Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Roads
Maintenance Branch

Guideline for Construction of Cement Treated Sub-base/Base

(2024)

FOREWORD

Cement Treated Sub Base/ Base (CTB) provides a stiffer and stronger base than an unbound granular base and found more beneficial in area having fluctuating water table. This guideline has been prepared mainly based on the following sources:

Cement Treated Sub Base/Base (CTB) provides a stiffer and stronger foundation compared to an unbound granular base and is especially beneficial in areas with fluctuating water tables. This guideline has been primarily developed based on the following sources:

- Guideline for the design of stabilized pavement, IRC SP 89 (Part II)-2018, Indian Road Congress
- Guideline for the design of flexible pavement, IRC 37-2018, Indian Road Congress
- Standard Specification for Road and Bridge 2073 with amendment 2078, Department of Road, Nepal

These guidelines cover the design and construction of Cement Treated Base/Sub Base, including mix design, material requirements, and construction procedures.

I hope these guidelines will assist road engineers in adopting a rational and economical approach to road pavement design.

Thank you

Er. Ram Hari Pokharel
Director General
Department of Roads
June 2024

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ACKNOWLEDGEMENT

This guideline for construction of Cement Treated Sub Base/ Base has been prepared as per the contract agreement between the Department of Roads (DoR), Maintenance Branch, and M/S ERMC Pvt. Ltd. in joint venture with M/S Eptisa Servicios De Ingenieria S.L.

It is part of the initiative "Develop Notes as and When Necessary to Support the Reform Process of Road Maintenance in DoR," as specified in the Terms of Reference (TOR) for the Consulting Service for Program Management Consultant for Periodic Maintenance.

I express my sincere thanks and gratitude to DoR Director General Mr. Ram Hari Pokharel, former DoR Director General Mr. Sushil Babu Dhakal, and the Maintenance Branch team.

Additionally, I extend my heartfelt thanks to the members of the review committee and experts for their efforts in developing this guideline.

I believe that this guideline will be instrumental for road engineers in achieving better performance in surface dressing works.

Thank you

Er. Prabhat Kumar Jha

Deputy Director General

Department of Roads, Maintenance Branch

June 2024

Contents

ABBREVATION

AIV	-	Aggregate Impact Value
ASTM	-	American Society of Testing and Material
CTB	-	Cement Treated Base
CTSB	-	Cement Treated Sub Base
DOR	-	Department of Road
MDD	-	Maximum Dry Density
IRC	-	Indian Road Congress
IS	-	Indian Standard
MPa	-	Mega Pascal
kN	-	KiloNewton
OMC	-	Optimum Moisture Content
PI	-	Plasticity Index
UCS	-	Unconfined Compressive Strength

LIST OF TABLES

1 CEMENT TREATED SUB- BASE / BASE

1.1 Introduction

Cement treated Sub Base (CTSB) / Cement Treated Base (CTB) is a general term that applies to a mixture of sub base/base with measured amounts of cement and water that hardens after compaction and curing to form a strong, durable, frost resistant paving material. Other terminology such as soil-cement base, cement-treated aggregate sub base/base, cement-stabilized roadbed, and cement-stabilized sub base/base are sometimes used.

Cement treated base/sub-base is used in pavement layer in highways and airports. The structural properties of Cement treated base/ sub-base depend on the soil/aggregate material, quantity of cement, curing conditions, and age.

Standard Specification of Road and Bridge 2073, 2ndAmendment 2078 referred here after as specification detailed the requirement of Cement Treated Soil sub base/base under clause 1202

1.2 Advantage of CTSB/CTB

- The resilient modulus of the CTSB/CTB is higher than the unstabilized sub base and base. The resilient modulus of the CTB is considered as 5000 Mpa for CTB having 7 days compressive strength of 4.5 to 7 Mpa whereas the unstabilized crushed rock base placed over the CTSB, the resilient modulus is taken as 350 MPa. Similarly the resilient modulus of the CTSB is taken as 600 Mpa for the design. The poison ratio for the cement treated material is taken as 0.25 whereas the poison ratio for untreated granular material is taken as 0.35.[1]
- Unstabilized sub base/ bases have high deflection due to low stiffness, which results in high surface strains and eventual fatigue cracking. The higher stiffness provided by cement-stabilized bases/sub- base produces lower deflections, resulting in lower surface strains and longer pavementlife.
- Soils/aggregates in cement-stabilized bases are tightly bound together by cement. The entire mass is hardened into a slab with enough rigidity and strength to spread loads overa large area of the subgrade. Unstabilized granular bases concentrate loads on a small area.
- Even in severe climates the strength of CTB increases due to continued cement hydration.
- Rutting can occur in the surface, base, and subgrade of unstabilized bases due to repeated wheel loading. Cement stabilized bases resist consolidation and movement, thus virtually eliminating rutting in all layers but the asphalt surface.
- Moisture intrusion can destroy unstabilized pavement bases, but not when cement is usedto bind the base. CTB pavements form a moisture-resistant base that keeps water out andmaintains higher levels of strength, even when saturated, thus reducing the potential for pumping of subgrade soils

[1] *Guideline for the design of flexible pavement, IRC 37-2018, Indian Road Congress*

2 DESIGN

The material property design requirement discussed here are referred to the DoR Standard specification for road and Bridge, IRC 37, IRC SP89 2018, ASTM D558,ASTM D559,ASTM D1632,ASTM D1633

2.1 Material Requirement

Major ingredients of the CTSB/CTB are sub base/ base materials, cement, and water.

2.1.1 Sub base/Base Material

For use in cement treated sub base/base, the material shall be sufficiently well graded to ensure a well – finished surface and have a grading within the range given in Table 1.

For use in a sub-base course uniformity coefficient shall not be less than 5.

Table 1 Grading limits of Material for Stabilization with Cement 2

Sieve size	Percentage by mass passing
53.0 mm	100
37.5 mm	95-100
19.0 mm	45-100
9.5 mm	35-100
4.75 mm	25-100
600 micron	8-65
300 micron	5-40
75 micron	0-10

The physical requirements for the material to be treated with cement for use as CTSB/CTB shall be as mentioned in table 2.

Table 2 Physical Requirement of the Base and Sub base Material to be treated with Cement [3]

Physical properties	Test method	Requirement forClass I & II	Requirement for Class III ,IV and maintenance work
Aggregate Impact Value(AIV)	IS 2386-4 or IS5640	Maximum 40	Maximum 45
Liquid Limit	IS 2720-5	maximum 25	maximum 25
Plasticity Index	IS 2720-5	Maximum 6	Maximum 6
CBR at 95 % dry density(at IS 2720- part8)	IS 2720-5	Minimum 30 unless specified in the Contract	Minimum 25 unless specified in the Contract

To achieve the most economical cement factor for durable CTB, it is recommended to use soil/aggregates that provide dense, well-graded blends in order to help minimize segregation andproduce a smooth finished surface. Gap-graded soil/aggregate mixes that are dominated by twoor three sizes are not desirable for most CTB applications.

[2] Clause 1202 of Standard Specification of Road and Bridge 2073, 2nd Amendment 2078

[3] *Clause 1201 of Standard Specification of Road and Bridge 2073, 2nd Amendment 2078*

2.1.2 Cement

Cement for stabilization shall comply with the requirements of IS : 269,455,1489 or NS 49

2.1.3 Water

The water to be used for the cement stabilization shall be clean . Potable water shall be preferred.

2.2 Strength Requirement

The CTB material shall have 7 days unconfined compressive strength (UCS) of 4.5 to 7 MPa and CTSB shall have 7 days unconfined compressive strength (UCS) of 1.5 to 3 MPa.[4]

Clause 1202 of standard specification of road and Bridge state that the mix design shall be doneon the basis of 7-day unconfined compressive strength (UCS) and/or durability test under 12 cycles of wet-dry conditions. The laboratory strength values shall be at least 1.5 times the minimum field UCS value stipulated in the Contract.

2.3 Quantity of Cement

The quantity of the cement to be mixed in the CTB shall be such that it should meet the design criteria of the UCS as stipulated in the contract document. The objective is to have a "balanced design," where enough cement is used so that the resulting stabilized base is strong, durable, and relatively impermeable. The desired UCS shall be clearly mentioned in the contract document.

BoQ Language (Sample for Base)

Providing, laying and spreading of CementTreated Base to achieve the seven days minimum unconfined compressive strength of ------ **MPa (but not more than 7 MPa) at field** as per Drawing and TechnicalSpecifications (clause 1202)

2.4 Process for Determination of OMC/MDD and Compressive strength of Cement Treated Base and sub base (ASTM method)

2.4.1 Finalize the Gradation of the Material

The sub base/base material used in the cement stabilization shall meet the gradation and physical requirement as mentioned in the Table 1 and Table 2. Effort shall be made to give well-graded blends in order to help minimize segregation andproduce a smooth finished surface. If required trail mix of different material shall be conducted to obtain the desired gradation.

2.4.2 Determine the OMC and MDD at Different Cement Content

The OMC and MDD of the cement treated sub base/Base is determined following the procedure as prescribed in ASTM D 558.

Mold— Cylindrical metal mold having a volume of 944±11 cm^3 with an internal diameter of 101.60 ±0.41 mm.to permit preparing compacted specimens of soil-cement mixtures of this size. The mold shall be provided with a detachable collar assembly approximately 63.5 mm. in height.

Manual Rammer—A manually operated metal rammer having a 50.80±0.13-mm diameter circular face and a mass of 2.49±0.01 kg. The rammer shall be equipped with a suitable guide sleeve to control the height of drop to a free fall of 304.8±1.6 mm above the elevation of the soil-cement.

Two distinct test methods based on the size of the soil material have been established in ASTM D 558. These methods are differentiated by the particle size: one for soil material passing through a 4.75 sieve and another for soil material passing through a 19mm sieve.

[4] *Guideline for the design of flexible pavement, IRC 37-2018, Indian Road Congress*

Determination of Optimum moisture content and MC and Density

a) Using Soil Material Passing 4.75 mm sieve

1) Prepare the sample for testing by breaking up the soil clumps to pass the 4.75-mm sieve in such a manner as to avoid reducing the natural size of the individual particles. When necessary, first dry the sample until it is friable under a trowel. Drying may be accomplished by air drying or by the use of drying apparatus such that the temperature of the sample does not exceed 140°F (60°C)
2) Add to the soil the required amount of cement conforming to Specification
3) Mix the cement and soil thoroughly to a uniform color. When needed, add sufficient water to dampen the mixture to approximately four to six percentage points below the estimated optimum water content and mix thoroughly
4) Form a specimen by compacting the prepared soil cement mixture in the mold, with the collar attached, in three equal layers so as to give a total compacted depth of about 130 mm. Compact each layer by 25 blows from the rammer dropping free from a height of 305 mm above the approximate elevation of each finally compacted layer. The blows shall be uniformly distributed over the surface of the layer being compacted. During compaction, the mold shall rest on a uniform, rigid foundation
5) Remove the extension collar after compaction and carefully trim the compacted mixture even with the top of the mold by means of a knife and straightedge. Determine and record the mass of the mixture and mold
6) Remove the material from the mold and slice vertically through the center. Take a representative sample of the material, weighing not less than 100 g, from the full height of one of the cut faces. Immediately, determine and record the mass of the moist material and container.
7) Dry in an oven at 110 + 5°C for at least 12hours or to a constant mass. Determine the mass of the dry soil
8) Take new sample as described above and add sufficient water to increase the water content of the soil-cement mixture by one or two percentage points, mix, and repeat the procedure described above for each increment of water added. Continue this series of determinations until there is either a decrease or no change in the mass of the moist material and the mold
9) Plot the dry density Vs moisture content and determine the OMC and Dry density for the particular cement content.
10) Repeat the procedure for the other cement content.

b) Using Soil Material Passing 19 mm sieve

1) Prepare the sample for testing by segregating the aggregate retained on a 4.75-mm sieve and breaking up the remaining soil aggregations to pass the No. 4.75-mm sieve in such a manner as to avoid reducing the natural size of individual particles. When necessary, first dry the sample until it is friable under a trowel. Drying may be accomplished by air drying or by the use of drying apparatus such that the temperature of the sample does not exceed 140°F (60°C).
2) Sieve the prepared soil over the 75-mm, 19.0-mm, and 4.75-mm sieves. Discard the material retained on the 75-mm sieve. Determine the percentage of material, by oven-dry mass, retained on the19.0-mm and 4.75-mm sieves.
3) Saturate the aggregate passing the 19.0-mm sieve and retained on the 4.75-mm sieve by soaking in water; surface-dry the material as required for later testing.
4) Select and maintain separate representative samples of soil passing the 4.75-mm sieve and of saturated, surface-dry aggregate passing the 19.0-mm sieve and retained on the 4.75-mm sieve so that the total sample will weigh approximately 5 kg or more. The percentage, by oven-dry mass, of aggregate passing the 19.0-mm sieve and retained on the 4.75-mm sieve shall be the same as the

percentage passing the 75-mm sieve and retained on the No. 4.75-mm sieve in the original sample.

5) Add to the portion of the soil sample passing the 4.75 mm sieve, the amount of cement conforming to Specification required for the total sample specified above. Mix the cement and soil thoroughly to uniform color.

6) Add water in desired amount generally four to six percentage below the optimum moisture content to this soil-cement mixture and mix thoroughly.

7) Add the saturated, surface dry aggregate to the soil-cement mixture passing the 4.75-mm sieve and mix thoroughly.

8) Form a specimen by compacting the prepared soil cement mixture in the mold, with the collar attached, in three equal layers so as to give a total compacted depth of about 130 mm. Compact each layer by 25 blows from the rammer dropping free from a height of 305 mm above the approximate elevation of each finally compacted layer. The blows shall be uniformly distributed over the surface of the layer being compacted. During compaction, the mold shall rest on a uniform, rigid foundation

9) Remove the extension collar after compaction and carefully trim the compacted mixture even with the top of the mold by means of a knife and straightedge. Determine and record the mass of the mixture and mold.

10) Remove the material from the mold and slice vertically through the center. Take a representative sample of the material, weighing not less than 500 g, from the full height of one of the cut faces. Immediately, determine and record the mass of the moist material and container.

11) Dry in an oven at 110 + 5°C for at least 12hours or to a constant mass. Determine the mass of the dry soil

12) Take new sample as described above and add sufficient water to increase the water content of the soil-cement mixture by one or two percentage points, mix, and repeat the procedure described above for each increment of water added. Continue this series of determinations until there is either a decrease or no change in the mass of the moist material and the mold

13) Plot the dry density Vs moisture content and determine the OMC and Dry density for the particular cement content.

14) Repeat the procedure for the other cement content.

For detail procedure of mixing and compacting refer to ASTM D 558 Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures

2.4.3 Preparation of Sample for the Unconfined Compressive Strength Test

Two alternative procedure are provided in ASTM C1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

Method A -This procedure uses a test specimen pre-pared in a mold complying with Test Methods ASTM D 559 i.e with the sample size of 101.6 mm in diameter and 116.8 mm in height. (Sometimes referred to as a proctor mold, resulting in a height over diameter ratio of 1.15)

This test method may be used only on materials with 30 % or less retained on the ·19.0-mm Sieve

Method B -This procedure uses a test specimen with a height over diameter ratio of 2.0 prepared in a cylindrical mold in accordance with Practice ASTM D1632 to produce the sample of size i.e. 71.1 mm in diameter and 142.2 mm in height. This test method is applicable to those materials that pass the 4.75-mm sieve.

Method A makes use of the same compaction equipment and molds commonly available in soil laboratories and used for other soil -cement tests. It is considered that Method A gives a relative measure of strength rather than a rigorous determination of compressive strength. Because of the lesser height to diameter ratio

(1.15) of the cylinders the compressive strength determined by Method A will normally be greater than that for Method B.

Because of the greater height to diameter ratio 2, method B gives a better measure of compressive strength from a technical viewpoint since it reduces complex stress conditions that may occur during the shearing of Method A specimens.

Sample Preparation and Curing Specimens:

Sample are prepared following the method described in the MDD/OMC determination (section 2.4.2) for respective soil size using the mold as described above. Cure the specimens in the molds in the moist room for 12 h, or longer if required, to permit subsequent removal from the molds using the sample extruder. Return the specimens to the moist room, but protect from dripping water for the specified moist curing period. Generally the specimens will be tested in the moist condition directly after removal from the moist room.

2.4.4 Loading of Sample for the Unconfined Compressive Strength Test

Place the specimen on the lower bearing block making certain that the vertical axis of the specimen is aligned with the center of thrust of the spherically seated block.

Apply a constant rate of deformation without shock to produce an approximate rate of strain of 1.3 mm/min. Alternatively the load may be applied at a constant rate that results in a rate of stress of 70 to 210 k.Pa/s . Apply the load until it decrease steadily indicating failure. Record the maximum load carried by the specimen during the test. Calculate the unit compressive strength of the specimen by dividing the maximum load by the cross sectional area of the cylinder.

2.5 Conversion of Cylinder Strength to the Cube Strength

It should be noted that in the UCS test the results can be affected by both the size and shape of the sample tested, e.g. a cube or cylinder specimen. In the UK the compressive strength concrete is tested using cubes (100mm or 150mm) rather than cylinders[5]. The Indian Standard/Nepal Standard use the cube (150*150*150) as the standard size for reporting the strength of concrete. A higher strength is obtained for cubes because the test machine plates offer greater lateral restraint due to the lower aspect ratio. In BS EN 206-1 the 2:1 cylinder strength is taken to be about 20% less than the cube strength for normal structural concrete but with higher strength classes, the cylinder strength achieves a higher proportion of the cube strength[5].

The cylinder results are often converted to those for 150 mm cube by multiplying the result with a correction factor as given in table below:

Table 3 Correction Factor[6]

Specimen Shape and Size	Correction Factor (to150mm cube)
Cylinder – 142 mm x 71 mm mean Dia.	1.25
Cylinder – 115.5 x 105 mm mean Dia.	1.04

2.6 Calculation of the Required Cement Content

After having determined the OMC and the unconfined compressive strength at different cement content, graph of Cement content Vs UCS (corrected using the factor as mentioned in table 3) shall be plotted. With the help of this graph, required cement content for the desired laboratory UCS shall be determined.

Again at the determined cement content OMC and MDD shall be determined as mentioned above which shall be used in the construction. Optionally upon the instruction from the Engineer a confirmatory strength test shall be done as before actual implementation at site.

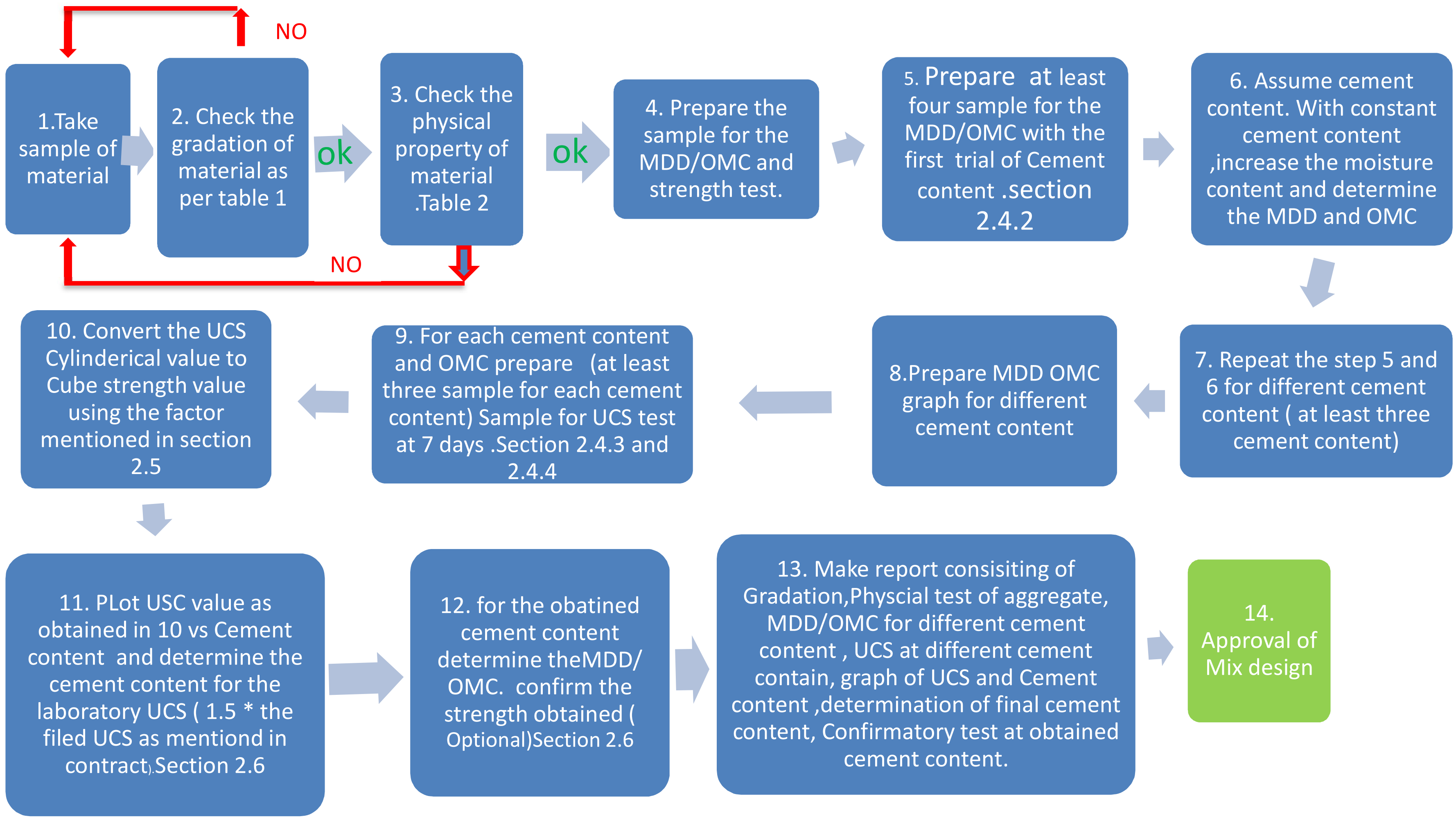
[5] *Properties of concrete for use in Euro code 2: A cement and concrete industry publication*

[6] *Guideline for the design of stabilized pavement, IRC SP 89 (Part II)-2018, Indian Road Congress*

2.7 Crack Relief Layer

Cemented layers, normally develop transverse and longitudinal cracks due to shrinkage and thermal stresses during hydration and during its service life. Studies have shown that incorporating a stress absorbing membrane interface (SAMI) or a crack relief layer can effectively solve the problem of reflective cracks in bituminous overlays and also extends the service life of the composite pavement. The crack relief layer may consist of dense graded crushed aggregates of 100 mm thickness conforming to specifications wet mix macadam (WMM) (clause 1208 of Standard specification of road and Bridge) or the Stress Absorbing Membrane Interlayer (SAMI) of elastomeric modified binder applied at the rate of 1.0 – 1.2 kg / m^2 covered with 0.1 m^3 of 11.2 mm aggregates.

3 FLOW CHART FOR MIX DESIGN



4 CONSTRUCTION OF CEMENT TREATED SUB-BASE/BASE

In CTSB/CTB construction, the objective is to thoroughly mix a Sub base/ base material with the correct quantity of cement and enough water to permit maximum compaction. The resulting CTSB/CTB must be adequately cured to provide the necessary moisture needed for cement hydration to fully harden the mixture. The fundamental control factors for quality are:

- Cement content
- Moisture content
- Mixing
- Compaction
- Curing

Following work procedure shall be followed during the construction

a. The contractor shall submit the following to the Engineer at least 30 days before start of any production of CTSB/CTB:

   Mix design done by the contractor at the laboratory acceptable to the Engineer for the approval. This mix design shall include details on gradation and other physical properties of base/sub base material, cement test reports, compressive strengths, and required moisture and density to be achieved during compaction.

b. Checking of the layer below

   Before CTSB/CTB processing begins, the bottom layer shall be in lines and grades as shown in the drawing. During this process, any unsuitable soil/aggregate or material shall be removed and replaced with acceptable material. The bottom shall be firm and able to support without yielding or subsequent settlement the construction equipment and the compaction of the CTSB/CTB. Soft or yielding portion shall be corrected and made stable before construction proceeds.

c. Mixing and Placing

   Mixing of the CTSB/CTB can be done either by a central mixing plant or in place, using single-shaft or multiple-shaft mixers. Agricultural disks or motor graders are not acceptable mixing equipment. The equipment used for mix-in-place construction shall be a rotavator or similar approved equipment capable of pulverizing and mixing the sub base/base with additive and water to specified degree to the full thickness of the layer being processed, and of achieving the desired degree of mixing and uniformity of the stabilized material. If so desired by the Engineer, trial runs with the equipment shall be carried out to establish its suitability for work

Central-Plant-Mixed Method:

CTSB/CTB shall be central-plant mixed in an approved continuous-flow or batch-type pugmill, or rotary-drum mixer. The plant shall be equipped with metering and feeding devices that will add the base material, cement, and water into the mixer in the specified quantities. If necessary, a screening device shall be used to remove oversized material from the raw feed prior to mixing. Base material and cement shall be mixed sufficiently to prevent cement balls from forming when water is added. The mixing time shall be that which is required to secure an intimate, uniform mixture of the soil/aggregate, cement, and water.

The CTSB/CTB mixture shall be transported from the mixing plant to the paving area in trucks. Contractor shall protect the CTSB/CTB material during transport from moisture variations due to weather conditions. The total elapsed time between the addition of water to the mixture and the start of compaction shall be the minimum possible. Haul time shall not exceed 30 minutes, and compaction shall start as soon as possible after spreading. In no case shall the total elapsed time exceed 45 minutes between the addition of water to the soil/aggregate and cement and the start of compaction.

Immediately prior to placement of the CTSB/CTB material, the receiving surface shall be in a moist condition. The mixture shall be placed without segregation at a quantity that will produce a uniformly compacted layer conforming to the required grade and cross section. The mixture shall be spread by one or more approved spreading devices. Not more than 60 minutes shall elapse between placement of CTSB/CTB material in adjacent lanes at any location except at longitudinal and transverse construction joints.

Mixing CTB in a continuous-flow-type pugmill.

Photo Credit: **Portland cement Association**

Mixed-in-Place Method

Photo Credit: **Portland cement Association**

In mixed-in-place construction, cement is uniformly distributed over the area to be processed.

Before deploying the equipment, the Subbase/base shall be spread uniformly on the prepared surface in a quantity sufficient to achieve the desired compacted thickness of the stabilized layer. The material in place and surface conditions shall be approved by the Engineer before the next phase of construction is begun.

Before cement is applied, initial pulverization or scarification may be required to the full depth of mixing.

The specified quantity of cement shall be applied uniformly in a manner that minimizes dust and is satisfactory to the Engineer. If cement is applied as slurry, unless an approved retarding admixture is used, the time from first contact of cement with water to application on the soil/aggregate shall not exceed 60 minutes. The time from slurry placement on the soil/aggregate to start of mixing shall not exceed 30 minutes.

Mixing shall begin as soon as possible after the cement has been spread and shall continue until a uniform mixture is produced. Mixing shall be continued until the product is uniform in color, meets gradation requirements, and is at the required moisture content throughout.

Mixing CTB in place using a single-shaft traveling mixer.

Photo Credit: **Portland cement Association**

Construction with Manual Means: Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations, as in small-sized jobs. Where manual mixing is permitted, the material shall first be freed of all vegetation and other deleterious matter and placed on the prepared sub grade/ subbase. The material shall then be pulverized by means of crow-bars, pick axes or other means approved by the Engineer. Water in requisite quantities may be sprinkled for aiding pulverization. On the pulverized material, the cement in requisite quantities shall be spread uniformly and mixed thoroughly by working with spades or other similar implements till the whole mass is uniform. After adjusting the moisture content to be within the limits mentioned later, the mixed material shall be leveled up to required thickness so that it is ready to be rolled.

d. Compaction: Moisture content at the time of compaction shall not be less than the optimum moisture content determined and nor more than 2 % above it. No section shall be left undisturbed for longer than 30 minutes during compaction operations. Immediately after spreading, grading and leveling of the mixed material, compaction shall be carried out with approved equipment (100 kN roller) . Rolling shall commence at edges and progress towards the center, except at super elevated portions where it shall commence at the inner edge and progress towards outer edge. During rolling the surface shall be frequently checked for grade and crossfall (camber) and any irregularities corrected by loosening the material and removing/adding fresh material. Compaction shall continue until the density achieved is at least 98 per cent of the maximum dry density for the material.

e. During the finishing process the surface shall be kept moist by means of fog-type sprayers. Compaction and finishing shall be done in such a manner as to produce a dense surface free of compaction marks, cracks, ridges, or loose material.

   All compaction operations shall be completed within 2 hours from the start of mixing or the shorter period as may be necessary in the dry weather

f. Curing:

   After completion of final finishing, the surface shall be cured by being kept continuously moist for a period of 7 days with a fog-type water spray that will not erode the surface of the CTB. Subsequent pavement course shall be laid soon after to prevent the surface from drying out and becoming friable. No traffic of any kind shall ply over the completed base unless permitted by the Engineer. Finished portions of CTSB/CTB that are traveled on by equipment used in constructing an adjoining section shall be protected in such a manner as to prevent equipment from permanently deforming or damaging completed work

4 REFERENCE:

1) Guideline for the design of stabilized pavement, IRC SP 89 (Part II)-2018, Indian Road Congress. Guideline for the design of flexible pavement, IRC 37-2018, Indian Road Congress
2) Guide to Cement Treated Base by: Gregory E Halsted, David R Luhr, Wayne S Adska, Portland Cement Association Publication
3) Methods of test for stabilized soils, Part 3: Test for determination of moisture content-dry density relation for stabilized soil mixtures, IS 4332-3 (1967)
4) Methods of test for stabilized soils, Part 5: Determination of unconfined compressive strength of stabilized soils IS 4332-5 (1970), Reaffirmed 2006
5) Properties of Concrete for use in Eurocode 2, A cement and concrete industry publication
6) Standard Specification for Road and Bridge2073 with amendment 2078, Department of Road, Nepal
7) Standard Test Methods for Moisture and Density Relation of Soil and Cement Mixture ASTM D558
8) Standard Test Methods for Wetting and Drying Compacted Soil Cement Mixture ASTM D559/D559M-15
9) Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory ASTM D1632
10) Standard Test Method for Compressive Strength of Molded Soil Cement Cylinder ASTM D1633