

COST COMPARATIVE STUDY ON FLEXIBLE PAVEMENT DESIGN IRC 37 – 2012 OVERSTABILIZED

SUBGRADE SOILS

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ABSTRACT: *Some road advancement materials have ended up being exceptional and costly in many places in India in light of immense improvement practices required for the change of new structure workplaces like lanes. The road improvement cost is shyly depends upon black-top outside thicknesses, and this covering thickness will change in perspective of materials quality (E) for a given action. In case the material quality is low the required covering thickness is more, and the a different way. To beat this issue the black-top business scans for strategies for upgrading lower quality materials through modification process that is speedily available for use in roadway advancement. Solid/lime treatment has transformed into a recognized strategy for growing the quality and quality of soils and irrelevant sums, decreasing measure of sums. Indian Roads Congress (IRC) developed a Special Publication (SP) for mix design of lime/concrete treated base/subgrade. The title of the wander "Cost Comparative Study on Flexible Pavement Design (IRC: 37-2012) Over Stabilized Subgrade Soils" objective is plan of versatile black-tops over lime offset subgrade soils by changing its quality through modification, and taking a gander at the life cycle cost of picked diagram decisions under IRC:37-2012 guidelines". At to begin with, inquire about office examination was carried on the accumulated sub-survey soils with lime change. Starting there, new versatile black-tops are proposed for all subgrade quality regards as per the arrangement rules IRC: 37– 2012, and Mechanistic – Empirical layout method communicated in R-56 ask about arrangement upheld by MORTH. For the black-top examination and arrangement reason IITPAVE*

diagram decisions under the rate examination given by Public Works Department (PWD) of Telangana to evaluate the functional black-top arrangement course of action. At 3% lime change with the sub-level soil, we found it as perfect percent to save the best cost of road advancement with examination of other %. 3% lime development to the sub-survey soil is giving for the most part most noteworthy quality. With that, the wander cost per kilometer is decreasing by 11% appearing differently in relation to the 0% lime extension. i.eRs. 72,00,590/- per kilometer saving in road improvement.

Keywords: MORTH ,IITPAVE programing, lime, over stabilized subgrade soils.

INRODUCTION

Persuading dark best setup is a champion among the most fundamental parts of meander chart. The dark best is the bit of the street which is most clear to the driver. The condition and sufficiency of the expressway is a great part of the time judged by the smoothness or repulsiveness of the dark best. Lacking dark best conditions can understand broadened client expenses and travel delays, braking and fuel utilize, vehicle reinforce repairs and likelihood of expanded incidents. The dark best life is generously affected by the measure of liberal load redundancies related, for example, single, couple, trade and quad turn trucks, transports, tractor trailers and mechanical assembly. A genuinely organized dark best structure will consider the related stacking. Subgrade layer is the most decreased layer operating at a profit top structure fundamental the base course or surface course, subordinate upon the kind of dark best. For the most part, subgrade contains various locally

accessible soil materials that occasionally may be touchy and furthermore wet that can't have enough quality/strength to help dark best stacking.

IMPORTANCE OF THE STUDY

In India, 28.33% of the aggregate land range is secured by diminish cotton soils. Despite the way that Black cotton soils are known for their plenitude and making uncommon thing yields, from fundamental arranging viewpoint, they are famous for their low quality and low bearing purpose of constraint. Regardless, we can't just dismissal their quality and let the extents with such soils to fall behind being created. In a making economy like India, all of open land must be used for improvement of structure.

OBJECTIVES OF THE STUDY

The goal of the meander is to pick the fitting stabilizer to influence a fiscally astute dark to top game plan strategy on dull cotton soils. The goals of the meander work are consolidated as takes after:

Identification of the meander territory, where dull cotton soils are typical, and picking the physical properties of such soils.

Selection of reasonable stabilizer and its ideal blend degree, in context of level of significant worth change required.

Traffic overviews, investigation and calculation of configuration movement that may happen amid the plan life of the asphalt.

Designing of adaptable asphalts with the assistance of IITPAVE programming at different blend extents of stabilizer added to the subgrade soil.

Carrying out continuous rate examination, and amount estimation for the got asphalt outline choices.

Selecting the ideal stabilizer blend extent which is savvy in the given outline situation by performing money saving advantage examination on different blend extents.

TYPES OF PAVEMENTS

Black-top contains more than one layer of different material maintained by a layer called sub survey. Generally black-top is two sort versatile black-top and unyielding black-top. Versatile black-tops are so named in light of the fact that the total black-top composed effects, or flexes, under stacking. A versatile black-top structure is commonly made out of a couple of layers of material.

Each layer gets the stores from the above layer, spreads them out then passes on these piles to the accompanying layer underneath. Normal versatile black-top structure including:

Surface Course: This is the best player and the layer that connects with movement. It may be made out of one or a couple of assorted HMA sub layers. HMA is a mix of coarse and fine sums and dark best clasp.

Base Course: This is the layer direct underneath the HMA layer and all things considered contains add up to (either offset run-settled).

Sub-Base Course: This is the layer (or layers) under the base layer, and moreover this layer called as waste layer on Indian setting. As off both versatile and unbendable black-tops, minimum of 150mm thickness is required.

Sub-level: This is the layer stacked with picked get an area soil, and goes about as a foundation to the total black-top layers. In Indian setting the base thickness of compacted layer is 500mm.

In light of assistant direct, the black-tops are extensively orchestrated into three arrangements as takes after;

1. Flexible Pavement
2. Rigid Pavement
3. Composite Pavement.

1. Flexible Pavement :

A versatile black-top structure is ordinarily made out of a couple of layers of material with better quality materials on top where the energy of stress from movement loads is high and lower quality materials at the base where the tension power is low. Versatile pavements can be destitute down as a multilayer structure under stacking.

A typical versatile black-top structure contains the surface course and shrouded base and sub-base courses. Each of these layers adds to fundamental help and drainage.

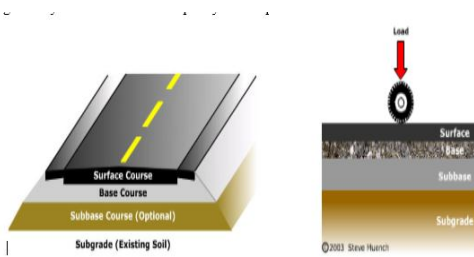


Fig 1.2: shows a typical cross section and the layer compositions of a flexible pavement.

2. Rigid Pavement:

An unbending asphalt structure is made out of a Pavement Quality Concrete (PQC) surface course and fundamental Dry Lean Concrete (DLC) base and a run of the mill subbase courses of GSB layer to go about as a seepage layer. Another term normally utilized is Portland bond concrete (PCC) asphalt, in spite of the fact that with the present pozzolanic added substances, concretes may never again be in fact delegated "Portland." The surface course (solid section) is the stiffest layer and gives the greater part of quality. The base or subbase layers are requests of greatness less firm than the PQC surface yet make essential commitments to asphalt waste and ice security and give a working stage to development gear.

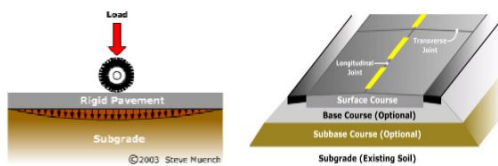
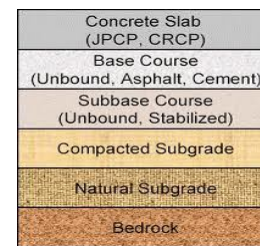


Figure 1.3 Typical Sections for a Rigid Pavement

3. Composite Pavement :

A composite dark best is made out of both hot blend dim best (HMA) and water driven bond concrete. Usually, composite asphalts are dim best surfaces over solid balance base/sub-bases. The HMA surface may have been set as the keep going time of at an opportune time headway, or as an essential piece of a modifying or thriving treatment. Composite dark best direct under activity stacking is mix of flexible cum firm dark tops. The consumption life of settled base/sub-base may enlist as for all intents and purposes indistinguishable as resolute dark tops and HMA surface layer weariness life will overview as demonstrated by the standard chart system flexible dark tops Figure 1.4 will address the conventional composite dark best cross area.



LABORATORY INVESTIGATION

The prime convergence of this area is to evaluate and appreciate the dim cotton soils physical properties from the best illustrative accumulated examples. So that, the procured physical essentials may give an arrangement to pick a honest to goodness alteration material for the investigation consider and layout. Starting at now our ECLAT counsels are working for arranging a 4-way National Highway that continues running over Black Cotton soil strata in the region of Bihar. For this investigation consider we assembled the enough measure of best illustrative case of dim cotton soil from Nadargul town in Saroornagarmandal of Rangareddy District for look into focus examination. The Black Cotton soil existing at Nadargul has a harsh property that of the earth exists at Bihar broaden site and their relative development examine data are collected from NHAI.

TESTS ON EXISTING SUBGRADE MATERIALS

The tests on assembled subgrade soils

Tests on Existing Subgrade

Testing Criteria	
Description of Test	Standard Code Applicable
Soil Classification	IS 1498
Sieve Analysis	IS 2720 (Pat - 4)
Atterberg Limits	IS 2720 (Pat - 5)
Laboratory Compaction Test (Modified Proctor Test)	IS 2720 (Pat - 8)
4-day soaked CBR at 3 energy levels	IS 2720 (Pat - 16)
Free swell Index	IS : 2720 (Pat-40)

Sieve Analysis

The grain assess examination is extensively used as a piece of course of action of soils. The data obtained from grain measure dispersal twists is used as a piece of the blueprint of channels for earth dams and to choose suitability of soil for road advancement, runway et cetera.

Information got from grain evaluate examination can be used to predict soil water improvement regardless of the way that vulnerability tests are all the more all around used. Speculation/Principle: The earth is sieved through a course of action of sifters. The material hung on different strainers is settled. The level of material hung on any strainer is given by

Where M_n mass of soil hung on sifter "n"

M = mean mass of the illustration.

The total level of the material held

Where , et cetera are the rates hung on strainer 1, 2 et cetera which are coarser than sifter 'n'. The rate superior to the sifter "n"

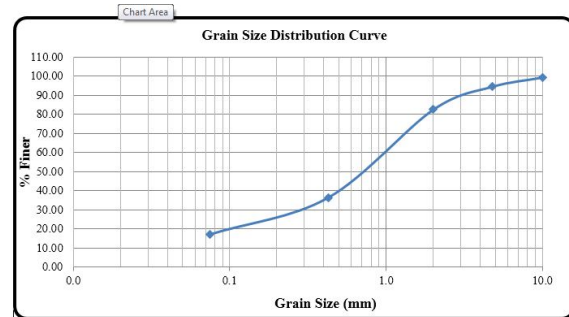
Sort of Sieve Analysis:

1. Mechanical Sieve Analysis
2. Wet Sieve Analysis
3. Hydrometer Analysis

As it is elucidated before dull cotton soil test is accumulated for look into office examination purposes

IS Sieve Size (mm)	Weight Retained (gm)	Weight Retained (%)	Cumulative Weight Retained (%)	Cumulative Passing (%)	Remarks
10.0	6.0	6	0.60	99.40	Sand
4.75	49.0	55	5.50	94.50	
2.00	120.0	175	17.50	82.50	
0.425	461.0	636	63.60	36.40	
0.075	191.0	827	82.70	17.30	
Pan	173.0				Silt & Clay
Total	1000				

Description of Particle	IS Sieve size (mm)	Percentage
Gravel	Coarse 75.0 - 19.0	5.50
	Fine 19.0 - 4.75	
Sand	Coarse 4.75 - 2.00	82.70
	Medium 2.00 - 0.425	
	Fine 0.425 - 0.075	
Silt & Clay	Passing through 0.075	11.80



Waterberg Limits

Beyond what many would consider possible are an essential measure of the possibility of a fine-grained soil. Dependent upon the water substance of the earth, it may appear in four states: solid, semi-solid, plastic and liquid. In each express the consistency and lead of an earth is interesting and in this way are its outlining properties. As needs be, the farthest point between each state can be portrayed in perspective of a modification in the soil's lead. Beyond what many would consider possible can be used to perceive dregs and soil, and it can perceive differing sorts of buildups and muds. These purposes of imprisonment were made by Albert Atterberg, a Swedish logical master. They were later refined by Arthur Casagrande. The implications of quite far proposed by Atterberg are not, without any other person's information, adequate for the confirmation of their numerical regards in the exploration office, especially in context of the optional thought of these definitions. In context of this, Arthur Casagrande and others prescribed more rational definitions with extraordinary reference to the examination office devices and procedures made with the ultimate objective of the confirmation of quite far.

Shrinkage bind:

Beyond what many would consider possible (SL) is the water content where propel loss of soddenness won't achieve any more volume diminish. Beyond what many would consider possible is generously less routinely used than quite far and beyond what many would consider possible.

Plastic limit:

Quite far (PL) is the water content where soil starts to show plastic direct. A string of soil is at its plastic purpose of repression when it is moved to a broadness of 3 mm or begins to crumble. To upgrade consistency, a 3 mm width post is much of the time used to gage the thickness of the string while coordinating the test.

Liquid cutoff:

Liquid limit (LL or WL) is portrayed as the subjective furthest reaches of water content at which the soil will go from the plastic state into the liquid state. At this limit, the earth has a little estimation of shear quality, losing its ability to stream as a liquid. In a manner of speaking, beyond what many would consider possible is the base sogginess content at which the earth tends to stream as a liquid.

Adaptability document:

Adaptability document (PI or IP) is the extent of water content inside which the earth demonstrates plastic properties; that is, it is the difference among liquid and plastic purposes of control.

$$PI \text{ (or IP) } = (LL - PL) = (WL - WP)$$

Right when quite far can't be settled, the material is said to be non-plastic (NP). Flexibility petition for sands is zero. For real evaluation of the flexibility properties of an earth, it has been found appealing to use both quite far and the malleability document regards

Shrinkage record:

Shrinkage record (SI OR IS) is described as the refinement between the plastic and shrinkage cutoff purposes of a soil; figuratively speaking, it is the extent of water content inside which an earth is in a semisolid state of consistency.

$$SI \text{ (or IS) } = (SL \text{ OR IS) } = (WP - WS)$$

Consistency record:

Consistency record or Relative consistency (CI or IC) is described as the extent of the refinement between liquid most distant point and the trademark water substance to the malleability document of an earth:

$$CI \text{ or IC } = (LL - w)/PI = (WL - W)/IP$$

Where w = ordinary water substance of the earth (water substance of a soil in the undisturbed condition in the ground).

$$\text{If, IC} = 0, w = LL$$

$$IC = 1, w = PL$$

$IC > 1$, the earth is in semi-solid state and is firm.

$IC < 0$, the ordinary water content is more unmistakable than LL, and the earth carries on like a liquid.

Liquidity record:

Liquidity document (LI or IL) or Water-adaptability extent is the extent of the complexity between the general water content and beyond what many would consider possible to the flexibility record:

$$LI \text{ or (IL) } = (w - PL)/PI \text{ or (IP) } = (w - WP)/IP$$

$$\text{In case, IL} = 0, w = PL$$

$$IL = 1, w = LL$$

$IL > 1$, the soil is in liquid state.

$IL < 0$, the soil is in semi-solid state and is strong.

$$\text{Plainly, CI} + LI = 1$$

Summary of Atterberg's Limits of Subgrade Soil

Description	Liquid Limit		Plastic Limit	
	1	2	1	2
Determination No.	19	21		
Penetration in mm/ No of Blows (D)	E	F	A-46	
Container No				
Wt.of Container and wet soil (W1) gm	93.06	102.41	41.42	
Wt.of Container and dry Soil (W2) gm	73.2	75.78	39.34	
Wt.of Container (W3) gm	34.34	28.22	32.94	

Proctor Compaction Test

This lab test is performed to choose the association between the soginess content and the dry thickness of a soil for a predefined compactive effort. The compactive effort is the measure of mechanical essentialness that is associated with the soil mass. A couple of particular techniques are used to preservationist soil in the field, and a couple of cases join pressing, kneading, vibration, and static load compaction. This exploration focus will use the pressing or impact compaction method using the sort of equipment and theory made by R. R. Delegate in 1933, along these lines, the test is generally called the Proctor test.

Two sorts of compaction tests are routinely performed: (1) The Standard Proctor Test, and (2) The Modified Proctor Test. Each of these tests can be performed in three interesting systems as outlined out in the associated Table 1. In the Standard Proctor Test, the earth is compacted by a 5.5 lb pound falling a partition of one foot into a soil filled shape. The frame is stacked with three comparable layers of soil, and each layer is subjected to 25 drops of the sledge. The Modified Proctor Test is vague to the Standard Proctor Test beside it uses, a 10 lb pound falling a detachment of 18 inches, and uses five proportional layers of soil instead of three. There are two sorts of compaction molds used for testing. For standard delegate, 100mm dia and for modified delegate, 150 mm dia molds are used.

Centrality:

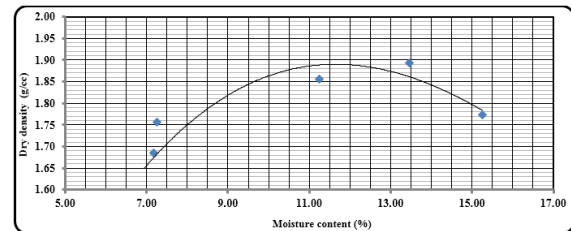
Mechanical compaction is a champion among the most generally perceived and fiscally sagacious strategies for

offsetting soils. A basic endeavor of geotechnical engineers is the execution and examination of field control tests to ensure that compacted fills are meeting the supported blueprint particulars. Plan particulars regularly express the required thickness (as a level of the "most extraordinary" thickness measured in a standard research focus test), and the water content. All around, most planning properties, for instance, the quality, strength, impenetrability to shrinkage, and imperviousness of the soil, will upgrade by extending the earth thickness

Standard Proctor Test Data

Dry Density Determination							
S.No	Determination No	1	2	3	4	5	6
1	Wt. of Mould + Compacted Soil (gm)	9653	9925	10100	10505	10460	10696
2	Wt. of Mould (gm)	5862	5862	5862	5862	5862	5862
3	Wt. of Compacted Soil (1-2) gm	3791	4063	4238	4643	4598	4834
4	Volume of Mould(cc)=	2250	2250	2250	2250	2250	2250
5	Wet density of soil, (3/4) gm/cc	1.685	1.806	1.884	2.064	2.044	2.148
Moisture Content Determination							
6	Container No.	A-43	A-35	A-19	A-31	A-14	B-40

7	Wt. of wet soil+Container gm	64.00	64.00	67.00	83.00	98	104
8	Wt. of dry soil+Container gm	62.09	61.82	64.75	77.98	89.73	96
9	Wt. of Container gm	34.56	31.42	33.71	33.36	35.49	36.53
10	Wt. of Water (7-8) gm	1.91	2.18	2.25	5.02	8.27	8.00
11	Wt. of Dry soil (8-9) gm	27.53	30.40	31.04	44.62	54.24	59.47
12	Water Content (10/11)*100 %	6.94	7.17	7.25	11.25	15.25	13.45
13	Dry density (5/1+(12/100)) gm/cc	1.58	1.68	1.76	1.85	1.77	1.89



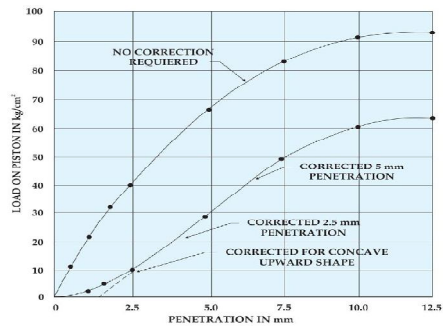
Free Swell Index of Soil

To choose the free swell record of soil as per May be: 2720 (Part XL) – 1977. Free swell or differential free swell, in like manner named as free swell rundown, is the extension in volume of soil with no outside basic when subjected to submergence in water.

CBR METHOD

CBR in Dry Condition: The material used for coordinating the test will be in a dry condition. The shape containing the

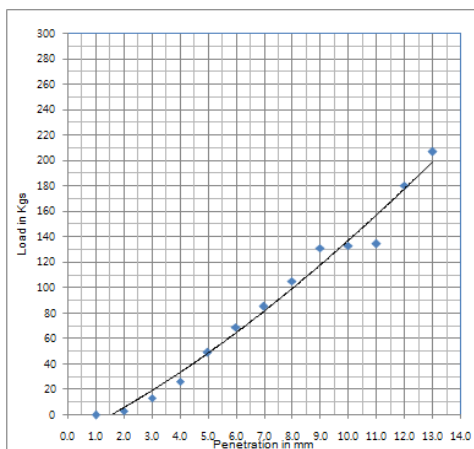
case with the base plate in position yet the best face revealed may be determined to the lower platen of the testing machine. Extra charge weights, satisfactory to make a power of stacking proportionate to the largeness of the base material and the black-top may be put on the testing machine. Rest of the strategy will be same as delineated underneath for the test in soaked condition.



Load Vs Penetration Graph

Summary of CBR Test Results of Subgrade Soil

GENERAL INFORMATION		LOAD PENETRATION TEST DATA					
	Penetration (mm)	Proving ring reading	Corrected load (Kg)	Proving ring reading	Corrected load (Kg)	Proving ring reading	Corrected load (Kg)
Type of compaction used: Dynamic	0.0	0	0.0	0	0.0	0	0.0
Period of soaking: 04 days	0.5	4	13.1	1	3.3	2	6.6
Wt of surcharge used (kg) : 5 Kgs	1.0	5	16.4	4	13.1	4	13.1
Proving ring capacity: 30KN	1.5	10	32.8	8	26.2	8	26.2
Least count of proving dial : 3.28	2.0	16	52.5	15	49.2	12	39.4
	2.5	20	65.6	21	68.9	16	52.5
	3.0	24	78.7	26	85.3	17	55.8
	4.0	30	98.4	32	105.0	19	62.3
	5.0	38	124.6	40	131.2	20	65.6
	6.0	41	134.5	40.5	132.8	21	68.9
	7.5	45	147.6	41	134.5	22	72.2
	10.0	61	200.1	55	180.4	24	78.7
	12.5	72	236.2	63	206.6	29	95.1
Corrected unit load from graph(Kg) for 2.5mm			62		69		43
Corrected unit load from graph(Kg) for 5.0mm			118		119		68
CBR at 2.5mm (%)			4.5		5.0		3.1
CBR at 5.0mm (%)			5.7		5.8		3.3
CBR Reported (%)			5.7		5.8		

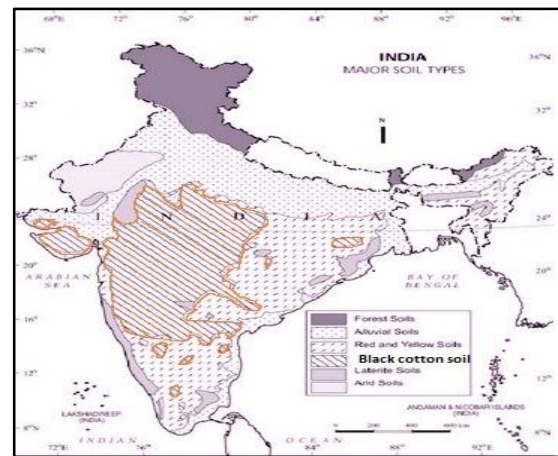


IDENTIFICATION OF PROPER STABILIZER AND LABORATORY TESTING

Around 25% mass of the aggregate amount of chose soil sort was seen to be going through the 75micron strainer, in view of the determinations said in IRC SP:89-2010, if the dirt has pliancy index(PI) more noteworthy than 20% i.e., (PI>20%) LIME is appropriate for the adjustment of such kind of soil. Concrete adjustment is utilized at where the granular soils are available. What's more, if the dirt whichhave versatility list under 20% i.e., (PI<20%).

SOILS SUITABLE FOR LIME STABILIZATION

Since the useful impacts of lime adjustment are the consequence of different responses between the fines bit of the dirt and lime, fine-grained soils, for example, earth and silty-mud, react generally positively. A base earth substance of roughly 10 percent and a versatility record (PI) more prominent than 10 are attractive, in spite of the fact that advantages have been noted for bring down PI silty soils containing less dirt.



Lime Usage in Construction

Class A-Used for to a great degree poor soils (PI> 45 to 50). Lime is connected in 2 applications with a base 12-hour and most extreme 72-hour progressing period between applications. Class B-Used for decently poor soils. This class is the most ordinarily one utilized. Lime is connected in one application with a base 12-hour and most extreme 72-hour progressing period before conclusive preparing.

Class C-Used for negligible soils that are regularly workable yet require some decrease in versatility. This class is once in a while utilized on DOT ventures. Lime is connected, blended, formed and last reviewed to get the following layer in the asphalt framework. There is no progressing period for this sort development.

Chemical Composition of Lime

According to NLA – 1988, the properties of business limes (for both, brisk and High appraised) are given in Tables.

Table 3.2. Properties of commercial limes—Quick lime

Constituent	High Calcium Range, %		Dolomitic Range, %	
CaO	92.25 - 98.00		55.50 - 57.50	
MgO	0.30 - 2.50		37.60 - 40.80	
SiO ₂	0.20 - 1.50		0.10 - 1.50	
Fe ₂ O ₃	0.10 - 0.40		0.05 - 0.40	
Al ₂ O ₃	0.10 - 0.50		0.05 - 0.50	
H ₂ O	0.10 - 0.90		0.10 - 0.90	
CO ₂	0.40 - 1.50		0.40 - 1.50	
Specific Gravity	3.2 – 3.4		3.2 - 3.4	
Specific Heat at 100°F (38°C)	0.19 BTU/lb	442 J/kg	0.21 BTU/lb	488 J/kg
Bulk Density, pebble lime	55 - 60 lb/ft ³	880 - 960 kg/m ³	55 - 60 lb/ft ³	880 - 960 kg/m ³

Table 3.3. Properties of commercial limes—Quick lime: Hydrated Lime

Principal Constituent	High Calcium Ca(OH) ₂		Dolomitic (Monohydrated) Ca(OH) ₂ ·MgO	
Specific Gravity	2.3 - 2.4		2.7 - 2.9	
Specific Heat at 100°F (38°C)	0.29 BTU/lb	674 J/kg	0.29 BTU/lb	674 J/kg
Bulk Density	25 - 35 lb/ft ³	400 - 560 kg/m ³	25 - 35 lb/ft ³	400 - 560 kg/m ³

Soil– Lime Reactions

Lime is used broadly to change the building properties of fine-grained soils and the fine-grained divisions of more granular soils. It is best in treating plastic muds fit for holding a ton of water. The particles of such soils have uncommonly negative-charged surfaces that draw in free cations (i.e., positive-charged particles) and water dipoles. Along these lines, an exceptionally diffused water layer fits in with the earth particles, thusly segregating the particles

and influencing the mud to wind up obviously weak and insecure. The extension of lime to a fine-grained soil inside seeing water begins a couple of reactions. The two fundamental reactions, cation exchange and flocculation–agglomeration, happen rapidly and convey incite changes in soil malleability, workability, uncured quality, and load-turning properties.

DESIGN OF NEW FLEXIBLE PAVEMENTS ON STABILIZED SUB-GRADE SOIL

TRAFFIC STUDIES

The prime perspective behind the framework of any road black-top is to energize the protected, quick and pleasant improvement of various sorts of vehicles on that road. This goal must be expert when the black-top fashioner has an exact gage of the amount of vehicles that will use the road in the midst of its diagram life period. If the black-top is proposed to withstand quite recently some by and large assessed action stack rather than precisely expected weights, the black-top will be slanted to bomb even before it accomplishes its framework life. Thusly a black-top fashioner must have the ability to gage the total development volume that is depended upon to use the road for the coming 15 or 20 years. With a particular ultimate objective to understand that data, Traffic volume contemplates must be coordinated. These examinations involve counting differing classes of vehicles which are using the road for both "in" and "out" headings. To get a right gage of the total number of vehicles using the road for the length of an entire year, one must count the amount of vehicles using the road for the whole year, for the duration of the entire burdensome day. This a dull work and in addition irrational dynamically. To beat this obstacle the Indian Road Congress has endorsed in its dispersion IRC: 37-2012, that examination of the present day ordinary development should be done in perspective of seven-day-24-hour check. It suggests that the Traffic Volume Studies must be coordinated on a road, at a particular crossing point, for the span of the day for a period of 7 days.

CONDUCTING THE TRAFFIC VOLUME STUDIES

As indicated by IRC: 37-2012, it is recommended that movement volume studies should be coordinated at each station, around the day, for a period of 7 days diligently.

Average Daily Traffic

The base year Average Daily Traffic (ADT) is orchestrated into business, explorer and non-automated development in perspective of the gathered movement volume disregard reviews carried on the different ranges of wander road. The purposes of enthusiasm of Annual Average Daily Traffic (AADT) is given in the imperative area and layout of business vehicles related to black-top

The action volume data was recorded for 7 one of a kind classes of vehicles which consolidate...

- Littler than typical Bus
- Transport
- Min LCV
- LCV
- Couple Axle Trucks
- Tridem Axle Trucks
- Multi Axle Trucks

COMPOSITION OF FLEXIBLE PAVEMENT

At Indian setting the versatile black-tops shyly contains the going with layer association as underneath, and the normal cross section

The versatile black-top association layers;

- Sub-Grade.
- Granular Sub Base (GSB)
- Wet Mix Macadam (WMM)

- Dense bitumen Macadam (DBM)
- Bitumen's strong (BC)

SUB-GRADE LAYER

Subgrade is that bit of the earth roadbed which in the wake of having been created to sensibly close conformance with the lines, levels, and cross-portions appeared on the plans, gets the base or surface material. It is the best 500 mm of the bank quickly underneath the base of the black-top, and is contained in-situ material, picked soil, or offset soil that structures the foundation of a black-top. It should be all around compacted to oblige the degree of rutting in black-top as a result of additional densification in the midst of the organization life of black-top. Subgrade ought to be compacted to no less than 97 for each penny of research office dry thickness achieved with overpowering compaction as per Seems to be: 2720 (Part 8) for Expressways, National Highways, State Highways, Major District Roads and other energetically trafficked avenues.

IRC: 37-2012 DESIGN METHODOLOGY

The tenets on blueprint of versatile black-top were first brought out in 1970, which relied upon California Bearing Ratio (CBR) of subgrade and action similar to number of business vehicles (more than 3 tons stacked weight). These tenets were changed in 1984 in which design development was considered the extent that aggregate number of equivalent standard center point store of 80 kN in countless axles (msa) and setup diagrams were surrendered to movement to 30 msa using an observational approach. The principles were rethought again in 2001 when black-tops were required to be proposed for movement as high as 150 msa. The refreshed tenets used a semi-mechanical approach in perspective of the delayed consequences of the MORTH's investigation plot R-56 executed at IIT Kharagpur.

The item, FPAVE was made for the examination and blueprint of versatile black-tops. Multilayer adaptable theory was grasped for push examination of the layered flexible structure. A considerable number of data accumulated from different parts of India under various research designs of MORTH were used for the headway of shortcoming and rutting criteria from field execution data. The movement configuration has transformed starting now and into the foreseeable future accordingly has the advancement. The volume of couple, tridem and multi-center point vehicles has extended unpredictable and heavier rotate loads are ordinary. Experience has been grabbed on the usage of new sort of advancement and materials, for instance, stone framework dark best, balanced bitumen, foamed bitumen, bitumen emulsion, warm dark best, cementitious bases and sub-bases, since the generation of the last change of the standards. Consistent and also financially available manufactured soil stabilizers are when in doubt adequately used as a piece of trial portions. Thought is based on exhaustion safe bituminous mixes with high thickness latches for considerable development with a view to fabricate world class long life bituminous black-tops. The tenets contained in this record reflect the present learning in the subject. Conventional improvement material like sums is winding up progressively uncommon by prudence of natural stresses and moreover legitimate impediments on quarrying while the advancement activity has broadened superbly. This has moved fixation from broad scale usage of custom.

COST BENEFIT ANALYSIS OF PAVEMENT DESIGN OPTIONS

LIFE CYCLE COST ANALYSIS

Life cycle cost examination is the way toward assessing the economy of the asphalt by breaking down the underlying expense and marked down future cost, development cost for the asphalt, preventive support, restoration and furthermore the remaking cost for a clear timeframe it is the

cost estimation choice in the distinctive finish contrasting options to do a venture. The LCCA influences a detail to investigation of steps that include from beginning to culmination of the venture.

RATE ANALYSIS

The procedure of assessment of the cost of consumption that are to be used for the aggregate culmination of the venture and different stages that are engaged with it .Rate Analysis additionally incorporates into the distinctive sorts of instrument and gear's utilized. The Rate investigation is ascertained per Kilometer. The rates and cost for the materials its transportation and laying is taken according to the territorial Public Work Department Rate (PWD) that are been booked per a year.

RATE ANALYSIS FOR THE PROJECT ROAD

The investigation extend street is a run of the mill Four-path new adaptable asphalt, and the asphalt contains the accompanying layers as appeared in Fig 5.1 underneath. As a piece of money saving advantage examination between the different asphalt outline choices, it is have to do the rate investigation for each layer to develop the street. The rate examination of each layer is given in the consequent segments according to the State PWD rates.



Table 5.1: Rate Analysis of Sub-grade Material for a Cubic Meter

Sr No	Ref. to MORTH Spec.	Description	Unit	Quantity	Rate <u>Rs</u>	Cost <u>Rs</u>
1	308	Construction of Subgrade				
		Construction of sub-grade and earthen shoulders with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2				
		Unit = cum				
		Taking output = 100 cum				
		a) Labour				
		Mate	day	0.040	151.44	6.06
		Mazdoor	day	1.000	136.69	136.69
		b) Machinery				
		Hydraulic excavator 1 cum bucket capacity @ 60 cum per hour	hour	1.670	1315.00	2196.05
		Tipper 10 tonne capacity	tonne.km	175KL	2.50	4375.00
		Add 10 per cent of cost of carriage to cover cost of loading and unloading				437.50
		Dozer 80 HP for spreading @ 200 cum per hour	hour	0.500	3757.00	1878.50
		Motor grader for grading @ 50 cum per hour	hour	2.000	2419.00	4838.00
		Water tanker with 6 km lead	hour	4.000	290.00	1160.00
		Vibratory roller 8-10 tonnes @ 80 cum per hour	hour	1.250	1556.00	1945.00
		c) Material				
		Cost of water	KL	24.000	25.00	600.00
		Compensation for earth taken from private land	cum	100.000	60.00	6000.00
		d) Overhead charges @ 8 % on (a+b+c)				1885.82
		e) Contractor's profit @ 10% on (a+b+c+d)				2545.86
		Cost for 100 cum = a+b+c+d+e				28004.48
		Rate per cum = (a+b+c+d+e)/100				280.04
					64%	280.00

Granular-Sub Base

GSB is the second layer that is laid over sub-base. The material to be used for the work ought to be regular sand, moorum, shake, squashed stone, or blend thereof depending on the investigating required. Materials like squashed slag, beat strong, piece metal and kankar close-checked on granular sub-base materials, one each for most outrageous atom size of 75 mm, 53 mm and 26.5 mm. For such material is to be transported for the Quarries that are accessible inside the shorter range to the site. The open material is to fairly spread by the work in a layer and totally compacted with roller. The Rate examination for cubic meter of sub-base.

CONCLUSIONS

All in all dark cotton soils have poor bearing quality. Such soils when come into contact with water experience swelling. Then again such soils have a tendency to experience shrinkage in dry seasons when the water gets dissipated. Amid this swell and therapist cycle if substantial burdens are forced on such soils, they will disintegrate and may cause disappointment of asphalt or super-structure. To evade this, such sorts of soils are to be either supplanted from its Sub-review or to be dealt with by the procedure of adjustment. In our venture work we have endeavored to give a financially savvy arrangement such issue by utilizing lime adjustment procedure.

The finishes of the venture ponder are recorded down as takes after;

- Such a sort of dark cotton soils are gathered for the venture ponder, and the Plasticity Index and CBR esteem was recorded as 21 and 5.23 separately.
- Based on the investigation soil physical properties, the best appropriate stabilizer (Lime) was chosen according to the Indian Roads Congress (IRC) rules.
- The stabilizer was added to the dark cotton soil at different substance (like 3%, 6%, 9% and 12%), to comprehend the change of physical and quality properties.

% Lime	0%	3%	6%
9%	12%	Fluid Limit	54
42	43	42 Pliancy Index	21
24	11	8	12 CBR (%)
5.2	22.0	26.0	35.0 45.5
- New adaptable asphalts are outlined with the assistance of IRC: 37-2012 rules and IITPAVE programming, for every one of the alternatives proceeds different CBR individual of lime content.
- Thereafter, with the assistance of calendar rates given in Public Works Department, rate examination are completed for all the asphalt layers to know the constant rates on ground.
- Finally, money saving advantage examinations were done between all the asphalt outline choices to recognize the best arrangement with minimal effort.
- 3% lime expansion to the sub-review soil is giving moderately most extreme quality. With that, the venture cost per kilometer is lessening by 11% contrasting with the 0% lime expansion. i.e.Rs. 72,00,590/ - per kilometer sparing in street development.
- Hence, 3% of lime expansion to the sub-level soil is the ideal answer for extend street.

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