

SPECIFICATION SECTION 05300 – CEMENT TREATED BASE COURSE

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SPECIFICATION SECTION 05300 – CEMENT TREATED BASE COURSE

1. DESCRIPTION

This Specification Section prescribes the Cement Treated Base Course constructed on a prepared and finished Base Course in conformity with the dimensions and cross sections shown on the Drawings. The Contractor shall have full responsibility for completion of Works in compliance with Technical Specifications, Drawings and as may be directed by the Engineer.

2. MATERIAL REQUIREMENTS

2.1 Reference Standards

The most recent edition of the following standards shall apply to the materials covered in this Specification Section:

Vietnamese Standards:

TCVN8858-11 Cement Treated Aggregate Bases for Road Pavement Specification for Construction and Acceptance

TCVN 8859-11 Graded Aggregate Base and Subbase Pavement-Specification for Construction and Acceptance

TCVN2682-09 Portland Cements – Specifications

TCVN 6260-09 Portland Blended Cements – Specifications

TCXDVN 302-04 Water for Mixing Concrete and Mortar – Specifications

22TCN346-06 Testing Procedure on Definition of Compaction of Road Foundation and Embankment by Sand Cone Method

22TCN318-04 Testing Process for Determination of Abrasion of Aggregate by Los Angeles Method. International Standards:

AASHTO T104 Soundness of Aggregate by Use of Sodium or Magnesium Sulfate

AASHTO T11-05 Materials Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing. ASTM C117-03

AASHTO T27-99 Sieve Analysis of Fine and Coarse Aggregates. ASTM C 136-96

AASHTO T96 Resistance to Degrading of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

AASHTO T104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

AASHTO T176 Plastic Fines in Graded Aggregates and Soils by Use of the

Sand Equivalent Test

ASTM E950 Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

2.2 Material Requirements

- a) Where relevant, the provisions of Specification Section 07100 Concrete and Concrete Structures shall apply to the supply and use of the Cement Treated Base Course in the Works but shall be modified by the particular requirements of this Specification Section which shall take precedence.
- b) The requirements for the Base Course aggregate material is specified in Specification Section 05100 Subbase and Base Courses. Base Course aggregate shall be mixed with water and treated with ordinary Portland cement of the mandated specification and in the proportions directed by the Engineer after the execution of laboratory and Site trials described herein below.
- c) Cement for Cement Treated Base Course includes types of Portland cement with technical characteristics satisfying the requirements of TCVN 2682:1999 or Portland blended cement satisfying the requirements of TCVN 6260:1997. The cement grade for Cement Treated Base Course shall be not less than 30MPa.
- d) The requirements for water for mixing Cement Treated Base Course shall comply with the water requirements for mixing concrete and mortar in TCXDVN 302:2004.
- e) Mixing shall take place at the concrete mixing plant specified in Specification Section 07100 Concrete and Concrete Structures. Aggregate materials and cement shall first be placed in the mixer, water shall then be added as required to bring the water content of the resulting mixture to within the range determined in the laboratory and Site trials. Special care shall be taken to ensure uniformity and homogeneity in the mix. A weighing device shall ensure the accuracy, especially for weighing cement and water amount; allowable tolerances by weighing are $\pm 2\%$, $\pm 0.5\%$ respectively and $\pm 1\%$ by quantity.

2.3 Strength Requirement

Cement Treated Base Course shall satisfy two criteria for limited compression strength and limited splitting compression strength shown in Table 1.

Table 1 - Requirements for Strength of Cement Treated Base Course

Position of Cement Treated Base Course	Required limit strength, MPa	
	Compressive Strength (after 14 days)	Splitting Compressive Strength (after 14 days)
Base Course of cement concrete and asphalt concrete surface layer of	≥ 4.0	≥ 0.45

3. CONSTRUCTION REQUIREMENTS

3.1 Field and Laboratory Trials and Compaction Density Control

- a) Site pavement trial provisions in subsection 3 of Specification Section 05100 Subbase and Base Courses, shall generally apply when carrying out trials for the Cement Treated Base Course but shall be modified by the particular requirements of this Specification Section, which shall take precedence.
- b) A series of 150 mm test specimens shall be made from mixtures having varying water contents ranging from 4% to 8% by weight of the dry materials and at least 6 specimens being made from each selected water content.
- c) The Specimens shall be compacted in the mould with vibrating hammers, as described in BS 1377 Test 14 until refusal and cured for 7 days; after which the mean dry density of each group shall be calculated.
- d) The moisture content/density relationship shall be plotted and the moisture content corresponding to the maximum density as determined from a smooth curve drawn through the points so obtained shall be the optimum moisture content.
- e) The maximum dry density to be used for the control of the compaction of the Cement Treated Base Course shall be determined in the pavement trials carried out in accordance with the procedure set out hereunder:
 - i) The course shall be spread by an approved mechanized paver between the side forms, as described herein below, on a completed and approved underlying course in accordance with Specification Section 03400 Embankment.
 - ii) The loose material shall be spread in a layer of such thickness that after compaction the thickness shall not be less than 150 mm.
 - iii) The water content of the material shall initially be controlled so that immediately prior to compaction it is within a range of 2% of the optimum water content determined herein above.

- iv) In order to reach the required density, the layer shall first be compacted by light weight steel roller with 2 passes, and then by rubber-tired roller or smooth wheeled vibrating roller as the Engineer may decide. In the event of rubber-tired roller, 15-20 passes are required; but 6-10 passes are required if smooth wheeled vibrating roller is used. Finally, this shall be followed by smooth steel roller until no further compaction takes place and the surface become smooth. All the passes shall be determined from the result of trial laying section and approved by the Engineer.
- v) On completion of compaction and between 10 hours and 24 hours after the course has been compacted the dry density achieved in the course shall be measured as set out in BS 1377 Test 15. Twelve such measurements shall be made at locations within the trial area selected by the Engineer and the average of the twelve dry density measurements shall be the maximum dry density (MDD) for the Cement Treated Base Course used in the works, provided that no individual result shall fall below the average by 3%.
- f) The blended Cement Treated Base shall be compacted within the optimal moisture parameters; the allowable tolerance of moisture is -1%. The moisture content shall not be greater than optimal moisture and the compaction density to be achieved throughout the execution of the Permanent Works shall be not less than 100% MDD (AASHTO T 180 or 22TCN 333-06 Improved Proctor Method) determined in the laboratory, whichever is the greater. Any section of the Works which falls below the stipulated density requirements shall be removed and replaced at the Contractor's expense.
- g) Following the determination of the maximum dry density, further trials shall be carried out to demonstrate the suitability of the methods which the Contractor proposes to adopt for the laying of the course.

3.2 Laying and Compaction

- a) Mixture shall be laid between forms in regular lanes using an approved mechanical paver. It shall be spread evenly to a depth which will result in the thickness specified herein above, in accordance with the procedure agreed with the Engineer following the trials described herein above.
- b) The maximum compacted thickness of any layer shall not exceed 150 mm. Courses exceeding 150 mm in thickness but not exceeding 200 mm thick are to be spread in two equal layers and compacted separately but laid as a homogenous course with no more than four hours elapsing between the mixing of cement treated base materials for the first layer and the final compaction of the upper layer.
- c) Where a total thickness exceeding 200 mm is required, the Cement

Treated Base Course shall be laid as two separate layers and cured for seven days as provided for herein below.

- d) Final compaction and finishing shall be completed within two hours after the cement comes into contact with the aggregate materials or within such period as the Engineer may deem necessary to avoid the mixture from commencing to set before compaction is carried out.
- e) The Engineer shall have full and specific authority to stop any layer from being compacted if, in his opinion, the spread material has commenced to set before compaction has commenced.
- f) At the end of a working session laying shall be terminated at a stop end. On resumption of work the layer shall be cut back to remove all loose materials and form a clean vertical face and freshly mixed materials shall be butted tightly against the previous work.
- g) Longitudinal joints between lanes shall be treated in a similar manner. The Contractor shall ensure that full compaction is obtained at all the joints.
- h) Immediately after the final compaction of each layer, the surface of the layer and any exposed edge shall be cured as specified herein below.
- i) Side forms and stop ends used in the construction of the layer shall not be removed until at least twelve hours after the completion of compaction and the edges exposed by such removal shall be protected from damage and cured as mentioned herein below.
- j) Areas of the course which are loose, segregated, inadequately compacted, damaged by traffic or which are otherwise defective shall be cut out to the full depth of the layer and replaced with properly compacted and cured material at the Contractor's expense and to the approval of the Engineer.

3.3 Protection and Curing

- a) No traffic shall be permitted to run on any layer of Cement Treated Base Course for 7 days after laying or for such longer period as may be necessary to ensure that the course is not damaged by traffic. Furthermore the Contractor shall restrict the traffic on the course to that essential for the completion of the Works.
- b) The completed Cement Treated Base Course shall be kept continuously damp by lightly spraying the spread course with water, from the time of completion of compaction until the curing is complete.
- c) Within four hours of completing the compaction (after 2 hours if outdoor air temperature is over 30°C), the surface layer of the Cement Treated Base Course shall be cured by one of following methods:
 - Fully covering with acidic emulsified bitumen at a rate of 0.8-1.0 liter/m². This bitumen membrane shall fully cover and seal all the

exposed sides of the Course.

- Fully covering the surface of the course with 5cm of sand and watering for the subsequent 7 days to keep the sand moist.
- d) 14 days after the completion of the curing the next layer of the pavement may be constructed. (the sand layer shall be removed before the subsequent works start) .

3.4 Test Requirements

- a) Aggregate mixture shall be checked before being placed into a mixing machine or spread on the road as follows:
 - i) Every 500 tons checks for grading shall be conducted; grading shall be within the range as stipulated for base course aggregate. The cleanliness of aggregate shall be checked based on plasticity index and organic impurity as stipulated for the base course;
 - ii) Every 2000 tons the wearability of grading shall be tested by Los Angeles method and the diamond shaped grain percentage shall be checked in accordance with the requirements for base course;
- b) During each working shift the moisture of the aggregate mixture shall be checked by roasting it on the pan or drying drum so as to adjust the water amount for the mixing in good time.

Every working shift on the Site is required to take samples from the mixture (on spreader or in heaps dumped by trucks or from the mixed aggregate layer on the road) and deliver it to the laboratory for testing moisture of the mixture before compacting.

- c) Checking density after compaction:
 - i) The density shall be checked, at every completed construction section of the spread track immediately after compacting the cement treated mixture layer using the sand cone method. The result of dry volumetric mass, which is taken from an average from 3 samples shall not be less than maximum dry volumetric mass as specified in AASHTO T180 or 22TCN 333-06 Improved Proctor method.
 - ii) Additionally, frequent checking of the spreading course thickness (considering compaction coefficient) shall be conducted to ensure the mixture layer is achieving the design density after compaction.
- d) Check the strength of the mixture at the mixing plant and at the Site after construction every 1000 tons. Testing shall be performed as stipulated in article 2.3.

3.5 Acceptance Requirements

- a) Every 1000 linear meters of carriage way, 6 cores (3 for compressive test

and 3 for splitting compressive test) shall be drilled for testing in each lane. The cores shall not be located on the same cross section but evenly distributed over 1000 linear meters. The cores shall be tested for strength, thickness and dry volumetric mass. Core holes shall be filled with Cement Treated Base Course and duly compacted immediately after core extraction is completed.

b) Tolerances

- i) The maximum tolerance for compressive strength is 1% but the average compressive strength over 1000 meters shall be less than 1%;
 - ii) Thickness is $\pm 5\%$;
 - iii) Foundation surface elevation is -1.0cm to +0.5cm;
 - iv) Structure layer width is ± 10 cm;
 - v) Crossfall is $\pm 0,5\%$;
- c) Flatness/smoothness shall be tested by using a 3 meter straight edge; the allowable gap shall not exceed 5mm; every 1000m. Testing shall take place in at least 5 places (5 cross-sections); at each position, the checking shall be performed on each lane for both longitudinal and horizontal direction of road.

4. MEASUREMENT AND PAYMENT

4.1 Method of Measurement

- a) The Cement Treated Base Course shall be measured for payment in cubic meters from the Drawings or the approved shop drawings. The measurement shall be conducted on plan over the top surface of the aforementioned course.
- b) The Cement Treated Base Courses provisions, material requirements and construction requirements identified in this Specification Section shall be measured for payment in pay item 05300-01.
- c) Any Cement Treated Base Courses Works not specifically identified in this Specification Section but which are necessary for the performance of the Works shall be deemed to be included in pay item 05300-01.

4.2 Basis of Payment

The work under this Specification Section shall be paid for in accordance with the applicable unit prices as indicated in the Bill of Quantities and given below. Payment shall constitute full compensation for performing the requirements of the Contract for the item of work as specified including furnishing all necessary labor, materials, tools, equipment, incidentals and tests.

<u>Pay Item</u>	<u>Description</u>	<u>Unit</u>
05300	Cement Treated Base Course	
05300-01	Cement Treated BaseCourse, thickness=15cm	m ³