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Abstract

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 characteristics, and low noise pollution. The ultimate aim is to ensure that the transmitted stresses due to wheel load are sufficiently reduced, so that they will not exceed bearing capacity of the subgrade. Two types of pavements are generally recognized as serving this purpose, namely flexible pavements and rigid pavements. This chapter gives an overview of pavement types, layers, and their functions, and pavement failures. Improper design of pavements leads to early failure of pavements acting the riding quality.

Keywords : flexible pavement and rigid pavement.

1. INTRODUCTION.

India is a vast country, the economic prosperity of the country dependent upon its products and economic transportation to the marketing center. The road also play important role in the defence of our country as well as in cultural progress. India is a country of more villages, but more attention is given to the national importance than the district or village road. Large quantity of the perishable agricultural product of India goes west on account of day in reaching market. Such thing can be avoided by providing faster and larger transport facility in rural areas. Progress and prosperity of mountaineous area like Himalayan region also depend on proper road network system. Thus from the above points, one can conclude that the system of well design, well constructed and well maintained road is essential and agricultural, commercial, industrial and cultural progress that is for over all development of the country.

The geometric design of highway is a design phase of highway engineering which deals with the physical dimensions and layout of the visible feature of the highway such as horizontal alignment, vertical alignment, sight distance and intersection at the same time it does not include design of structure element of the road such as thickness of pavement and bases and stability of the foundation. The geometric design of highway should be such that it should provide optimum efficiency in traffic operation along with speed, safety and comfort. It can be seen that the avoidance of minute geometric design feature result in severe accident. Hence it is one of the most important branch of highway engineering.

A Dutch chemist called Van Marum was probably the first person to detect ozone gas sensorial. In the description of his experiments, he mentioned the notion of a characteristic smell around his electrifier. However, the discovery of ozone was only just mentioned by name decennia later, in a writing of Schönbein that dates back to 1840. This discovery was presented to the University of München. Schönbein had noticed the same characteristic smell during his experiments, that Van Marum had tried to identify earlier. He called this gas 'ozone', which is distracted from ozein; the Greek word for scent. Generally, the discovery of ozone is ascribed to Schönbein. Moreover, Schönbein is mentioned as the first person to research the reaction mechanisms of ozone and organic matter.

1.1 History Of Pavement

1.1.1 EARLY DEVELOPMENT

Footpath was the only mode of transport in early days. Animal was also use for transport of people and goods. After invention of wheels the simple animal drawn vehicle was constructed and mostly used. This brought up the necessity of providing a hard surface which can bear the weight of moving vehicle and passengers. Such a hard surface was existed in 'Mesopotamia' in 3500 B.C. the first road in 'Assyrian' empire was constructed by about 1900 B.C.

1.1.2 ROMAN ROAD

During the roman period, the road was constructed on a large extent. Romans are from the people who start construction of road in the early period about 312 B.C. they design wide and effective road network radiating from rom to various part.

1.1.3 TRESAGUET METHOD

After the degeneration of Roman Empire, there was a need of developing new technique and method of construction. PIERREY TRESAGUET developed and improved method in France by the year 1764 A.D. when FRANCE was under the rule of NAPOLEON.

1.1.4 MATCALF METHOD

Jhon Metcalf was engaged in the construction work of road in the England when Tresaguet was working in France. He constructed road about 290 km. Of road in north England.

1.1.5 TELFORD CONSTRUCTION

Thomas Telford was the founder of institution of civil engineering at London. He also believed the old concept of road construction that heavy foundation can be used in pavement construction

1.1.6 MACADAM CONSTRUCTION

Jhon Macadam proposed or developed on entirely new method of construction which then proves very much effective and economic, due to replacement heavy foundation stone.

2. WHAT IS PAVEMENT

A multi layer system that distributes the vehicular load over a large area .pavement is the structure consisting of superimposed layer of selected and process material whose primary function is to distribute the applied vehicle load to the sub grade. Pavement is the upper part of road way, airport or parking area structure. It includes all layers resting on the original ground. It consists of all structural element or layer including shoulders.

It can also be defined as “structure which separates the tires of vehicles from the under laying foundation”

2.1 Requirements of a Pavement

An ideal pavement should meet the following requirements:

- i. Sufficient thickness to distribute the wheel load stresses to a safe value on the sub-grade soil.
- ii. Structurally strong to withstand all types of stresses imposed upon it.
- iii. Adequate coefficient of friction to prevent skidding of vehicles.
- iv. Smooth surface to provide comfort to road users even at high speed.
- v. Produce least noise from moving vehicles.
- vi. Dust proof surface so that traffic safety is not impaired by reducing visibility.
- vii. Impervious surface, so that sub-grade soil is well protected.

2.1 TYPE OF PAVEMENT

2.1.1 Rigid pavement

2.1.2 Flexible pavement

2.1.1 RIGID PAVEMENT

It is the category of pavement which passes remarkable flexural strength or flexural rigidity. The material strength use in the construction of this type of pavement is portland cement concrete, either plain or reinforced. Therefore it is also called as ‘CC’ pavement. The cc pavement is expected to sustain up to 45 kg/cm² of flexural stresses. The rigid pavement has a slab action and is capable of transmitting a wheel load through much wider area below the pavement slab. Flexural stresses are developed at different location in the cc pavement and critical combination of stresses is maximum in it. The stresses in the rigid pavement are analysed using elastic theory. Elastic theory state that, rigid pavement is an elastic plate resting over an elastic or viscous foundation the slab can serve as both wearing surface as well as effective base coarse



Fig.1: rigid pavement

2.1.1 ADVANTAGES OF RIGID PAVEMENT

1. Longer life span about 30 year.
2. It provide good and rigid riding surface.
3. It has low maintainance cost.
4. Ability to place directly on poor soils.
5. Good night visibility even under wet condition.

2.1.1 DISADVANTAGES OF RIGID PAVEMENT

1. It has a high initial cost.
2. It is not possible to restore a failed or badly cracked pavement.
3. It is difficult to lay underground cables and sewer after the construction of pavement.
4. It becomes to smooth and slippery due to long service life and thus re texturing of pavement is difficult and expensive.
5. It's creats noise when used by animal drawn vehicles.

2.1.2 FLEXIBLE PAVEMENT

It is category of pavement which have low or negligible flexural strength and are rather flexible in their structural action under the load. The material used in the construction of this type of pavement are bituminous concrete, all granular material with or without bituminous binder, crushed aggregate gravel, soil aggregate mixes, etc. The intensity of vertical compressive stresses maximum on the top layer and wheel of vehicles. The stresses get distributed in larger area in the shape of truncated cone, hence top layer has to strongest and constructed with good quality of material whereas the stresses

at the bottom layer is comparatively lower hence it may be constructed with inferior material with lower cost



Fig.2: flexible pavement

A typical flexible pavement consists of four components, namely

1. Soil sub-grade.
2. Sub – base course.
3. Base course.
4. Surface course.



Fig.3: component of flexible pavement

2.1.1 ADVANTAGES OF FLEXIBLE PAVEMENT

1. The deteriorated condition of the road surface can be restored with thin bituminous resurfacing layer.
2. Strengthening of flexible pavement is also possible by providing additional surface layer.
3. Easy to construct and repair frost heave and settlement.
4. Deteriorated material can be further used to next construction work.

2.1.2 DISADVANTAGES OF FLEXIBLE PAVEMENT

1. Shorter life span under heavy use.
2. Higher maintenance of drainage system, shoulder and pavement surface and repair work.
3. Once the stripping of bituminous starts it then results in rapid deterioration.
4. Night visibility of bituminous surface is very poor, particularly under wet conditions.

3 FEATURES

1. Presents new information on sustainable pavement materials, construction practices, and maintenance.
2. Provides new coverage of environmental mitigation for transportation projects, including impact assessment, alternatives analysis, and enforcement.
3. Expands coverage of techniques, such as forensic investigations for determination of type and cause of distress.
4. Offers a chapter on standards to help students understand their importance and practicality.

5. Includes numerous new photographs and schematics to further enhance students' understanding of different topics. Contains links to online resources, wherever applicable, so students can build their own library for each topic.

3.1 Difference between Flexible And Rigid Pavement

1. Flexible pavement differs from rigid pavement in terms of load distribution. In flexible pavements, load distribution is primarily based on a layered system. While, in case of rigid pavements, most of the load is carried by the slab itself and a slight load goes to the underlying strata.
2. Structural capacity of flexible pavement depends on the characteristics of every single layer. While, the structural capacity of rigid pavements is only dependent on the characteristics of the concrete slab. This is so, because of the low bearing soil capacity of the underlying soil.
3. In flexible pavements, load intensity decreases with the increase in depth. Because of the spreading of loading in each single layer. While, in case of rigid pavement, the maximum intensity of load is carried by the concrete slab itself, because of the weak underlying layer.
4. In flexible pavement, the deflection basin is very deep, because of its dependency on the underlying layers. While, in case of rigid pavement, the deflection basin is shallow, this is because of the independency of rigid pavement on the underlying layers.
5. Flexible pavement has a very low modulus of elasticity (less strength). The modulus of elasticity of rigid pavement is very high, because of the high strength of concrete and its greater load-bearing capacity compared to flexible pavements.
6. In flexible pavements, the underlying layers play a very important role. Therefore, more role is played only by the underlying layers. In case of rigid pavements, the slight function of the underlying layers is played by the top layer (that is, the slab) by itself. Therefore, the main part is taken by the sub-layers.

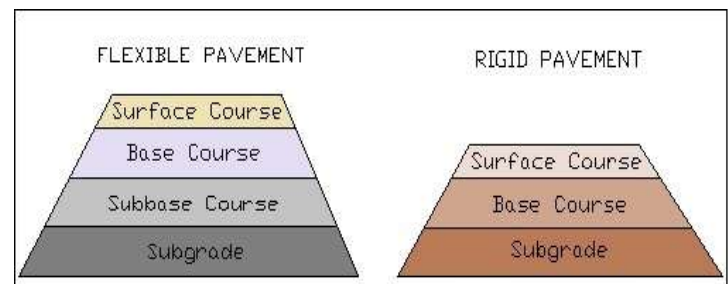


Fig.4: difference between flexible and rigid pavement

4. CONCLUSION

Pavements form the basic supporting structure in highway transportation. Each layer of pavement has a

multitude of functions to perform which has to be duly considered during the design process. Different types of pavements can be adopted depending upon the traffic requirements. Improper design of pavements leads to early failure of pavements affecting the riding quality also. And it is solve the problems related to pavement. It also helps to improving quality and life of the pavement. The good pavement is also decrease the rate of accident. When the flexible pavement is well designed then the cost of the project is reduced. In the rural area the flexible pavement is much suitable as compaire to the urban area because the traffic density and use of the road. And in the rural area the fund is limited and the construction cost of the rigid pavement is very high as compaire to flexible pavement then the flexible pavement is use. The strength of the flexible pavement is less as compaire to rigid pavement but the maintance cost is low. The

material use for the construction of flexible pavement is easily available in rural area.

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