

Design of Flexible Pavement using Over-Burnt Bricks

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Abstract— In developing countries, a good number of bricks (approximately 10% to 15%) are severely overburnt due to uncontrolled distribution of temperature in the kiln. These bricks are dark red in colour, severely distorted, and swollen. These bricks are considered useless and are not allowed in any other construction work. In this study, the feasibility of utilizing these overburnt bricks in pavement by mixing it with layer of soil in pavement to improve the strength of soil. And perform Californian Bearing Ratio test (CBR TEST) to check the strength. It was found that overburnt brick aggregates are stronger, less absorptive, and denser in general than the ones from the (Type A) bricks. Therefore, these bricks may be conveniently and economically used in pavement. As road pavement tends to be very costly.

Keywords—Over Burnt Brick, Pavement, Cost

I. HIGHWAY PAVEMENT

A route pavement may be a structure consisting of superimposed layers of processed materials higher than the natural soil sub-grade, whose primary perform is to distribute the applied vehicle masses to the sub-grade. The pavement structure ought to be able to give a surface of acceptable riding quality, adequate skid resistance, favourable lightweight reflective characteristics, and low pollution. The final word aim is to make sure that the transmitted stresses thanks to wheel load area unit sufficiently reduced, in order that they're going to not exceed bearing capability of the sub- grade. 2 forms of pavements area unit usually recognized as serving this purpose, particularly versatile pavements and rigid pavements. This chapter provides an summary of pavement sorts, layers, and their functions, and pavement failures. Improper style of pavements ends up in early failure of pavements poignant the riding quality.

Types of pavement are:

- Flexible pavement
- Rigid pavement

Rigid Pavements:-

A rigid pavement is built from cement concrete or concrete slabs. Grouted concrete roads square measure within the class of semi-rigid pavements.

The design of rigid pavement relies on providing a structural cement concrete block of comfortable strength to resist the masses from traffic. The rigid pavement has rigidity and high modulus of physical property to distribute the load over a comparatively wide space of soil.

Flexible pavement:-

Flexible pavements can transmit wheel load stresses to the lower layers by grain-to-grain transfer through the points of contact within the granular structure.

The wheel load performing on the pavement are distributed to a wider space, and also the stress decreases with the depth. Taking advantage of this stress distribution characteristic, versatile pavements unremarkably has several layers. Hence, the look of versatile pavement uses the thought of superimposed system. supported this, versatile pavement is also made in a very range of layers and also the high layer must be of highest quality to sustain most compressive stress, additionally to wear and tear. The lower layers can expertise lesser magnitude of stress and quality material is used versatile pavements area unit made victimisation hydrocarbon materials. Types of versatile pavement are:

- Conventional versatile pavement
- Full depth asphalt pavement
- Contained rock asphalt mats

Layers of Flexible Pavement:

Base course:-

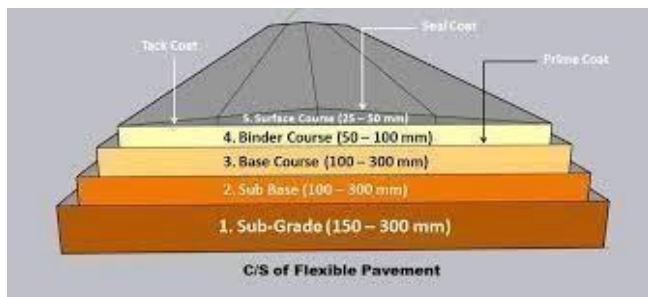
The base course is that the layer of material sort of a shot to a lower place the surface of binder course and it provides further load distribution and contributes to the sub-surface drain it should be composed of the crushed stone, crushed scoria, and different untreated or stable materials.

Sub base course:-

The sub-base course is that the layer of fabric to a lower place the bottom course and also the primary functions area unit to produce structural support, improve drain, and scale back the intrusion of fines from the sub-grade within the pavement structure.

Sub grade:-

The top soil or sub-grade could also be a layer of natural soil able to receive the stresses from the layers above. it's essential that at no time soil sub-grade is overstressed. It should be compacted to the fascinating density, near the optimum wet content. it is the compacted natural soil sort of as hot below the pavement layers; this act as a foundation for the route. the very best surface of the subgrade is termed the formation level.



Soil Stabilization:

Soil stabilization a general term for any physical, chemical, mechanical, biological or combined technique of adjusting a natural soil to m enhancements embody increasing the burden bearing capabilities, strength, and overall performance of unaltered subsoils, sands, and waste materials so as to strengthen road pavements.

Some of the renewable technologies are: enzymes, surfactants, biopolymers, artificial polymers, co- polymer based mostly product, cross-linking cinnamene acrylic polymers, tree resins, ionic stabilizers, fibre-reinforcement, atomic number 20 chloride, calcite, atomic number 11 chloride, Mg chloride and additional. a number of these new helpful techniques produce hydrophobic surfaces and mass that forestall road failure from water penetration or significant frosts by inhibiting the ingress of water into the treated layer.

II. MATERIAL

Over Burnt Brick:

This are ground moulded brick. It's surface and edge is rough. Quality of brick are inferior. Our company specializes in providing a distinct assortment of Over Burnt Bricks. This innovative segment is widely demanded in varied sectors for meeting diverse applications. In line with international norms, this brick is processed using quality tested basic material and advanced techniques.

Collection of brick:

We got overburnt brick from the brick klin near Balda. Collected about 7 to 10 kg of brick. Then we broke (grinded) the collected bricks into very small pieces with the use of hammer.



Soil collection:

We took the soil from the backyard of our team member's house in NANI SARON, VALSAD. We diged about 1m for collecting soil as soil at the top goes through more wear n tear, deep down we can get good and fresh soil.



Procedure:

We collected over burnt brick from nearby kiln. Then we crushed the brick with the use of rammer, hammer and sieved the crushed powder and collected in one container.

Further we mixed soil and over-burnt brick powder in different proportion and made three different samples and performed Standard Procter test to know OMC and MDD.

Three sample we made:

1. Soil-75% ,Over burnt brick powder-25%
2. Soil-65% ,Over burnt brick powder-35%
3. Soil-50% ,Over burnt brick powder-50%

As above mention composition we conducted test of soil like Liquid limit test, Plastic limit test, Procter test.

III. TEST RESULT

To know the type of soil and optimum moisture content further performed liquid limit test and Standard Procter test respectively. Following is the result shown below:

Sr. No.	Test Parameters	Units	Test Results	Test Methods	
1	Particle Size Analysis	a) Gravel	%	0.00	IS 2720 (Part 4)
		b) Sand	%	20.10	
		c) Silt	%	79.90	
		d) Clay	%	79.90	
2	Consistency properties	Liquid Limit	%	43.25	IS 2720 (Part 5)
		Plastic Limit	%	24.10	
		Plasticity Index	%	19.15	
3	IS Classification	—	CI	IS 1498 - 1970	
4	Light Compaction	MDD	gm/cc	1.553	IS 2720 (Part 7)
		OMC	%	17.58	

Further mixed soil and over-burnt brick powder in different proportion and made three different samples and performed Standard procter test to know OMC and MDD.

Sample 1-
Soil-75%, Brick powder-25%

Sr. No.	Test Parameters	Units	Test Results	Test Methods	
1	Light Compaction	MDD	gm/cc	1.665	IS 2720 (Part 7)
		OMC	%	17.85	

Sample 2-
Soil-65%, Brick powder-35%

Sr. No.	Test Parameters	Units	Test Results	Test Methods	
1	Light Compaction	MDD	gm/cc	1.743	IS 2720 (Part 7)
		OMC	%	16.71	

Sample 3-
Soil-50%, Brick powder-50%

Sr. No.	Test Parameters	Units	Test Results	Test Methods	
1	Light Compaction	MDD	gm/cc	1.743	IS 2720 (Part 7)
		OMC	%	16.71	

IV. CONCLUSION

As per test result, in first sample as over burnt powder is added 25% in soil we did not get desire CBR value of soil. In second sample as over burnt brick powder is added 35% in soil we get more CBR value than the 25% soil sample. In third sample as over burnt brick powder is added 50% in soil we get lesser CBR value than 35% of soil.

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