403.5. Strength

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

Cement treated soil sub-base /base shall be tested for the unconfined compressive strength (UCS) value at 7 days, actually obtained in situ. In case of variation from the design UCS, in situ value being on lower side, prior to proceeding with laying of base/surface course on it, the pavement design shall be reviewed for actual UCS value. The extra pavement thickness needed on account of lower UCS shall be constructed by the Contractor at his own cost.

403.6. Arrangements for Traffic

During the period of construction, arrangement of traffic shall be maintained in accordance with Clause 112.

403.7. Measurements for Payment

Stabilised soil sub-base/ base shall be measured as finished work in position in cubic metres.

403.8. Rates

The Contract unit rate for cement treated soil sub-base/base with pretreatment with lime if required shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8 (i) to (v).

404. WATER BOUND MACADAM SUB-BASE/BASE

404.1. Scope

404.1.1. 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 subgrade/ sub-base/ base or existing pavement, as the case may be and finished in accordance with the requirements of these Specifications and in close conformity with the lines, grades, cross-sections and thickness as per approved plans or as directed by the Engineer.

404.1.2. It is, however, not desirable to lay water bound macadam on an existing thin black topped surface without providing adequate drainage facility for water that would get accumulated at the interface of existing bituminous surface and water bound macadam.

404.2. Materials

404.2.1. Coarse aggregates : Coarse aggregates shall be either crushed or broken stone, crushed slag, overburnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel/ shingle is used, not less than 90 per cent by weight of the gravel/ shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-6. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS : 2386 (Part 5).

404.2.2. Crushed or broken stone: The crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and other deleterious material.

TABLE 400-6. PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE COURSES

Test		Test Method	Requirements
1.	* Los Angeles Abrasion value Or	IS:2386 (Part-4)	40 per cent (Max)
	* Aggregate Impact value	IS: 2386 (Part-4) or IS:5640**	30 per cent (Max)
2.	Combined Flakiness and Elongation Indices (Total) ***	IS:2386 (Part-1)	30 per cent (Max)

* Aggregate may satisfy requirements of either of the two tests.

** Aggregates like brick metal, kankar, laterite etc. which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with IS: 5640.

*** The requirement of flakiness index and elongation index shall be enforced only in the case of crushed broken stone and crushed slag.

404.2.3. Crushed slag : Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11.2 kN per m^3 and the percentage of glossy

the top layer shall be treated with a penetration coat of binder described in Clause 405.3.2.

405.3.2. **Application of penetration coat over the top layer:** Before the application of the penetration coat, the surface shall be cleaned of dust, dirt and other foreign matter, using mechanical broom or any other equipment specified by the Engineer. Dust removed in the process shall be blown off with the help of compressed air.

The binder shall be heated to the temperature appropriate to the grade of bitumen used and sprayed on the dry surface in a uniform manner at the rate of 25 kg per 10 m^2 area in terms of the residual bitumen with the help of either self-propelled or towed bitumen pressure sprayer with self-heating arrangement and spray nozzle capable of spraying bitumen at specified rates and temperatures so as to provide a uniform, unbroken spread of bitumen. Excessive deposits of binder caused by stopping or starting of the sprayer or through leakage or any other reason shall be suitably corrected.

Immediately after the application of binder, the key aggregates, in a clean and dry state shall be spread uniformly on the surface at the rate of 0.13 m^2 per 10 m^2 area, preferably by means of a mechanical gritter, capable of spreading aggregate uniformly at specified rates or otherwise manually with the approval of the Engineer, so as to cover the surface completely. Immediately after the application of the key aggregates, the entire surface shall be rolled to Clause 506.3.8.

405.4. Surface Finish and Quality Control of Works

The surface finish of construction shall conform to the requirements of Clause 902.

Control on the quality of material and works shall be exercised by the Engineer in accordance with Section 900.

405.5. Arrangements for Traffic

During the period of construction, arrangement of traffic shall be done as per Clause 112.

405.6. Measurements for Payment

Breaking the existing cement concrete pavement slabs, crushing and recompacting the slab material as sub-base/base course shall be measured as a single item in terms of the volume of sub-base/base laid in position in cubic metres.

Penetration coat shall be measured as finished work in square metres.

405.7. Rates

405.7.1. The Contract unit rate for crushed cement concrete sub-base/base course shall be payment in full for carrying out the required operations including full compensation for:

(i) making arrangements for traffic to Clause 112 except for initial treatment to verges/shoulders and construction of diversions;

(ii) breaking the cement concrete slabs, crushing, sieving and recompacting the slab material as sub-base/base course;

(iii) all labour, tools, equipment and incidentals to complete the work to the Specifications; and

(iv) carrying out the work in part widths of road where directed.

405.7.2. The Contract unit rate for penetration coat shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 504.8.

406. WET MIX MACADAM SUB-BASE/BASE

406.1. Scope

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared subgrade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.

406.2. Materials

406.2.1. Aggregates

406.2.1.1. Physical requirements: Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-10 below.

TABLE 400-10. PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WET MIX MACADAM FOR SUB-BASE/BASE COURSES

	Test	Test Method	Requirements
1.	*Los Angeles Abrasion value or	IS: 2386 (Part-4)	40 per cent (Max.)
	*Aggregate Impact value	IS: 2386 (Part-4) or IS:5640	30 per cent (Max.)
2.	Combined Flakiness and Elongation indices (Total)	IS: 2386 (Part-1)	30 per cent (Max.)**

* Aggregate may satisfy requirements of either of the two tests.

** To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part-5).

406.2.1.2. **Grading requirements** : The aggregates shall conform to the grading given in Table 400-11.

TABLE 400-11. GRADING REQUIREMENTS OF AGGREGATES FOR WET MIX MACADAM

IS Sieve Designation		Per cent by weight passing the IS sieve
53.00	mm	100
45.00	mm	95-100
26.50	mm	—
22.40	mm	60-80
11.20	mm	40-60
4.75	mm	25-40
2.36	mm	15-30
600.00	micron	8-22
75.00	micron	0-8

Materials finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

406.3. **Construction Operations**

406.3.1. Preparation of base : Clause 404.3.1. shall apply.

406.3.2. **Provision of lateral confinement of aggregates :** While constructing wet mix macadam, arrangement shall be made for the lateral

confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in Clause 407.4.1.

406.3.3. **Preparation of mix :** Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the Engineer may permit the mixing to be done in concrete mixers.

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

406.3.4. **Spreading of mix** : Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub- base/base in required quantities. In no case should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher or motor grader. For portions where mechanical means cannot be used, manual means as approved by the Engineer shall be used. The motor grader shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

The paver finisher shall be self-propelled, having the following features :

(i) Loading hoppers and suitable distribution mechanism

(ii) The screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without cutting or otherwise marring the surface profile.

(iii) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during