STUDY ON HIGHWAY FAILURE AND ITS MAINTENANCE

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***ABSTRACT*: One of the main purposes of Highway failure and its maintenance is to provide a better road surface for the road users and carry traffic smoothly and safely with minimum cost. Paved roads in tropical and sub-tropical climates often deteriorate in different ways to those in temperate regions, because of the harsh climatic conditions, lack of proper design and quality control, high loads and inadequate assessment for identifying causes of distresses before carrying out maintenance and rehabilitation. A pavement distress that occurs at the surface can have a number of different causes which must be properly identified before corrective action is taken.**

Proper maintenance is very essential for longer life of the road surface. In this thesis work, describe a maximum possible cause of failure of different roads and also be discussed maintenance technique to repair the road surface using different pavement maintenance materials. Coir Geotextiles and Polygaurd is used in the road construction maintenance to avoid the chances of the pavement failure and accidental cases.

OBJECTIVE

The primary objective of the study is to determine the various factor which are responsible for the failure of the different type of road surface and also be applied the proper method of maintenance to avoid the failure problem of the road. And also be evaluating the engineering properties of material used in pavement. Coir Geotextile and Polygaurd used in the construction of the pavement to minimise the failure problem of the highway.

The scope of study included the following:

1- Determination of physical properties of materials.
2- To identify the cause of the failure of pavement.
3- To provide proper technique and materials of maintenance.
4- Stability comparison of conventional and modified approach.
5- The economics of pavement.

INTRODUCTION

Highway Pavement Failure

A highway pavement is a structure consisting of superimposed layers of processed materials above the natural soil sub-grade, whose primary function is to distribute the applied vehicle loads to the sub-grade. The pavement structure should be able to provide a surface of acceptable riding quality, adequate skid resistance, favorable light reacting characteristics, and low noise pollution. The major Flexible pavement failures are fatigue cracking, rutting, and thermal cracking. The fatigue cracking of flexible pavement is due to horizontal tensile strain at the bottom most of the asphaltic concrete. The failure criterion relates allowable number of load repetitions to tensile strain and this relation can be determined in the laboratory fatigue test on asphaltic concrete specimens. Rutting occurs only on flexible pavements as indicated by permanent deformation or rut depth along wheel load path.

Failure may be caused by

- Inadequate Stability
- Excessive application of stresses
- Plastic deformation Failures in sub base or Base course.
- Inadequate stability
- Loss of binding action
- Loss of bearing course materials
- Inadequate wearing course
- Rutting due to high variation in ambient temperature.
- Uncontrolled heavy axle loads.
- Limitation of pavement design procedures to meet local environmental conditions.

There are various category of Distress or failure: these which are responsible for the highway failure Such as cracking may be longitudinal, fatigue, transvers, reflecting, block, edge cracking. And others Such as rutting, corrugation, shoving, depression, overlay bumps, potholes, patching, reveling, stripping, polished aggregate, pumping, segregation, checking, bleeding and delamination.

Highway Maintenance

Preserving and keeping each type of roadway, roadside, structures as nearly as possible in its original condition as constructed or as subsequently improved and the operation of highway facilities and services to provide satisfactory and safe transportation, is called maintenance of Highways.

The various maintenance functions includes:-

1. Surface maintenance

2. Roadside and drainage maintenance

3. Shoulder and approaches maintenance

4. Snow and ice control

5. Bridges maintenance

6. Traffic service

Highway maintenance is closely related to the quality of construction of originall road.

- Insufficient pavement or base thickness or improper construction of these elements soon results in expensive patching or surface repair.
- Shoulder care becomes a serious problem where narrow lanes force heavy vehicle to travel with one set of wheels off the pavement.
- Improperly designed drainage facilities, mean erosion or deposition of material and costly cleaning operation or other corrective measures.
- Sharp ditches and steep slopes require manual maintenance as compare to cheap maintenance of flatter ditch and soil by machine.
- In snowy country, improper location extremely low fills and narrow cuts leave no room for snow storage, creating extremely difficult snow removal problems.

LITERATURE REVIEW

Highway failure and maintenance of the road involves the consideration of numerous factors, of which the most important are: truck volume, weight and distribution of axle loads, HMA and underlying material properties, and the supporting capacity of the sub grade soils. Typical reconstruction projects should have a design life of 20 years for reconstructions and 10 years for rehabilitations unless mitigating circumstances exist. Proper maintenance provide a smooth and fast travelling to the traffic and road users .so overall we can say that highway failures are directly related to the materials used during the construction of the highway and method of the construction. To the use of Coir Geotextile and Polygaurd in construction of the road to reduce the problem of the failure. Ultimately we can say that moisture problem is the main reason for the failure of the pavement surface. So road surface may be free from the moisture.

METHODOLOGY

Flexible Pavement

Premix types of Bituminous Constructions are generally carried out in the field using appropriate plants. There are two types of mixing Plant and travelling Plant. The canter mixing plant consists of units for batching different materials, separate heating units for mixed aggregates and bitumen and a mixing unit of large capacity. The aggregates, filler and bitumen are transported to the site of the mixing plant which is stationed at a suitable location and the bituminous mix is again transported from the plant to the construction site. Generally there is very good control on the quality of the mix obtained from the central mixing plant. The travelling Plant is a smaller unit and can be shifted from time to time the road side as the bituminous construction progresses. In hot mix constructions the heated aggregates are mixed with heated bitumen in a central or travelling plant. In cold mix method, the aggregates at atmospheric temperature are mixed with bituminous material of low viscosity in cold or after slight heating.

Bituminous Construction procedures

In this Article, the material requirements, plants and equipment and construction process Employed for the following types of bituminous constructions have been presented:

- surface Dressing
- Grouted or Penetration Macadam
- Built-up Spray Grout
- Bitumen Bound Macadam
- Bitumen Carpet

Construction Procedure for Bituminous Concrete road

The bituminous concrete is the highest quality of construction in the group of black top surfaces. Being of high cost specifications, the bituminous mixes are properly designed to satisfy the design requirements of the stability and durability. The mixture contains dense grading of coarse aggregate, fine aggregate and mineral filler coated with bitumen binder. The mix is prepared in hot-mix plant. The thickness of the bituminous concrete layer depends upon the traffic and quality of base course.

Rigid Pavement

Portland cement concrete (PCC) is the most common material used in the construction of rigid pavement slabs. The reason for its popularity is due to its availability and the economy. Rigid pavements must be designed to endure frequently repeated traffic loadings. The typical designed service life of a rigid pavement is between 30 and 40 years, lasting about twice as long as a flexible pavement.

Steps for the construction of concrete pavements

1. Preparation of Sub-grade and Sub-base

2. Placing of forms

3. Batching of material and Mixing

4. Transporting and Placing of Concrete

5. Compaction and Finishing

6. Floating and Straight Edging

7. Belting, Brooming and Edging

8. Curing of Cement concrete

Testing of highway materials:-

There are various tests which are very useful for better performance of highway.

(a) Moisture Condition Value (MCV) Test:-There is a relationship between compacting efforts, moisture content and density. The MCV test involves testing a soil at fixed moisture content and by increasing the number of blows of a rammer, determining the compactive effort beyond which no further increase in density occurs.

(b) California Bearing Ration (CBR) Test:-The CBR test involves the insertion of a 50mm diameter plunger into the ground surface at a rate of 1mm per minute, whilst the load is recorded.

(c) Dynamic Cone Penetrometer:-A standard concrete is hammered through the unbound layers of a pavement using a standard effort from a falling weight.

(d) Ground Penetrating Radar (GPR):- From GPR test in addition to the thickness profile we can know about areas of high moisture, voiding, and joint condition.

(e) Penetration Test on Bitumen:-Its basic principle is to determine the depth to which a needle penetrated as asphalt sample under specified conditions of load, time and temperature.

(f) Softening Point Test on Bitumen:-The softening point is defined as the temperature at which a bitumen sample can no longer support the weight of a 3.5-g steel ball. Ball & Ring apparatus is used.

(g) Viscosity of Bitumen:-Shear stress is applied to a film of bitumen sandwiched between 2 flat plates and the rate of strain is measured. The viscosity in Pascal second is given by shear stress divided by the rate of strain.

(h) Los Angles Abrasion Value Test:-The Los Angles Abrasion test is to indicate the resistance to abrasion.

(i) Flakiness Index Test:-Flakiness Index is the percentage by weight of particles, whose least dimension is less than three-fifth of its mean dimension.

(j) Elongation Index Test:-Elongation Index is the percentage by weight of particles whose largest dimension (i.e. length) is greater than one and four-fifths times its mean dimension.

(k) Sulphate Soundness Test:-This test is for checking resistance to disintegration after immersion in a 20% solution of sodium sulphate. This test is used for assessing weather susceptibility.

(l)Ten Percent Fine Value (TFV):-A test specimen is compacted in a standardized manner into a steel cylinder fitted with a freely moving plunger. The specimen is then subjected to a load applied through the plunger.

(m) Percentage Refusal Density:-This is a measure of relative state of compaction of a site sample of laid DBM or asphalt concrete to that of a similar samples compacted to refusal (i.e. It will not compact further even though it may still contain (void) lab conditions.

(n) Polished Stone Value (PSV):- It involves polishing aggregate specimen with a pneumatic tyre coated with an abrasive paste.

(o) Sand Patch Test:-Macro texture is measured by Sand Patch test. It is a measure of resistance to aquaplaning.

(p) Sideway Coefficient Routine Investigation Machine (SCRIM):-It operates by dragging a wheel at an angle to its direction of travel. The test is carried out on a wet road surface since the presence of water leads to minimum skid resistance.

(q) Deflectograph:-Deflectograph measures the transient deflection of the road surface under the action of a rolling wheel at loading conditions to assess structural condition of pavements.

(r) Falling Weight Deflectometer:-The FWD is used for pavement evaluation.

(s) Pavement Condition Survey:-Traffic Speed Condition Survey (TRACS) were introduced for data collection (e.g. surface distress) on the trunk road network .

EXPECTED OUTCOMS

- Life of the road should be increased.
- Safety of road user.
- Road surface free from the distress.
- Avoid the accidental cases.
- Road surface prepared to fast moving traffic.
- Coir Geotextile and Polygaurd provide crack free surface.
- Road construction and maintenance phenomena are cost effective.

REFRENCE

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