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ANALYSIS AND EVALUATION OF ROAD DEFECTS ON FLEXIBLE PAVEMENT

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ABSTRACT

According to the research, the flexible pavement defects and its causes are defined in terms of decrease in serviceability which was caused by the development of different types of deteriorations like cracks, surface defects, disintegration etc. on the flexible pavement. This case study attempts to identify the various parameters that affect the performance of the flexible pavement and by rid off this problem by applying the remedial measures over the particular stretch. Sohana to Kharar was chosen as a case study. It is a pursuit towards a study of the road condition of Punjab with respect to varying soil, traffic and climatic conditions, periodic performance evaluation of selected roads of representative types and development of distress prediction . By taking the measurement of each part, we measured the various type of defects, corresponding to that we found out pavement condition Index (PCI). A PCI is a numerical index which tells us about the condition of the road as per its range that is 0 to 100 which was coming out to be very poor. Testing was done to know the reason of the pavement failures and we found out that the most of theas damaged by alligator cracks by repetitive heavily loading of the vehicles and surface defects. Pavement also damaged due to poor drainage and inadequate designing and poor quality of material.

Keywords:- Flexible Pavement, distresses, analysis, evaluation.

INTRODUCTION

GENERAL

Pavement is anything which is being covered , that is the covering of solid material like floor laid so that is to make a comfortable and hard surface for travel. Road pavement is a durable material for surface which is resting on an area design to sustain vehicular traffic or walk traffic, such as a road or pedestrian. Pavement is generally classified as

i. Flexible pavement
ii. Rigid Pavement
iii. Semi-Rigid pavement
iv. Composite pavement

FLEXIBLE PAVEMENT

The pavement which constructed with different number of layers of granular materials and covering of one or more of the waterproofing asphalt layer is considered as flexible. In these flexible pavements, due to the strength of each layer is different; the load distribution pattern changes from one layer to another. The strongest material is to be provided on the top layer and the weakest layer is to be provided to the bottom layer.

RIGID PAVEMENT

Rigid pavements are those pavements which are constructing from reinforced concrete slabs (RCC) or cement concrete. The design criteria of this type of pavement are based on providing a cement concrete slab of sufficient strength to sustain the loads from vehicular movement. The rigid pavement has high modulus of elasticity and rigidity to distribute the load over a large area of the soil.

SEMI-RIGID PAVEMENT

The type of pavements in which a semi rigid base layer, which is usually made up of cement- stabilized base or cement treated base, is laid with a top flexible layer of bituminous mixture. Typical examples of semi rigid pavements are the lean-concrete base, soil-cement
and lime-pozzolona concrete construction.

COMPOSITE PAVEMENT

The pavements are called "composite" since they consist of layers of the different materials bonded together. A composite type of pavement is the one which consists of multiple structurally significant layers of heterogeneous composition. The type of composite pavements generally provides are:

- Asphalt concrete over plain concrete cement (AC/PCC)
- Plain concrete cement over plain concrete cement (PCC/PCC)

An highway which is either flexible or rigid can get deteriorated in its level of serviceability due to various causes. These factors are

1. Traffic loading
2. Environmental Factors
3. Quality of the material
4. Drainage

According to IRC, a pavement is designed for its design period of 10 years. After its design period pavement is likely to fail and needs maintenance operations to extend its life further.

Various types of failures are:

1) Alligator Cracking
2) Block Cracking
3) Hungry Surface
4) Formation of Corrugations
5) Depressions
6) Fatty surface or Bleeding
7) Formation of Potholes
8) Loss of Aggregates
9) Stripping
10) Reflection Crack

LITERATURE REVIEW

FLEXIBLE PAVEMENT DETERIORATION AND ITS CAUSES

Sharad. S. Adlinge, Professor AK Gupta

IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)

ISSN: 2278-1684, PP: 09-15

In this research the failure of pavement was defined in terms of decreasing the serviceability caused by development of cracks and formation of ruts. Before going into maintenance part, it is better to interpret the causes of failure. The purpose of this study was to evaluate the causes of pavement failure and discuss the particular remedies which can be adopted to improve the pavement performance.

CONCLUSION

The causes of deterioration were summed up as follows:

a) Impact load of traffic, especially of new roads on where the road is designed for comparatively for less traffic.

b) When a new road is constructed with better facilities the traffic from other roads also gets diverted to this new facility causes fatigue to newly constructed pavement.

c) Temperature fluctuations were considered to be prime cause of bleeding and cracking.

d) When shoulders provided were not adequate, it lead to edge failures.

APPLICATION OF WASTE PLASTICAS AN EFFECTIVE CONSTRUCTION MATERIAL IN THE FLEXIBLE PAVEMENT

SasaneNeha .B. Gaikwad .Harish, Dr. JR Patil, Dr. S.D. Khandekar

International Research Journal of Engineering and Technology (IRJET)

Volume: 02, Issue: 03/June-2015

To preserve a particular road so that it behaves well in future for design period, it needs a systematic and pre-planned approach. It will reduce its maintenance operations and will increase its service life. Nowadays a pavement is subjected to various types of loading and which increases rapidly at an alarming rate causing failure of a pavement before it is expected to fail. The paper included various laboratory tests bitumen,ggregate and bitumen-aggregate plastic mix.

CONCLUSION

a) After performing various tests like penetration test, marshal stability test and ductility test on bitumen with addition of waste plastic it was been observed that with the increase in quantity of waste plastic in bitumen, the properties of bitumen were enhanced.

DESIGN APPROACH FOR GEOCELL REINFORCED FLEXIBLE PAVEMENTS

ChandanBasu&Jitendra Kumar Soni

Highway Research Journal

Indian Road Congress

Volume 6, Geocell is a recent development in civil industry. It has a unique three dimensional structure which makes it more important when compared to other geo synthetics. When the local soil is confined with a geosynthetic material like geocell, it shows better structural properties. When the geocells are incorporated in the pavement layers, it facilitates better load distribution and reduces the vertical stresses that are transmitted to the underlying layers. Use of geocells reduces pavement thickness and allows it to give adequate support for moving loads.

CONCLUSION

Geocell when used properly in flexible pavement depending upon the requirement, it can yield significant reduction in bituminous layers and reduces the overall cost of pavement. However this technology needs skilled and experienced installation. Besides cost saving it also reduces the overall construction time and increases the service life of a particular pavement.

ANALYSIS OF THE INFLUENCE OF SOFT SOIL DEPTH ON SUBGRADE CAPACITY FOR FLEXIBLE PAVEMENTS

Carvajal E & Romana M.

Proceeding of Int. conference on soil mechanics and Geotech. Paris 2013

Flexible pavement structure is analyzed on soft soil subgrade, through the finite element modeling of a multilayered system, with objective to evaluate the effect of soft soil on the pavement depth. The analysis also includes iterative procedure to evaluate influence of small strains on stiffness of the soil sample. A simple static load imposed by a heavy truck was considered to evaluate the pavement.

CONCLUSION

It was concluded that deep ground treatments are needed to be applied for achieving an allowable capacity of soft soil up to a minimum depth of 6m, otherwise maintenance cost will increase. The theoretical procedure done by finite element modeling system depicted that soft soil may be significant for long term behavior of flexible pavement, especially in case when shallow treatment of subgrade would be uneconomic.

CONSIDERATION OF THE DETERIORATION OF STABLISED SUBGRADE SOIL IN ANALYTICAL ROAD PAVEMENT DESIGN

Jabar M. Rasul, Michael P.N. Burrow, Gurmel S. Ghataora

Transportation Geotechnics(2016), vol.9:96-109

The stabilization of road subgrade soil may improve its mechanical properties considerably, however under the combined effect of cumulative traffic load and weathering these materials deteriorate over time and lose performance. However, current road design procedures neglect such deterioration of stabilised soils and consequently their use may result in the under design of road pavements and as a result unplanned maintenance and /or premature road failure.

An extensive experimental program was carried out consisting oflaboratory durability tests to determine the mechanical behavior of stabilized subgrade soils,in terms of permanent deformation and resilient modulus, under cycles of wetting and drying.Results of the durability tests were used to validate an analytical predictive equation which considers the changes that take place to the material after cycles of wetting and drying. The experimental results show a decrease in the resilient modulus after 25 cycles of wetting anddrying cycles for 3 types of fine grained subgrade soils stabilized with varying amounts of lime-cement. In order to adequately replicate the stress dependency of the performance of the stabilised subgrades for analytical pavement design, two equations were developed that relate the resilient modulus of a stabilised soil with unconfined compressive strength (UCS). The developed equations were utilized with a numerical finite element model of a road pavement to determine the most appropriate road pavement designs, on an engineering basis, for a variety of stabilised soils.

CONCLUSION

a) A novel relationship which can predict the deteriorated resilient modulus values for different stabilizer contents and types from a deteriorated resilient modulus value of one specified stabilizer content which was tested for durability.

b) Two correlation equations derived from permanent deformation and unconfined compressive strength tests. The equations predict with an adequate accuracy the resilient modulus from the unconfined compressive strength and the stress state, for three soil types at four different stabilizer contents. The correlation equations can be used to determine a set of resilient modulus values for a series of different stress states.

c) A procedure to take into account the nonlinearity of the stress dependency of the resilient modulus values of stabilized and unstablized subgrade soils.

d) A performance model for stabilized subgrade soils which can predict with a satisfactory degree of accuracy the incremental accumulation of permanent deformation. FATIGUE AND RUTTING EIVES IN FEEXIBEE PAVEMENT

Ahmed Ebrahim Abu El-MaatyBehiry

Ain Sham Engineering journal (2012) 3,367-374

In this research, the flexible pavement is designed based on climatic conditions and axle load limits. According to the Egyptian code has specified certain load limits that should not be exceeded. The heavily loaded vehicles like overweight trucks cause many type of deterioration to the pavement and thus reduce its life. The motive of the study is studying the effect of axle load increase, and the variation in pavement modulus on the overall pavement life.

This research used the BISAR software and the Egyptian environmental materials conditions of pavement to evaluate the tensile strains which are occurring on the asphalt concrete (AC) layer and the compressive strains above the subgrade surface. Base thickness and subgrade resilient modulus were the key elements which control the equilibrium between fatigue and rutting lives.

CONCLUSION

a) Tensile and compressive strain increased with increasing axle loads and decreased with increasing asphalt layer elastic modulus. Furthermore, fatigue and rutting lives decrease dramatically with increasing the axle load, especially after the axle load exceeds 150 kN for fatigue life and 120 kN for rutting life.

b) Fatigue life has no sensitivity with the variation of base thickness compared with rutting life, which is high sensitive. While both fatigue and rutting lives have a good sensitivity with the variation of surface thickness specially at base thickness thicker than 300 mm.

The increase of elastic modulus of asphalt or base layers has not obvious effect on the rutting life at base thickness thinner than 300 mm, thicker thickness lead to obvious increase in Rutting life. With respect to fatigue life, it has no sensitivity with the variation of base thickness while has a good sensitivity with the variation of surface modulus or base modulus at all values of base thickness.he maximum allowable axle load should not exceed 135kN because it will cause a fast deterioration rate to the pavement especially in summer season.

The pavement design life is governed by fatigue failure with smaller axle loads that is less than 150 kN and by rutting failure with greater axle loads.

FUTURE COPE AND RECOMMENDATIONS

1) The rehabilitation will be focus on National way road to save it from early damage.
2) The special attention will be given to the areas having high severity level.
3) Future road performance will be assessed and forecasted.
4) Control of surface water or infdtration is needed by providing adequate drainage.
5) Adequate road markings to save it from collision of vehicles should be provided.
6) All the above parameters affects the allocation of funds for maintenance option for different stretches of the road.

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