3.1 Highway Pavement

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 reflecting characteristics, and low noise pollution.

Need of Highway Pavement

- ✓ Road surface should be stable and un-yielding.
- ✓ Uneven and undulating, vehicle operating cost, road user cost, time cost and accident cost will increase.
- ✓ Earthen roads yield and are unstable under adverse weather condition and wheel loads.

Basic Requirements of Quality Pavement

The pavement should meet the following requirements:

- ✓ Sufficient thickness to distribute the wheel load stresses to a safe value on the sub grade soil
- ✓ Structurally strong to withstand all types of stresses imposed upon it
- ✓ Adequate coefficient of friction to prevent skidding of vehicles
- ✓ Smooth surface to provide comfort to road users even at high speed

Types of Highway Pavement

1.Flexible Pavements - flexible pavements will transmit wheel load stresses to the lower layers by grain-to-grain transfer through the points of contact in the granular structure. The Typical layers of a flexible pavement are,

Seal Coat:

- ✓ It is a thin surface treatment used to water-proof the surface.
- ✓ To provide skid resistance.

Tack Coat:

- ✓ It is a very light application of asphalt, usually asphalt emulsion diluted with water.
- ✓ Provides proper bonding between two layer of binder course and must be thin, uniformly cover the entire surface, and set very fast.

Prime Coat:

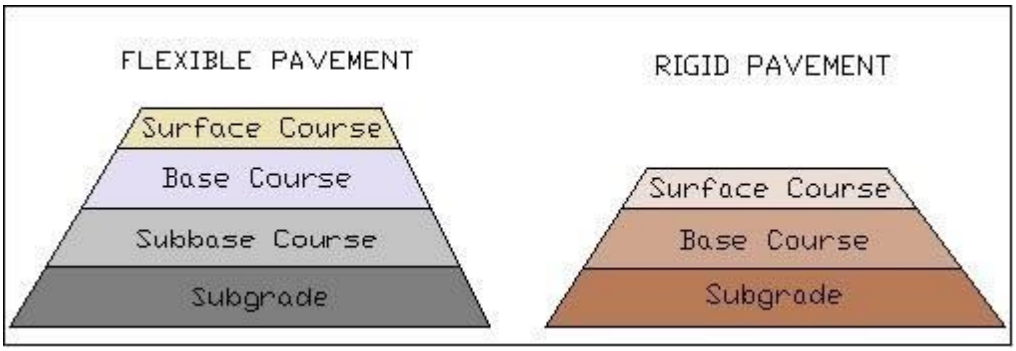
- ✓ It is an application of low viscous cutback bitumen to an absorbent surface like granular bases on which binder layer is placed.
- ✓ Provides bonding between two layers.

2.Rigid pavements -Rigid pavements have sufficient flexural strength to transmit the wheel load stresses to a wider area.

Types of Rigid Pavement

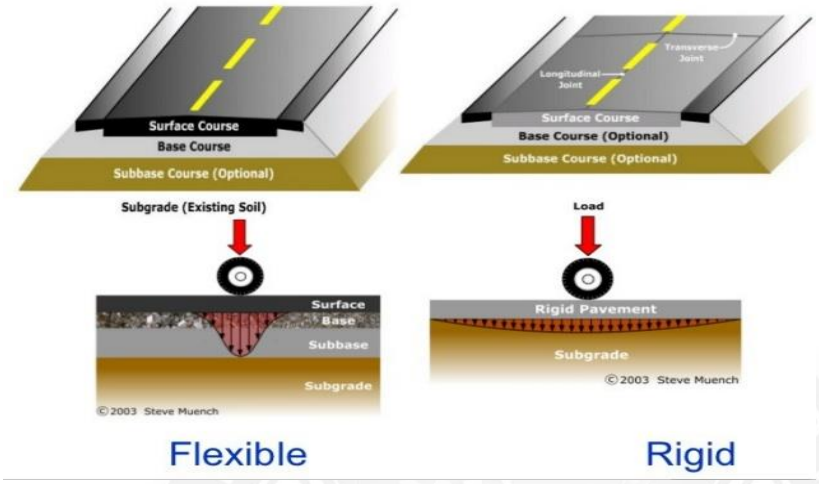
Rigid pavements can be classified into four types:

- Jointed plain concrete pavement(JPCP)
- Jointed reinforced concrete pavement(JRCP)
- Continuous reinforced concrete pavement (CRCP)and
- Pre-stressed concrete pavement(PCP)



Critical Load Positions

Since the pavement slab has finite length and width, either the character or the intensity of maximum stress induced by the application of a given traffic load is dependent on the location of the load on the pavement surface. There are three typical locations are *interior, edge* and *corner*. These locations are termed as critical load position



Factors Affecting Pavement Design

Traffic and loading

Traffic is the most important factor in the pavement design. The key factors include contact pressure, wheel load, axle configuration, moving loads, load, and load repetitions.

Contact pressure

The tire pressure is an important factor, as it determines the contact area and the contact pressure between the wheel and the pavement surface. Even though the shape of the contact area is elliptical, for sake of simplicity in analysis, a circular area is often considered.

Wheel load

The next important factor is the wheel load which determines the depth of the pavement required to ensure that the subgrade soil is not failed. Wheel configuration affects the stress distribution and deflection within a pavement. Many commercial vehicles have dual rear wheels which ensure that the contact pressure is within the limits. The normal practice is to convert dual wheel into an equivalent single wheel load so that the analysis is made simpler.

Axle configuration

The load carrying capacity of the commercial vehicle is further enhanced by the introduction of multiple axles.

Moving loads

The damage to the pavement is much higher if the vehicle is moving at creep speed. Many studies show that when the speed is increased from 2 km/hr to 24 km/hr, the stresses and deflection reduced by 40 per cent.

Repetition of Loads

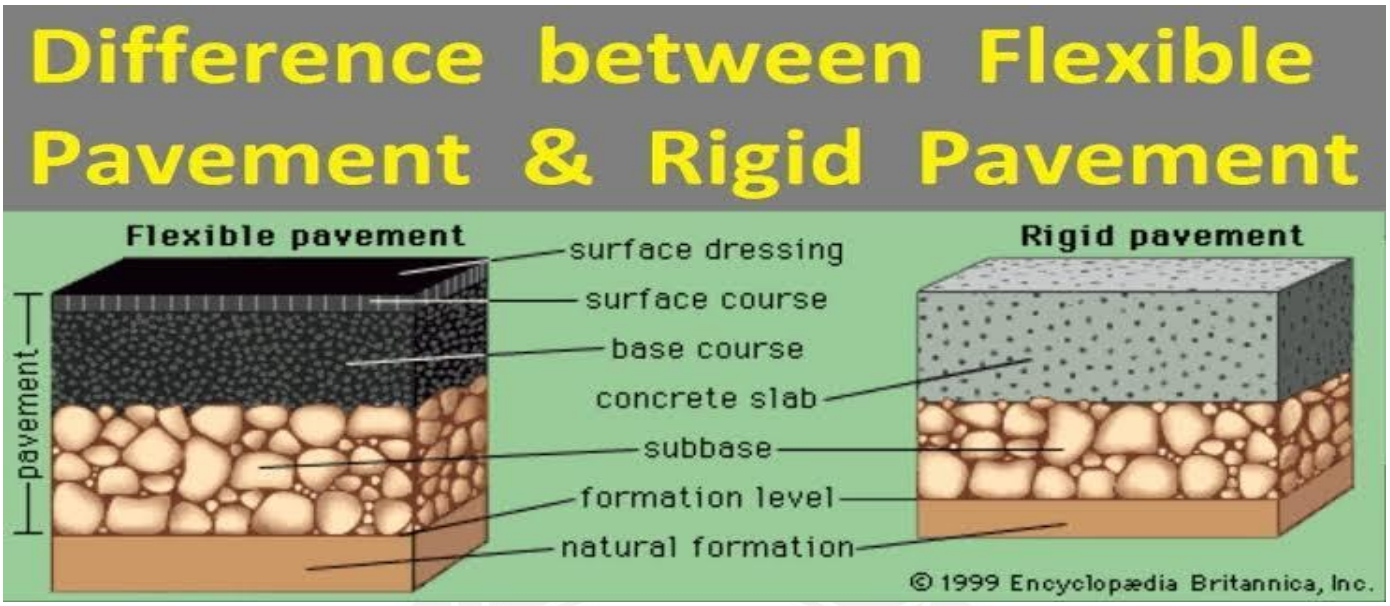
The influence of traffic on pavement not only depends on the magnitude of the wheel load, but also on the frequency of the load applications. Each load application causes some deformation and the total deformation is the summation of all these.

Environmental factors

Environmental factors affect the performance of the pavement materials and cause various damages. Environmental factors that affect pavement are of two types, temperature and precipitation.

Difference Between Flexible Pavement and Rigid Pavement

Properties	Flexible	Rigid
Design Principle	Empirical method Based on load distribution characteristics of the components	Designed and analyzed by using the elastic theory
Material	Granular material	Made of Cement Concrete either plan, reinforced or prestressed concrete
Flexural Strength	Low or negligible flexible strength	Associated with rigidity or flexural strength or slab action so the load is distributed over a wide area of subgrade soil.
Normal Loading	Elastic deformation	Acts as beam or cantilever
Excessive Loading	Local depression	Causes Cracks
Stress	Transmits vertical and compressive stresses to the lower layers	Tensile Stress and Temperature Increases
Design Practice	Constructed in number of layers.	Laid in slabs with steel reinforcement.
Temperature	No stress is produced	Stress is produced
Force of Friction	Less. Deformation in the sub grade is not transferred to the upper layers.	Friction force is High
Opening to Traffic	Road can be used for traffic within 24 hours	Road cannot be used until 14 days of curing
Surfacing	Rolling of the surfacing is needed	Rolling of the surfacing in not needed.


Difference between Flexible Pavement & Rigid Pavement
Flexible pavement
Rigid pavement
pavement
surface dressing
surface course
base course
concrete slab
subbase
formation level
natural formation
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