

# Flexible Pavement Deterioration

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**ABSTRACT** –The development of higher stresses leads to performance failure of the pavements. If the flexible pavements fails to carry the design loads satisfactorily, then the failure is of structural type. It is of functional type, if the flexible pavement does not provide a smooth riding surface. The uneven surface not only causes discomfort to human, but also increases the Vehicle Operating Cost (VOC), thus influencing the overall transportation cost. We required to understand the causes of deterioration of pavement and also preferred the proper maintenance technique. The objective of this study to identify the various factors causes deterioration of constructed any roads. The results revealed in the forms of cracks, rutting and potholes in the wheel path. The causes of pavement deterioration include: traffic loading, environment/climate influences, drainage deficiencies, materials quality problems, construction deficiencies, and external contributors. Based on the results, recommendations were provided to helps highway engineers in selecting the most effective repair techniques for specific kinds of distresses.

**Key words:** PAVEMENT, PERFORMANCE, DETERIORATION, CAUSES ETC.

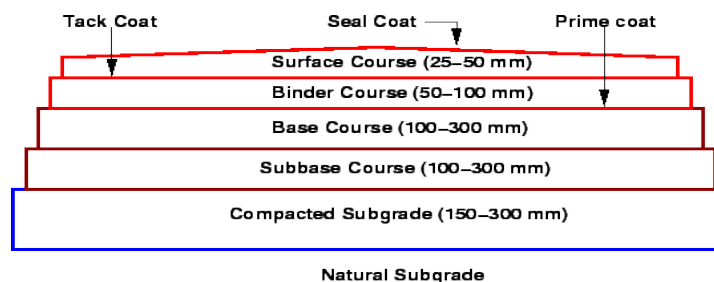
**INTRODUCTION-** A main road pavement could be a structure consisting of various layers by using different materials on top of the natural soil sub-grade, whose primary perform is to transfer the applied vehicle masses to the sub-grade. The pavement structure ought to be ready to give a surface of acceptable limit riding quality, adequate skid resistance, favorable light weight reflective characteristics and low pollution. The final aim is to make sure that the transmitted stresses because of wheel load area unit sufficiently reduced, in order that they're going to not exceed bearing capability of the sub-grade. Two sorts of pavements area unit typically recognized as serving this purpose, specifically versatile pavements and rigid pavements.

## Types of Pavements

1. Flexible pavement
2. Rigid pavement

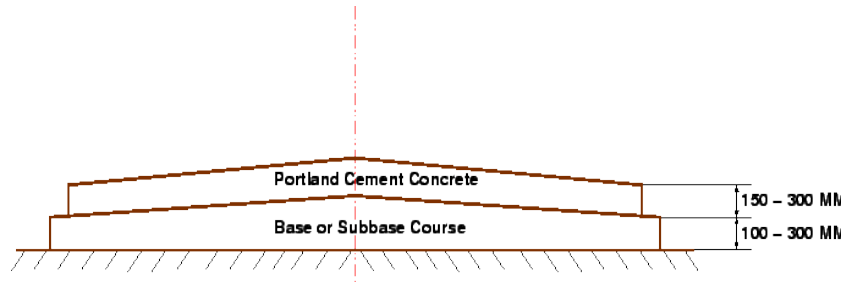
1. Flexible pavement

Flexible pavement will transmit wheel load stress to the lower layers by grain ti grain transfer through the points of contact among the granular structure.



2. Rigid pavement

Rigid pavements have sufficient flexural strength to transmit the wheel load stresses to a wider area below. A typical cross section of the rigid pavement is shown below as figure. Compared to flexible and rigid, pavements are placed either directly on the prepared sub-grade or on a single layer of granular or stabilized material. Since there is only one layer of material between the concrete and the sub-grade so, this layer can be called as base or sub-base course.



## LITERATURE REVIEW

Deterioration of highway pavement is a very serious problem that causes unnecessary delay in traffic flow, distorts pavement aesthetics, damages of vehicle and most significantly, causes road traffic accident that had resulted into loss of lives and properties. Pavement surface deformation affects the safety and riding quality on the pavement as it may lead to premature failures.

The most significant road defects observed in the field are potholes, cracks, edge defects, depressions and corrugation. At the same time he emphasized that traffic over loading, pavement age, road geometry, weather, drainage, construction quality as well as construction materials, maintenance policy play the major role as road deteriorate agents. However, understanding the causes for pavement deterioration failures is essential step towards minimizing risks to have good road performance.

## PAVEMENT PERFORMANCE MODELS IN THE INDIAN PERSPECTIVE

The most commonly used models are HDM- 4 and AASHTO performance models. The performance models that are developed for Indian perspective are briefly reviewed here to compare the same with the models developed in the present study. These are categorized under three groups, considering the attributes that are related. These are:

- i. **Distress Characteristics Based Models:** These models predict the information on roughness, rut depth, raveling, potholes etc. being developed as a result of traffic factor and age.
- ii. **Pavement Performance Rating Models:** These models define the performance of the pavement using certain arbitrary or weighted values. These values varies within a certain range. Different researchers have proposed various indices. These include PSI (Present Serviceability Index), PCI (Pavement Condition Index), PCR (Pavement Condition Rating), etc.
- iii. **Models Based on Environmental Factors:** These models consider the effect of various environmental factors like temperature of soil, pavement layers and surroundings, freeze and thaw cycles, humidity and precipitation, movement of ground water, capillary water or surface water etc. on the performance of the pavements.

## What Causes Pavement Failure

### Cracking

Asphalt cracking by far makes up for the most of pavement failure issues because of its tendency to spread and the wide variety of elements that can cause cracking. It is fairly normal for an asphalt surface to crack over time due to the settling of soil and the exposure to the outdoor elements, however, there are some less usual and most common cracking issues that can form from improper mix design for flexible and rigid pavement construction.

### Alligator Cracking

Alligator cracking also known as map cracking. Alligator cracking forms when the sub -grade and asphalt- base begins to compress from bearing of repeated traffic loading. Repeated traffic loading and stress concentration will help the individual cracks to get connected. Initial cracks will form on surface and spread through water intrusion and further asphalt base compression.

**Edge Cracking**

Edge cracking forms along the edge of a road and is caused by water damage, insufficient base material, and heavy road usage and make becomes brittle.

**Block Cracking**

Block cracking is formed by seasonal temperature differences and due to this condition the asphalt to expand and contract. Block cracking will form if an asphalt surface has too rigid of a mix design that does not give the surface room for seasonal density changes.

**Joint Cracking**

These are joint cracks that are observed in the flexible overlay projects over a rigid pavement. The rigid pavement joint that are an underlying experience these cracks.

**Transverse Cracking**

Transverse cracks running across an asphalt roadway and are caused by settling, shifting base material, improper paver operation, and extreme temperature shifts.

**Linear Cracking**

Linear cracking running parallel with the roadway and are most commonly caused by pavement fatigue but it can also be an issue related to weaker points in a parking lot or roadway pavement joints.

**Potholes**

Potholes are formed in the pavement through prolonged water intrusion from existing cracks in the road surface. If alligator cracks and other asphalt stress cracks are not treated, water entrapped will begin to erode the surface all the way down to the sub base. This will cause large holes with some depth to form in the asphalt which will spread and cause damage to vehicles tires. Water entrapped will increase the rate of expansion of distress. Once a potholes is formed, a patch can be applied to the surface, but because the sub-base has been destroyed the area will continue to become compacted.

**Depression**

A depression in an asphalt surface is occurs by uneven sub-bases or compactions over time. Depressions have a lower height than the asphalt surface which will cause the area to hold water for longer. Water buildup can be causes further issues like raveling or potholes.

**Rutting**

Rutting is channeled depressions in an asphalt surface that form over a long time from exceeded weight limits and improper base construction. Over time heavy traffic loads will begin to compact the asphalt along a pavement creating tire ruts. If rutting or depress forms in an asphalt surface the base must be repaired or restructured to account for heavier vehicle traffic. There are two types of rutting, one is pavement rutting and other is Subgrade rutting.

**Ravelling**

Ravelling is caused by the continued intrusion of water in asphalt bitumen and the degradation of an asphalt top coat. The top layer of asphalt bitumen get into down water and sunlight will continue to damage the top surface causing the bond between asphalt bitumen and aggregates to break. The aggregates are some time coated with dust particles that result in lack of bonding with bitumen. When water begins to make inroads into an asphalt surface it will cause further cracks and pavement failure to occur.

### **Austin Asphalt Repair**

If your road, parking lot, or asphalt surface is experiencing pavement failure, it is best to fix the issue before it worsens or spreads. At Lone Star Paving we offer a **free on-site consultation** where we can identify and come up with an action plan for asphalt pavement issues. If you suspect your asphalt surface is sustain pavement failure.

### **Conclusion**

- It is clear from the number of possible deterioration causes and mechanisms that pavement deterioration is not a straight forward thing to measure and monitor. It is therefore necessary to make sure that measurements and investigations are aimed at finding out the underlying causes. In this way maintenance can be targeted. For instance it is grossly inefficient to have a philosophy which sees a certain thickness of overlay as a standard remedial measure without a proper assessment to ascertain whether there may not be a more cost effective solution. It may be as simple as repairing the drainage.

It was pointed out that understanding the causes of pavement deterioration will

- It was pointed out the understanding the causes of pavement deterioration will significantly contribute to the proper selection of effective maintenance technique results in prolonged service life of roads.

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