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I.S Specifications for Flexible Pavement

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Abstract: *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, thorough analysis of the existing pavement is greatly required at this point of time, as an excessive amount of vehicle loads is passing through the project and it is unknown whether or not the road pavement might sustain its structural integrity. The structural integrity of road is depending upon various components of road pavements. In this paper we attempt to give all the requirements & standards of various components of flexible pavements with their test method given by I.S. & minimum required frequency test to be conducted.*

Keywords: *Flexible Pavement, IS Specifications,*

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I. INTRODUCTION

In simple terms, a flexible pavement can be defined as a pavement layer compressing of a mixture of aggregates and bitumen, heated and mixed properly and then laid and compacted on a bed of granular layer.
Flexible pavements are those which are flexible in their structural action under the loads. Some important features of these pavements are:

- It has a flexural strength.
- It reflects the deformation of lower layers.
- It will transmit the vertical compressive stress to bottom layers by grain to grain transfer

The lower layer have to take up only lesser magnitudes of stress and there is no direct wearing action due to traffic loads, therefore inferior materials with low cost can be used in the lower layers.
Components of flexible pavement and there functions

1. Embankment
2. Cutting
3. Sub grade
4. Granular sub base
5. Prime coat / Tack coat
6. Wet mix macadam
7. Dense bitumen macadam
8. Bituminous concrete

1. EMBANKMENT

An embankment refers to a volume of earthen material that is placed and compacted for the purpose of rising grade of road way. Embankment constructed of a material that usually consists of soil but may also include aggregate, rock, or crushed paving material. The coarser materials are placed at the bottom of embankment in order to provide a firm foundation for the embankment and also to facilitate drainage and prevent saturation.

Sr. no.	Test	Test Method	Min. frequency
1.	Gradation/ sand content	IS:2720(Pt. 4)	2 test per 3000cum
2.	MDD&OMC (BY heavy compaction)	IS:2720(pt. 8)	2 test per 3000 cum
3.	Moisture content test	IS:2720(pt. 2)	1 test per 250 cum
4.	Liquid limit & plastic limit	IS:2720(pt. 5)	2 test per 3000 cum
5.	Free swell index	IS:2720 (pt. 40)	2 test per 3000 cum
6.	Degree compaction	IS:2720(pt28)	1 test per 3000 sq m or min. 10 pits
7.	Deleterious content	IS:2720 (pt. 27)	As & when required

TABLE 1: EMBANKMENT UPTO 3 METER HEIGHT

Sr. no.	Test	Test Method	Min. frequency
1.	Gradation/ sand content	IS:2720(Pt. 4)	2 test per 3000cum
2.	LL & PI	IS:2720(pt. 5)	2 test per 3000 cum
3.	MDD & OMC (by heavy compaction)	IS:2720(pt. 8)	2 test per 3000 cum
4.	Moisture Content Test	IS:2720(pt. 2)	1test per 250 cum
5.	Free swell index	IS:2720 (pt. 40)	2 test per 3000 cum
6.	Degree of compaction	IS:2720(pt28)	1 test per 3000 sq m or min. 10 pits
7.	Deleterious content	IS:2720 (pt. 27)	As & when required

TABLE 2: EMBANKMENT EXCEEDING 3 METER HEIGHT

2. CUTTING:-

In civil engineering, a cutting is where soil or rock from relative rise along a route is removed cuts are typical used in road, rail and canal construction to reduce the length and grade of a route. Cut and fill construction uses the spoils from cuts to fill in deep to cost-effectively create relatively straight routes at steady grades.

Sr. no	Test	Test method	Min. Frequency
1	Gradation or sand content	IS 2720 (PT4)	2 test per 3000 CU.M
2	MDD & OMC (By heavy compaction)	IS 2720 (PT8)	2 test per 3000 CU.M
3	CBR at 97% MDD	IS2720 (PT 16)	1 test per 3000 CU.M
4	Liquid Limit & Plastic Limit	IS2720(PT 5)	2 test per 250 CU.M
5	Free swell index	IS2720 (PT 40)	2 test per 3000 CU.M
6	Chemical Analysis(SO3)	IS IS2720 (PT 27) & BS 1377	1 test per source
7	Deleterious content	IS 2720(PT 27)	As and when required.

TABLE 3: BORROW AREA MATERIAL

3. SUBGRADE

Sub-grade is the bottom most layer which is nothing but natural soil layer compacted up to required depth generally about 150 to 300 mm to receive the loads coming from top layers, this layer termed as foundation for the pavement system. The sub grade should be strong enough to take the stresses and also it is important to keep the stresses coming from top layers should be within the limit of Sub grade capacity, To reduce the amount of stress on soil Sub grade, provide the thick layers of base course, sub base course and surface course.

Sr. no.	Test	Test Method	Min. frequency
1.	Grading / Sand Content	IS:2720 (Pt.4)	2 Test per 3000 cum.
2.	Water absorption	IS:2720 (Pt.8)	2 test per 3000 cum.
3.	CBR at 98% compaction	IS:2720 (Pt.16)	1test per 3000 cum.
4.	MDD & OMC	IS:2720 (Pt.2)	1 test per 250 cum.
5.	Moisture content prior to compaction	IS:2720 (Pt.5)	2 tests per 3000 cum.
6.	degree of Compaction	IS:2720 (Pt.40)	2 tests per 3000 cum.
7.	LL and PI	IS:2720 (Pt.28)	1 test per 2000 sq m. or min 10 pits
8.	Deleterious constituents	IS:2720 (Pt.27)	As and when

TABLE 4: SUBGRADE

4. GRANULAR SUB BASE COURSE

Granular sub base is the layer in road foundation just above the compacted soil layer that is above sub-grade.

The GSB can be prepared by laying and compacting well graded material on prepared sub grade in accordance with specifications. The material to be used for the work shall be natural sand, crushed gravels, crushed stones or combination of them based on grading required.

Sr. No.	Test	Test Method	Min. frequency
1.	Grading of coarse graded material	IS:2386 (pt.1)	1 per 400 cum
2	Water absorption	IS:2386 (pt.3)	1 per source
3.	CBR at 98% compaction	IS:2720(pt. 16)	As required
4.	MDD & OMC	IS:2720 (pt.8)	As required
5.	Moisture content prior to compaction	IS:2720 (pt.2)	1 per 400 sq m.
6.	degree of Compaction	IS:2720 (pt.28)	1 per 1000 sq m.
7.	LL and PI	IS:2720 (pt.5)	1 per 400 cum.
8.	Deleterious constituents	IS : 2386 (Pt.2)	1 per source
9.	Soundness (IF W.A. > 2%)	IS:2386 (Pt.5)	1 per source and as required
10.	AIV	IS:2386 (Part-4)	IF WA more than 2%

TABLE 5: GRANULAR SUB BASE COURSE

5. WET MIX MACADAM

Wet mix macadam, this is the new method where aggregate are mixed with water before laying and the wet mix is laid and then rolled. Wet mix roads are superior to WBM road. It acts as a binder course for heavy commercial vehicles .it is durable as it performs well in almost all situations.

Sr. no.	Test	Test Method	Min. frequency
1	Aggregate impact value	IS: 2386 (Pt.4)	1 per 1000 cum.
2	Flakiness and Elongation index (Combined total)	IS: 2386 (Pt.1)	1 per 500 cum.
3.	Liquid limit	IS:2720 (Pt.5)	1 per 200 cum.
4.	Plasticity Index	IS:2720 (Pt.5)	1 per 200 cum.
5.	Los Angeles Abrasion value	IS:2386 (pt.4)	1 per Source
6.	Water absorption	IS:2386 (Pt.3)	1 per Source
7.	Soundness Test	IS:2386 (Pt.5)	1 per Source
8.	Grading	IS:2386 (Pt.1)	1 per 200 Cum.

TABLE 6: WET MIX MACADAM

6. PRIME COAT / TACK COAT

Prime coat is an application of low viscous cut back bases on which binder layer is placed .It provides bonding between two layers. Tack coat is a very light application of asphalt, usually asphalts emulsion dilute with water. It provides proper bonding with two layer of binder course and must be thin, uniformly cover the entire surface and set very fast.

Sr. No.	Test	Test method	Min. frequency
1.	Quality of binder Prime coat(S.S.) Tack coat(R.S)	IS 8887-2004	One set test per lot
2.	Temperature of binder application	Below 15 degree C	One set test per lot
3.	Rate of spray	IRC SP 11	Three test per day

TABLE 7: PRIME COAT / TACK COAT

7. DENSE BITUMINOUS MACADAM

Dense bitumen macadam is a binder course used for roads with more number of heavy commercial vehicles and a close graded premix materials having a void content of 5 to 10 percent. This surface is durable as it performs well in almost all situations. It provides good quality smooth surface and improved skid resistance. Due to the high cost it should be properly designed.

SR .no.	Test	Test Method	Min. frequency
1.	Quality of binder	IS:73	1 set of test per lot
2.	Los Angeles abrasion value	IS:2386(pt.4)	1 test per 350 cum of aggregate for each source
3.	Flakiness index & elongation index	IS:2386(pt.1)	1 test per 350 cum of aggregate for each source
4.	Coating and stripping	IS:6241	1 per source
5.	Water absorption & specific gravity	IS:2386(pt.3)	1 per source
6.	Soundness test	IS:2386(pt. 5)	1 per source

7.	Sand equivalent value	IS:2720(pt.37)	1 per source
8.	Plasticity index	IS:2720(pt.5)	1 per source
9.	Mix grading/ bitumen content	Bitumen extraction & sieving (appendix 5 of IRC:SP. 11) IS: 2386 (Pt. 1)	1 test/400 T of mix and min 2 tests per plant per day
10.	Job mix formula	Mix design	Every change of material
11.	Grading of the individual aggregate & combined gradation	IS:2386 (pt. 1)	1 test for 400t of mix or a min of 2 tests per day per unit
12.	Layers thickness	Site check	After every 5th truck load
13.	Density of compacted layer	IRC 111 2009/ASTM D2014	1 per 700 sq m or min 3 tests for acceptance criteria
14.	Moisture susceptibility of mix	IRC 111 2009, Annex A/AASHTO-T 283-89	1 test per each mix type
15.	Stability & voids analysis of mix & GMM	IRC 111 2009	3 tests per 400t of mix or a min of 2 tests per day per plant

TABLE 8: DENSE BITUMEN MACADAM

8. BITUMINOUS CONCRETE

The bituminous paving technique was first used rural roads the term foamed asphalt refers to a mixer of pavement construction aggregates and foamed bitumen. The foamed bitumen or expanded bitumen, is proceed by a process in which water is injected into the hot bitumen Resulting in spontaneous foaming. The bituminous mix design aims to determine the proportion of bitumen, filler, fine aggregate and coarse aggregate and produce a mix which a workable, strong, durable and economical.

Sr. No.	**Test**	**Test method**	**Min. frequency**
1.	Quality of binder (modified binder as approved)	IRC SP : 53	1 set of test per lot.
2.	Los angles abrasion /aggregate impact value	IS : 2386 (Pt 4)	1 test per 350 cum of aggregate of each source & whenever there is changes the quality of aggregate.
3.	Flakiness index and elongation index(total)	IS: 2386 (Pt 1)	1 test per 350 cum of aggregate of each source &whenever there is change the quality of aggregate
4.	Coating and strip	IS:6241	1 test per source.
5.	Water absorption	IS:2386(Pt 3)	1 test per source.
6.	Soundness test	IS:2386 (Pt5)	1 test per source.
7.	Sand equivalent value	IS: 2720(pt37)	1 test per source.
8.	Plasticity index	IS:2720(Pt5)	1 per source.
9.	Grading of individual aggregates and combined gradation	IS :2386(Pt1)	1 test for 400t of mix or a min. of 2 test per day per plant.

TABLE 9: BITUMENOUS CONCRETE

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