

To Study of Pavement Failure in Rigid and Flexible Pavement

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Abstract:- Transportation system is the backbone of a country's economy. A country's economical growth depends on how better the form of transportation system is available. Roads are the common aspect of a land based transportation system. Goods are mostly transferred by roads in developing countries by trucks and people use roads to move around as it is a cheap mode of transportation. So, when a highway fails it causes a great harm in economy and the life of the people who are dependent on the highway. A simple failure in a highway crates domino effects. In a cycle this simple failure does not only affect the lives of people on that region but also the economy of the country. This paper investigates empirically the socio and economic impact of a highway failure and the well-being of the people living in the proximity. It points out the connection between the importance of highway system and what happens when this system gets tempered and what are the effects and the solution regarding this failure. We have tries our best to make it a standard paper and used information from a lot of sources and analyzed the problems.

Keywords – Transportation system, pavement, layer, mode of failure, variation of load

I. INTRODUCTION:

The most important component of any developed or developing country is their ability to reach, communicate and transfer needs from one place to another. This ability makes a country prosper economically, connects nationally and internationally and allows its citizens to grow socially. The key to this connectivity of any country is its sidewalks, especially its highways. Sophisticated highways offer better quality transport. The ease of transport promotes access to markets, materials and opportunities for locals and facilitators. This improves the gain, the standard of living and, in turn, increases the demand for more transport. So highways and transport are interdependently linked to the economic development of a country.

Secondly, the biggest challenge today is to maintain a standard quality of transport service. The difficulties of paving are commonly attributed to this decline in quality. Difficulties, if serious, cause a partial or sometimes complete failure of the motorway. These difficulties hamper the flow of transport. Which in turn affects most of the population, especially in rural and agricultural areas where regular transportation of products is the key to sustenance.

II. OBJECTIVES OF THE STUDY

The objectives of the study are as follows:

a) To investi gate the typical failures of flexible pavement under Vikas nagar City Corporation area.

b) Toreview the maintenance procedure practice by Vikas nagar City Corporation and Roads & Highway

A. Qualifications of A Perfect Highway:

A good facilitated highway is bound to have some geometric and structural features. These features follow a specific design to ensure that the highway is perfect for the usage of the people. Some of these features according to the report on Risk Analysis of Highway Failure by Dr. Dennis Randolaf (published december 2003) are

1. Geometric features like,

- Suitable Super-elevation on curves and bends.
- Sufficient and safe Camber for proper surface drain.
- Proper Location of crown
- Sufficient number and width of lane.
- Safe curves and bends o Horizontal, summit, Valley, hair pin bends etc.
- Sufficient Right of way.
- Proper extra widening.

B. Structural features:

- Sufficient friction on top layer as per speed limit.
- Uniformity in pavement thickness
- Proper selection of Slope protection structures like, Retaining and revetment walls, toe walls, roadside arboriculture.
- Less undulation in surface layer
- Absence of ruts, potholes and jerks.
- Kerbs, side drainage, pits and ditches, outlets, cross drainage structures like culverts, bridges
- Safe Tunnels if required
- Proper selection of material on different layers as per AASHTO requirement.
- Side benching.
- Road side development

C. Traffic Marking post and signs

- Regulatory and warning signs.
- Traffic lights.
- Pavement marking.

III. ROAD PAVEMENT FAILURE AND MAINTENANCE

A. Alligator cracking:

Alligator cracking is characterized as a series of interconnected cracks creating small, irregular shaped pieces of pavement. The sizes of these irregular shaped pieces vary, from less than 12-inches to 24-inches. The cracking pattern is similar to the pattern found on alligator skin, and therefore the source of its name. The cause of this

type of cracking is the failure of the bound layer due to repeated traffic loading resulting in the disintegration of the surface and eventually potholes. The cracking starts out of sight, at the bottom of the surface course or in the stabilized base where the tension stresses are the highest. As the pavement flexes under repeated wheel loading the crack moves upward toward the surface eventually leading to failure. As the wheel loading continues, more cracks are formed. Repair - The type of repair is dependent on the extent and severity of the failure area. There are three levels of severity used in rating alligator cracking.



Figure: Alligator cracking.

Low severity cracking:

Low gravity is characterized by a cracking area with very narrow cracks with almost no surface deterioration. Cracking is often isolated and many times cracking may not be interconnected to other areas and there is not much distortion. These cracks can be sealed to prolong the useful life of the flooring, but the underlying cause can still lead to further premature cracks.



Figure: Low severity cracking

B. Medium severity cracking:

The average gravity is characterized by interconnected cracks that form a small area of the typical crocodile pattern. Cracks may show signs of slight flaking, without visible pumping. Sealing of surface cracks may be an option, but must be carefully considered to avoid creating slippery points on the surface of the floor. In smaller areas a correct solution would be to remove and replace the base and the surface (ie a box out and replacement). Providing underground drainage can help prevent the need for future repairs. Larger areas will require remediation or reconstruction.



Figure: Medium severity cracking.

C. High Severity cracking:

The cracking of high-gravity alligators is characterized by an area of interconnected cracks of moderate to severe shoulder that create a complete pattern of cracking. Pieces of asphalt can be loose or missing from traffic and the pumping of water or fine material under the floor may be present on the surface. Providing underground drainage can help prevent the need for future repairs. The larger areas will require reconstruction reconstruction. In all cases, it is advisable to examine the drainage in these areas as this type of failure can be caused by poor drainage within the base layer problem. There is no single remedy for treatment during road repair. Without properly repairing the drainage and / or the basic problem that causes the alligator to crack, it will only prolong the cracking return.

An asphalt overlay will only temporarily repair a cracked alligator road.



Figure: High Severity cracking

IV. OTHER TYPE OF PAVEMENT FAILURE:

A. Transverse crack : Transverse cracking is an unrelated crack that crosses a sidewalk, perpendicular to the direction of the road. The transverse cracks can be the result of: the reflection of a crack or a joint in a layer of flooring below a shrinkage construction joint (due to low temperature or hardening of the bitumen) in an asphalt surface the failure structural of a concrete base path.



Figure: Transverse crack

B. Edge cracking: Long, arching cracks near the edge of the pavement. First there is one, then later another one. And before too long the edge of the road begins to ravel and deteriorate.

C. Pothole: The holes are bowl-shaped depressions of various sizes in the floor surface. They generally have sharp edges. It is more likely that potholes will occur on roads with a course of thin surfaces. They are usually caused when the severity of cracks increases. They cause roughness and discomfort for the cyclist and are a major cause of accidents, especially in dark periods when visibility is very low.



Figure: Pothole

D. Pumping cracking: It was a very common crack on the highway that occurs when longitudinal cracks or any kind of cracks occur and are not repaired and the upper water attacks the lower part of the floor and day after day the surface of the floor is softer and once totally destroys.



Figure: High Severity cracking



Figure: Transverse crack



Figure: Edge cracking.



Figure: Pumping.

Table-1-Table for type of failure, its maintenance type, machinery use in maintenance and location of the failure in Vikasnagar City

Type of Failure	Maintenance type	Machinery use	Location if failure
Longitudinal Cracking	Routine	Hoes, Pay loader, Dump truck, roller	Court road
Transverse Cracking	Routine	Hoes, Dump truck, Smooth roller	Bypass road, mandi road
Potholes	Routine	Hoes, Hand road roller and Mixing machine	All over RCC
Raveling	Routine	Hoes, Bitumen distributor, Dump truck, Smoothroller	Dakpathar road
Water Bleeding	Periodic	Back hoe, Dump truck, Tractor, Water sprinkler, Bitumen distributor, Asphalt mixing plant, Road sweeping vehicle etc	All over RCC
Rutting	Routine	Hoes, Bitumen distributor, Dump truck, Smoothroller	Geetabwanroad,phadaigali

V. RECOMMENDATIONS

On the basis of the study, the following recommendations are made:

- The road maintenance deserve much more emphasis than is usually placed on it in order to protect the investment that have been made on our road system and maintenance program should be collected be chalked out by the concerned department well ahead to take up the maintenance work in time on the basis of priority determined in relation to field conditions and available funds.

- Funds required for proper and timely maintenance of roads should be provided to the organizations concerned.

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