Macroscopic study of Failures in Flexible Pavement and their Possible Remedies.

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Abstract

Objective: during this research work, emphasis was made on the defects in flexible pavement and therefore the maintenance in flexible pavements. Within the past, many researchers have already studied the defects and problems of maintaining the flexible pavements everywhere the planet. Methods: Efforts are made to refer a number of the publications associated with this subject. Various defects in flexible pavements are identified since the existence of flexible pavement. Pavement structure are often destroyed during a single season thanks to water penetration. Findings: Defects in flexible pavements may be a problem of multiple dimensions, phenomenal growth of vehicle traffic (in terms of no. of axle loading of economic vehicles), the rapid expansion within the road network, non-availability of suitable technology, material, equipment, skilled labor and poor funds allocation have all added complexities to the matter flexible pavements. Maintenance is about of activities directed towards keeping a structure during a serviceable state during its design life. Maintenance of a road network involves a spread of operations, i.e., identification of deficiencies and planning, programming and scheduling for actual implementation within the field and monitoring. Application: The essential objective should be to stay the paved surface and appurtenances in fitness and to increase the lifetime of the road assets to its design life. Broadly, the activities include identification of defects and therefore the possible cause there off, determination of appropriate remedial measures; implement these within the field and monitoring of the results.

Keywords: Defects, Flexible Pavement, Maintenance, Road, Rutting, paved Roads.

1. Introduction A road network system is probably one among the foremost important necessities for the economic development of any country, particularly developing countries. Many of developing countries, therefore, invest huge amount on construction, while many developing countries appreciate the need for huge investment in capital development of roads. Only a couple of give due importance to the road maintenance. it's found more glamorous to start new construction than to take care of what's already alive. But unfortunately, pavement structure is often destroyed during a single season thanks to water penetration. Maintenance activities could also be required at intervals throughout the year, but their frequency varies with traffic, topography and climate, sort of roads, grading and repairing pot holes and ruts for paved roads. They include repairing pot holes, surface patching, sealing of cracks and paved surface marking. Transportation contributes to the economic, industrial, social and cultural development of any country. Transportation is significant for the economic development of any region since every commodity produced whether it's food, clothing, industrial products or medicine needs transport at production and distribution stages. The inadequate transportation facilities retard the method of socio-economic development of the country. The adequacy of transportation of a rustic indicates its economic and social development. the foremost demanding
fact is that this country must provide road links both for major proportions of villages and marked centers like significant important roads, important buildings, destinations of faculties and hospitals, etc. India possesses second largest road network within the world. The road network has expanded from 4 lakh km in 1947 to twenty lakh km in 1993 and almost 55 lakh kms as on 31 March, 2015. India has but 3.8 kms of road per 1000 people; including all its paved and unpaved roads. In terms of quality, all season, 4 or more lane highways; India has but 0.07 kms of highway per 1000 people as of 2010. Construction of roads involves substantial investment and thus proper maintenance of those assets is of paramount importance. The road user cost, comfort and safety are influenced to an outsized extent by its state of maintenance. the standard of roads may be a critical indicator of a nation’s economic vitality because a poor road transport system can constrain the situation of economic activity, hamper the mixing of economic markets, limit the gains from specialization and eventually become a serious barrier to growth and competitiveness. In India large road networks built at great expense, are inadequately maintained and used more heavily than the planning values. the most deficiencies affecting our transportation system aside from inadequate capacity and insufficient pavement thickness include poor riding quality, week and distressed bridges/culverts, congested sections, excessive axle loading, and lack of wayside amenities and enforcement. Among various modes, roads and road transport has come to occupy a dominant position within the transportation. Factors that contributed during this direction are flexibility, door to door service, reliability and speed. India has second largest road network across the planet at 4.7 million km. This road network transports quite 60 per cent of all goods within the country and 85 per cent of India’s total passenger traffic. The Indian roads carry almost 90% of the country’s passenger traffic and around 65% of its freight. Maintenance of roads may be a problem of multiple dimensions, phenomenal growth of vehicle traffic (in terms of no. of axle loading of economic vehicles), the rapid expansion within the road network, non-availability of suitable technology, material, equipment, skilled labor and poor funds allocation have all added complexities to the matter of the upkeep of roads. the upkeep of existing roads tends to urge neglected at the value of latest construction and financial constraints. India may be a vast country having extreme variation in climate. North-Eastern region gets very heavy rainfall and annual rainfall the maximum amount as 600 cm per annum has been recorded, whereas the deserts of Western India get very less rainfall. Even during a particular area the difference between maximum and minimum temperature of the year could also be as high as 420c. North India experiences heavy snowfall during winter at altitudes above 2000m. These climate have great influence on the sort of problems existing on the road as only 47% are surfaced roads, balance being earthen roads.

2. Types of Defects:
Various defects in flexible pavements have been seen and those are listed below:
(a) Cracks:
• Alligator Cracking
• Longitudinal Cracking
• Block Cracking
• Edge Cracking
• Centre Cracking
(b) Rutting and Shoving:
• Rutting Classification
• Shoving
(c) Pot Holes and Patching:
• Pot Holes
• Patch Deterioration and Repairs
(d) Bleeding, Revealing and Weathering:
• Bleeding
• Revealing and Weathering
(e) Miscellaneous Type of Defects:
• Polished Aggregates
• Corrugations

3) Problems Faced During Road Maintenance:
The various sorts of problems faced during maintenance of roads generally are discussed in short below:
1) Problem of drainage system: Efficient drainage is a must for any highway system, especially in heavy rainfall mountainous and low lying areas; all drainage structure must be well designed and adequately maintained.
2) Geological problem in India, we experience frequent landslides, flash flood etc. In hilly regions and shifting sand dunes in desert of western regions cause a lot of problems to highway engineers, the extreme and adverse climatic conditions reduce the efficiency of man and machine.
3) Shortage of equipment skilled labour, lack of modern technology and non existence of updated guideline standards and norms for maintenance of roads.
4) Damage to subgrade due to seepage of water into the subgrade.
5) Poor internal control during initial construction stage and inadequate thickness of pavement, excessive overloading adds to the upkeep enforcement problems.
6) Stability of subgrade and top layer is decreased under adverse moisture conditions, frost action and temperature variation.

4) Classification of Maintenance Activities:
Engineering maintenance as far because the road cares should be taken as comprising several small scale engineering activities that are administered at varying intervals, depending upon climate, terrain, traffic and design standards of the roads. All the operations described here are aimed toward keeping or restoring the road to a state of preservation and acceptable standards for its current and intended uses. These operations are often classified as routine, recurrent, periodic and urgent. The routine activities are likely to be required, regardless of the engineering characteristics of the road or the density of traffic it carries. Grass cutting, cleaning of ditches, culverts and bridges and road sign maintenance are including in cost activities.
Maintenance of highway is assessed under the subsequent categories:
• Routine Maintenance
• Periodic Maintenance
• Special Maintenance

1). Routine Maintenance: Activities involved in routine maintenance are regardless of the engineering characteristic of road and density of traffic carried by it. These are required to be administered throughout the year. The works to be carried under this category are as follows:
• Upkeep of carriageway.
• Road sign maintenance.
• Maintenance of berms/shoulder and subgrade.
• Maintenance to pot holes, checking cracks and other visible defects.
• Removal of drains blockage and clearing of choked culverts.
• Rectification of corrugations formed.
• Minor repair of culverts/bridges.

2) Periodic Maintenance: It is the periodic maintenance and renewal of existing surface. In this sort of maintenance a surfacing layer over the pavement at regular intervals of your time so on preserve the characteristics of the pavement and offset the wear and tear and tear caused by traffic, weathering, etc. and thereby prolongs the life of pavement. The various sorts of periodic maintenance are as follows:
a) For unpaved Roads:
• Gravelling
b) For paved Roads:
• Surface dressing
• Thin Premix carpet
• Thin mix seal surfacing
• Improving Drains
• Road surface marking

3) Special Maintenance: The type, frequency and degree of maintenance of pavements can influence performance and time at which major rehabilitation like overlay is required. Pavement rehabilitation is performed thanks to following two reasons:
1) To correct existing distress and improve riding quality.
2) To increase the structural capacity of pavement.
In order to extend the service lifetime of an existing road, the works to be administered are widening, overlays, removing old surfaces and constructing new pavements, improving drains, culverts, bridges, repairing walls and stabilization of soils.
Overlay is important when pavement section cross their maximum acceptable limits of deflection, rut depth, roughness and cracking and there’s increase in traffic intensity. Overlay is usually laid when Characteristic Deflection (DC), Rut Depth Index (RDI), Crack Index (CI) and Roughness Index (RI) reach acceptable limits.

5. Status of ongoing Researches:
HninEiEiKhaing and Dr. Tin TinHtwe (2014), in their study the main purpose was to enhance the pavement of Maguway Yangon Highway so as to supply a satisfactory surface over which the vehicles could move safely. In this study failure patterns were classified between every five miles for the prevailing pavements by visual inspection. The stress and deflection of above mentioned highway decided by using the tactic of soil mechanics of three layered system. The required overlay thickness was evaluated in accordance with Indian Road Congress Formula (IRC). From this study it was concluded that maximum overlay thickness was 6 inches and the minimum was 4.5 inches; whereas maximum granular overlay thickness was 12 inches and minimum was 9 inches.
Mr. EtikalaNagaraju (2015), during this study the main focus was on rehabilitation of pavement and its maintenance. As the road networks are subjected to severe deterioration resulting in premature failure of the pavements. From this study it is concluded that significant savings could be obtained by choosing various rehabilitation strategies that include recycled materials in new layers.
Magdi M.E. Zumrawi (2015), the main focus of this study was to visually inspect and evaluate flexible pavement failures for maintenance planning. It is very important to identify and then examine the causes of failed pavements and further to select proper treatment option. This study consists of two tasks during which first part covers the visual inspection of existing pavement failures whereas the second task was to research the particular causes of those failures. In this study, Obeid Khaitim Road was selected for research study. The damaged pavement due to severe cracking and effect of rutting failures. The damage to existing roads could be due to poor drainage conditions, inadequate design and improper pavement materials used.
Aggarwal et al. (2005), has given an overview of the issues of road framework in developing countries due to rapid traffic growth, inadequate funding for maintenance and maintenance , lag of skilled man power, attitude towards maintenance etc.
Thubeetal.(2005), critically reviewed the maintenance management strategy for low volume roads in India and stressed the need for development of pavement distress data base, deterioration models, optimal
investment and maintenance strategy and highlighted the necessity for an appropriate National level policy regarding paving of unpaved low volume roads in India.

Woods and Adcox (2004) concluded failure of pavement should also be formulated as structural, functional, or materials failure, or a sum up of those factors. Structural failure is that the loss of load carrying capability, where the pavement is not any longer ready to absorb and transmit the wheel loading through the structure of the road without causing further deterioration. Functional failure may be a vast concept, which make us aware of the loss of any function of the pavement like skid resistance, structural capacity, and serviceability or passenger safety. Materials failure occurs thanks to the disintegration or loss of fabric characteristics of any of the component materials.

Caltrans in (2001), divided the main types of pavement failures as deformation failures or surface texture failures. Deformation failure includes corrugations, depressions, potholes, rutting and shoving also. These failures could also be due to either traffic (load associated) or environmental (non-load associated) influences. It may also reflect serious underlying structural or material problems which will cause cracking. Failures of surface texture include bleeding, cracking, polishing, stripping and raveling. These failures indicate that while the road pavement should be structurally sound, the surface not performs the function it's designed to try to which is generally to provide skid resistance, a smooth running surface and stop water leakage and other sorts of pavement failures include edge defects, patching and roughness.

Ahmed (2008), potholes are a sign of structural surface failure and that they result from growth of an opportunity within the surfacing, often as a results of severe alligator cracking as shown in Plate 2. Once water enters pavement layers, the bottom and/or subgrade become wet and unstable, and therefore the resultant degradation results in rapid climb of pothole area and depth.

Sikhdar et al. (1999), researched that if the potholes are numerous or frequent, indicate underlying problem like inadequate pavement or aged surfacing requiring rehabilitation or replacement. The main focus was on the water entering in pavement is usually the cause, and will be caused by a cracked surface, high shoulders or pavement depressions ponding water on pavement, porous or open surface, and clogged side ditches.

Sandeep Choudhary and Dr. P.K. Agarwal (2013), the main objective of this study was to develop an innovative strategy for maintenance of highway pavement, focusing on the highway pavements are deteriorating at a faster rate due to lack of maintenance, leading to higher Vehicle Operating Cost and also increasing the no. of accidents.

Sharad S. Adlinge and AK. Gupta (2013), this paper defines the pavement failure in terms of decreasing serviceability caused by the event of cracks and ruts. The study reflects the possible causes of pavement distresses and to recommend remedies to minimize the effects. In this study various pavement preservation techniques and measures are discussed from the past experience which would be helpful in increasing the serviceable life of pavement.

6. Conclusion:

After going through number of researches I conclude that defects in flexible pavement is a problem since long time and there is a need of identification of problems and rectifying them. Thus it is concluded that a research
needs to be done so as to see the various alternatives which can be adopted. The research should mainly have the objectives as:

1) To identify type and classification of common defects in flexible pavements.
2) To identify the causes of these defects and suggest remedial measures.
3) To identify the deficiencies in existing pavement maintenance practices.
4) To rectify the identified defects for smooth movements of traffic flow.

References:


