

Maintenance of Roads

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Road development helps tremendous improvement for socio-economic development as compared to rail or air transport. As per NHAI (National Highway Authority of India) India has about 34 lakh km road network out of which 200 Km Express Highways, 70,548 Km National Highways(NH), 1,31,899 Km State-Highways(SH), 4,67,763 Km Major District Roads(MDR), and rest is Rural and Other Roads. This is next only to USA, but the standards are quite poor. Earlier financial allocation were deficient even for maintenance let alone development. But in recent years due to growth of Indian economy the road development and maintenance are taken care as a programmed one by which in another decade, India would definitely have better developed and maintained road. Some of the maintenance aspects of roads are discussed in the following sections.

Types of pavements

Flexible Pavements : These pavements consists of different layers of granular materials of varying thickness and materials on top, depending on traffic volume.

Rigid Pavement: This type of pavement consists of a cement concrete pavement laid on a well prepared sub-base or base course.

Cement concrete or rigid pavements have much longer life than flexible pavements. Due to hard surface, they are fuel efficient, have good riding quality, have increased load carrying capacity and have very low maintenance cost compared to the flexible pavements.

Non-conventional road construction materials

There is need to produce and use high quality construction materials which are suitable to various environment and geoclimatic conditions to sustain the traffic demand. Non-conventional road construction materials such as fly ash, iron and steel slag, marble dust from quarry, processed municipal wastes, plastic wastes, jute and geo-textiles can be used as replacement for the conventional materials wherever they are economical. In hilly regions and desert a special pavement technique as inter-locking pavement blocks may be helpful. Advanced pavement materials such as geosynthetics, polymer modified bitumen, rubberized mastic asphalt, etc. are useful for extending life of pavements. Introducing nano technology materials can improve fluidity, strength and durability of the roads.

Pavement Performance

Several forms of structural distress are developed which ultimately result into functional failures. The most important to a road user is the functional condition

which determines the comfort, safety, user cost. Structural damage usually results increased functional deterioration. Present performance is very complex phenomenon due to the fact that large variations are observed on account of change in material characteristics, quality of construction, traffic volume and loadings, environment factors, maintenance inputs and so on. The distress in low volume flexible pavements are rutting, cracking, pothole and edge drops. The different alternatives for limiting cracking are base improvement, crack sealing and overlay.

Maintenance cost and Life cycle cost

The maintenance cost includes the maintenance of pavement during the design life of pavement to keep the pavement at the specified service level. A comparison of different costs are shown in Figure 1.

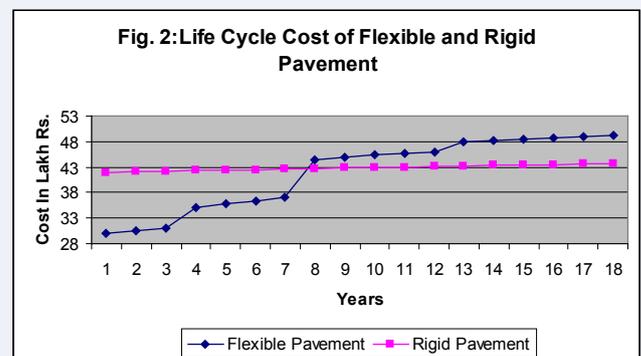
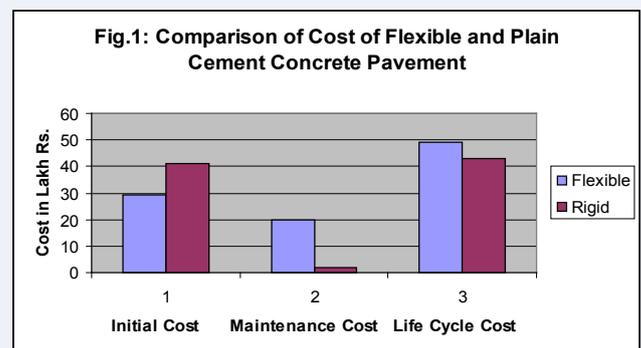


Figure 2 shows the comparison of life cycle costs of flexible and rigid pavements. The cost of maintenance of flexible pavement is much higher (more than 11 times) than the maintenance cost of rigid pavement. Figure 2 shows that the break even point is at 8th year from construction of the road i.e. after 8 years the life cycle cost of flexible pavement becomes higher than that for rigid pavement. As the design life of the pavements in general is more than 8 years, cement concrete pavements may prove to be economical.

Maintenance of State Roads

Majority of the road length under the state roads other

than national highways is single lane only. The funds available for maintaining the roads, in traffic worthy conditions, are not adequate and no tools are available for making the inputs in a scientific manner. A variety of vehicles are used for the transportation of goods. They range from animal drawn bullock-carts to the fast moving vehicles. The extent of overloading on 2-axle trucks is very high. Presently pavement maintenance of rural roads based on the judgment and experience. It is therefore desirable that there should be systematic PMS (Pavement Management System) based on the relevant data. Different maintenance and improvement alternatives can be used to upkeep the pavement life.

Maintenance objectives

The basic objective of maintenance is to maintain and operate the road system in such a manner that:

- Comfort, convenience and safety are assured;
- The investment in roads, bridges and appurtenances is preserved;
- The aesthetics and compatibility of the highway system with the environment are achieved, and
- The necessary expenditure of resources is accomplished with continuing emphasis on economy.

Maintenance Operations and Activities

Indian Road Congress (IRC) 2002 makes a distinction between preventive and corrective maintenance. Road maintenance operations are further classified as:

- Routine maintenance (described in IRC, 2002, as "ordinary repairs");
- Periodic maintenance (described in IRC, 2002, as "periodical renewals");
- Flood damage repairs / emergent repairs.

These categories are compatible with conventional international practice of dividing maintenance operations into Routine, Periodic and Emergency activities. IRC (2002) distinguishes between 46 routine and 33 periodic maintenance activities for gravel and bituminous roads. Some of the main activities under each type of maintenance are explained below.

Road users normally judge the quality of a road and maintenance effectiveness on the basis of the ride it offers and its appearance. The comfort with which users can travel and the speeds which can be achieved with safety are no doubt important aspects for maintenance.

However, for preserving roads as assets, there are other important activities such as clearing and repairing drainage structures and erosion control which would also reduce the incidence of emergencies requiring special repairs. The balancing of these routine maintenance activities along with a regular programme of periodic maintenance and prompt response to emergencies would make an effective maintenance programme as given below:

a) Routine ("Ordinary") (frequent)

Activities required to be carried out once or more per year on a road section. These activities are typically small scale or simple, but widely dispersed, and mainly require unskilled labour under skilful supervision. The need for these can, to a large degree, be estimated and planned and can often be carried out on a regular basis.

Activities include:

- i. Inspection
- ii. Keeping the roadway clear of debris
 - Cleaning / excavating ditches and drains
 - Cleaning culverts, inlets and outlets
 - Minor repairs on drainage structures (mainly culverts)
 - Reshaping, grading, dragging unpaved surfaces
 - Patching potholes (paved and unpaved surfaces)
 - Resealing minor cracked areas
 - Repairing traffic signs, road markings
 - Repairing erosion damage and its control measures
 - Controlling vegetation

iii. Reporting major damages to the road

b) Periodic (infrequent)

Activities required on a road section at intervals of a few years. They are normally large scale and require specialist equipment and skilled resources. These activities are costly but can be planned well in advance.

They include: (i) regravelling (ii) resealing (iii) resurfacing and (iv) major structural repairs

Emergency ("special repairs" or "flood damage repairs / emergent repairs")

These are activities that are required from time to time whenever sudden and unforeseen damage occurs, such as flood damage, major landslides or and damage to structures. Emergency activities cannot be estimated based on the annual maintenance needs assessment and no advanced planning for specific cases may be made. However, it is necessary to reserve a certain proportion of the overall maintenance funds for emergency cases.

Activities include :

- i. Repair and rehabilitation of failed drainage structures
- ii. Repair and restoration after landslides and slips
- iii. Repair and restoration after washouts

The above norms of maintenance of roads along with GIS(Geographical Information System) based pavement management systems are available, for collecting and collating road inventory data through GPS (Geographical Positioning System) integrated non-destructive technology based instruments, to achieve timely intervention of maintenance activities.