

# Various Types of Road Defects in Flexible Pavement and Maintenance

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**Abstract:** *Various defects in versatile pavements are proverbial since the existence of versatile pavement. Pavement structure is additionally destroyed in an exceedingly terribly single season with water penetration. Defects in versatile pavements may well be a cringe of multiple dimensions, fantastic growth of machine traffic (in terms of no. of shaft loading of economic vehicles), the fast enlargement within the road network, non-availability of acceptable technology, material, equipment, labor and poor funds allocation have all else complexities to the matter versatile pavements. Maintenance is ready of activities directed towards keeping a structure in an exceedingly terribly serviceable state throughout its vogue life, Maintenance of a road network involves a spread of operations, i.e., identification of deficiencies and developing with, programming and programming for actual implementation within the sphere and looking out. The essential objective need to be to stay the amount and appurtenances in condition and to increase the lifetime of the road assets to its vogue life. Broadly, the activities embody identification of defects and to boot the potential cause there off, determination of acceptable remedial measures; implement these within the sphere and looking out at of the results. Pavement failure is written in terms of decreasing utility caused by the event of cracks and ruts. Before going into the upkeep ways in which, we tend to have to be compelled to check abreast of the causes of failure of pavements. Failures of pavements are caused to several reasons or combination of reasons. This paper summarizes the continued researches concerning the defects in versatile pavement and to boot the maintenance in versatile pavements. A well-developed transportation infrastructure is crucial for economic, industrial, social and cultural development of a rustic. Maintenance is ready of activities directed towards keeping a structure in an exceedingly terribly serviceable state throughout its vogue life, Maintenance of a road network involves a spread of operations, i.e., identification of deficiencies and developing with, programming and programming for actual implementation within the sphere and looking out. The essential objective need to be to stay the amount and appurtenances in condition and to increase the lifetime of the road assets to its vogue life. This paper discusses the potential causes of pavement failures, and recommend better ways in which throughout to attenuate and hopefully eliminate the causes of failures in pavements.*

**Keywords:** Versatile, Defects, Flexible Pavement, Rapid Expansion, Maintenance, Road, Rutting, Paved Roads.etc.

## I. INTRODUCTION

A Road defect refers to the defects because the visible proof of an undesirable condition within the pavement moving usefulness, structural condition or look. The definition of a "road defect" includes any a part of a road, highway, or construction site that doesn't meet the rules for a secure road. A road network system is maybe one in every of the foremost vital wants for the economic development of any country, notably developing countries. several of developing countries, therefore, invest vast quantity on building, whereas several developing countries appreciate the requirement for vast investment in capital development of roads. solely a couple of provide due importance to the road maintenance. Ordinarily the term pavement solely suggests that the surface layer. however within the coming up with

of the highways, it suggests that the pavement total thickness together with carrying course, base course and sub-base course. it's exhausting and difficult crust made over the natural subgrade so as to produce stable and levelled or flat surface for vehicles. For coming up with functions and reckoning on structural operate and behavior, the road pavements varieties area unit typically divided :

## **II. FLEXIBLE PAVEMENT**

Defects with unit of measure causes and treatment:

### **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

#### **a) Alligator Cracking**

These square measure the interconnected cracks that resembles the skin of an alligator. The on top of are known as follows:

- Series of interconnected cracks.
- Many sided, sharp angulate, sometimes longest aspect < one feet.
- Initially seems a longitudinal crack.

#### **Measurement:**

- Sq.m of surface area at different severity levels. Rate entire area at highest severity level whenever different severity levels exists.

#### **Severity Level/Classification:**

The classification has conjointly been done as per TRRL (Transport and Road analysis Laboratory), i.e., m/sq.m. The severity levels are classified as below:-

- Low – Longitudinal disconnected hairline cracks running parallel to every different, cracks not spalled. Usually dimension is < 3mm. Surface still offers fairly sensible riding quality.
- Moderate – Cracks area unit gently spalled and type a pattern of articulated items. Cracks of dimension 3mm to 6mm area unit seen.
- High – Cracks area unit severely spalled and wider than 6mm. These area unit clearly visible whereas driving on road and provides terribly poor riding quality.

#### **Causes:**

The causes of the higher than cracking square measure as follows:

- Ageing of binder or initial over heating ends up in breakableness of binder.
- Inadequate pavement thickness or excessive overloading or each.

- Unstable subgrade or lower layers, resulting in excessive deflection of the surface significantly within the wheel tracks. Unstable conditions in subgrade or lower layers of the pavement would possibly arise from saturation thanks to poor emptying conditions.

#### **Treatment:**

The treatment for every kind of cracks depends on pavement remains structurally sound or has become distorted or unsound. wherever the pavement is structurally sound, cracks ought to be stuffed with low viscousness binder. Suspension seal or sand hydrocarbon mixture fix will be wont to fill wide cracks. If the cracks area unit fine over massive areas a lightweight cut-back or an blended hydrocarbon or fog seal will be broomed into the cracks and gently stuffed with sand to stop the studying of the binder by the traffic. The intensive alligator cracking in wheel path can cause rutting and thus the pavement can become structurally unsound. The unsound cracked pavements can want strengthening or rehabilitation treatment.

#### **b) Longitudinal Cracking**

These cracks are relatively parallel to pavement center line, may appear either at the joint between the pavement and the shoulder or at the joint between two paving lanes.

#### **Units of Measurement**

- Linear measurement at each severity level.

#### **Severity Level or Classification**

Low – Cracks with breadth but 3 mm with material in fitness.

- Moderate – Cracks with breadth from 3mm to 6mm and with random cracking on the longitudinal crack, sealing material, material isn't in fitness.
- High – Cracks with breadth over 6mm and in depth cracking on the crack. Usually in the middle of fibre etc. and might be simply seen whereas driving.

#### **Causes**

Alternate wetting and drying to a lower place the shoulder surface due to poor emptying and additionally to variation in temperature.

- A weak joint between conterminous spreads within the layers of the pavement provides rise to lane joint cracks.
- Different geological phenomenon condition

#### **Treatment**

Treatment depends on whether or not pavement remains structurally sound or not, if structurally sound then treatment is also done as under:

- Fill cracks with hydrocarbon binder.
- A suspension seal or sand hydrocarbon intermixture fix for wide cracks.
- A fog-seal if the cracks are fine and extended over massive space.

#### **c) Block Cracking**

These cracks seem as interconnected cracks forming blocks of sq. or rectangular form on pavement surface. the scale of the block cracking varies from a thousand sq.cm to ten thousand sq.cm (1 sq.ft. to 10 sq.ft.). Block cracking is shown in images below.

### **Units of Measurement**

- Square feet or square metre of surface area at each severity level.

### **Severity Level**

Low – Blocks outlined by unspalled cracks with a mean breadth of 3mm and sealing material being in condition. The blocks area unit typically of larger size at low sever.

- Moderate – Moderately spalled cracks and mean breadth between three to 6mm.
- High – Blocks well outlined by cracks that area unit severely spalled and therefore the mean breadth bigger than 6mm. the dimensions of the block is reduced as compared to low and moderate severity levels.

### **Causes**

Inadequate pavement thickness and unstable condition of subgrade and lower layers. Shrinkage of hydrocarbon layer itself with age. Ageing and breakableness of binder.

### **Treatment**

The block cracking should be repaired by laying a interface treatment followed by giving surface layer as per original existing surface.

### **d) Edge Cracking**

These area unit fairly continuous cracks, parallel to and frequently upto zero.5m from the sting of pavement. Edge cracks if not repaired in time result in edge breaking and lane to shoulder drop off and separation happens.

### **Severity Level**

- Low – Cracks with no break-up or raveling with mean width upto 3mm.
- Moderate – Cracks with some break-up or raveling and mean width between 3mm to 6mm.
- High – Cracks with considerable break-up or raveling along edge and the width is more than 6mm.

### **Causes**

Lack of lateral support from shoulder. Poor drain and frost serious condition. Inadequate pavement dimension forcing traffic to maneuver too on the topic of the sting of the pavement. Settlement or yielding of the underlying materials. Non provision of more dimension of pavement on curves.

### **Treatment**

- Improve the shoulder condition and give lateral support to pavement.
- Seal the cracks with either of these depending on severity level and width of cracks as follows:-
- Low viscosity binder.
- A slurry seal.
- Fog seal.

### **e) Center Cracking**

The cracking pattern appears all along the centre line of pavement. These are similar to longitudinal cracks and are not commonly seen. The centre cracking are shown in photograph.

### **Unit of Measurement**

- Length in meters as per each severity level.

### **IJRER Severity Levels**

- Low – Cracks with sealant material in good condition and mean width upto 3mm.
- Moderate – Cracks with some break-up or raveling and mean width between 3mm to 6mm.
- High – Cracks with considerable break-up or raveling along center line of the pavement and width is more than 6mm. It can be easily noticed while driving on the road.

### **Causes**

- Improper or weak joint between adjoining, spreads all along the centre line of the pavement.
- Different moisture conditions on both sides of the pavement.
- Different frost heave conditions along the centre line.
- Improper design of pavement with reference to camber.

### **Treatment**

It is better to take full precautions while constructing a pavement. The general treatment method for cracks explained earlier can also be used. This can be rectified by sealing the cracks with slurry seal and or fog seal depending on width of the cracks. While inspection of cracks on site, cracks with width  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch were cleaned first and then sealed. The sealing material used was Asphalt Emulsion Slurry Seal (crack filler/seal master).

After filling the cracks the selected stretch was allowed to dry for 24 hours and no traffic was allowed to move on that stretch for 24 hours. After 24 hours the traffic was allowed to move on that stretch. The inspections were made after every week for a month to see the status of that road stretch. While inspection, it was clearly seen that no further deterioration found for the selected stretch. The bond between the two cracks was also good and the riding quality seemed to be good also.

### **f) Rutting and Shoving**

Rutting is a longitudinal surface depression or groove in the wheel path. If the rutting is accompanied by adjacent bulging, it may be sign of subgrade movement. This phenomenon takes place when either pavement thickness is inadequate or there is heavy channelized traffic.

### **Unit of Measurement**

The rut depth can be measured in mm and width of rutting can be measured in meters.

### **Causes**

- Weak pavement and heavy channelized traffic.
- Improper mix design and lack of stability.
- Inadequate compaction of the mix at the surface or in the underlying layers during construction.
- Intrusion subgrade clay into base course.

### **Treatment**

- Fill with premix open/dense graded material and compact to the desired levels after applying a tack coat.
- If rutting is due to subgrade failure then excavation and rectification of subgrade is done.

### **g) Shoving**

It is a form of plastic movement resulting into localized bulging of surface. Shoving occurs characteristically at points where traffic starts or stops or at sharp curves. Shoving is shown in photographs.

### **Unit of Measurement**

It really cannot be measured in facts and figures but the effect can be seen or riding quality.

### **Severity Levels**

- Low – When effect on riding quality is quite low.
- Moderate – When it is possible to drive with low speed only.
- High – When riding quality is very bad and extensive bumpy ride is experienced

### **Causes**

- Lack of stability in mix (excessive binder, high proportion of fines, too soft binder) of surface or base course.
- Pushing action by wheels of heavy traffic at time of acceleration and de-acceleration.
- Lack of bond between bituminous surface and underlying layers.

### **Treatment**

- Filling the depression with premix materials after applying suitable tack coat.
- Remove the material in the affected area down to a firm base and laying a suitable premix patch.

### **h) Pot holes and Patching**

These are bowl shaped holes of various sizes in the surface layer or extending into the base course. These are caused by localized disintegration of material and usually appear at water logged places or after rains.

### **Unit of Measurement**

- Depth in cm and area of pot hole in cm.sq.

### **Causes**

- Localized disintegration of materials.
- Ingress of water in the pavement through cracks in surface course.
- Poor bond between surface and base course layers.
- Less bitumen content in localized areas or too thin bituminous surface.

### **Treatment**

Treatment is done by patch work or patch repairs. To fill pot holes (after cleaning) with the premix open/dense graded patching or even penetration patching and followed by compaction.

### **e) Patch Deterioration and Repairs**

This is the portion of the pavement surface that has been removed and replaced/repared. The damage to surface could be because of cracking, pot holes, etc. These are shown in photograph.

### **Unit of Measurement**

- Square metre of surface area and number of patches at each severity level.

### **Severity Level**

- Low – Patch is in good condition or has low severity distress of any kind.
- Moderate – Patch has moderate severity distress of any type and patch repairs carried out as per type of distress.
- High – Patch has high severity distress of any type.

### Causes

- Poor mix design and obsolete (out of date) maintenance technique.
- Opening of road to traffic before repaired patch sets properly.
- When repairing of small defects are not done in time.

### Treatment

- To have proper mix design and choose aggregates and binders as per prevailing climatic conditions and specifications.
- The repaired patch should merge with the type of original surface and eradicate the cause of failure.

## III. MAINTENANCE OF HIGHWAY

- Routine Maintenance
- Periodic Maintenance
- Special Maintenance

A road network system is maybe one altogether the foremost vital requirements for the economic development of any country, notably developing countries. several of developing countries, therefore, invest huge quantity on construction, whereas several developing countries appreciate the requirement for huge investment in capital development of roads. just some provide due importance to the road maintenance. it's found more exciting to guide off new construction than to remain up what's already alive. however sadly pavement structure is additionally destroyed throughout one season because of water penetration. Maintenance activities is to boot needed at intervals throughout the year, however their frequency varies with traffic, topography and climate, type of roads, grading and repairing pot holes and ruts for sealed roads. They embrace repairing pot holes, surface fixture, waterproofing of cracks and level marking. Transportation contributes to the economic, industrial, social and cultural development of any country.

### A) Highway Maintenance Types and Activities

| Type of Maintenance                     | Pavement Type | Activities                                                                                                                                                                                                     |
|-----------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preventive (periodic)                   | Flexible      | Rejuvenation<br>Mill and replacement of surfacing                                                                                                                                                              |
| Remedial (routine, recurrent, reactive) |               | Road sign repair and replacement<br>Safety repair and replacement<br>Drainage (subsurface, chutes, channels, batter drains, lined catch-drains) clearing and repair<br>Grass-cutting and pruning of vegetation |

## IV. CONCLUSION

We have a tendency to conclude that defects in versatile pavement is a haul since while and there's a requirement of identification of issues and rectifying them. so it's all over that an enquiry has to be done thus on see the varied alternatives which might be adopted. Conclusions are drawn ,Proper style, regular review and maintenance of system is of utmost importance in conserving the investment created on transportation and in providing comfort and safety to the road user. The classifications of every kind of distresses are known. The cause and treatment is completely different for various severity levels of every distress. The defects in existing transportation and in maintenance practices should be clearly understood and eradicated. The influencing parameters are cracks and cracking pattern, roughness, rut depth, pot holes and deflections. The higher than parameters are classified in keeping with their severity levels. Maintenance call are often taken supported the factors of reaching anyone or all of the influencing parameters to their most acceptable limits. The tiny distress (cracking, potholes, shoving, rutting, etc.) should be repaired before any major maintenance (overlay, renewal coat) is completed. Even reduced thickness of overlay can show higher results if minor defects are repaired before overlays are done.

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