बिहार सरकार
ग्रामीण कार्य विभाग

पत्रांकः– मु0अ0नि0एवं गु0नि0)विविध कार्य–06–165 / 24- 4620 /पटना / दिनांकः– 23/08/25

प्रेक,

अभियंता प्रमुख,
ग्रामीण कार्य विभाग,
बिहार, पटना।

सेवा में,

सभी अधीक्षण अभियन्ता,
जाँच एवं गुणवत्ता नियंत्रण अंचल,
सभी कार्यपालक अभियन्ता,
जाँच एवं गुणवत्ता नियंत्रण प्रमंडल,
सभी सहायक अभियन्ता,
जाँच एवं गुणवत्ता नियंत्रण प्रयोगशाला
ग्रामीण कार्य विभाग

विषयः– जाँच एवं गुणवत्ता नियंत्रण, अंचल / प्रमंडल / प्रयोगशाला को क्रियाशील करने हेतु आवश्यक दिशा–निर्देश के संबंध में।

महाशय,

विदित है कि विभागीय पुर्नगठन संकल्प संख्या–6800 दिनांक–28.11.2023 के फलस्वरुप नवसृजित 108 जाँच एवं गुणवत्ता नियंत्रण प्रयोगशाला के सफल संचालन हेतु पूर्व में विभागीय पत्रांक–3689 दिनांक–13.12.2024 (अनु0) द्वारा इसके संचालन हेतु आवश्यक दिशा–निर्देश निर्गत है जिसके अन्तर्गत कार्यालय भवन की स्थापना, तकनीकी मानव बल की उपलब्धता, प्रशिक्षण / उन्मुखीकरण एवं online अनुश्रवण की व्यवस्था वर्णित है।

जाँच एवं गुणवत्ता नियंत्रण प्रयोगशाला के प्रभावकारी संचालन हेतु निम्नलिखित निदेश के आलोक में अपने कार्यों का नियमित निष्पादन करना सुनिश्चित करेंगे :–

1. सभी संबंधित अभियंताओं को MIS के अवलोकन हेतु Log in ID एवं Password उपलब्ध जाएगा जिसके माध्यम से अपने क्षेत्राधीन योजनाओं की अद्यतन स्थिति से अवगत होकर निरीक्षण कार्य संपादित करेंगे।
2. सभी अपने क्षेत्राधीन प्रत्येक माह न्यूनतम 20 निर्माणाधीन पथ / पुल का निरीक्षण कर जाँच प्रतिवेदन विहित प्रपत्र में MIS पर upload करेंगें। पथ / पुल का चयन निर्माणाधीन योजनाओं के विभिन्न चरणों के प्राथमिकता के अनुरूप करेंगें।
3. कार्यपालक अभियन्ता, कार्य प्रमंडल द्वारा निर्माणाधीन पथ / पुल में कराये गये कार्य के विरुद्ध भुगतान हेतु प्रस्तुत अधियाचना प्रपत्र के साथ जाँच एवं गुणवत्ता नियंत्रण प्रयोगशाला द्वारा निर्गत गुणवत्ता जाँच प्रतिवेदन अनिवार्य रूप समर्पित किया जाना है।
4. यदि सहायक अभियंता, जाँच एवं गुणवत्ता नियंत्रण प्रयोगशाला द्वारा निर्गत प्रतिवेदन नकारात्मक है तो इस परिप्रेक्ष्य में कार्य स्थल में कराये गये सुधारात्मक कार्य की गुणवत्ता

जाँच प्रतिवेदन संबंधित कार्यपालक अभियंता/अधीक्षण अभियंता, जाँच एवं गुणवत्ता नियंत्रण, प्रमंडल/अंचल से प्राप्त करने के पश्चात् ही कार्यपालक अभियंता, कार्य प्रमंडल द्वारा अधियाचना समर्पित किया जाना है।

5. जिस निर्माण सामग्री की जाँच स्थलीय प्रयोगशाला में नहीं हो सकती उसकी जाँच पूर्व से सृजित अन्य जाँच एवं गुणवत्ता नियंत्रण प्रमंडल में करना सुनिश्चित करेंगें।
6. आपके द्वारा जाँच कार्य हेतु विभिन्न मद (वाहन भाड़ा, ईंधन एवं मजदूरी) में वास्तविक खर्च हेतु निधि उपलब्ध कराया जाएगा।
7. जाँच एवं गुणवत्ता नियंत्रण कार्य को प्रभावकारी बनाने हेतु संबंधित प्रयोगशाला/प्रमंडल/अंचल के नियंत्री पदाधिकारी सहायक अभियंता/कार्यपालक अभियंता/अधीक्षण अभियंता के कार्यों का अनुश्रवण मुख्यालय स्तर पर किया जाएगा एवं उनका अंतरश्रेणन (Inter Grading) तैयार कर विभागीय रूप अनुशंसित किया जाएगा।
8. सभी सहायक अभियन्ता, जाँच एवं नियंत्रण प्रयोगशाला को निदेश दिया जाता है कि संबंधित कार्य प्रमंडल से विभाग द्वारा उपलब्ध कराये गये जाँच उपकरण को 24 घण्टे के अंदर प्राप्त करना सुनिश्चित करेंगें।
9. जाँच एवं गुणवत्ता नियंत्रण, प्रयोगशाला/प्रमंडल/अंचल में न्यूनतम कार्यबल उपलब्ध कराने हेतु युक्तिकरण(Rationlaisation) की प्रक्रिया अपनायी जाएगी।
10. आपके द्वारा संपादित कार्यों की समीक्षा हेतु सप्ताहिक रूप से V.C के माध्यम से अधीक्षण अभियंता, गुणवत्ता प्रबंधन कोषांग द्वारा अनुश्रवण किया जाएगा।

उक्त प्रस्ताव पर सक्षम प्राधिकार का अनुमोदन प्राप्त है।

विश्वासभाजन

अनु0–

- जाँच प्रपत्र– (Annexture-A)
- जाँच की आवृति– (Annexture-B)
- निर्माण समाग्री के जाँच की पद्धति– (Annexture-C)

(मो0 सुल्तान अहमद)
अभियंता प्रमुख
ग्रामीण कार्य विभाग।

ज्ञापांकः– मु0अ0(नि0एवं गु0नि0)विविध कार्य–06–165/24 - 4620 पटना/दिनांकः– 23/08/25

प्रतिलिपि – अपर मुख्य सचिव/सचिव, ग्रामीण कार्य विभाग के आप्त सचिव को सादर सूचनार्थ समर्पित।

अभियंता प्रमुख

ज्ञापांकः– मु0अ0(नि0एवं गु0नि0)विविध कार्य–06–165/24 - 4620 पटना/दिनांकः– 23/08/25

प्रतिलिपि – अभियन्ता प्रमुख–सह–अपर आयुक्त–सह–विशेष सचिव/अभियन्ता प्रमुख, ग्रामीण कार्य विभाग, बिहार, पटना को सूचनार्थ समर्पित।

अभियंता प्रमुख

ज्ञापांकः– मु0अ0नि0एवं गु0नि0)विविध कार्य–06–165/24 -420 पटना/दिनांकः– 23/08/25
प्रतिलिपि – सभी मुख्य अभियन्ता/सभी अधीक्षण अभियंता, कार्य अंचल ग्रामीण कार्य विभाग, बिहार, पटना को सूचनार्थ प्रेषित।

अभियंता प्रमुख

ज्ञापांकः– मु0अ0नि0एवं गु0नि0)विविध कार्य–06–165/24 - 4620 पटना/दिनांकः– 23/08/2025
प्रतिलिपि – सभी कार्यपालक अभियन्ता, कार्य प्रमंडल को सूचनार्थ एवं अनुरोध है कि अपने प्रक्षेत्र में निर्माण कराये जा रहे विभिन्न योजनाओं की गुणवत्ता जाँच हेतु जाँच एवं गुणवत्ता नियंत्रण, अंचल/प्रमंडल/प्रयोगशाला को अपेक्षित सहयोग करना सुनिश्चित करेंगे एवं सहायक अभियंता, जाँच एवं गुणवत्ता नियंत्रण, प्रयोगशाला को जाँच उपकरण हस्तगत करायेंगे एवं उनसे जाँच प्रतिवेदन अधियाचना से पूर्व लेना सुनिश्चित करेंगें। कृत कार्रवाई से मुख्य अभियन्ता, निर्माण एवं गुणवत्ता नियंत्रण को QMC के Mail id- rwdtqc@gmail.com पर अवगत कराना सुनिश्चित करेंगें।

अभियंता प्रमुख

ज्ञापांकः– मु0अ0नि0एवं गु0नि0)विविध कार्य–06–165/24 -4620 पटना/दिनांकः– 23/08/25
प्रतिलिपि – आई0टी0 मैनेजर को विभागीय वेबसाईट पर अपलोड करने हेतु प्रेषित।

अभियंता प्रमुख

Format -"A" (For Roads / Approach Roads)

1 **Name of Scheme–**
2 **Name of Road –** **Chainage/Location**
3 **Name of Circle –**
4 **Name of Division -** **Block-**
5 **Length of Road (Sanctioned) -** **Actual Length-**
6 **Date of inspection-**

Sl. No.	Parameters	Remarks
1	**Attention to Quality**	
I.	Field laboratory established with all necessary equipment (Attach Geo tagged Photographs)	
II.	QC Register Part-1 & Part-2 maintained and mandatory test conducted as per provisions	
III.	Mention the name of tests conducted & their findings related to the following materials	
(a)	Cement/concrete	
(b)	Sand	
(c)	Stone	
(d)	Steel	
	Awarded grade	
2	**Geometrics**	
I.	Chainage (m)	
II.	Roadway width(m)	
III.	Carriageway width (m)	
IV.	Carriageway camber (%)	
V.	Shoulder width (m)	
VI.	Shoulder camber (%)	
VII.	Side slope (V:H)	
VIII.	Super elevation(%) / Widening (m)	
	Awarded grade	

(276)

3	**Earth Work and sub grade**	
I.	Chainage (m)	
II.	Soil identification/classification	
III.	Degree of Compaction (%)	
	Awarded grade	
4	**Sub-Base**	
I.	Chainage (m)	
II.	Thickness of the layer (mm)	
III.	Gradation of Sub-base material	
IV.	Plasticity of sub base material	
V.	Compaction of sub base layer (%)	
	Awarded grade	
5	**Base Coarse-Water Bound Macadam (WMM/WBM)**	
I.	Chainage (m)	
II.	Thickness of each layer of WBM/WMM (mm)	
III.	Plasticity of Crushable Aggregate	
IV.	Volume of filter material (%)	
V.	Gradation of Coarse Aggregate	
	Awarded grade	
6	**Bituminous Base Coarse (BM)**	
I.	Chainage (m)	
II.	Percentage of Bitumen Content	
III.	Thickness of Bituminous layer	
IV.	Grading of Coarse Aggregate	

	Awarded grade	
7	**Bituminous Layer-premix Carpet (PMC) / MSS/ SDBC**	
I.	Chainage (m)	
II.	Percentage of Bitumen Content	
III.	Thickness of Bituminous layer	
IV.	Grading of Coarse Aggregate	
V.	Quality of wearing surface (Attach the test report of **IRI**)	
	Awarded grade	
8	**Dry lean Cement Concrete**	
I.	Chainage (m)	
II.	Thickness (mm)	
III.	Compressive Strength of CC in Concrete Pavement / Concrete Block	
IV.	Awarded grade	
9	**CC/PQC/Panel Concrete Pavements**	
I.	Chainage (m)	
II.	Thickness of the pavement (mm)	
III.	Width of the pavement (m)	
IV.	Compressive Strength of CC in Concrete Pavement / Concrete Block	
V.	Quality of workmanship joints & edges etc.	
VI.	Quality of wearing surface (Attach the test report of **IRI**)	
	Awarded grade	
8	**Shoulders**	
I.	Chainage (m)	
II.	Width of the shoulder (m)	
III.	Quality of material for Shoulders	
IV.	Degree of Compaction (%)(Attach the test report)	

	Awarded grade	
9	**Cross Drainage Works**	
I.	Chainage (m)	
II.	Type of CD structure	
III.	Quality of material, such as concrete(cube test), stone/brick masonry, hume pipe including size etc.	
IV.	Quality of workmanship, such as positioning of Hume pipes, wing walls, cushion over hume pipes, vent clearance etc.	
V.	Parapet Walls	
	Awarded grade	
10	**Side Drain and Catch Water Drain**	
I.	Chainage (m)	
II.	General quality of side Drains /Catch Water Drains and their integration with CD Structures	
	Awarded grade	
11	**Road Furniture and Markings**	
I.	Main informatory Board (As per norms)	
II.	Citizen Informatory/ Maintenance Board (As per norms)	
III.	Kilometer post/200 m Stone/ Precautionary/ Mandatory Sign Boards	
IV.	Road Marking	
	Awarded grade	

Note:- * Attach Test Report
* Attach Relevant Photographs

(Signature)
Name of AE/EE/SE-
Office-

Format -"B"(For Bridges)

Division- **Block-**

1. **Name of Scheme–**
2. **Type of Bridge –** **Chainage/Location**
3. **Name of Stream –**
4. **Length of Bridge-**
5. **Type of Foundations-**
6. **Number of Span and Span length-**
7. **Width of Bridge-**

Sl. No.	Parameters	Remarks
1	**Attention to Quality**	
I.	Field laboratory established with all necessary equipment (Attach Geo tagged Photographs)	
II.	QC Register Part-1 & Part-2, reinforcement register maintained and mandatory test conducted as per provisions	
III.	Mention the tests conducted & their findings related to the following materials	
(a)	Cement	
(b)	Fine Aggregate	
(c)	Coarse Aggregate	
(d)	Steel	
	Awarded grade	
2	**Arrangements at site**	
I.	Form work/ Shuttering	
II.	Curing facilitation/frequency	
III.	Compaction (Machinery availability)	
IV.	Reinforcement (laying, fitting & spacing)	
	Awarded grade	
3	**Foundation**	
I.	TBM (upload geo-tagged photographs)	
II.	Shape and size of piers	

III.	Pile Load Test Conducted as per Norms (attach the test reports)	
IV.	Dismantling of the pile beyond cut off level.	
V.	Bottom plugging in case of **well foundation** by using tremie method	
VI.	Tilting & Shifting of Well within allowable limits	
VII.	Compressive Strength of the concrete cube (attach the test reports)	
VII.	Texture of the finished concrete structure	
VIII.	In order to assess quality of concrete in case of doubt, if any, Non Destructive Test (NDT) such as Rebound hammer, Ultrasonic Pulse Velocity (UPV) etc. has been conducted. (If Yes, then attach the test report)	
	Awarded grade	
4	**Sub Structure**	
I.	Granular/ filler material behind the abutments and returns done properly	
II.	Marking on bridge components with the date of casting	
III.	Compressive Strength of the concrete cube (attach the test report)	
IV.	In order to assess quality of concrete in case of doubt, if any, Non Destructive Test (NDT) such as Rebound hammer, Ultrasonic Pulse Velocity (UPV) etc. has been conducted. (If Yes, then attach the test report)	
	Awarded grade	
5	**Super Structure**	
I.	Thickness of Deck Slab (mm)	
II.	Camber of Deck Slab (%)	
III.	Drainage spout	
IV.	Bearing- Type of Bearing & their Condition	
V.	Compressive Strength of the concrete cube	
VI.	Kerb	
VII.	Quality of wearing surface (Attach the test report of IRI)	
VIII.	Railing	

IX.	Expansion Joints	
X.	Approach slab width, slope etc.	
XI.	Stopper	
XII.	In order to assess quality of concrete in case of doubt, if any, Non Destructive Test (NDT) such as Rebound hammer, Ultrasonic Pulse Velocity (UPV) etc. has been conducted. (If Yes, then attach the test report)	
	Awarded grade	
6	**Protection works**	
I.	Types/ Durability of Materials	
II.	Workmanship / finishing	
III.	Adequacy of weep hole	
iv	Temporary Diversion During Construction	
	Awarded grade	
7	**Bridge Furniture and Markings**	
I.	Main informatory Board (As per norms)	
II.	Citizen Informatory/ Maintenance Board (As per norms)	
III.	Bridge Marking/ Painting	
IV.	Guard Stones fixed on Approaches	
V.	Mandatory and Caution signage	
	Awarded grade	

Note:-

* Attach Test Report
* Attach Relevant Photographs

(Signature)

Name of AE/EE/SE-

Office-

1803.2. Tests on Earthwork, Subgrade, Granular Sub-base/Base/ Wearing Courses

Borrow Material : Grid the borrow area at 25 m c/c (or closer, if the variability is high) to full depth of proposed working. These pits should be logged and plotted for proper identification of suitable sources of material. The following tests on representative samples shall be carried out :

(a) Sand content (IS:2720 Part 4), one test per 4000 cu.m of soil

(b) Plasticity Test [IS:2720 (Part 5)] : Each type to be tested, one test per 4000 cu.m of soil

(c) Compaction Test [IS:2720 (Part 7)] : Each soil type to be tested, one test per 4000 cu.m of soil

(d) Deleterious Content Test [IS:2720 (Part 27)] : As and when required by the Engineer

(e) Natural Moisture Content Test [IS:2720 (Part 2)] One test for every 500 cu.m of soil

(f) CBR Test on materials to be incorporated in the Subgrade on soaked samples [IS : 2720 (Part 16)] : One CBR test for every 5000 cu.m atleast or closer as and when required by the Engineer.

Tests on Earthwork, Subgrade, Granular Sub-base/Base/Wearing Courses : The types of tests, their frequency and related acceptance criteria on Earthwork, Subgrade, Granular Sub-base/Base/Wearing courses shall be as given in Table 1800.2.

TABLE 1800.2 : FREQUENCY OF TESTS FOR EARTHWORK, SUBGRADE, GRANULAR SUB-BASE/BASE/WEARING COURSES

Sl. No.	Type of Test	Frequency
(1)	**Earthwork**	
	(a) Placement moisture content (IS:2720 Part 2)	1 in 250 cu.m for each layer, subject to a maximum of 4 tests per day
	(b) Degree of compaction (IS:2720 Part 28)	One set of the tests per 2000 m area comprising 5 to 6 measurements
	(c) CBR of subgrade on remoulded samples (IS:2720 Part 16)	As required

(2) Granular Sub-base/Base/Wearing Courses (Other than WBM)

(a) Gradation (IS:2720 Part 4)	2 tests per 500 cu.m subject to a minimum of 2 tests per day
(b) Atterberg's Limits (IS:2720 Part 5)	2 tests per 500 cu.m subject to a minimum of 2 tests per day
(c) Placement moisture content (IS:2720 Part 2)	2 tests per 500 cu.m subject to a minimum two tests per day
(d) Degree of compaction (IS:2720 Part 28)	One set of tests per 2000 sq.m comprising 5 to 6 measurements
(e) CBR (IS:2720 Part 16)	1 in 1000 cu.m

(3) Lime/Cement/Lime-GBFS/Lime-Flyash Stabilised Sub-base

(a) Pulverisation of soil	Regularly
(b) Purity of Lime (IS:1514)	1 in 5 tonnes of lime or for each lot
(c) Placement moisture content (IS:2720 Part 2)	2 tests per 500 cu.m subject to minimum two tests per day
(d) Degree of compaction (IS:2720 Part 28)	One set of tests per 2000 sq.m comprising 5 to 6 measurements subject to minimum two tests per day
(e) CBR or Unconfined Compresive Strength test on a set of 3 specimens (IS:2720 Part 16) (IS:4332 Part 5)	1 in 100 cu.m subject to a minimum one test per day

(4) WBM Courses

(a) Aggregate Impact Value of Stone Aggregates (IS:2386 Part 4)	1 in 250 cu.m or source
(b) Grading of aggretates and screenings (IS:2386 Part 1)	2 tests per 250 cu.m or per day
(c) Flakiness Index (IS:2386 Part 1)	1 in 250 cu.m or per day
(d) Atterberg's Limits of binding material (IS:2720 Part 5)	1 to 50 cu.m or per day
(e) Water Absorption (IS:2386 Part 3)	1 test per source

(5) Wet Mix Macadam

(a) Aggregate Impact Value (IS:2386 Part 4)	1 in 200 cu.m of aggregate
(b) Grading (IS:2386 Part 1)	1 in 100 cu.m of aggregate
(c) Flakiness Index (IS:2386 Part 1)	1 in 200 cu.m of aggregate
(d) Atterberg's Limits of portion of aggregate passing 425 micron sieve (IS:2720 Part 5)	1 in 100 cu.m of aggregate
(e) Density of compacted layer	1 test per 500 sq.m

N.B. : If the daily output is less than the unit suggested for frequency, at least one test (for each type of test) is to be performed daily on the completed work.

1803.3. Tests on Bituminous Construction

The tests and their minimum frequencies for the different types of bituminous works shall be as given in Tables 1800.3 to 1800.7.

TABLE 1800.3 : FREQUENCY OF TESTS FOR PRIME COAT AND TACK COAT

Sl. No.	Test	Test Method	Frequency
(1)	Quality of binder	Viscosity, Residue on 600 micron sieve and Storage Stability Tests for Emulsions (IS:8887) Viscosity and Flash Point Tests for Cutbacks (IS:217)	One test per lot or per 10 tonnes
(2)	Temperature of binder for cutback, when used	Appendix - 10.6 of IRC:SP:20	Regularly
(3)	Rate of spread of binder	Appendix - 10.7 of IRC:SP:20	One test per 500 sq.m. not less than 2 tests per day

TABLE 1800.4 : FREQUENCY OF TESTS FOR BITUMINOUS MACADAM

Sl. No.	Test	Test Method	Frequency
(1)	Quality of binder	Penetration, Softening Point & Ductility Tests for Paving Bitumen (IS:73) Penetration, Softening Point and Elastic Recovery Tests for Modified Bitumen (IRC:SP:53)	One test per lot or per 10 tonnes
(2)	Temperature of binder	Appendix - 10.6 of	Regularly IRC:SP:20
(3)	Aggregate impact value	IS:2386 (Part 4)	1 test per 250 cu.m per source
(4)	Flakiness index	IS:2386 (Part 1)	1 test per 250 cu.m per source
(5)	Stripping of aggregate	IS:6241-1971	1 set of 3 representative specimens per source
(6)	Water absorption	IS:2386 (Part 3)	1 set of 3 representative specimens per source
(7)	Grading of aggregates	IS:2386 (Part 1)	1 test per 100 cu.m or per day
(8)	Binder content	Appendix-10.8 of IRC:SP:20	2 tests per day per plant
(9)	Thickness	-	Regularly
(10)	Density of compacted layer	Appendix-10.9 of IRC:SP:20	1 test per 1000 sq.m or per day

TABLE 1800.5 : FREQUENCY OF TESTS FOR BUILT-UP SPRAY GROUT/ MODIFIED PENETRATION MACADAM

Sl. No.	Test	Test Method	Frequency
(1)	Quality of binder	Penetration, Softening Point & Ductility Tests for Paving Bitumen (IS:73) Penetration, Softening Point and Elastic Recovery Tests for Modified Bitumen (IRC:SP:53)	One test per lot or 10 tonnes
(2)	Temperature of binder	Appendix-10.6 of IRC:SP:20	Regularly
(3)	Aggregate impact value	IS:2386 (Part 4)	1 test per 250 cu.m per source
(4)	Flakiness index	IS:2386 (Part 1)	1 test per 250 cu.m per source
(5)	Stripping of aggregate	IS:6241-1971	1 set of 3 representative specimens per source
(6)	Aggregate grading	IS:2386 (Part 1)	1 test per 100 cu.m of aggregate
(7)	Water absorption	IS:2386 (Part 3)	1 set of 3 representative specimens per source
(8)	Soundness of aggregate	IS:2386 (Part 5)	1 test per source
(9)	Rate of spread of binder	Appendix-10.7 of IRC:SP:20	1 test per 1000 sq.m or per day
(10)	Rate of spread of aggregates	Appendix-10.10 of IRC:SP:20	1 test per 1000 sq.m or per day

TABLE 1800.6 : FREQUENCY OF TESTS FOR SURFACE DRESSING/ SEAL COAT

Sl. No.	Test	Test Method	Frequency
(1)	Quality of binder	Penetration, Softening Point & Ductility Tests for Paving Bitumen (IS:73) Penetration, Softening Point and Elastic Recovery Tests for Modified Bitumen (IRC:SP:53) Viscosity, Residue on 600 micron sieve and Storage Stability Tests for Emulsion (IS:8887)	One test per lot or 10 tonnes
(2)	Temperature of binder	Appendix-10.6 of IRC:SP:20	Regularly
(3)	Aggregate impact value	IS:2386 (Part 4)	1 test per 250 cu.m per source
(4)	Flakiness index	IS:2386 (Part 1)	1 test per 250 cu.m per source
(5)	Grading of aggregates	IS:2386 (Part 1)	1 test per 50 cu.m per source
(6)	Stripping of aggregate	IS:6241-1971	1 set of 3 representative specimens per source
(7)	Water absorption	IS:2386 (Part 3)	1 set of 3 representative specimens per source
(8)	Soundness of Aggregates	IS:2386 (Part 5)	1 test per source
(9)	Rate of spread of binder	Appendix-10.7 of IRC:SP:20	1 test per 1000 sq.m and not less than 2 tests per day
(10)	Rate of spread of aggregates	Appendix-10.10 of IRC:SP:20	1 test per 1000 sq.m and not less than 2 tests per day

TABLE 1800.7 : FREQUENCY OF TESTS FOR OPEN GRADED PREMIX SURFACING/MIX SEAL SURFACING

Sl. No.	Test	Test Method	Frequency
(1)	Quality of binder	Penetration, Softening Point & Ductility Tests for Paving Bitumen (IS:73) Penetration, Softening Point and Elastic Recovery Tests for Modified Bitumen (IRC:SP:53) Viscosity, Residue on 600 micron sieve and Storage Stability Tests for Emulsion (IS:8887)	One test per lot or 10 tonnes
(2)	Aggregate impact value	IS:2386 (Part 4)	1 test per 250 cu.m per source
(3)	Flakiness index	IS:2386 (Part 1)	1 test per 250 cu.m per source
(4)	Stripping of aggregate	IS:6241-1971	1 set of 3 representative specimens for each source
(5)	Water absorption	IS:2386 (Part 3)	1 set of 3 representative specimens for each source
(6)	Grading of aggregates	IS:2386 (Part 1)	1 test per 50 cu.m or per day
(7)	Soundness (magnesium and sodium sulphate)	IS:2386 (Part 5)	1 test per source
(8)	Temperature of binder at application	Appendix-10.6 of IRC:SP:20	Regularly
(9)	Binder content	Appendix-10.8 of IRC:SP:20	1 test per 500 cu.m or per day
(10)	Thickness	-	Regularly

1803.4. Tests on Paving Quality Cement Concrete Road Construction

The tests and their minimum frequencies during cement concrete pavement construction are given at Table 1800.8.

TABLE 1800.8 : FREQUENCY OF QUALITY CONTROL TESTS FOR PAVING QUALITY CEMENT CONCRETE PAVEMENT

(1) Levels and Alignment			
(i) Level tolerance			Clause 1802.3; to be checked for each day's work
(ii) Surface Regularity (Transverse and Longitudinal)			Regularly
(iii) Width of pavement and position of paving edges			Clause 1802.2; to be checked for each day's work
(iv) Pavement thickness			Regularly at grid points
(v) Alignment of joints			To be checked for each day's work
(vi) Depth of Dowel Bars			To be checked for each day's work
(2) Quality of Materials and Concrete			
Control tests for materials and concrete shall be as under:			
(a) Cement			
Physical and chemical tests	IS:269 IS:455 IS:1489 IS:8112 IS:12269		Once for each source of supply and occasionally when called for in case of long/improper storage. Besides, the Contractor also shall submit daily test data on cement released by the Manufacturer
(b) Coarse and Fine aggregates			
(i) Gradation	IS:2386 (Part 1)		One test for each day's work.
(ii) Deleterious constituents	IS:2386 (Part 2)		One test for each day's work
(iii) Water absorption/ content	IS:2386 (Part 3)		Regularly as required subject to a minimum of one test a day for coarse aggregate & two tests

			a day for fine aggregate. This data shall be used for correcting the water demand of the mix on daily basis.
(c)	Coarse Aggregate		
	(i) Aggregate Impact Test	IS:2386 (Part 4)	One test per source
	(ii) Soundness	IS:2386 (Part 5)	One test per source
	(iii) Alkali aggregate reactivity	IS:2386 (Part 7)	One test per source
(d)	Water Chemical Tests	IS:456	Once for approval of source of supply, subsequently only in case of doubt.
(e)	Concrete		
	(i) Strength of concrete	IS:516	Minimum 6 cubes and 6 beams per day's work (3 each for 7 day and 28 day strength)
	(ii) Workability of fresh concrete-Slump Test	IS:1199	One test per 3 cubm of concrete at paving site or one test for each dumper laid at plant site.

1803.5. Tests on Roller Compacted Concrete Road Construction

The tests and their minimum frequencies during roller compacted concrete road construction shall be as given below:

(1) Levels and Alignment

Same as given at Sl. No.1 in Table 1800.8.

(2) Quality of Materials and Concrete

Same as given at Sl. No.2 in Table 1800.8 for :

(a) Cement

(b) Coarse and Fine Aggregates

(c) Coarse Aggregate and

(d) Water

For strength of concrete (IS:516), a minimum of 3 cubes and 3 beams

shall be cast for each 100 sq.m or part thereof, laid each day.

For Workability of fresh concrete (Slump Test), at least one test to be carried out per 3 cu.m of concrete at paving site or per day.

(3) In-situ Density

The dry density of the laid material shall be determined (IS:2720 Part 28) from three density holes for each 2000 sq.m or part thereof laid each day.

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EARTH WORK

WATER CONTENT OF SOIL

PURPOSE :

The properties of soil like shear strength and compaction characteristics are greatly influenced by its water content and the changes there in.

Oven Drying Method (Standard Method)

STEPS :

1. Take any suitable non-corrodible air-tight container. Clean the container tin with lid. Dry and weigh (W1).
2. Take the required quantity of soil specimen in container, crumbled and placed loosely and weigh with lid (W2).
3. Then keep it in an oven with the lid removed and maintain the temperature of the oven at 110°C ± 5°C.
4. If the soil contains gypsum or other minerals having loosely bound water of hydration or with significant amount of organic material, the drying may be carried out at 60-80°C.
5. Dry the specimen in the oven for 24 h.
6. Take out container from oven, place the lid back on the container and cool the container in a desiccator.
7. Record the final weight (W3) of the container with lid and dried soil sample.
8. calculate the percentage of moisture content using the formula:

$$\text{Moisture content} = \frac{W_2 - W_3}{W_3 - W_1} \times 100$$

WATER CONTENT OF SOIL

ILLUSTRATIVE EXAMPLE

Table No.-EW-1

Sample No.	Tin No.	Wt. of Tin (gm)(W_1)	Wt. of Tin+wet soil (gm) (W_2)	Wt. of Tin+ Dry Soil (gm) (W_3)	Loss of water (W_2) (W_3)	Wt. of dry soil (W_3) (W_1)	Water content (%) $\frac{W_2-W_3}{W_3-W_1} \times 100$
1	A	15.09	69.22	64.91	4.31	49.82	8.65
2	B	14.48	70.28	65.80	4.48	51.32	8.73
3	C	14.24	68.74	64.02	4.72	49.78	9.48

Note: Speedy Moisture Meters are also available in market. These are based on the principle that water will react with calcium carbide to form acetylene gas. Quantity of gas formed is directly proportional to the water present. The quantity of gas can be read from a pressure gauge which is calibrated in percentage of moisture on wet weight basis. This can then be converted to moisture content based on dry weight.

Liquid Limit, Plastic Limit and Plasticity Index

PURPOSE:

The Liquid and Plastic Limits (Atterberg Limits) of soil indicate the water contents at which certain changes in the physical behavior of soil can be observed. From Atterberg limits, it is possible to estimate the engineering properties of fine-grained soils. Plasticity is the property that enables a material to undergo deformation without noticeable elastic recovery and without cracking or crumbling. Plasticity is a major characteristic of soils containing an appreciable proportion of clay particles.

A. Liquid Limit (LL)

STEPS:

1. Take 120 g of soil passing IS: 425 micron sieve.

2. Mix it with distilled water to form a uniform paste. The paste shall have a consistency that will require 30 to 35 drops of the cup to cause required closure of the standard groove. In case of clayey soils, paste may be left standing for 24 h to ensure uniform distribution of moisture throughout the soil mass.

3. Remix the soil thoroughly and place a portion of the paste in the cup of the apparatus.

4. Squeeze down and spread the sample with as few strokes of spatula as possible, at the same time trim it down to a depth of 1cm at the point of maximum thickness. Level the specimen to half the cup.

5. Cut the paste with the standard grooving tool along the centre line In case where grooving tool type A does not give a clear groove as in sandy soil, use grooving tool type B or C.

6. Start rotating the handle at 2 revolutions per second.

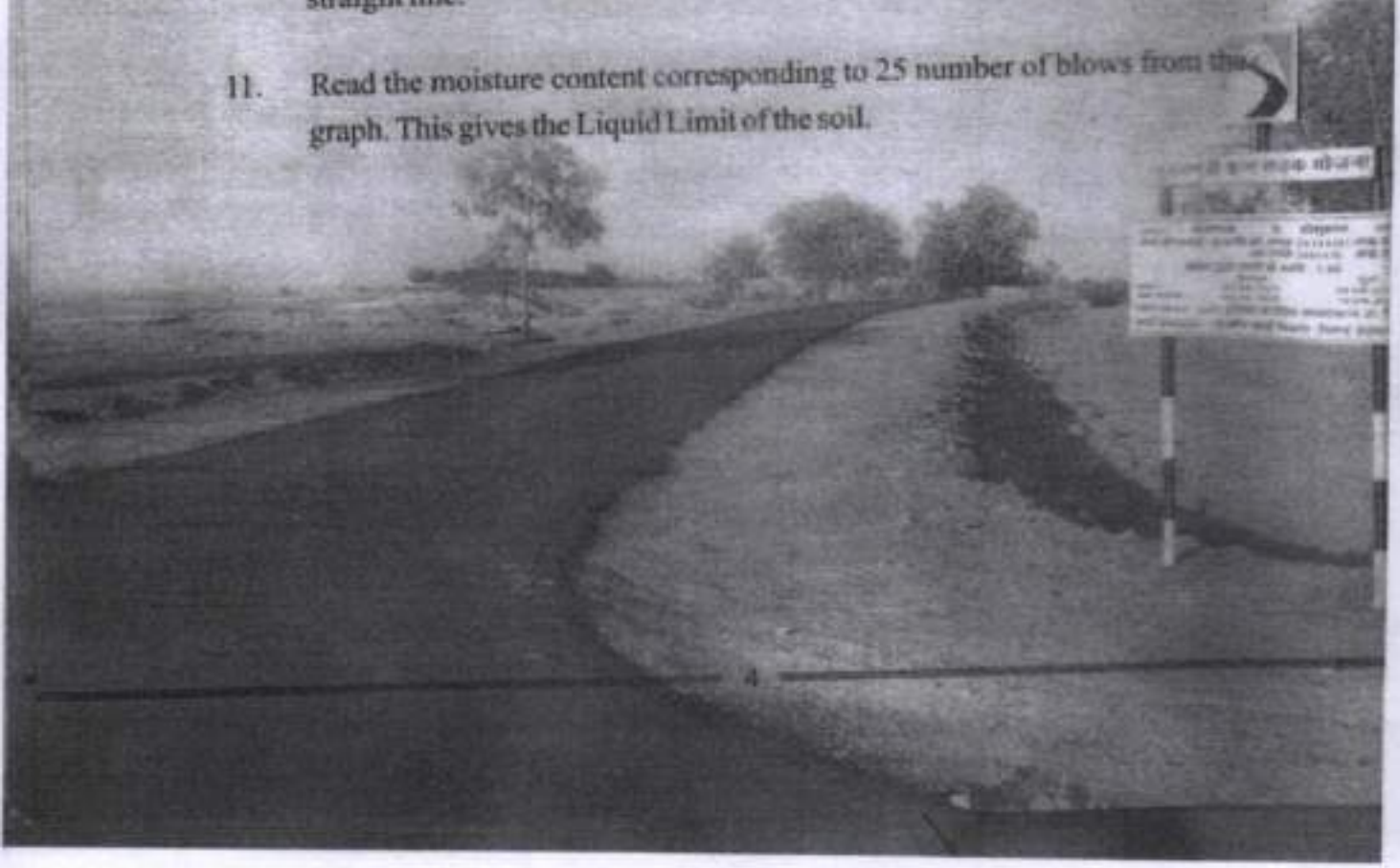
7. Count the number of blows till two parts of the sample come into contact at the bottom of the groove along a distance of 12 mm. This length shall be measured with the end of the grooving tool or a ruler.

8. Record the number of blows and determine moisture content of the sample taken near the closed Groove.

9. Repeat the test by changing the moisture content so that the number of blows to close the groove is not less than 15 or more than 35, such that the points on the flow curve are evenly distributed.

10. Plot a graph between log (number of blows) and moisture content and fit a straight line.

11. Read the moisture content corresponding to 25 number of blows from the graph. This gives the Liquid Limit of the soil.



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Determination of Liquid Limit

ILLUSTRATIVE EXAMPLE **Table No.-EW-2**

Container Number	D_1	Remarks
Weight of container + wet soil (W_2)	54.87	
Weight of container + dry soil (W_3)	42.96	
Loss of Moisture (W_2-W_3)	11.91	
Wt. of container (W_1)	14.26	
Wt. of soil (W_3-W_1)	28.70	
Moisture content % $\frac{W_2-W_3}{W_3-W_1} \times 100$	41.50	

LL = 41.50 %

B. Plastic Limit (PL)

STEPS :

1. Take about 20 g of soil passing IS: 425 micron sieve.
2. Mix it with distilled water to form a paste which is plastic enough to be easily moulded with fingers. In the case of clayey soils, leave the soil mass standing for 24 h to obtain a uniform distribution of moisture.
3. Take about 8 g of soil from the paste and make a ball.
4. Roll the ball on a glass plate with hand to make a thread of uniform diameter throughout its length. The rate of rolling shall be between 80 and 90 strokes per minute counting a stroke as one complete motion of the hand forward and back to the starting position again.

5. When the diameter of thread reaches 3 mm, remold the soil again to a ball.
6. Repeat the process of rolling and remolding until the thread of soil just starts crumbling at a dia greater than 3 mm. This shall be considered a satisfactory end point, provided the soil has been rolled into a thread 3 mm in diameter immediately before. At no time, shall an attempt be made to produce failure at exactly 3 mm diameter by allowing the thread to reach 3 mm, then reducing the rate of rolling or pressure or both, and continuing the rolling without further deformation until the threads fall apart.
7. Determine the moisture content of the crumbled threads.
8. Repeat the test two more times with fresh portion of the soil mix.
9. The average of the moisture content of the soil in the three trials gives the Plastic Limit of the soil.

Determination of Plastic Limit (PL)

ILLUSTRATIVE EXAMPLE **Table No.-EW-3**

Container Number	K_1	Remarks
Weight of container + wet soil (W_2)	35.36	
Weight of container + dry soil (W_3)	30.50	
Loss of Moisture (W_2-W_3)	4.86	
Wt. of container (W_1)	13.80	
Wt. of soil (W_3-W_1)	16.70	
Moisture content %= $\frac{W_2-W_3}{W_3-W_1}$ X 100	29.10	

Plastic Limit (PL) = 29.10 %

C. Plasticity Index (PI)

Plasticity Index is determined by subtracting the value of plastic limit from the value of the liquid limit. PI =LL – PL

Plasticity Index (PI) = LL-PL = 41.50% - 29.10% = 12.40 %

CALIFORNIA BEARING RATIO (C.B.R)

PURPOSE:

The CBR is a measure of resistance of a material to penetration of [redacted] plunger under controlled density and moisture conditions. CBR test values mainly for designing pavement structure. A cylindrical plunger of 50 mm diameter to penetrate a pavement component material at 1.25 mm/minutes. The load for 2.5 mm and 5 mm are recorded. This load is expressed as a percentage of standard load value at a respective deformation level to obtain CBR value.

CBR in Soaked Condition

STEPS:

1. After 96 h of soaking and after measuring the swelling, find the weight of the mould with soaked specimen (to be used for finding degree of compaction after soaking).

2. Drain the excess water by keeping the specimen vertically or by tilting for 10- 15 min (for sandy specimen no tilting is to be done).

3. Remove the filter paper on the specimen and keep it in the CBR testing machine to show penetration when the specimen is loaded.

4. Place the same surcharge weight as used while soaking.

5. Adjust the penetration measuring micrometer and the platform on which the CBR mould containing. The specimen rests, to show penetration when the specimen is loaded.

6. Start loading the specimen, after adjusting the penetration dial and the proving ring to zero mark.

7. Note the deflections in the dial gauge of the proving ring for corresponding penetrations as per the requirement. (Deflections are noted for penetrations of 0.5, 1.0, 1.5, 2.0, 2.5, 4.0, 5.0, 7.5, 10.0 and 12.5 mm of the plunger).
8. Plot the deflections against the penetration (in mm) in a semi-log graph

9. Find the correction required to be applied for the deflections

10. Correct the deflection by shifting the points actually plotted. (If a correction of 0.5 mm is observed, instead of taking deflection for penetration of 2.5 mm, deflection for 3 mm shall be taken).

11. Take the deflection for 2.5 mm and, 5 mm (for corrected curves, corrected deflection shall be taken).

12. Convert these deflections into loads by applying the calibration factors.

Find the CBR values for these penetrations by using the formula.

$$CBR = \frac{P_T \times 100}{P_S}$$

Where P_T =Load corresponding to the chosen penetration.

P_S=Standard load for the penetration from the table given below.

Penetration Depth	Unit Standard Load	Total Standard Load
2.5 mm	70 kg/sqm	1370 kg
5 mm	105 kg/sqm	2055 kg

The higher of the two values is reported as CBR

C.B.R

ILLUSTRATIVE EXAMPLE

Table No.-EW-4

Times of Penetration min-sec	Penetration in mm	Proving Ring Reading No. of division	Corresponding Load in kg from calibration chart 1 div = 0.932 kg	Standard Load Plunger area 19.64 cm²	Soaked CBR (%)		Remarks
1	2	3	4	5	6		7
		1	1	Std load in kg	CBR Value at 2.5mm	5.0mm	
0-0	0.0	-	-				
0-24	0.5	21	19.57				
0-48	1.0	31	28.89				
1-12	1.5	40	37.28				
1-36	2.0	45	41.94				
2-0	2.5	51	47.53	1370	3.5 %	3.36 %	3.5%
3-12	4.0	65	60.58				
4-0	5.0	74	68.97	2055			
6-0	7.5	89	82.95				
8-0	10.0	[illegible]	93.2				
10-0	12.5	[illegible]	100.66				

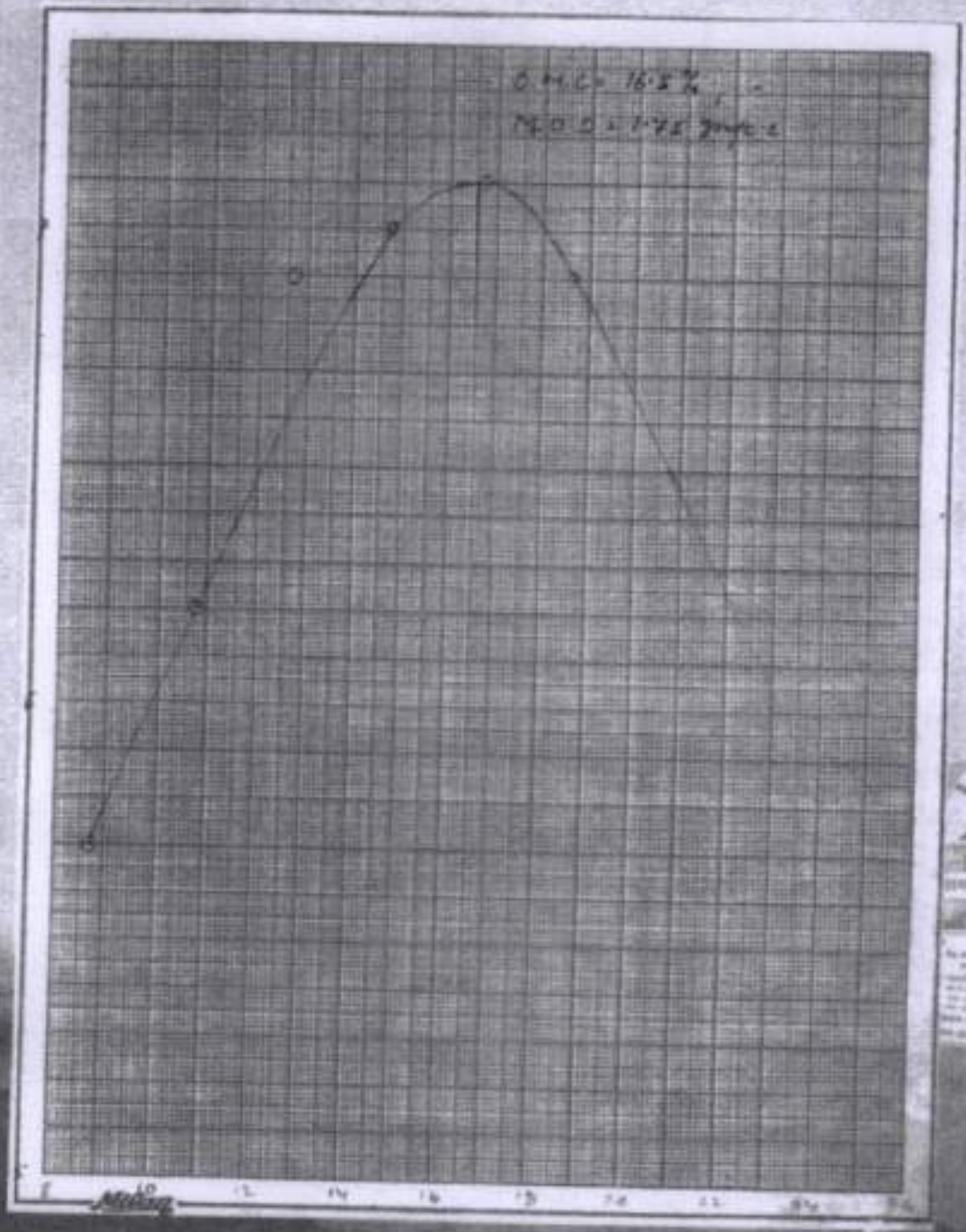
Proctor Density

PURPOSE:

Compaction is measured in terms of dry density achieved. This is a function of water content, the compactive effort and the nature of soil. For the same compactive effort, this test determines the optimum moisture content and the maximum dry density of a given soil.

STEPS:

1. Weigh the mould (W1) to the nearest 1g with base plate attached.


O.M.C = 16.5 %
M.D.D = 1.75 gm/cc

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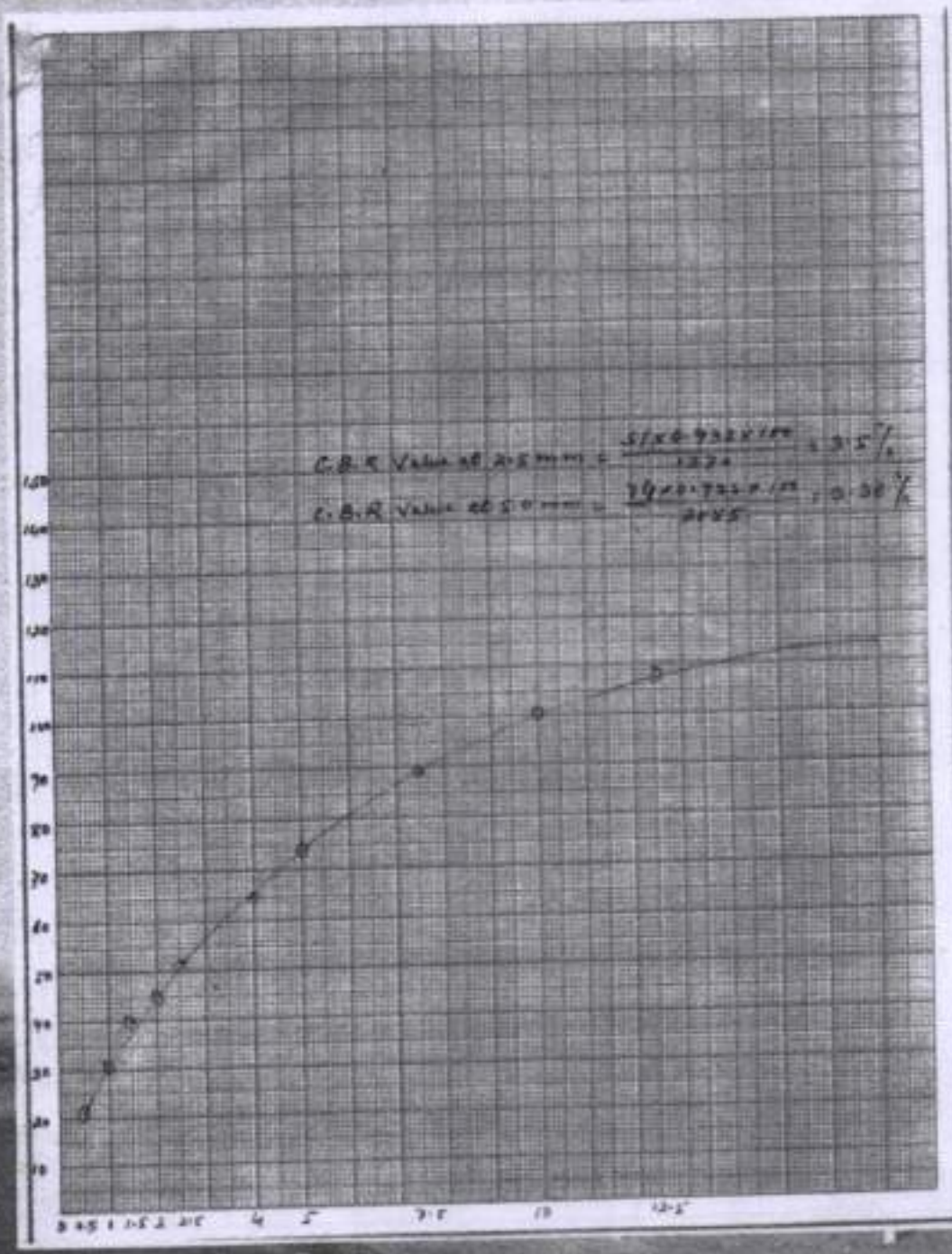
C.B.R Value at 2.5 mm = 5/x 0.932 x 100 / 1324 = 3.5%
C.B.R Value at 5.0 mm = 29/x 0.932 x 100 / 2445 = 0.38%

2. Take about 6 kg of air dried soil passing 20 mm IS sieve for soils not susceptible to crushing during compaction, or about 15 kg of materials passing a 19 mm sieve for soils susceptible for crushing during compaction. Sieve this portion on a 19 mm sieve and reject the coarse fraction after recording its proportion of the total sample.

Calculations

Bulk Density γ_m in g/ml of each compacted specimen shall be calculated from the equation:

$$\gamma_m = \frac{m_2 - m_1}{Vm}$$

where

m_1 = mass in g of mould and base;

m_2 = mass in g of mould, base and soil; and

Vm = volume in ml of mould.

The dry density, γ_d in g/ml, shall be calculated from the equation:

$$\gamma_d = \frac{100 \times \gamma_m}{100 + w}$$

Where

w = water content of soil in percent.

The dry density γ_d obtained in a series of determinations shall be plotted against the corresponding moisture contents w. A smooth curve shall be drawn through the resulting points and the position of the maximum on this curve shall be determined.

DENSITY OF SOIL

ILLUSTRATIVE EXAMPLE

Table No.-EW-5

Sl. No.	Weight of Mould + compacted soil (g) W_2	Weight of wet soil (g) W_2-W_1	Wet density (g/cc)	Container No.	Weight of container (g)	Weight + wet soil (g)	Weight of container + dry soil soil (g)	Weight of water (W1(g)	Weight of dry soil (W2(g)	Moisture content (%) (W)	Dry density (gm/c)
1	3580	1480	1.48	A	14.00	36.14	34.60	1.54	20.60	7.48	1.37
2	3880	1780	1.78	B	13.00	38.08	35.80	2.28	22.80	10.00	1.61
3	4040	1940	1.94	C	14.00	41.56	38.50	3.06	24.50	12.49	1.72
4	3850	1750	1.75	D	15.00	45.58	41.30	3.94	26.30	14.98	1.52
5	3970	1870	1.87	E	14.00	46.31	41.50	4.81	27.50	17.49	1.59
6	3920	1820	1.82	F	13.00	49.96	43.80	6.16	30.80	20.00	1.51

Note - Weight of mould W_1(g)=2100 gm, Volume of mould Vm(cm^3)=1000 c.c.

SAND REPLACEMENT METHOD

PURPOSE:

Field density of soil affects its permeability and compressibility. Also the compaction of soil is measured in terms of dry density achieved.

STEPS:

1. The pouring cylinder shall be filled so that the level of the sand in the cylinder is within about 10 mm of the top. Its total initial weight (W_1) shall be found and shall be maintained constant throughout the tests for which the calibration is used. Volume of sand equivalent to that of the excavated hole in the soil (or equal to that of the calibration container) shall be allowed to run out of the cylinder. The shutter of the pouring cylinder shall then be closed and the cylinder placed on a plane surface such as the glass plate. (Sand should be clean natural sand passing 1.0 mm IS sieve and retained on 600 micron).

2. The shutter on the pouring cylinder shall be opened and sand allowed to run out. When no further movement of sand takes place in the cylinder, the shutter shall be closed and the cylinder moved carefully.

3. The sand that has filled the cone of the pouring cylinder (that is the sand that is left on the plane surface) shall be collected and weighed to the nearest gram repeated at least three times and the mean weight (W_2) taken.

4. The internal volume (V) in cc of the calibrating container may be calculated from its internal dimensions.

5. The pouring cylinder shall be placed concentrically on the top of the calibrating container after being filled to the constant weight (W1). The shutters on the pouring cylinder shall be closed during this operation. The shutters shall be opened and sand allowed to run out. When no further movement of sand takes place, the shutter shall be closed. The pouring cylinder shall be removed and weighed to the nearest gram.

6. These measurements shall be repeated at least three times and the mean weight (W_3) taken.

7. A flat area, approximately 45 cm square, of the soil to be tested shall be exposed and trimmed down to a level surface, preferably with the aid of the scraper tool.

8. A round hole approximately 10 cm diameter and the depth of the layer to be tested up to a maximum of 10 cm depth shall be excavated in the soil. No loose material shall be left in the hole. The metal tray with a central hole shall be laid on the prepared surface of the soil with the hole over the portion of the soil to be tested - the hole in the soil shall then be

excavated using the hole in the tray as a patter. This tray shall be removed before the pouring cylinder is placed in a position over the excavated hole. The excavated soil shall be carefully collected and weighed to the nearest gram.

9. The moisture content (W) of the excavated soil shall be determined by taking representative sample of soil. Alternatively, the whole of the excavated soil may be dried and weighted (W_d).

10. The pouring cylinder filled to the constant weight (W_1) shall be placed so that the base of the cylinder covers the hole concentrically, the shutters on the pouring cylinder shall be closed during this operation.
The shutter shall then be opened and sand allowed to run out into the hole.

11. The pouring cylinder and surrounding area shall not be vibrated during this period. When no further movement of sand takes place, the shutter shall be closed. The cylinder shall be removed and weighed to the nearest gram (W_2).

12. The weight of sand (W_a) in g required to fill the calibrating container shall be calculated from the following formula.
$Wa = W_1 - W_2 - W_c$
Where
W_1 - Weight of pouring cylinder and sand before pouring into calibrating Cylinder in g
W_c - Mean weight of sand in cone in g
W_2 - Mean weight of cylinder with residual sand after pouring into calibrating cylinder and cone in g

13. The bulk density of the sand Ys in (g/cc) shall be calculated from the

formula:

$Ys = Wa / V$

Where

V = Volume of calibrating cylinder in cc

14. The weight of sand (W_s) in g required to fill the excavated hole shall be calculated from the following formula.

$W_s = W_1 - W_4 - W_2$

Where, W_1 - Weight of cylinder and sand before pouring into hole in g, W_2 - Mean weight of sand in cone, in g, W_4 - Weight of cylinder and sand after pouring into hole and cone in g

15. The bulk density of the soil Y_s shall be calculated from the following formula:

$$Yb = \frac{Ww}{Wb} Ys \text{ g/cc}$$

Where, Ww - Weight of natural soil excavated in g; Wb - Weight of sand required to fill the hole in g; Ys - Bulk density of sand

16. The density of the dry soil Yd shall be calculated from the following formula.

$$Yd = \frac{Ww}{Wb} \times Ys \text{ g/cc or } \frac{100}{100 + W} \times Yb \text{ g/cc}$$

Where, W - Moisture content of the soil in percent, Ww - Weight of dry soil from the hole in g and, Wb - Weight of sand required to fill the hole in g. The following values shall be reported.

(a) Dry density of soil in g/cc.

(b) Moisture content of the soil in percent.

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SAND REPLACEMENT METHOD

ILLUSTRATIVE EXAMPLE **Table No.-EW-6**

(a)	**Calibration**	
	i. Mean weight of sand in cone (of pouring cylinder) (W_2) in g.	390 gm
	ii. Volume of calibrating cylinder (V) in cm^3.	1179 gm/c.c.
	iii. Weight of sand (+cylinder) before pouring into calibrating container (W_1) in g.	7000 gm
	iv. Mean weight of sand (+cylinder) after pouring into calibrating container (W_3) in g.	4900 gm
	v. Weight of sand to fill calibrating cylinder ($W_c = W_1 - W_3 - W_2$) in g.	1710 gm
	vi. Bulk density of sand $Y_s = (W_c/v) g/cm^3$.	1.44 gm/c.c.
(b)	**Determination of soil density**	
	i. Determination number	
	ii. Weight of wet soil from hole (Ww)in g.	2283 gm
	iii. Weight of sand (+cylinder) before pouring into hole (W_1) in g.	7000 gm
	iv. Weight of sand (+cylinder) after pouring into hole and cone (W_4) in g.	4917 gm
	v. Mean weight of sand in cone (W_2) in g.	1390 gm
	vi. Weight of sand in hole in g. $Wb = (W_1 - W_4 - W_2)$	1693 gm
	vii. Bulk density $Yb = (W_b/W_c) \times Y_s$ g/cm^3	1.94
	viii. Moisture content container number	
	ix. Moisture content (W) percent.	13.2
	x. Weight of dry soil from the hole in g. (Wd)	2016 gm
	xi. Dry density $Yd = (W_d/W_b) \times Y_s$ gm/cm^3	1.71gm/c.c.

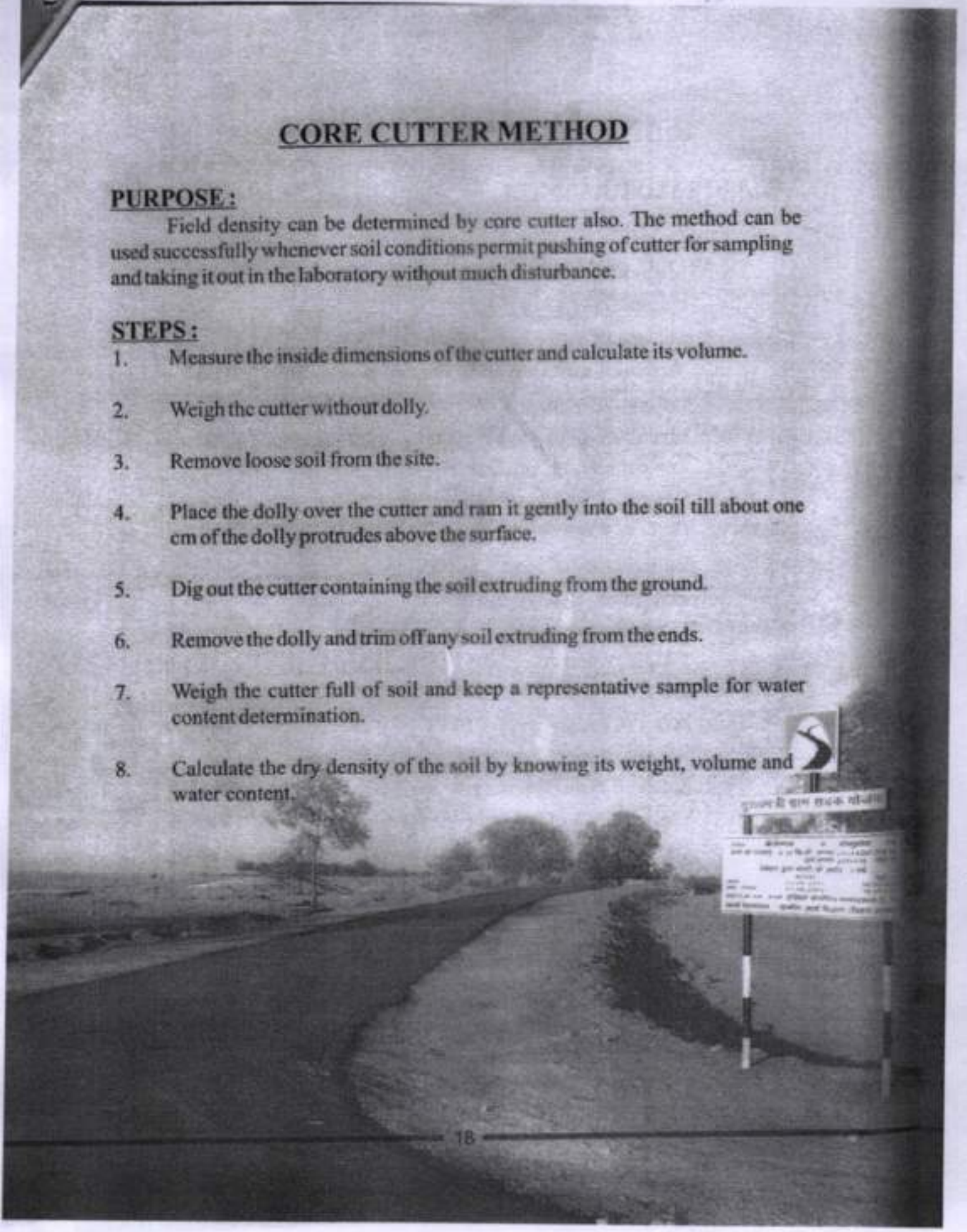
CORE CUTTER METHOD

PURPOSE :

Field density can be determined by core cutter also. The method can be used successfully whenever soil conditions permit pushing of cutter for sampling and taking it out in the laboratory without much disturbance.

STEPS :

1. Measure the inside dimensions of the cutter and calculate its volume.
2. Weigh the cutter without dolly.
3. Remove loose soil from the site.
4. Place the dolly over the cutter and ram it gently into the soil till about one cm of the dolly protrudes above the surface.
5. Dig out the cutter containing the soil extruding from the ground.
6. Remove the dolly and trim off any soil extruding from the ends.
7. Weigh the cutter full of soil and keep a representative sample for water content determination.
8. Calculate the dry density of the soil by knowing its weight, volume and water content.



CORE CUTTER METHOD

ILLUSTRATIVE EXAMPLE

Table No.-EW-7

Sl. No.	Observation	
1.	Volume of core cutter = V cm³	1021
2.	Weight of empty core cutter = W_g	940
3.	Weight of core cutter + wet soil = W_1 g	2923
4.	Weight of wet soil = W_t-W_g	1983
5.	Bulk Density $\gamma_b = \frac{W_1 - W}{V}$ g/cm³	1.942 gm/cc
6.	Container No.	X_1
7.	Weight of container + soil sample = W_2g	46.95
8.	Weight of container after oven drying = W_3g	42.25
9.	Moisture content = W_2-W_3 g	4.70
10.	Weight of empty container = W_4 g	12.10
11.	Weight of Dry Soil = W_3-W_4 g	30.15
12.	Percentage of Moisture content $W = \frac{W_2 - W_3}{W_3 - W_4} \times 100$ %	15.59%
13.	Dry Density $\gamma = \frac{100}{100 + m} \times \gamma_b$ g/cm³	1.68 gm/cc

Degree of compaction = F.D.D x 100/ M.D.D = $\frac{1.68 \times 100}{1.72}$

= 97.67 %

FIELD DENSITY BY CORE CUTTER METHOD

SURFACE PROFILE OF COMPACTED EARTH WORK

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SUB-BASE/BASE COURSE

This work shall consist of laying and compacting well graded material on prepared Subgrade in accordance with the requirements of Specifications.

GRADATION ANALYSIS OF AGGREGATE

PURPOSE :

A combination of well graded coarse and fine aggregates is essential for producing a durable granular mix for pavement courses.

STEPS :

1. The coarse aggregates used for granular construction are normally of the sizes 80 mm, 40 mm, 20 mm, 10 mm and 4.75 mm. The fractions from 4.75 mm to 150 micron are termed as fine aggregates. The size 4.75 mm is a common size appearing in both the fractions.

2. Grading pattern of aggregates – coarse, fine or combined – is determined by sieving a sample successively through all the sieves mounted one over the other in order of size, with the larger sieve on the top. The material retained on each sieve after shaking, represents the fraction of aggregate coarser than the sieve in question and finer than the sieve above.

3. Sieve analysis gives the gradation and the fineness modulus which is an empirical factor obtained by adding the cumulative percentages of aggregates retained on each of the dividing standard sieves and dividing it by 100. The larger the figure, the coarser the material.

4. Bring the sample to an air dry condition either by drying at room temperature or in oven at a temperature of 100°C to 110°C. Take the weight of the sample.

5. Clean all the sieves and sieve the sample successively on the appropriate sieve starting with the largest.

6. Shake each sieve separately over a clean tray.

On completion of sieving, note down the weight of the material retained on each sieve.

GRANULAR SUB-BASE

G.S.B

GRADATIONS :-

IS Sieve Designation	Per cent by Weight Passing the IS Sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53mm	-	100	-
26.5 mm	55-75	50-80	100
4.75 mm	10-30	15-35	25-45
0.075 mm (75 micron)	< 10	< 10	< 10

Notes:

1. Atterberg Limits: - The material passing 425 micron sieve for all the three gradings when tested, shall have liquid limit not more than 25 and plasticity index not more than 6 percent. On clayey sub-grades, the percent passing IS Sieve 0.075 mm shall not exceed 5.

2. Aggregate Impact Value: - The wet Aggregate Impact Value shall not exceed 50.

3. California Bearing Ratio: - Sub – base layer shall have a minimum soaked CBR value of 20. CBR Value upto 15 can be permitted with the approval of the competent authority.

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G.S.B-1

ILLUSTRATIVE EXAMPLE **Table No.-SBC-1**

Wt. of Sample taken – 44.524 kg

I.S. Sieve mm	Wt. of sample retained in (gm)	% of wt. retained	Cumulative % of Wt. retained	% of Wt. passing	Required value
75	0.0	0.0	0.0	100	100
26.5	14.061	31.58	31.58	68.42	55-75
4.75	19.622	44.07	75.65	24.35	10-30
0.075	7.529	16.91	92.56	7.44	<10

WATER BOUND MACADAM
W.B.M

This work shall consist of clean, crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary, and water laid on a properly prepared sub-grade/sub-base/base or existing pavement, as the case may be and finished in accordance with the requirements of Specifications.

W.B.M.

Grading No.	Size Range	IS Sieve Designation	Per cent by weight passing
1.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2.	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3.	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken 45.456 kg

Table No.-BC-2

I.S. Sieve Size (mm)	Wt. of sample retained	% of wt. retained	% of Cumulative retained	% of Wt. passing	Required value	Remarks
9.0	0.0	0.0	0.0	100	100	
63	2.509	5.52	5.52	94.48	90-100	
53	21.637	47.60	53.12	46.88	25-75	
45	17.969	39.53	92.65	7.35	0-15	
22.4	[illegible]	3.69	96.34	3.66	0-5	

SCREENINGS

Screenings should normally consist of same material as the coarse aggregate.

However, where economic considerations so warrant, non-plastic material such as moorum or gravel with LL less than 20 and PI less than 6 may be used.

Fraction passing 75 micron should not exceed 10 percent.

GRADING FOR SCREENINGS

Grading Classification	Size of Screenings	IS Sieve Designation	Per cent by weight passing the IS Sieve
A.	13.2 mm	13.2 mm	100
		11.2 mm	95-100
		5.6 mm	15-35
		180 micron	0-10
B.	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 micron	15-35

SCREENING

ILLUSTRATIVE EXAMPLE

Table No.-BC-3

Sl. No.	Sieve Size in mm	Weight of Sample Taken 2.5 kg					Remarks
		Weight Retained	% of Wt. Retained	% of Cumulative Retained	% of Wt. Passing	Required Value	
1	11.2	0	0	0	100	100	
2	5.6	200	8.00	8.00	92.00	90-100	Type - B
3	180 Micron	1500	60.00	68.00	32.00	15-35	

AGGREGATE IMPACT VALUE
A.I.V

PURPOSE :

The purpose of determining the Aggregate Impact Value is to assess its resistance to disintegration against Impact loading.

STEPS :

1. Take the test sample consisting of aggregates the whole of which passes 12.5 mm IS sieve and is retained on 10 mm IS sieve. Dry the aggregate comprising the test sample in an oven for a period of four hours or till such time that its weight becomes constant at a temperature of 105°C to 110°C. Cool the aggregates.

2. Use the aggregates as obtained above for conducting the test in a dry condition, following the procedure described below. For conducting the test under wet conditions, immerse the oven dried sample in water for three days. Surface dry the sample by suitable cloth and follow the procedure described later in this Section.

3. Aggregate shall be filled in the cylindrical measure in 3 layers by tamping each layer by 25 blows. Determine the net weight of aggregate in the measure (Wd). Transfer the sample from the measure to the cup of the aggregate impact testing machine and compact it by tamping 25 times.

4. The hammer is raised to height of 38 cm above the upper surface of the aggregate in the cup and is allowed to fall freely on the specimen.

5. After subjecting the test specimen to 15 blows, the crushed aggregate is sieved on IS 2.36 mm sieve.

6. Weigh the fraction passing through IS 2.36 mm sieve (W2).

7. Aggregate Impact Value (AIV) = $\frac{W2}{Wd} \times 100$

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A.I.V

ILLUSTRATIVE EXAMPLE **Table No.-BC-4**

Wt. of sample before impact (gm)	Wt. of sample after impact (gm)	Loss in wt. (gm)	A.I.V	Mean value	Remarks
342	279.62	62.38	18.24%		
340	280.26	59.74	17.57%	17.95%	
341	279.45	61.55	18.05%		

WATER ABSORPTION OF AGGREGATES

PURPOSE :

Water absorption shows the porosity of aggregates in one way. The more, it absorbs, the less it is durable.

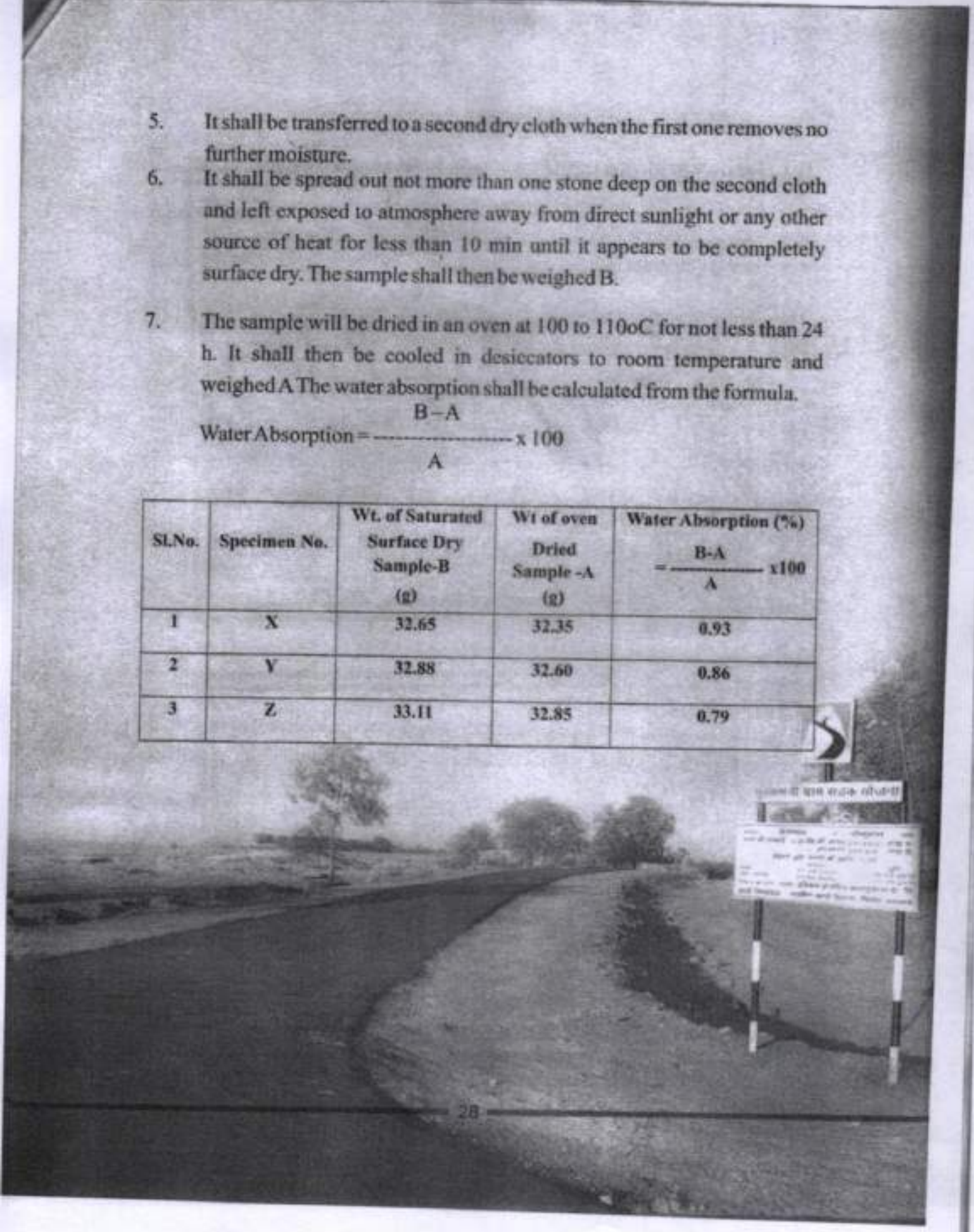
STEPS :

1. The test piece about 1 kg shall be washed to remove dust and immersed in distilled water in a glass vessel at a room temperature 20oC to 30oC for 24 h.
2. Soon after immersion and again at the end of the soaking period, entrapped air shall be removed by gentle agitation. This will be done by rapid clock wise and anti clock wise rotation.
3. The vessel shall then be emptied and test piece be allowed to drain.
4. The test piece shall then be placed on a dry cloth and gently surface dried with the cloth.

5. It shall be transferred to a second dry cloth when the first one removes no further moisture.
6. It shall be spread out not more than one stone deep on the second cloth and left exposed to atmosphere away from direct sunlight or any other source of heat for less than 10 min until it appears to be completely surface dry. The sample shall then be weighed B.
7. The sample will be dried in an oven at 100 to 110oC for not less than 24 h. It shall then be cooled in desiccators to room temperature and weighed A The water absorption shall be calculated from the formula.

$$\text{Water Absorption} = \frac{B-A}{A} \times 100$$

Sl.No.	Specimen No.	Wt. of Saturated Surface Dry Sample-B (g)	Wt of oven Dried Sample -A (g)	Water Absorption (%) $= \frac{B-A}{A} \times 100$
1	X	32.65	32.35	0.93
2	Y	32.88	32.60	0.86
3	Z	33.11	32.85	0.79



GRADATION TEST OF WBM AGGREGATES

SURFACE PROFILE OF COMPACTED SUB-BASE/BASE COURSE

BITUMINOUS CONSTRUCTION

BUILT-UP SPRAY GROUT
BUSG

The work shall consist of a two-layer composite construction of compacted crushed coarse aggregates with application of bituminous binder after each layer, and with key aggregates placed on top of the second layer, in accordance with the requirements of Specifications to serve as a base course and in conformity with the lines, grades and cross-sections shown on the drawings. Aggregates shall conform the Gradation test; Aggregate Impact value test and water absorption test as mentioned on page no. - 21, 26 and 27

B U S G

GRADATION

IS sieve designation (mm)	Cumulative percent by weight of total aggregate	
	Coarse Aggregate	Key Aggregate
53.0	100	-
26.5	40-75	-
22.4	-	100
13.2	0-20	40-75
5.6	-	0-20
2.8	0-5	0-5

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COURSE AGGREGATE

BUSG

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken 38.342 kg **Table No. BT-1**

I.S. Sieve Size (mm)	Wt. of sample retained	% of wt. retained	% of Cumulative retained	% of Wt. passing	Required value	Remarks
53.0	0.0	0.0	0.0	100	100	
26.5	19.037	49.65	49.65	50.35	40-75	
13.2	12.994	33.89	83.54	16.46	0-20	
2.8	4.846	12.64	96.18	3.82	0-5	

KEY AGGREGATE

BUSG

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken 11.580 kg **Table No.-BT-2**

I.S. Sieve Size (mm)	Wt. of sample retained	% of wt. retained	% of Cumulative retained	% of Wt. passing	Required value	Remarks
22.4	0.0	0.0	0.0	100	100	
13.2	6.340	54.75	54.75	45.25	40-75	
5.6	3.582	30.93	85.68	14.32	0-20	
2.8	1.186	10.24	95.92	4.08	0-5	

BITUMINOUS MACADAM
B.M

This work shall consist of construction in a single course having 50 mm or 75 mm thickness of compact crushed aggregates premixed with a bituminous binder on a previously prepared base to the requirement of Specifications. Aggregates shall conform the Gradation test; Aggregate Impact value test and water absorption test as mentioned on page no. - 21, 26 and 27

Bituminous Macadam
B.M.

GRADATION:-

IS Sieve designation	Percent by weight passing the sieve	
	Grading 1 Nominal size 40 mm	Grading 2 Nominal size 19 mm
45.0 mm	100	-
37.5 mm	90-100	-
26.5 mm	75-100	100
19.4 mm	-	90-100
13.2 mm	35-61	56-88
4.75 mm	13-22	16-36
2.36 mm	4-19	4-19
300 micron	2-10	2-10
75 micron	0-8	0-8
Bitumen content, % by weight of total mixture 3.3-3.5		

Note:
Use Grading 1 for 75 mm thickness and Grading 2 for 50 mm thickness.

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ILLUSTRATIVE EXAMPLE

Wt. of Sample taken = 16.344 kg **Table No.-BT-3**

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value	Remarks
26.5	0.0	0.0	0.0	100	100	Grading 2 for 50 mm thickness
19.4	0.597	3.65	3.65	96.35	90-100	
13.2	4.571	27.97	31.62	68.38	56-88	
4.75	7.015	42.92	74.54	25.46	16-36	
2.36	2.367	14.48	89.02	10.98	4-19	
0.3	0.608	3.72	92.74	7.26	2-10	
0.075	0.562	3.44	96.18	3.82	0-8	

20 mm THICK PREMIX CARPET

This work shall consist of the preparation, laying and compaction of a premix surfacing material of 20 mm thickness composed of small-sized aggregate premixed with a bituminous binder on a previously prepared base, in accordance with the requirement of Specifications, to serve as a wearing course. Aggregates shall conform the Gradation test, Aggregate Impact value test and water absorption test as mentioned on page no. - 21, 26 and 27.

Aggregate	Quantity
(a) Nominal size 13.2 mm (passing 22.4 mm sieve and retained on 11.2 sieve)	0.18 m³
(b) Nominal size 11.2 mm (passing 13.2 mm sieve and retained on 5.6 mm sieve)	0.09 m³

PREMIX CARPET

PMC

ILLUSTRATIVE EXAMPLE

Nominal Stone Size -13.2 mm

Wt. of the Sample taken – 3.0 kg.

Table No.-BT-4

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value
22.4	0.0	0.0	0.0	100	100
11.2	2.915	97.17	97.17	2.83	0

ILLUSTRATIVE EXAMPLE

Nominal Stone Size – 11.2 mm

Wt. of the Sample taken – 4.225 kg.

Table No.-BT-5

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value
13.2	0.0	0.0	0.0	100	100
5.6	4.080	96.57	96.57	3.43	0

MIX SEAL SURFACING
M.S.S.

This work shall consist of the preparation, laying and compaction of mix seal surfacing material of 20 mm thickness composed of graded aggregates premixed with a bituminous binder on a previously prepared surface, in accordance with the requirement of Specification. Mix seal surfacing shall be of Type A or Type B. Aggregates shall conform the Gradation test; Aggregate Impact value test and water absorption test as mentioned on page no. -21, 26 and 27

M.S.S.
GRADATIONS

IS sieve designation (mm)	Cumulative percent by weight passing	
	Type A	Type B
13.2	-	100
11.2	100	88-100
5.6	52-88	31-52
2.8	14-38	5-25
0.090	0-5	0-5

M.S.S.

ILLUSTRATIVE EXAMPLE

Table No.-BT-6

Sl. No.	Sieve Size in mm	Weight of Sample Taken 5 kg.					Remarks
		Weight Retained (gm)	% of Wt. Retained	% of Cumulative Retained	% of Wt. Passing	Required Value	
1.	11.2	0	0	0	100	100	
2.	5.6	1500	30.00	30.00	70.00	52-88	Type A
3.	2.8 mm	2500	50.00	80.00	20.00	14-38	
4	90 micron	760	15.20	95.20	4.80	0-5	

SEAL COAT

This work shall consist of the application of seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall (camber).

The seal coat shall be any of the three types mentioned below:

Type A : Liquid seal coat comprising of an application of layer of bituminous binder followed by a cover of stone chips.

Type B : Premixed seal coat comprising of a thin application of fine aggregate premixed with bituminous binder.

Type C : Premixed seal coat comprising of an application of 6.7 mm size stone chips premixed with bituminous binder.

SEAL COAT

Type of seal coat	Quantity of aggregate required per 10 sqm area	Gradation requirement	
		100 % passing sieve designation	100% retained sieve designation
Type A	0.09 cum	11.2 mm	2.36 mm
Type B	0.06 cum	2.36 mm	180 microns
Type C	0.09 cum	9.5 mm	2.36 mm

TYPE-A

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken – 2.0 kg. **Table No.-BT-7**

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value
11.2	0.0	0.0	0.0	100	– 100
2.36	1.936	96.8	96.8	3.2	0

TYPE-B

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken – 2.0 kg. **Table No.-BT-8**

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value
2.36	0.0	0.0	0.0	100	100
0.180	1.924	96.2	96.2	3.8	0

TYPE-C

ILLUSTRATIVE EXAMPLE

Wt. of the Sample taken – 2.0 kg. **Table No.-BT-9**

Sieve Size in mm	Wt. retained in gm	% of wt. Retained	% of cumulative retained	% of wt. passing	Required Value
9.5	0.0	0.0	0.0	100	100
2.36	1.914	95.7	95.7	4.3	0

SEMI DENSE BITUMINOUS CONCRETE S.D.B.C

PURPOSE:

Semi dense bituminous concrete use in wearing courses and profile corrective courses on previously prepared bituminous bound surface. This work shall consist in a single or multiple layers. Aggregates shall conform the Gradation test; Aggregate Impact value test and water absorption test as mentioned on page no.- 21, 26 and 27

S.D.B.C

GRADING	1	2
Nominal aggregate size	13 mm	10 mm
Layer Thickness	35-40 mm	25-30 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing.	
45	-	-
37.5	-	-
26.5	-	-
19	100	-
13.2	90-100	100
9.5	70-90	90-100
4.75	35-51	35-51
2.36	24-39	24-39
1.18	15-30	15-30
0.6	-	-
0.3	9-19	9-19
0.15	-	-
0.075	3-8	3-8
Bitumen content % by mass of total mix	Min 4.5	Min 5.0

S.D.B.C

ILLUSTRATIVE EXAMPLE

Wt. of Sample Taken 18.240 kg **Table No.-BT- 10**

Sieve Size (mm)	Wt. Retained (gm)	% of wt. Retained	% of cumulative retained	% of wt. Passing	Required Value
13.2	0.0	0.0	0.0	100	100
9.5	1.213	6.65	6.65	93.35	90-100
4.75	9.242	50.67	57.32	42.68	35-51
2.36	2.358	12.93	70.25	29.75	24-39
1.18	1.426	7.82	78.07	21.93	15-30
0.3	1.793	9.83	87.90	12.10	9-19
0.075	1.273	6.98	94.88	5.12	3-8

BINDER CONTENT (BITUMEN EXTRACTOR METHOD)

PURPOSE :

The test determines the bitumen content in the bituminous mix.

STEPS :

1. A representative sample of about 500 gm to be exactly weight and placed in the bowl of the extraction apparatus.
2. Cover the sample with commercial grade Benzene.
3. The mixture is allowed to stand for about one hour before starting the centrifugal machine.
4. The dried filtering is weighed and then fitted around edge of the bowl and the cover of the bowl is clamped tightly.

5. A beaker is placed under the drain to collect the extract.

6. The machine is revolved and the speed is maintained till the solvent ceases to flow from the drain.

7. The machine is allowed to stop and 200ml of Benzene is added to the bowl and the procedure is repeated.

8. The filter ring is removed, the residual material is dried first in air and then in oven at constant temperature of 110°C±5°C till constant weight is obtained.

9. Filter the extract through a filter paper.

10. Dry the filter paper in the oven and determine the weight of fines in the extract.

BINDER CONTENT

ILLUSTRATIVE EXAMPLE **Table No.-BT-11**

Sl. No.	Sample No.	1	2	3
1.	Wt. of mix taken before extraction (A)gm	500	500	500
2.	Wt. of filter paper before extraction (B)gm	3.310	3.40	3.300
3.	Wt. of mix after extraction (C)gm	464	460	458
4.	Wt. of filter paper after extraction (D)gm	5.310	4.40	5.300
5.	Wt. of filler collected from extract after allowing for setting (E)gm	10	12	15
6.	Wt. of filler collected in filter paper (B-D)=F gm	2	1	2
7.	Wt. of aggregate + filler paper (C+E+F) = G gm	476	473	475
8.	Percentage of Bitumen (in the mix) (A-G)x100 / A	4.8%	5.4%	5.0%

SURFACE PROFILE OF COMPACTED BT COURSE

THICKNESS CHECK OF BT COURSE

P.C.C ROAD AND CD WORKS

The works shall consist of construction of un-reinforced, plain cement concrete pavement in accordance with the required specification and in conformity with the lines, grades and cross section shown on the drawings.

BRICK

Colour and Dimension of Bricks

PURPOSE:

It is necessary to check the size and color of bricks before using them.

STEPS:

1. It should be seen that the bricks have a uniform color and are free from cracks, organic matter and flows and nodules of free lime.

2. They should have rectangular faces with sharp corners and emit a ringing sound when struck. The size should be as per local practice with tolerance of ±5 percent.

DIMENSION TEST

ILLUSTRATIVE EXAMPLE **Table No- B-1**

Sl. No.	Code No.	Measurement (cm)			Reqd. Limit	Remarks
		Length	Width	Height		
1	A	24.8	11.6	6.9	As	
2	B	24.6	11.5	6.7	Per	
3	C	25.0	11.7	7.0	Standard	
4	D	24.7	11.6	6.8	Size	
5	E	24.8	11.6	6.8		

(716)

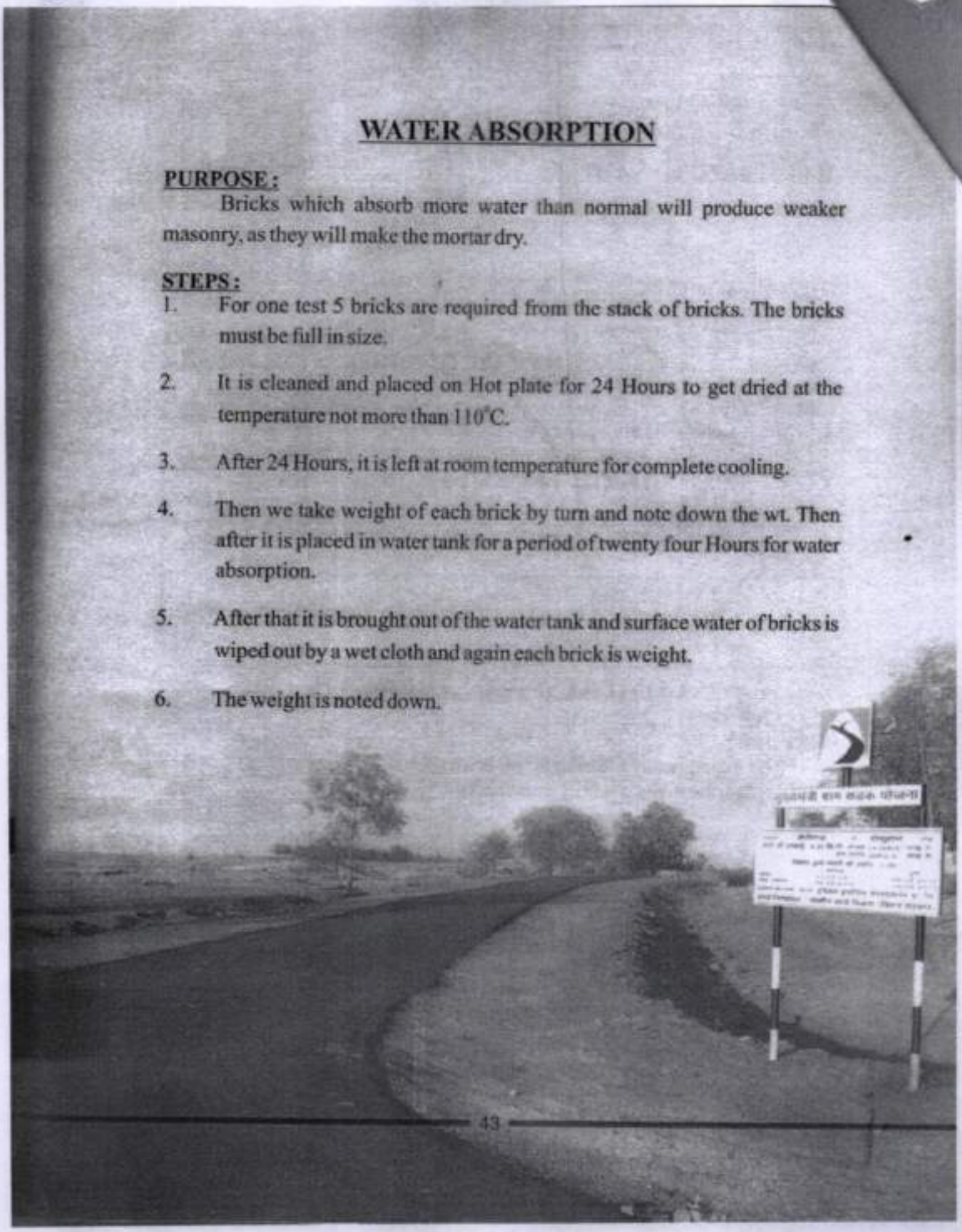
WATER ABSORPTION

PURPOSE :

Bricks which absorb more water than normal will produce weaker masonry, as they will make the mortar dry.

STEPS :

1. For one test 5 bricks are required from the stack of bricks. The bricks must be full in size.
2. It is cleaned and placed on Hot plate for 24 Hours to get dried at the temperature not more than 110°C.
3. After 24 Hours, it is left at room temperature for complete cooling.
4. Then we take weight of each brick by turn and note down the wt. Then after it is placed in water tank for a period of twenty four Hours for water absorption.
5. After that it is brought out of the water tank and surface water of bricks is wiped out by a wet cloth and again each brick is weight.
6. The weight is noted down.



WATER ABSORPTION

ILLUSTRATIVE EXAMPLE

Table No- B-2

Sl. No.	Code No.	Absorption of Water				Average	Max. Saturation Value	Remarks
		Wt. of sample taken (kg)	sample after saturation (kg)	Wt. of water (kg)	% of absorbed water			
1	A	3.506	3.990	0.484	13.8			
2	B	3.480	3.918	0.438	12.6			
3	C	3.538	3.991	0.453	12.8	13.1%	25%	
4	D	3.495	3.949	0.454	13.0			
5	E	3.500	3.973	0.473	13.5			

COMPRESSIVE STRENGTH

PURPOSE:

The Compressive Strength of bricks broadly indicates the overall quality of the raw material and its manufacturing process.

STEPS:

1. Every Brick contains frog mark on its bigger surface. This mark must be filled by mortar of cement and sand in the ratio of 1:3.
2. Then brick should be let free for 24 hours in a wet cloth for 24 hours for complete setting of the mortar in the frog mark.
3. Now each sample should be placed in water tank for three days for hardening of the mortar filled in the frog mark.

(214)

4. After that each sample is brought out of the tank and upper surface wiped by a wet cloth and test on the compression testing Machine.

5. The brick should be placed in machine between two pieces of ply wood and frog mark filled surface upward.

6. The load is applied at uniform rate until failure occurs. The load view is noted.

CRUSHING STRENGTH

ILLUSTRATIVE EXAMPLE

Table No- B-3

Sl. No.	Code No.	Crushing Strength 1KN=102.4 kg				Reqd. Limit	Remarks
		Area = length x Width (cm.)	Load (KN)	Crushing Strength kg/cm²	Average Value		
1	A	287.68	287	101.8			
2	B	282.90	287	103.5			
3	C	292.50	290	101.2	101.8	100	100A
4	D	286.52	290	103.3			
5	E	287.68	280	99.3			

FINENESS MODULUS

ILLUSTRATIVE EXAMPLE

Table No.-S-4

Sieve Size	Individual wt. Retained (gm)	% individual wt. Retained	% Cumulative wt. Retained	Sum of % Cumulative Wt. Retained	Fineness Modulus = Sum of % Cumulative Wt. Retained /100
4.75 mm	NIL	NIL	NIL		
2.63 mm	0.200	0.2	0.2	251.8 = 252	252/100 =2.52
1.18 mm	17.500	17.5	17.7		
600 micron	30.500	30.5	48.2		
300 micron	42.00	42.0	90.2		
150 micron	5.300	5.3	90.5		

ZONE OF SAND

	Required % of Passing For			
I.S. Sieve	Zone-I	Zone-II	Zone-III	Zone-IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-75	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Note-

It is recommendable that sand of grade zone IV should not be used in reinforced concrete.

ZONE OF SAND

ILLUSTRATIVE EXAMPLE

Total Wt. taken – 2.480 kg

Table No.-S-5

Sieve Size	Individual .wt Retained (gm)	% individual wt. Retained	% Cumulative wt. Retained	Sum of % Cumulative Wt. Retained	Required Value Zone II
10 mm	0.0	0.0	0.0	100	100
4.75 mm	0.199	8.02	80.02	91.98	90-100
2.36 mm	0.140	5.63	13.65	86.35	75-100
1.18 mm	0.405	16.33	29.98	70.02	55-90
600 micron	0.673	27.14	57.12	42.88	35-59
300 micron	0.631	25.44	82.56	17.44	8-30
150 micron	0.253	10.22	92.78	7.22	0-10

CONCRETE

Compressive Strength of Concrete Cubes

PURPOSE:

The tests are required to determine the strength of concrete and therefore its suitability for the job.

STEPS:

1. Representative samples of concrete shall be taken and used for casting cubes 15cmx15cmx15cm or cylindrical specimens of 15cm dia x 30cm long.

2. The concrete shall be filled into the moulds in layers approximately 5cm deep. It would be distributed evenly and compacted either by vibration or by hand tamping. After the top layer has been compacted, the surface of concrete shall be finished level with the top of the mould using a trowel; and covered with a glass plate to prevent evaporation.

3. The specimen shall be stored at site for 24± ½ h under damp matting or sack. After that, the samples shall be stored in clean water at 27±2°C; until the time of test. The ends of all cylindrical specimens that are not plane within 0.05 mm shall be capped.

4. Just prior to testing, the cylindrical specimen shall be capped with sulphur mixture comprising 3 parts sulphur to 1 part of inert filler such as fire clay.

5. Specimen shall be tested immediately on removal from water and while they are still in wet condition.

6. The bearing surface of the testing specimen shall be wiped clean and any loose material removed from the surface. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load cube as cast, that is, not to the top and bottom.

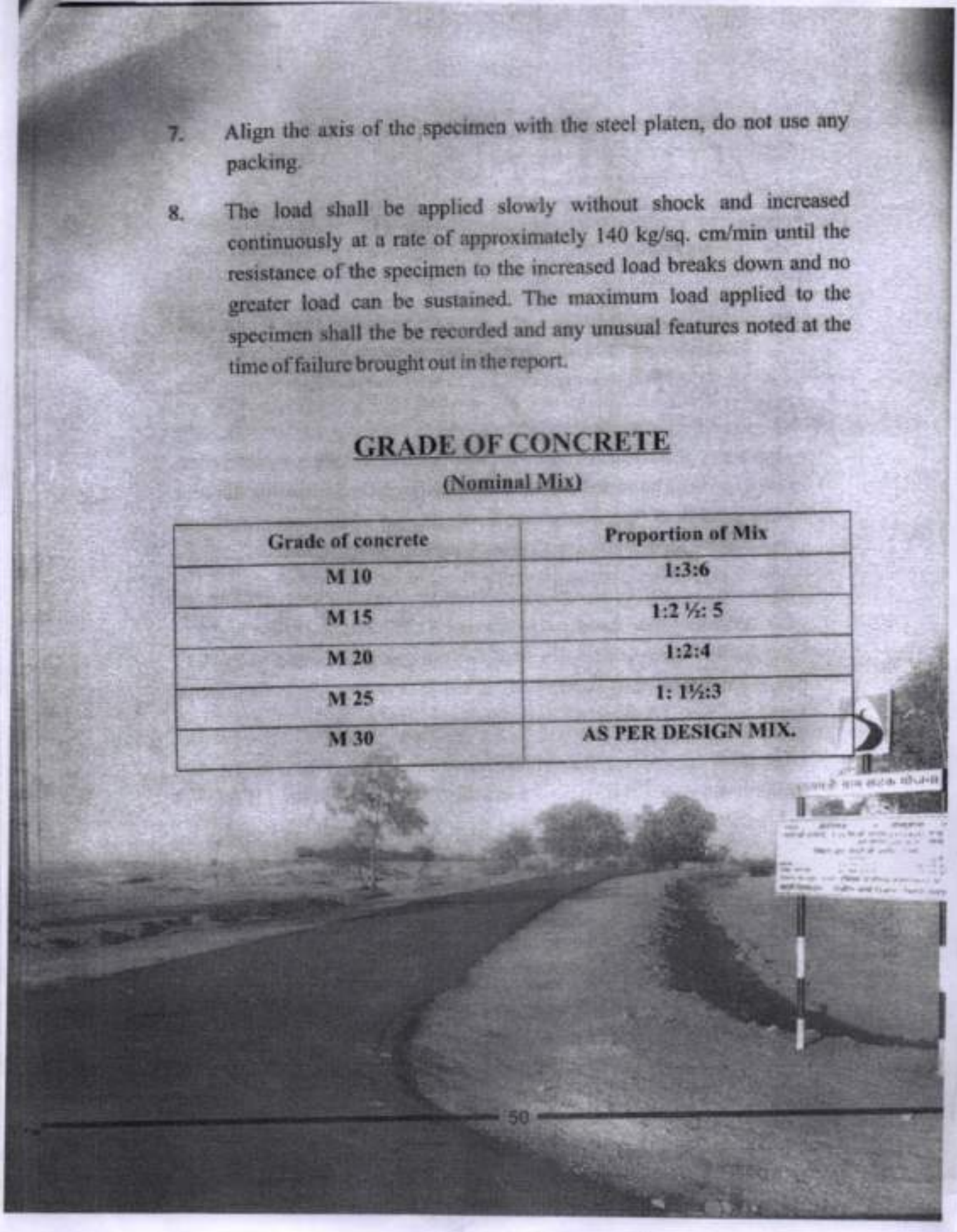
7. Align the axis of the specimen with the steel platen, do not use any packing.

8. The load shall be applied slowly without shock and increased continuously at a rate of approximately 140 kg/sq. cm/min until the resistance of the specimen to the increased load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall the be recorded and any unusual features noted at the time of failure brought out in the report.

GRADE OF CONCRETE

(Nominal Mix)

Grade of concrete	Proportion of Mix
M 10	1:3:6
M 15	1:2 ½: 5
M 20	1:2:4
M 25	1: 1½:3
M 30	AS PER DESIGN MIX.



COMPRESSIVE STRENGTH

CUBE TEST

ILLUSTRATIVE EXAMPLE

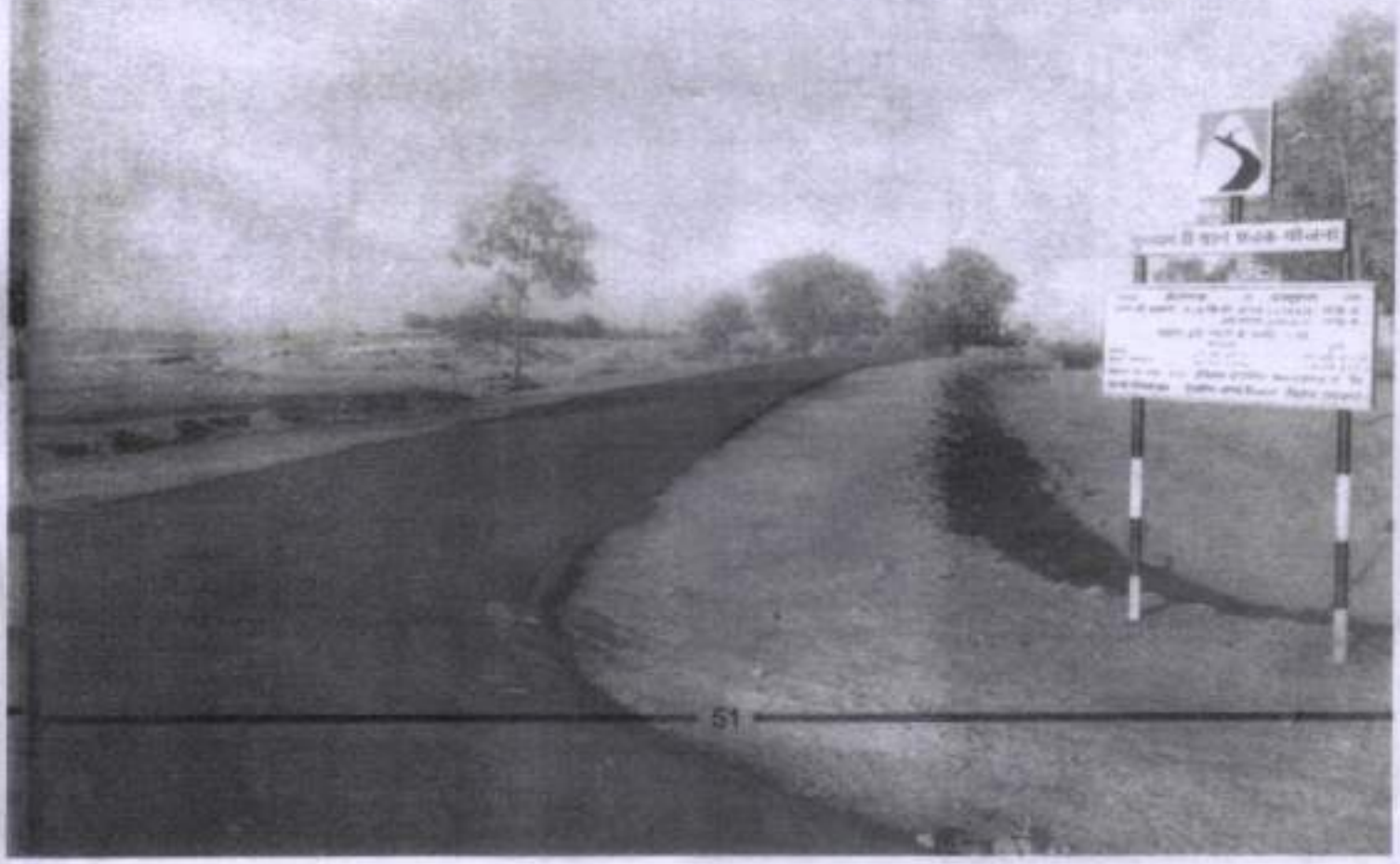
Date of Concreting. 16-12-2011

Date of Test. 13-01-2012

1 KN = 102.04 kg

Table No.-C-6

Identification of Mark	Wt. of Sample (KN)	Area of mould (cms)	Load at initial Cracking	Maximum load (KN)	Crushing Strength (kg/cms)	Average crushing strength (kg/cms)	Required crushing Strength (kg/cms)	Remarks
K1	9100	225	330	380	172.33			
K2	8800	225	290	330	149.66	160.24	150	M15
K3	8940	225	310	350	158.73			



Annexure-1800.1

List of Essential Equipment for Quality Control in Rural Road Construction Works

(i)	Post Hole Auger with extensions	One set
(ii)	Digging tools like pick axe, shovel, etc.	One set
(iii)	IS Sieves Nos. with lid and pan (90mm, 80mm, 63mm, 53mm, 45mm, 37.5mm, 26.5mm, 19mm, 13.2mm, 11.2mm, 9.5mm, 4.75mm, 2.8mm, 5.6mm, 3.35mm, 2.36mm, 600 micron, 425 micron, 300 micron, 150 micron, 180 micron, 90 micron and 75 micron)	One set
(iv)	Standard Proctor Density Test Apparatus with rammer	One set
(v)	Sand Pouring Cylinder with tray complete for field density test	One set
(vi)	Core Cutter (10cm dia.), 10cm/15cm height complete with dolly and hammer	One set
(vii)	Speedy moisture meter complete with chemicals	Two nos.
(viii)	Straight Edges	Three nos.
(ix)	Digital Thermometers	One set
(x)	Liquid Limit and plastic limit testing apparatus complete with Water bottle and glass wares	One set
(xi)	Gas burner, sand bath	Two nos.
(xii)	Camber Board	One no.
(xiii)	Electronic/digital balance 1 kg with the least count of 0.01 gm	One no.
(xiv)	Electronic/digital balance 5 kg	One no.
(xv)	Pan balance with weight Box, 5 kg	One no.
(xvi)	Oven (ambient to 200°C)	One no.
(xvii)	Water bath (ambient to 100°C)	One no.
(xviii)	Bitumen extraction apparatus	One no.
(xix)	Penetration apparatus (Bitumen)	Six nos.
(xx)	Enamelled tray	One set
(xxi)	Measuring tape, spatula, glassware, porcelain dish, pestle mortar	Three nos.
(xxii)	Trays for measurement of tackcoat quantity	Two nos.
(xxiii)	Slump cone	