

Evaluation of Flexible Pavement Failures

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Abstract –Pavement is a multi-layer system that distributes the vehicular loads over a larger area. It helps to make them durable and able to withstand traffic and the environment. Pavement consists of three basic layers the first layer is Sub grade (Gravel) which is the foundation layer, the second layer is sub base (layer Assistant foundation) and the top layer is base (a layer of pavement) which consists of Bituminous Carpet + Bituminous Macadam. Cracking of pavement is a defect that appears in the top layer of the road. Pavement can be under compression and tension at the same time, but in different directions. While a tire compresses a pavement downward, it forms a deflection basin which causes the pavement to go into tension in both horizontal directions. If the pavement is not strong enough, the asphalt is stretched too far, which separates and a crack forms in the wheel track. A crack may also form between the wheel tracks. The maintenance of roads means protecting, restoration and strengthening of all elements of the road to maintain sustainability of the road. Road maintenance also includes additional work that is necessary in order to raise the level of performance and reach the best level of safety and comfort for the road users. Roads are high-cost investments and need constant maintenance so that these investments continue to perform as required. Therefore, care must be taken to maintain the roads in optimum maintenance and in a scientific manner. The aim of this Study is to identify the most common types of cracks and defects which occur in Izki road and suggest suitable option for maintenance. The objectives are to identify different types of cracks & defects, to find out the different reasons that cause defects and cracks in Izki road and to suggest suitable maintenance methods. A 2km length of the road was selected for the study. Survey was carried out and the reasons for cracking and other failures in pavement

were studied. Finally, the required maintenance solution for each type of failures was identified and the best maintenance option was selected

I- INTRODUCTION

Transportation infrastructure plays a lead role in economic growth and development of country. India has the second largest highway and road network system in the world. They carry almost 90 percent passenger traffic of our country and 65 percent of freight. Most highways in India are narrow and congested with poor surface quality. Though highways are well designed as well as properly constructed but still it may require maintenance, the extent which will depend on several factors including the pavement type. The functional deterioration is indicated by the changes in surface condition of the pavement in the form of deterioration in the riding quality, which can be measured by simple methods; it is also possible to restore the surface to original condition of the pavement by providing a profile correction course and a resurfacing layer. Scope of transportation system has developed verylargely.

Ordinarily the term pavement only means the surface layer. But in the designing of the highways, it means the pavement total thickness including wearing course, base course and sub-base course. It is hard and tough crust constructed over the natural subgrade in order to provide stable and leveled or flat surface for vehicles. It is a structure consist from overlies layers of materials over the natural subgrade which its primary and major function is to transfer and distribute the vehicle axle loads to the subgrade. The structure of pavement should provide acceptable riding quality surface, sufficient skid resistance and minimum noise pollution. For designing purposes and depending on structural function and

behavior, the road pavements types are generally divided or classified into two types:

- i. Flexible pavement :- An be defined as a pavement layer comprising of a mixture of aggregates and bitumen, heated and mixed properly and then laid and compacted on a bed of granular layer.
- ii. Rigid pavement :- It is constructed from cement concrete or reinforced concrete slabs. Grouted concrete roads are in the category of semi-rigid pavements. The design of rigid pavement is based on providing a structural cement concrete slab of sufficient strength to resists the loads from traffic

Other pavement types include semi rigid or composite pavement and interlock cement concrete blocks pavement. These pavement types are less familiar than flexible and rigid pavement. Flexible pavement design is the process and method of selecting the most effective and economical composition of flexible pavement courses or layers to fit the subgrade foundation. And cumulative traffic axle load to be carried and handled during the pavements' design life. Flexible pavement structure design is different from building design and the bridges because of the fact that the design of pavement until today is based on semi-empirical or empirical method and there is no rationalistic design method. Flexible pavement design consists mainly from twosteps:

1. Material mix design to be used in each layer of the pavement.
2. Design the structure of the pavement

The main and major factor to be taken in consideration in the flexible pavement design are :-

1. Traffic volume
2. Climate and weather condition along the year
3. Road geometric design
4. Position.
5. Soil or subgrade
6. Drainage
7. Construction material

TYPES OF FAILURES OF FLEXIBLE PAVEMENT

Different types of failure encountered in flexible pavements are as follow:

1. Alligator cracking or Mapcracking
2. Consolidation of pavement layers
3. Shear failure cracking
4. Longitudinal cracking

5. Frostheaving
6. Lack of binding to the lowercourse
7. Reflection cracking
8. Formation of waves and corrugation



II- LITREATURE REVIEW

Hofstra and Klomp (1972) [1] found that the deformation in flexible pavements was greater in loading enforcement surface and gradually reduced depending on the depth. This is because the wheel tracking is a permanent deformation and thus increasing the depth increases the resistance and shear stresses are reduced. Asphalt with low shear strength, essential for resistance to repetitive loads of traffic, have intense display wheel tracking problem. The problem is more acute especially during the summer season, as high temperatures are observed on the roadway.

Sousa et al. (1991) [2] in their research told that wheel tracking gradually grows under the influence of repeated loadings and typically depicted in the form of deformations along the wheel tracks, accompanied by small rearrangements at the ends. Two causes that contribute to wheel tracking is the compression and shear deformation. Its appearance may occur at various times during the life of apavement.

Sikdar et al (1999) [3] reported that if the potholes are numerous or frequent, it may indicate underlying problem such as inadequate pavement or aged surfacing requiring rehabilitation or replacement. Water entering pavement is often the cause, and could

be caused by a cracked surface, high shoulders or pavement depressions ponding water on pavement, porous or open surface, or clogged side ditches.

Woods and Adcox (2004) [4] said pavement failure may be considered as structural, functional, or materials failure, or a combination of these factors. Structural failure is the loss of load carrying capability, where the pavement is no longer able to absorb and transmit the wheel loading through the structure of the road without causing further deterioration. Functional failure is a broader term, which may indicate the loss of any function of the pavement such as skid resistance, structural capacity, and serviceability or passenger comfort. Materials failure occurs due to the disintegration or loss of material characteristics of any of the component materials.

Ahmed (2008) [5] concluded the formation of cracks in the pavement surface causes numerous problems such as discomfort to the users, reduction of safety, etc. In addition to the above, intrusion of water causing reduction of the strength in lower layers as well as lowering of bearing capacity of subgrade soil by pumping of soil particles through the cracks is also a major problem associated with the pavements.

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