintenance of completed roads mandatory under the work agreement.**

Maintenance Objectives

- **The basic objective of maintenance strategy is to maintain and operate the road system in such a manner that:**
 - **Comfort, convenience and safety is assured;**
 - **The investment in roads, bridges and appurtenances is preserved;**
 - **The aesthetics and compatibility of the highway system with the environment is achieved; and**
 - **The necessary expenditure of resources is accomplished with continuing emphasis on economic development.**

Maintenance Operations and Activities

- **Road maintenance operations are classified as under:**
 - **Ordinary Repairs (Routine Maintenance);**
 - **Periodical Renewals (Periodic Maintenance);**
 - **Flood damage repairs / Special repairs ;**
- **These categories are compatible with conventional international practice of dividing maintenance operations into Routine, Periodic and Emergency activities.**

1. Ordinary Repairs

- For preserving roads as assets and to reduce the incidence of emergencies requiring special repairs.
- It includes pothole & patch repairs, crack sealing, roadside drainage, repairing of shoulders, clearing and repairing of culvert drainage structures, replacement of damaged retro-reflective signs, removal of litter, debris & dead animals, and erosion control;
- In Urban areas additional attendance needed for medians, footpath, street lights, fly-overs & subways, railings & removal of encroachment etc;
- In Hill Areas it also include maintenance of breast / retaining walls, removal of slips & snow clearances;
- Bridges require attendance to bearings, joints, wearing coat, railings, minor repairs to sub-structure & super-structure and clearance of weed in river channel.

2. Periodic Renewal

- It significantly extends service life by correcting functional deficiencies and improve riding quality;
- Resealing / Thin Overlays at a predetermined frequency are generally undertaken to safeguard crust in response to measured deterioration in road conditions;
- These operations tend to be large scale, requiring specialized equipment and skilled personnel. These activities are costly and planned well in advance.

3. Flood Damage Repairs & Special Repairs

- **Activities to mitigate sudden and unforeseen damage requiring immediate attention, such as flood damage, major landslides or /and damage to structures.**
- **Cannot be estimated based on the annual maintenance needs and no advanced planning for specific cases can be made. However, it is necessary to reserve a certain proportion of the overall maintenance funds for emergency cases;**
- **Activities include :**
 - **Repair and rehabilitation of failed drainage structures;**
 - **Repair and restoration after landslides and slips;**
 - **Repair and restoration after washouts.**

Strategy for Road Maintenance

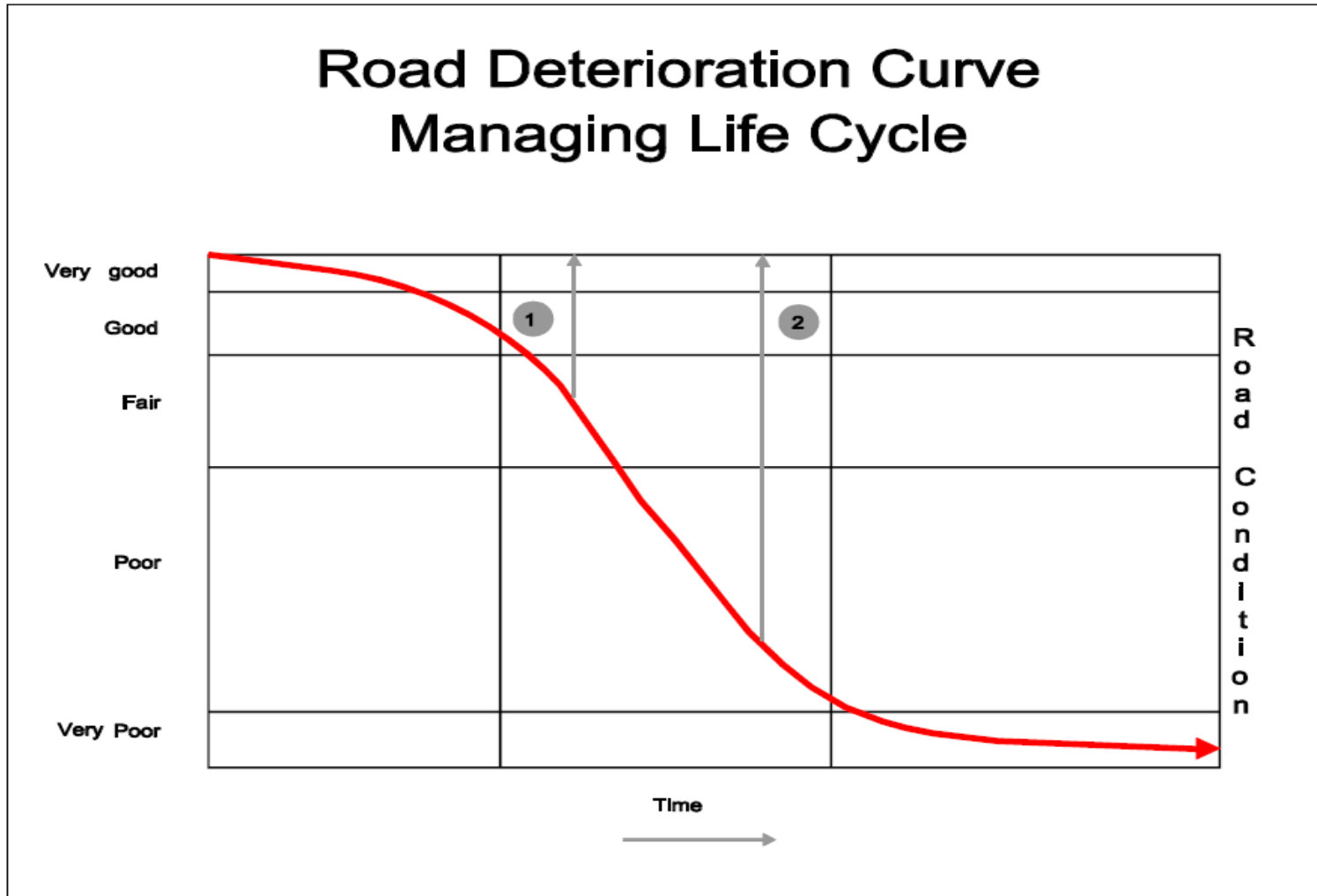
- **Balancing of routine maintenance activities along with a regular program of periodic maintenance and prompt response to emergencies makes an effective maintenance program;**
- **The norms of maintenance of roads along with GIS (Geographical Information System) for collecting and collating road inventory data through GPS (Geographical Positioning System) integrated with non-destructive technology based instruments are being evolved for timely intervention of maintenance activities;**

Strategy for Road Maintenance

(contd...)

- At each level the same agency is responsible for development as well as maintenances of its “own” network;
- Traditionally Maintenance work executed by Road Agencies (Labour Intensive Operations);
- To improve efficiency, several Road Administrations have started to contract out more and more of road Maintenance Activities to Private Sector;

Road Deterioration Curve Managing Life Cycle



Maintenance Levels: Serviceability Indicators

| S. No. | Serviceability Indicator | Level 1 (Good) | Level 2 (Average) | Level 3 (Acceptable) |
|--------|---|---|--|--|
| 1. | Roughness by bump integrator (Max. Permissible) | 2000 mm/km | 3000 mm/km | 4000 mm/km |
| 2. | Potholes/km (Max. Numbers) | Nil | 2-3 | 4-8 |
| 3. | Cracking and patch repairs (Max. Permissible) | 5 per cent | 10 per cent | 10-15 per cent |
| 4. | Rutting (20mm) (Max. Permissible) | 1.0 per cent | 1.5 per cent | 2.5 per cent |
| 5. | Skid resistance (Skid number by ASTM-274) Minimum Desirable | 50 SN | 40 SN | 35 SN |
| 6. | Defective bridge deck are and bump at approach (Max. Permissible) | Nil | 10 per cent | 10 per cent |
| 7. | User Information | All road signs, km stones and road marking in good condition | Only major road signs, km stones, some road markings in good condition | Signs only for major destinations and km stones in fair condition |

HISTORICALLY FAILING LOCATIONS IMPROVED

Before

After



Historically failing location with drainage problem in rolling terrain

Improved under Maintenance Works

ROUGHNESS VALUES SIGNIFICANTLY REDUCED

Before



After



Roughness Values were in the range of 1930 to 6570

Roughness Values brought down to 1340 to 3960 range after 1st year of Renewal

Sign Maintenance & Safety aspects improved

Before



Blind Curve in the rolling terrain causing accidents

After



Night photograph showing the signage's Lane Markings & Raised Pavement Markers

Impact of Poor Maintenance

- Road User Cost Study (RUCS) in India has brought out some eye-opening conclusions about the economic losses on account of the poor maintenance of roads -
 - the fuel consumption for a truck increases by 26 percent when roughness of the road surface increase from 3000 (asphalted surface) to 15000 (gravel surface) mm per km;
 - The fuel consumption can increase as high as 56 percent, if speed of a truck fall from about 45 kmph to 20 kmph;
 - Improvement in Riding Quality will save 1/5th of fuel bill of the country, apart from substantial saving of accidents etc;
 - Total economic return on cost of road improvement would be as high as 50 - 60 percent in one year alone;

Impact of Poor Maintenance

(contd...)

- The annual total VOC is estimated to be around US\$ 20 billion;
- The World Bank studies have confirmed that the economical losses due to inadequate capacity, insufficient pavement thickness and poor riding quality is estimated to be of the order of US\$ 6 billion per annum. These losses are interim of fuel consumption and vehicle maintenance (US\$ 4 billion per annum);
- Adverse effect on user's health due to poor roads is beyond imagination and estimation;
- Such losses are adversely affecting the Nation's economy and human life, this need to be reduced.

Policy Initiatives

- **Public Private Partnership projects – in built mechanism for Operation & Maintenance up to 30 years;**
- **Central Government grant for State Road maintenance;**
- **Finance Commission stressing on Maintenance Management System;**
- **As regards Rural Roads, five year maintenance responsibility of same contractor who builds the road.**

OMT - New Policy Initiative (Operate Maintain & Transfer)

- **Presently, maintenance of public funded roads is through Annual Operation & Maintenance contracts and user fee collected through different agencies;**
- **As maintenance is critical for the service life of road infrastructure, a need was felt to tap private sector efficiencies in operation, fee-collection and maintenance of public funded roads;**
- **In OMT contracts, the concessionaire is given contract for 5 to 9 years with responsibilities for maintenance and tolling together.**

Reforms Needed in Maintenance of Road Assets

- Equal priority to Asset Preservation and Management vis-à-vis Asset Creation;
- Maintaining and periodically updating the database on inventory of roads, bridges and other structures including their condition as decision support system for prioritizing maintenance interventions, i.e. need for appropriate Maintenance Management System (MMS);
- Reorganize maintenance operations by replacing the manual activities with mechanized mobile units to improve the productivity of the existing labour force;

Strengthening Operational Capacity

- **Standardize Maintenance Contracts based on performance for ensuring safe and competitive delivery;**
- **Develop Cadre of O&M Contractors (This will benefit PPP Entrepreneurs also);**
- **Enhancing Accountability of Maintenance Providers (Road Agencies and PPP Concessionaires / Contractors);**
- **Technical expertise to evaluate the effectiveness of current standards and practices;**
- **Auditing: Technical and Financial;**
- **Skill Development: Regular basis.**

Promotion of Non-conventional Road Construction Materials

- Conservation of natural resources: materials viz. fly ash, iron and steel slag, marble dust from quarry, processed municipal wastes, plastic wastes, jute and geo-textiles used as replacement for the conventional materials wherever they are economical;
- In hilly regions and desert inter-locking pavement blocks helpful;
- Use of high quality materials for Maintenance, suitable to various environment and geo-climatic conditions to sustain the traffic demand;
- Advanced pavement materials viz. geo-synthetics, polymer modified bitumen, rubberized mastic asphalt, etc. useful for extending life of pavements;
- Introducing nano-technology materials can improve fluidity, strength and durability of the roads.

The Road Ahead

- **Introduction Intelligent Transport System (ITS) for improved riding experience, road safety and transport management.**
- **Adopting global best practices, India aiming for a road maintenance strategy that minimizes investment, maximizes cost efficiency, reduces losses for users and is energy efficient;**
- **Immense opportunities available for introducing the best and the cost effective techniques / technology.**

We maintain our health

**Let us maintain health of our roads also,
to serve our
people and the economy.**

**Let us not lose what we have
or
what we are creating.**

Thank You

Current Scenario

- **Funds Availability : 40-50 percent of requirements;**
- **Financial requirements: Not more than 30 percent of what we are losing;**
- **Routine Maintenance: Lacking;**
- **Periodic Maintenance: Attention varies from State to State; Satisfaction Level around 50%.**
- **Weak Planning, Scheduling and Monitoring of Maintenance Operations;**
- **Poor Enforcement of Axle Load Limits;**
- **Lack of Proper Governance Environment in Delivery of Maintenance.**