



A Review of pavements and their types

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Abstract :

The pavements can be classified based on the structural performance into two, flexible pavements and rigid pavements. In flexible pavements, wheel loads are transferred by grain-to-grain contact of the aggregate through the granular structure. The flexible pavement, having less flexural strength, acts like a flexible sheet (e.g. bituminous road). On the contrary, in rigid pavements, wheel loads are transferred to sub-grade soil by flexural strength of the pavement and the pavement acts like a rigid plate (e.g. cement concrete roads). In addition to these, composite pavements are also available. A thin layer of flexible pavement over rigid pavement is an ideal pavement with most desirable characteristics.

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Key words : Roads, Rigid Pavements, Flexible Pavements, Structure, Concrete etc.

Introduction : Pavement is the durable surface material laid down on an area intended to sustain vehicular or foot traffic, such as a road or walkway. In the past, gravel road surfaces, cobblestone and granite setts were extensively used, but these surfaces have mostly been replaced by asphalt or concrete laid on a compacted base course. Road surfaces are frequently marked to guide traffic. Today, permeable paving methods are beginning to be used for low-impact roadways and walkways. Pavement in construction is an outdoor floor or superficial surface covering. Paving materials include asphalt, concrete, stone such as flagstone, cobblestone, and setts, artificial stone, bricks, tiles, and sometimes wood. In landscape architecture pavements are part of the hardscape and are used on sidewalks, road surfaces, patios, courtyards, etc

Highway and pavement design plays an important role in the DPR projects. The satisfactory performance of the pavement will result in higher savings in terms of vehicle operating costs and travel time, which has a bearing on the overall economic feasibility of the project. This paper discusses about the pavements, their types and comparative analysis.

Types Of Pavements



There are various type of pavements depending upon the materials used. A briefs description of all types is given here.

1) Flexible Pavements

Bitumen has been widely used in the construction of flexible pavements for a long time. This is the most convenient and simple type of construction. The cost of construction of single lane bituminous pavement varies from 20 to 30 lakhs per km in plain areas.

2) Rigid Pavements

A rigid pavement is constructed from cement concrete or reinforced concrete slabs. Grouted concrete roads are in the category of semi-rigid pavements. Rigid pavements, though costly in initial investment, are cheap in long run because of low maintenance costs.

Pros and cons of using bitumen in constructing pavements

Flexible pavements : In some applications, however, the performance of conventional bitumen may not be considered satisfactory because of the following reasons:

1. In summer season, due to high temperature, the bitumen becomes soft resulting in bleeding, rutting and segregation finally leading to failure of pavement.
2. In Winter season, due to low temperature, the bitumen becomes brittle resulting in cracking, raveling and unevenness which makes the pavement unsuitable for use.
3. In rainy season, water enters the pavement resulting into pot holes and sometimes total removal of bituminous layer.
4. In hilly areas, due to sub zero temperature, the freeze thaw and heave cycle takes place. Due to freezing and melting of ice in bituminous voids, volume expansion and contraction occur. This leads to pavements failure.
5. The cost of bitumen has been rising continuously. In near future, there will be scarcity of bitumen and it will be impossible to procure bitumen at very high costs.

Rigid Pavements : There are various merits in the use of Rigid pavements (Concrete pavements) are summarized below:

- a. Bitumen is derived from petroleum crude, which is in short supply globally and the price of which has been rising steeply. India imports nearly 70% of the petroleum crude. The demand for bitumen in the coming years is likely to grow steeply, far outstripping the availability. Hence it will be in India's interest to explore alternative binders. Cement is



available in sufficient quantity in India, and its availability in the future is also assured.

Thus cement concrete roads should be the obvious choice in future road programmes.

- b. Besides the easy available of cement, concrete roads have a long life and are practically maintenance-free.
- c. Another major advantage of concrete roads is the savings in fuel by commercial vehicles to an extent of 14-20%. The fuel savings themselves can support a large programme of concreting.
- d. Cement concrete roads save a substantial quantity of stone aggregates and this factor must be considered when a choice pavements is made,
- e. Concrete roads can withstand extreme weather conditions – wide ranging temperatures, heavy rainfall and water logging.
- f. Though cement concrete roads may cost slightly more than a flexible pavement initially, they are economical when whole-life-costing is considered.
- g. Reduction in the cost of concrete pavements can be brought about by developing semi-self-compacting concrete techniques and the use of closely spaced thin joints. R&D efforts should be initiated in this area.

Types of Pavements

There are two types of pavements based on design considerations i.e. flexible pavement and rigid pavement. Difference between flexible and rigid pavements is based on the manner in which the loads are distributed to the sub grade. Before we differentiate between flexible pavements and rigid pavements, it is better to first know about them. Details of these two are presented below:

- 1) **Flexible Pavements:** Flexible pavement can be defined as the one consisting of a mixture of asphaltic or bituminous material and aggregates placed on a bed of compacted granular material of appropriate quality in layers over the subgrade. Water bound macadam roads and stabilized soil roads with or without asphaltic toppings are examples of flexible pavements. The **design of flexible pavement** is based on the principle that for a load of any magnitude, the intensity of a load diminishes as the load is transmitted downwards from the surface by virtue of spreading over an increasingly larger area, by carrying it deep enough into the ground through successive layers of granular material.



Thus for flexible pavement, there can be grading in the quality of materials used, the materials with high degree of strength is used at or near the surface. Thus the strength of sub grade primarily influences the thickness of the flexible pavement.

2) Semi Rigid Pavements:

The pavements constructed using the waste materials, which are stronger the traditional aggregates may be treated as Semi-Rigid Pavement. A lot of research work has been done in this direction. But the work in terms of real construction is not visible.

3) Rigid Pavements:

A rigid pavement 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. The rigid pavement has rigidity and high modulus of elasticity to distribute the load over a relatively wide area of soil.

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