Government of the People's Republic of Bangladesh

LOCAL GOVERNMENT ENGINEERING DEPARTMENT

Bangladesh Agricultural Infrastructure Development Program

TECHNICAL SPECIFICATIONS FOR ROAD & ROAD STRUCTURES

October 2013

ROAD PAVEMENT CONSTRUCTION METHOD

1.0 EARTHWORKS FOR EMBANKMENT

a. REPORTING & MONITORING

The Contractor shall keep a Site Order Book on site at all times. Instructions on the work and all site visits shall be recorded in the Site Order book.

1.1 EMBANKMENT

a. Description

This work shall consist of the construction of embankment and fill by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from approved sources in accordance with these specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.

The location of borrow pit shall be approved by the Engineer and must be at a distance of 3.Om or 1.5 times the height of the embankment, whichever is higher from the toe to the designed embankment. The depth of excavation in borrow pits shall not exceed 0.8m under normal conditions.

b. Materials

All fill materials shall be free from roots, sods or other deleterious materials.

Materials for embankments shall be stockpiled outside the working areas. Materials shall be tested and approved by the Engineer.

The selected fill material so stockpiled shall satisfy the following criteria:

- Liquid limit of fraction passing 425 micron sieve shall not exceed 50%

- Plasticity index of fraction passing 425 micron sieve shall not exceed 20%

- The dry density after compaction in embankment layers more than 300mm below sub-grade level shall not be less than 95% (STD) of the maximum dry density.

- The dry density after compaction in embankment within 300mm below the top of the sub grade level (or such greater depth if shown in the plans and drawings) shall not be less than 98% (STD) maximum dry density

- Soaked (4 days) CBR greater than 3% at 95% **MDD** (STD).

- DCP Maximum 45mm per blow

- The moisture content at the time of compaction shall be the optimum moisture content (Standard Compaction) ± 5%.

In case if the embankment material is sand, side slopes and shoulders shall be covered by cohesive soil of PI value in between 8-20%.

1.1.1 **Construction Methods**

a. Preparation of Foundation for Embankment

Prior to placing materials for any embankment upon any area, all clearing and grubbing operations shall have been completed.

The original ground surface shall be prepared with scarifying, watering, aerating and compacting. The dry density after compaction shall not be less than 95% of MDD (STD).

Embankments in swamps or water shall be constructed as indicated on the Drawings and as described in these Specifications. The Contractor shall, when ordered by the Engineer, excavate or displace swampy ground and backfill with suitable material. Such backfill shall be river or beach sand unless otherwise directed by the Engineer.

b. Widening Existing Embankment

Where embankment fill is being carried out to widen an existing embankment the new fill material shall be fully keyed into the old embankment by means of benching which shall be in steps each not less than 300mm high and 600mm wide. Steps shall be cut in advance of the filling. Material cut in benches may be used as fill if it compiles with Article 1.1b above or as directed by the Engineer. Sample of stepping construction of widening road Embankment has been shown for Upazila Road in Plate No. URR-EW-WDI and for Union Road in Plate No. UNR-EW-WDI.

c. Embankment Fill from Roadway Excavation

Existing Sub-grade within 300mm depth of the existing road level, (or as specified) not having the required percentage of compaction, shall be excavated out.

Provided the excavated material is in accordance with article 1.1.1b then it shall be reworked and reused in widening or raising the embankment to the specified percentage of compaction and in accordance with paragraph 1.1.1d.

Where the item "embankment fill from roadway excavation" is used and paid for, there shall be no separate payment for sub grade preparation under section 1.2.

d. Compaction of Embankment

Embankment shall be constructed in layer not more than 150mm compacted layers. When necessary, each layer, before being compacted, shall be mixed with dry material or otherwise processed to bring the moisture content to within the limits established in Article 1.1b above. The material shall be so worked as to have uniform moisture content through the entire layer.

Each layer of material shall' be compacted uniformly by use of adequate and appropriate mechanical compaction equipment. The compaction shall be carried out in a longitudinal direction along the embankment and shall generally begin at the outer edges and progress toward the centre except in the super elevated area in such a manner that each section receives equal compactive effort.

Compaction equipment shall be operated over the full width of each layer as far as practicable.

Samples to determine the compaction, CBR & other parameters shall be taken regularly per finished layer as specified or as directed by the Engineer.

The Engineer shall test the compacted layer before the Contractor can commence a new layer. If the test results show that the density is less than the required density the Contractor shall carry out further compaction to obtain at least the required density.

e. Additional Filling

To ensure that, the embankment is properly compacted up to the edges of each layer, overfilling and compaction of minimum 300mm horizontally on both sides of the embankment is required, which later on has to be cut and removed. No extra payment will be made for this procedure.

Embankment construction or embankment widening must be completed before box cutting for pavement construction.

1.2 PREPARATION OF SUB-GRADE

a. Description

This work shall consist of the preparation of sub-grade in embankment in cut by scarifying, watering, aerating, compacting and shaping existing or previously placed material in accordance with these specifications and to the lines, levels grades, dimensions, camber and cross sections shown on the Drawings or as instructed by the Engineer.

b. Materials

All sub-grade material shall be suitable material in accordance with the requirements of Article 1.1b.

Any sub-grade material in cut or existing old embankment which is found to be unsuitable shall be removed and replaced as directed by the Engineer.

1.2.1 Construction Methods

The sub-grade shall be prepared after box cutting for pavement construction. Half width working may be allowed only with the prior written approval of the Engineer.

The sub-grade shall be prepared in lengths of not less than 100 meters and not more then 500 meters at a time.

When existing sub-grade compaction is found less than 98 percent STD, sub-grade material shall be excavated to a depth of 150mm and stockpiled and a further 150mm should be scarified and compacted to 98% STD. The excavated top layer material shall then be spread and compacted as specified. But if natural compaction of sub grade is 98% STD, two to three passes of 3-5 ton vibratory roller over natural sub-grade are specified to compact loose lump there upon and achieve rolled surface.

When necessary, each layer, before being compacted, shall be allowed to dry or be watered to bring the moisture content with ± 5% of optimum to make possible its compaction to the required density. The material shall be so worked as to have uniform moisture content through the entire layer.

The sub grade material shall be compacted uniformly by use of adequate and appropriate mechanical compaction equipment. The compaction shall be done in a longitudinal direction along the embankment and shall generally begin at the outer edges and progress toward the centre in such a manner that each section receives equal comp active effort.

Samples to determine the compaction, CBR & other properties shall be taken regularly per finished layer as specified or as directed by the Engineer.

However if sub-grade does not conform compaction to attain 4 percent soaked CBR, corrective procedure imparted in Article 13.b shall be followed.

1.3 IMPROVED SUB-GRADE

a. Description

This work shall consist of furnishing placing and compacting improved sub-grade material on a prepared and accepted sub-grade in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as instructed by the Engineer.

b. Materials

Material shall be of natural sand, free from vegetable matter, soft particles and excess clay. F. M. of Sand shall not be less than 0.8.

(a) **Plasticity:** The fraction passing the 425 micron sieve shall, have a Plasticity Index not greater than 6.

(b) **CBR:** The material shall have a soaked CBR value not less than 8% when compacted to 98% of maximum dry density (Modified).

(c) The material shall be free draining.

1.3.1 Construction Methods

a. Preparation of Improved Sub-grade

The sub-grade shall be shaped and compacted in conformity with the provisions of Section 1.2 and completed for at least 100 meters ahead of the placing of the improved sub-grade material. Notwithstanding any earlier approval of sub-grade, any damage to or deterioration of sub-grade shall be made good before improved sub-grade is laid.

Preparation of the sub-grade shall be carried out, unless otherwise agreed by the Engineer, immediately prior to laying the improved sub-grade.

b. Spreading

Improved sub-grade materials shall be spread in layers, with a compacted thickness up to 150mm subject to approval by the Engineer, and the layers shall be as nearly equal in thickness as possible.

Prior to spreading the improved sub-grade materials, full width of shoulder shall be constructed to the elevation of the top of Design Pavement.

c. Sprinkling, Rolling and Compacting

Immediately after each layer has been spread and shaped to camber or super elevation satisfactorily, it shall be thoroughly compacted with mechanical compaction equipment approved by the Engineer. Rolling operations shall begin from the outer edge of roadbed toward the centre, gradually in a longitudinal direction, except on super-elevated curves, where rolling shall begin at the low side and progress towards the high side.

The moisture content at the time of compaction shall be the optimum moisture content (Standard Compaction) ± 3%.

Each layer shall be compacted to at least 98% (modified) of the - maximum dry density. If the density measurement falls below the specified density level then further compaction shall be required, irrespective of the field compaction trial results.

In order to ensure required bearing capacity at the finished improved sub-grade level CBR tests shall be made. The CBR shall be such that the Laboratory Value obtained at the specified compaction and after 4 days soaking, shall exceed 8 percent. In areas where these requirements are not met, correction shall be made by such measures, as the Engineer deems necessary.

Improved sub-grade material that does not contain sufficient moisture to be compacted in accordance with the requirements of this section shall be reworked and watered as directed by the Engineer. The Contractor shall carry out this work at his own expense.

Improved sub-grade material containing excess moisture shall be reworked and dried prior to or during compaction. Drying of wet material shall be performed by methods approved by the Engineer, at the expense of the Contractor.

The finished improved sub-grade at any point shall not vary more than 20mm above or below the planned grade or adjusted grade. The thickness of the finished improved sub-grade shall be on average not less than the required thickness and not thinner than 20mm less than the required thickness at any point and the average of five thickness measurements in any 100 meters of road shall be not thinner than 15mm less than the required thickness. Improved sub-grade that does not conform to the above requirements shall be reworked, watered and thoroughly recompacted to conform.

Where the CBR value of Sub-Grade obtained more than 8% improved sub-grade may be discarded with the approval of proper authority.

1.4 PREPARATION OF IMPROVED SUB-GRADE FOR BITUMINOUS PAVEMENT REPLACING OLD HBB PAVEMENT

a. Description

This item will consist of leveling, dressing, cambering and compacting the existing improved sub-grade surface exposed after removal of the brick flat soling, HBB and the edging to receive new base course. Where necessary additional improved sub-grade materials shall be added to make the finished compacted improved sub-grade as per drawing.

b. Materials

Materials should meet the requirements of Article 1.3b.

1.4.1 Construction Method

The picking up of the brick pavement shall not be done for more than 100m at a time in order to avoid disturbance to traffic and damage to the sub-grade. The salvaged bricks from half or shall be stacked separately broken bricks in such a way that the disturbance to traffic is minimized.

Before picking up the brick pavement the contractor must provide base materials ready at the site so that this shall be placed and compacted immediately after preparation of the improved sub-grade.

The improved sub-grade shall be leveled, graded and cambered according to the design and compacted to 98% of MDD (**Modified**) using an appropriate roller. Where necessary additional improved sub-grade materials shall be added to make the finished compacted thickness as per drawing.

2.0 PAVEMENT WORKS

2.1 INTRODUCTION TO PAVEMENT WORKS

a. General

Section 3 of these Specifications covers all requirements for road pavements that will be incorporated in the works.

b. Preparation and Stockpiling of Materials

Materials to be used in pavement works shall be processed and stockpiled only in areas designated by the Contractor as approved by the Engineer. Preparation and storage of materials along the alignment will not be allowed. The Contractor shall make all arrangements and bear all costs associated with the provision of these storage areas.

The designated area shall be cleared of all vegetation and topsoil prior to commencing of work and the arrival of any materials.

Bricks of different frog marks, different materials and size fractions shall be kept in separate stockpiles divided as necessary to prevent contamination.

The site of the stockpile shall be cleared of all vegetation and debris, graded and drained and where the Engineer deems it necessary, the areas shall be surfaced with a 1 00mm layer of approved stone or with brick flat soling.

Each stockpile shall be built with a maximum height of 1.25m or as specified by the Engineer-in-Charge with sufficient space left in between two stacks for easy inspection.

The bottom 50mm layer of aggregate or any contaminated aggregate shall not be used in the work.

c. Brick aggregates/Stone aggregates

Brick aggregates may be replaced by stone aggregates. In case of hard shoulder both crushed and uncrushed stone can be used; in case of base course only crushed stone may be used provided that the quality of the stone satisfies the relevant specifications. Cost of stone aggregate will be determined by the Engineer and approved by concerned higher authority.

2.2 SHOULDERS

2.2.1 Pavement Simile Hard Shoulder

a. Description

This shoulder is an option similar to Design Pavement except Bituminous Carpeting. Bituminous Carpeting can be done over Pavement Simile Hard Shoulder when traffic volume exceeds 200 CVD per day. This Pavement Simile Hard Shoulder is constructed at the time pavement construction or later on.

b. Materials

The material shall be same as design pavement up to Base Course.

c. Construction Methods

The construction method shall be similar to design pavement construction up to Base Course.

2.2.2 HBB Hard Shoulder

2.2.2.1 Single Layer Brick Flat Soling

a. Description

This item consists of providing single layer brick flat soling on the sub-grade soil for Hard shoulder as directed by the Engineer.

b. Materials

The materials shall consist of First Class or Picked Jhama Bricks, which meet the requirements of Article 3.0b of these Specifications.

c. Construction Methods

The bricks shall be laid flat in one layer or as specified on the Sand Cushion of 125mm over consolidated and prepared surface. Bricks shall be laid in a regular and uniform manner. Interstices of bricks shall be filled with sand of min. FM 0.5 and water shall be applied by sprinkling. No bricks shall be laid on a foundation or any surface until the same has been inspected and approved by the Engineer. The gaps between two adjacent bricks should not exceed 10mm. The pattern and placing of the bricks shall be as indicated in the drawings.

2.2.2.2 Herringbone Bond Brick (HBB)

a. Description

This work shall consist of a base composed of bricks, laid on edge in a herringbone pattern, placed on a prepared single layer brick flat soling in accordance with these Specifications and to the lines, grades levels, dimensions and cross sections shown in the Drawings and as required by the Engineer.

b. Materials

The materials shall consist of First Class or Picked Jhama Bricks, which meet the requirements of Article 3.0b of these Specifications.

c. Construction Methods

Laying the Bricks

A sand cushion of 25mm thickness (minimum) with sand of F.M. not less than 0.5 will be placed over the brick flat soling. The brick then shall be laid on edge with 125mm across the surface in a single layer in a herringbone pattern to the lines, grades, levels, dimensions and cross section shown on the Drawings and as required by the Engineer. The edge of the layer shall be made with cut bricks to produce a line, which is compatible with brick edging. The joints shall be filled with sand of FM 0.5 brushed in and the completed layer shall be sprinkled liberally with water.

2.2.3 Earthen Shoulder

a. Description

This work consists of the provision of specified wide strips of shoulders adjacent to the pavement on either side. The shoulders shall be constructed in accordance with the lines, levels, dimensions and cross sections shown on the Drawings and as directed by the Engineer.

b. Materials

The material used shall meet the same requirements as that shown in Sections 1.1b.

c. Construction Methods

Pre-work measurement should be taken just before commencing the work. The material shall be spread in layers of uniform thickness to achieve 150mm of compacted thickness and sprinkled with water. After approval by the Engineer, compaction shall be carried out by approved mechanical plant. The material shall be compacted to a density of 95% (STD) of the maximum dry density and DCP maximum 45mm per blow to ensure minimum 3% soaked CBR. Samples to determine the compaction shall be taken regularly with a minimum one sample for each 100 linear meters per layer of each finished shoulder or as decided by the Engineer. Such density tests will be carried out. The Engineer shall approve the compacted layer before the Contractor can commence a new layer. If the test results show that the density is less than the required density the Contractor shall carry out further compaction to obtain at least the required density.

3.0 BRICK ON END EDGING

a. Description

This work consists of providing and placing brick on end edging along the road adjacent to the side of the pavement of single layer brick flat soling and herringbone bond brick or of water bound macadam and bitumen carpet.

b. Materials (Bricks)

The materials shall consist of First Class or Picked Jhama Bricks that should meet the requirements given below. First Class Bricks shall be made from good brick earth free from saline deposits, and shall be sand moulded. They shall be thoroughly burnt by coal without being vitrified, of uniform and good colour shall be regular and uniform in size, shape and texture with sharp square edges and parallel faces. They must be homogeneous in texture and emit a clear metallic ringing sound when struck one against the other. They shall be free from flaws, cracks, chips, stones, modules of lime or canker and other blemishes. A first Class Brick shall not absorb more than 16% of its weight of water after being soaked for one hour, and shall show no sign of efflorescence on drying.

Picked Jhama bricks are those that are so over-burnt as to become vitrified. Those bricks may be broken and used for aggregate in road works provided the vitrified mass has not become porous or spongy as a result of over-burning and the aggregate satisfies the requirements of those Specifications.

First Class Bricks should have the following dimensions after burning: 240mm x 115mm x 70mm (+5mm). Picked Jhama Bricks may have dimensions slightly below those for other brick but not less than 235mm x 110mm x 65mm. The unit weight of First Class Bricks shall not be less than 1100 kg per m^3 and the unit weight of picked Jhama Bricks shall not be less than 1200 kg per m^3.

The crushing strength of bricks shall be tested and the average crushing strength of Bricks shall not be less than 17 N/mm^2, but not less than 14 N/mm^2 in individual case.

c. Construction Methods

Bricks shall be laid on end edging with their longest side vertical and 75mm/125mm side as shown in the Drawing across the road including necessary excavation filling and ramming to the satisfaction of the Engineer. The completed work shall be true to line and level and grade as indicated on the Drawings. Interstices between brick edging and adjacent paving or brushing in sand until voids are filled shall fill soling; the edging shall be sprinkled then with water. End Edging shall be done before commencing Base Course.

4.0 HBB PAVEMENT

4.1 Single Layer Brick Flat Soling

a. Description

This item consists of providing single layer brick flat soling on the sub-grade or improved sub-grade as directed by the Engineer.

b. Materials

The materials shall consist of First Class or Picked Jhama Bricks, which meet the requirements of Article 3.0b of these Specifications.

c. Construction Methods

The bricks shall be laid flat in one layer or as specified on the Sand Cushioning of 125mm over consolidated and prepared surface. Bricks shall be laid in a regular and uniform manner. Interstices of bricks shall be filled with sand of FM 0.5 and water shall be applied by sprinkling. No bricks shall be laid on a foundation or any surface until the same has been inspected and approved by the Engineer. The gaps between two adjacent bricks should not exceed 10mm. The pattern and placing of the bricks shall be as indicated in the drawings.

4.2 Herringbone Bond Brick Pavement

a. Description

This work shall consist of a base composed of bricks, laid on edge in a herringbone pattern, placed on a prepared single layer brick flat soling in accordance with these Specifications and to the lines, grades levels, dimensions and cross sections shown in the Drawings and as required by the Engineer.

b. Materials

The materials shall consist of First Class or Picked Jhama Bricks that meet the requirements of Article 3.0b of these Specifications.

4.2.1 Construction Methods

a. Laying the Bricks

A sand cushion of 25mm thickness (minimum) with sand of F.M. not less than 0.5 would be placed over the brick flat soling. The brick then shall be laid on edge with 125mm across the surface in a single layer in a herringbone pattern to the lines, grades, levels, dimensions and cross section shown on the Drawings and as required by the Engineer. The edge of the layer shall be made with cut bricks to produce a line that is compatible with brick edging. The joints shall be filled with sand of FM 0.5 brushed in and the completed layer shall be sprinkled liberally with water.

b. Surface Tolerance

In those areas in which pavement is to be placed, any deviation in excess of five millimeters from the specified surface within 3 meter shall be corrected by removal, reshaping and relaying.

5.0 SUB-BASE

5.1 Description

This work shall consist of providing, laying and compacting sub-base on the finished approved sub-grade or improved sub-grade, to the lines, levels, dimensions and cross section shown on the drawings or as directed by the Engineer.

5.2 Aggregate-Sand Sub-base

5.2.1 Materials

The sub-base shall consist of AS (Aggregate & Sand), a homogeneous mixture of crushed stone or brick aggregates and local sand or natural or artificial mixture of sand free from vegetation and excess clay. The portion of sand in the mix shall not be more than 50 percent any way. The FM of sand shall not be less than 0.8 unless otherwise written permission of the authority.

5.2.2 The aggregate shall be crushed First Class or Picked Jhama Bricks or stones. The crushed bricks or stones shall comply with the following requirements:-

- o water absorption shall not exceed 18%
- o maximum size of aggregate shall be 38mm.
- o Aggregate Crushing Value of not more than 32% or as directed by the Engineer in the case of reuse of salvaged materials.
- o The material shall be well graded having no excess or deficiency in any size.

The Engineer may change the above grading when the laboratory results of the above proportion do not meet the quality requirements of the specification.

5.2.3 The resultant mixture Coarse Aggregate-Sand shall meet grading envelope as in Table 5.1 and also the following requirements:

a) Plasticity: The fraction passing the 425 micron sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6

b) CBR: The materials shall have a soaked CBR value not less than 30% when compacted to 98%(Modified) of maximum dry density.

Grading Requirements for Resultant Mixture of Sub-base material
Table 5.1

Sieve Size	% Passing by Weight
38 mm	100
20 mm	55-95
10 mm	35-75
4.8 mm	25-60
2.4 mm	15-50
600 micron	10-35
300 micron	10-25
75 micron	5-15

5.3 Construction Method

Sub-base materials shall be at or near the optimum moisture content (OMC) at the time of mixing. The coarse aggregate and sand shall be mixed thoroughly preferably over temporary stack yards made of steel plain sheets to obtain a homogeneous mix complying with the grading requirements of this section before placing it on the sub-grade or improved sub-grade. The mixing may be done by mechanical means or a combination of manual labour and machinery.

The mixed materials shall be spread uniformly upon the prepared and approved sub-grade or improved sub-grade. Total thickness required shall be in accordance with the drawings. The relationship between the loose thickness and compacted thickness shall be determined from field trials and used in controlling the loose thickness at the time of spreading the mix.

After spreading has been completed and the surface shaped according to the cross sectional requirements, rolling shall commence. A power roller weighing 8 to 10 tons or equivalent vibratory roller should do rolling. Rolling shall begin at the outer edge towards the centre of the road with the rear wheel overlapping the shoulder. When the aggregates become firm, the roller will be shifted to the opposite side of the road and the operation will be repeated. After both edges rolled modestly firm, the roller will be gradually moved towards the centre by overlapping 150mm of the rolled width until the mix has attained the required density. During initial stage of rolling sub-base materials shall be sprinkled with water to bring it to the correct moisture content, if found less.

Material shall conform to the grading envelope shown in the Table 5.1 and compacted to have a soaked CBR value not less than 30% for a layer of maximum 100mm (compacted) thickness.

The rolled surface shall be checked for correctness of levels and cross-falls and any irregularities therein shall be corrected by loosening the affected areas, adding or removing the necessary quantities of aggregate and re-rolling until the entire surface conforms to the correct levels and cross levels and cross-falls.

The dry density after compaction shall not be less than 98% of the maximum dry density (Modified). Samples to determine the compaction, CBR & other properties shall be taken regularly per finished layer as specified or as directed by the Engineer.

The prepared sub-base layer shall be protected against damage until covered by the base course. Moisture content at the time of compaction shall be the optimum moisture content ±3%.

The finished surface shall be within a tolerance of ± 10mm or of the elevation shown in the drawings and it shall no where vary more than 10mm from the straight edge 3m long applied to the surface parallel to the centre line of the pavement and no more than 12mm from a template conforming to the cross-section.

The depth over each 100m shall be measured in at least 3 places by digging holes. The average depth should be as per drawings but the minimum depth shall not be less than 95% of the specified depth.

6.0 WATER BOUND MACADAM BASE COURSE

a. Description

This work shall consist of providing, laying, watering and compacting water bound macadam base course on the prepared and accepted sub-base to the lines, levels, dimensions, and cross profiles shown on the Drawings or as directed by the Engineer in charge.

b. Materials

The base course material shall consist of crushed first class brick and/or picked Jhama brick aggregates well-graded and of desired strength, mechanically "Keyed" or locked by rolling and cemented or bounded together by the application of water.

The aggregate shall be crushed Picked Jhama or mixed with First class bricks. The crushed bricks shall comply with the following requirements:

- Water absorption shall not exceed 16%
- Maximum nominal size of aggregate shall be 38mm according to ASTM-C-131
- Los Angeles Abrasion Test (AASHTO Designation T-96) with a percentage of wears less than 40 at 500 revolutions or Aggregate Crushing Value of not more than 30% (According to BS-812).
- Flakiness index (as per BS-812) 15%
- Aggregate Impact Value of not more than 30% (According to B8-812).

Material shall conform to the grading envelope shown in the Table 6.1 and compacted to have a soaked CBR value not less than 80% for a layer of maximum 100mm (compacted) thickness

Grading Requirements for Water Bound Macadam Base Course

Table 6.1

SIEVE SIZE	% PASSING BY WEIGHT
38mm	100
20mm	60-80
10mm	40-60
4.8mm	25-45
2.4mm	15-32
600 micron	10-20
75 micron	0-15

The material shall be well graded with the envelope having no excess or deficiency in any size. The Engineer may change the above grading when the laboratory results of the above proportion do not meet the quality requirements of the specification.

6.1 Construction method

Prior to laying of base course the sub-base layer shall be shaped true to cross fall or super elevation and shall be rolled as necessary till the surface is smooth, firm and tight. The prepared sub-base layer shall be protected against damage until covered by the base course.

Mixing of various course aggregates should be carried out preferably over temporary stack yards made of steel plain sheets to obtain a homogeneous mix complying with the grading requirements of this section before placing it on the sub-base. Base materials shall be at or near the optimum moisture content (OMC) at the time of mixing.

Different kinds of materials shall not be mixed together except that sand or naturally occurring granular materials finer than 5mm size can be mixed with any of these materials to meet the grading requirements. The mixing may be done by mechanical means or a combination of manual labour and machinery.

During initial stage of rolling base materials shall be sprinkled with water to bring it to the correct moisture content, if found less.

The materials shall be spread in layers and the compacted thickness of each layer shall not exceed 100mm.

A powered roller weighing 8 to 10 tons or equivalent vibratory roller should do rolling. Rolling shall begin at the outer edge with the rear wheel overlapping the shoulder. When the broken aggregates become firm, the roller will be shifted to the opposite side of the road and the operation will be repeated. After both edges rolled modestly firm, the roller will be gradually moved towards the centre by overlapping 150mm of the rolled width until the entire base course is thoroughly compacted.

The base course shall be compacted to have a soaked CBR as specified in Article 6.0b. Samples to determine the compaction, CBR & other properties shall be taken regularly per finished layer as specified or as directed by the Engineer.

The finished surface of the base course shall at no place be more than ±l0mm from the designed level and the mean of five measurements of thickness taken in any 200 meters long section shall be equal to or more than the required base course thickness.

Engineer in-charge may allow spreading of sand of F.M. 0.8 as chocking materials to attain desired CBR in every compacted layer.

7.0 GENERAL REQUIREMENTS FOR BITUMINOUS SURFACING

7.1 Description

a. General

This work shall cover the general requirements that are applicable to all types of bituminous bound surfacing irrespective of gradation of mineral aggregate, grade and amount of bituminous materials used. Deviations from these general requirements are indicated in the specific requirements as set forth in the respective sections for each type.

The work shall consist of one or more courses of pre-mixed bituminous mixtures constructed on a prepared and accepted base course or other road bed in accordance with these Specifications and the specific requirements of the type under Contract, and in conformity with the required lines, levels, grades, dimensions and typical cross sections.

b. Composition of Mixtures

The bituminous mix shall be composed basically of coarse mineral aggregate, fine mineral aggregate, filler and bituminous binder. The several mineral constituents shall be sized, uniformly graded and combined in such proportions that the resulting blend meets the grading requirements for the specific type as required. To such composite blended aggregate shall be added bitumen within the percentage limits set in the specifications for the specific type. Grading of coarse aggregate shall conform Article 10.2.

7.2 Construction

7.2.1 Weather Limitation

Bituminous mixtures shall be placed only when the surface is dry, when the weather is not rainy and when the prepared roadbed is in a satisfactory condition. However, the Engineer may permit, in case of sudden rain, the placing of mixture then in transit if laid at specified temperature and if the roadbed is free from pools of water.

Such permission shall in no way waive the requirements for quality and smoothness of surface.

7.2.2 Progress of Work

No work shall be performed when there is insufficient hauling, spreading or finishing equipment or labour to ensure progress at a rate consistent with meeting proper temperatures and rates of compaction.

7.2.3 Equipment

a. **Equipment for preparation of bituminous binder**

Tanks or kettles for storage of bituminous binder shall be capable of heating the binder under effective control at all times to a temperature within the range specified. Bitumen shall not be heated in open pans or drums. Suitable means shall be provided for maintaining the specified temperature of the bituminous binder at all times. Generally Tar boilers fixed with thermometer are used to heat the bitumen.

b. **Thermometric Equipment**

Armoured thermometers in good condition reading from 50^0 C to 200^0C shall be available at the places of mixing and laying at all times.

c. Equipment for hauling bituminous mixtures shall have tight, clean and smooth metal sides that have been sprayed with soapy water, thinned fuel oil, paraffin oil or lime solution to prevent the mixture from adhering to the beds. The amount of sprayed fluid shall however be kept to the practical minimum. Any equipment causing excessive segregation of material by its suspension or other contributing factors, or that shows oil leaks in detrimental amount or that causes undue delays, shall upon direction of Engineer be removed from the site until such conditions are corrected.

d. The equipment for spreading and finishing shall be capable of spreading and finishing the mixture true to the lines, grades, levels dimensions and cross sections.

e. The Contractor shall provide suitable means for keeping all small tools clean and free from accumulation of bituminous material. He shall provide and have ready for use at all times enough tarpaulin or covers, as may be directed by the Engineer, for use during any emergency like rain, chilling wind, or unavoidable delay, for the purpose of covering or protecting any material that may have been dumped and not spread.

7.2.4 Preparation and Placing

a. **Preparation of Existing Surface**

Where the existing road bed is broken or shows instability, the unstable material shall be removed and disposed off as directed by the Engineer and be replaced with the same mixture as specified for the next course, compacted to the standard and elevation of the adjacent surface. The surface upon which the mixture is to be placed shall be swept thoroughly and cleaned of all loose dirt and other objectionable materials immediately before spreading the bituminous mixture, if directed by the Engineer Tack coat is to be applied before placing the next layer. If this has become necessary due to delays caused by the contractor in starting the next layer this will not be paid.

b. **Preparation of Bituminous Binder**

The bituminous binder shall be heated to the specified temperature (140^0C-155^0C for 60/70 or 80/100 penetration bitumen) in Tar boiler, kettle or tanks so designed as to avoid local overheating and to provide a supply of the bituminous binder at a uniform temperature at all times.

c. Preparation of Mineral Aggregate

The aggregates produced, whether by machine or by manual methods should be screened into the major component sizes prior to recombining in the correct proportions.

The mineral aggregates for the mixture shall be dried and heated at a temperature between 150°C-170°C before mixing. The aggregates shall be heated to the temperature specified in the relevant section.

d. Preparation of Mixture

The heated mineral aggregate prepared above, shall be combined in the amount of each fraction of aggregate required to meet the mix formula for the particular mixture. The bituminous material shall be measured or gauged and introduced into the mix in the amount determined by the Engineer. Only sufficient heat shall be applied during mixing to maintain the temperature of the mix without increasing the temperature. The proper amount of bituminous material shall be distributed over the mineral aggregate and the whole materials shall be thoroughly mixed for a period of at least 60 seconds, or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregate are coated uniformly. Mixing should not be carried out on fire, but on separate tray lay away from fire (if mixing manually).

e. Transportation and Delivery of Mixture

The mixture shall be transported from the mixer to the point of use in equipment conforming to the requirements of Article 11.2. Loading and transporting shall be such that spreading; compaction and finishing shall all be carried out during daylight hours unless the Contractor provides satisfactory illumination.

f. Spreading and Finishing

Upon arrival at the point of use, the mixture shall be spread and struck off to the grade, elevation, and cross-section shape intended, either over the entire width or over such partial width as may be practicable. The mixture shall be laid upon prime coated and an approved surface for new pavement and tack-coated surface for old pavement and only when the Engineer considers weather conditions suitable.

g. Compaction of Mixture

(i) Immediately after the mixture has been spread and struck off, the surface shall be checked and any inequalities adjusted. The mixture shall then be thoroughly and uniformly compacted by rolling. Each course shall be rolled as soon after being placed, as the material will support the roller without undue displacement or cracking.

(ii) All rollers shall be self propelled, capable for being reversed without backlash. Each roller shall be in good condition and worked by a competent and experienced operator. Generally Tandem roller is suitable for B.C work; in addition Pneumatic Tyre roller is also needed.

(iii) Rolling shall start longitudinally at the sides and proceed toward the centre of the pavement except that on super-elevated curves rolling shall begin at the low side and progress toward the high side. Successive trips of the roller and alternative trips shall not terminate at the same point.

Rolling shall start at a temperature of at least 130°C and shall be discontinued if temperature falls below 90°C.

The speed of the rollers shall not exceed four kilometers per hour for steel wheeled rollers and 6 kilometers per hour for pneumatic tyred rollers and shall at all times be slow

enough to avoid displacement of the hot mixture. Any displacements occurring as a result of reversing the direction of the roller or from any other cause shall at once be corrected with rakes and fresh mixture where required. Care shall be exercised in rolling not to displace the line and grade of the edges.

Rolling shall progress continuously as may be necessary to obtain uniform compaction while the mixture is in a workable condition and until all roller marks are eliminated.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excess water shall not be permitted.

Heavy equipment or rollers shall not be permitted to stand on the finished surface until it has thoroughly cooled or set.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is a cause for the removal and replacement of the contaminated pavement by the Contractor. The surface of the mixture after compaction shall be smooth and true to the established crown and grade within the tolerance specified. Any mixture that becomes loose and broken, mixed with dirt, or which is defective in any way, shall be removed and replaced with fresh hot mixture, which shall be compacted immediately to conform to the surrounding area. Any areas of one square meter or more showing an excess or deficiency of bituminous material shall be removed and replaced. All high spots, high joints, depressions, and honeycombs shall be adjusted as directed by the Engineer.

h. Joints

Both longitudinal and transverse joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints shall be arranged so that the longitudinal joint in the top course shall be at the location of the line dividing the traffic lanes. Lateral joints shall be staggered a minimum of 250 millimeters and shall be straight.

The edges of the pavement shall be straight and true to the required lines. Any excess material shall be cut off after final rolling and disposed off by the Contractor at the end of a day's work.

Just prior to recommencing operations, the sides of all longitudinal and transverse joints shall be painted with hot bitumen to ensure a satisfactory bond between the old and new work.

8.0 PRIME COAT

a. Description

This work shall consist of the careful cleaning of the surface of the granular base material to be primed and furnishing and applying bituminous material in accordance with these Specifications to the areas shown on the Drawings and as directed by the Engineer.

8.1 Materials

a. Bituminous Materials

Bituminous prime coat material shall be cut back bitumen, conforming to the requirements of ASTM/ AASHTO.

Cut back bitumen may be prepared by cutting back 60/70 (preferable) or 80/100 penetration grade straight run bitumen with kerosene/diesel in the ratio of 100 parts by volume of bitumen to 40-60 parts by volume of kerosene depending on the porosity of the surface and will be decided by field trials or as directed by the Engineer. The correct

amount is the quantity that is completely absorbed within 24 hours. The spraying temperature of the cutback bitumen shall be 100^{0}C to 120^{0}C.

b. Blotting Material

Blotting material shall be clean, dry, free-flowing sand not containing any cohesive materials or organic matter. Not more than 10 percent of the sand shall be finer than the 75-micron sieve.

8.2 Construction Methods

a. Weather Limitations

Prime coat work shall not be carried out when the weather conditions are, in the opinion of the Engineer, likely to adversely affect the stability of wet prime coat material. Such conditions may include but shall not necessarily be limited to rain, low temperatures or storms.

b. Cleaning Surface

Immediately before applying the prime coat material, all loose stones, dirt and other objectionable materials shall be removed from the surface with a broom or blower as appropriate. When so directed by the Engineer, a light application of water shall be made just before the application of the prime coat.

c. Application of Prime Coat

Prime coat material shall be applied by mechanical distributor or manually at a uniform rate of 1.20 liters/square meter as directed by the Engineer, and at a temperature between 100^{0}C to 120^{0}C. Additional primer shall be applied where surface conditions indicate this to be necessary as per decision of the Engineer. No further coatings shall be applied until the prime coat has been cured.

The contractor may be required to lay a trial section of prime coat for the approval of the Engineer regarding method of operations to achieve adequate penetration. Following the approval of the Engineer in writing of such trial section (s), the prime coat works may then be carried out strictly in accordance with the approved method and spray rate and the specification.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner as to prevent their being splattered or marred. No bituminous material shall be discharged into a borrow pit, gutter or kerb.

d. Maintenance and Opening to Traffic

After application of the prime coat there shall be a curing period of 48 hours or more, when traffic shall not be permitted to move on the coated surface. In case of any damage caused by traffic, the surface shall be rectified at the cost of the Contractor. The period of curing shall be extended if necessary till the bituminous material has penetrated and dried and, in the opinion of the Engineer, will not be picked up by traffic. At the end of the curing period, minor areas where prime coat material is still not dry shall be treated by sprinkling, blotting sand as necessary to avoid picking up of prime coat material before allowing traffic to use the coated areas. For existing roads, the work shall be done over half width at a time, the other half being used to carry the traffic.

9.0 TACK COAT

a. Description

This work shall consist of the cleaning and preparation of the bituminous surface specified, or otherwise as directed by the Engineer, together with the furnishing and application of the tack coat in accordance with these Specifications to the areas shown on the Drawings and as directed by the Engineer.

Tack Coat should be applied only in between two bituminous surfaces.

b. Materials

Bituminous tack coat material shall be 60/70(preferable) or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM / AASHTO.

9.1 Construction Methods

a. Weather Limitations

Tack coat work shall not be carried out when the weather conditions are, in the opinion of the Engineer, likely to adversely affect the stability of wet tack coat material. Such conditions may include but shall not necessarily be limited to rain, low temperatures or storms.

b. Cleaning Surfaces

Immediately before applying the tack coat all loose stone dirt and other objectionable materials shall be removed from the surface with a broom or blower as appropriate.

c. Application of Tack Coat

Tack coat material shall be applied by mechanical distributor or manually at a rate of 0.75kg-1.25kg/m^2 and at a temperature between 140^{0}C and 160^{0}C. Additional tack coat shall be applied where surface conditions indicate this to be necessary and, if the Engineer so directs.

The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner as to prevent their being splattered or marred. No bituminous material shall be discharged into a borrow pit, gutter or kerb.

10.0 BITUMINOUS CARPETING (BC)

a. Description

This work shall consist of a bituminous carpet of a bituminous macadam type of material constructed on a prepared and primed granular base course in accordance with these Specifications and to the lines, levels, grades, dimensions and cross-sections shown on the Drawings and as directed by the Engineer. The bituminous carpeting shall consist of a compacted single layer of surfacing of thickness as shown on the drawings.

10.1 Materials

a. Bituminous Material

Bituminous material shall be 60/70 or 80/100 (Preferably 60/70) penetration grade straight run bitumen complying with the requirement of ASTM / AASHTO.

b. Coarse Aggregate

The coarse aggregate shall be the material component consist of clean crushed rock or crushed gravel or blended combinations of both, free from decomposed stone, organic matter, shale, clay and any other substances which, in the opinion of the Engineer, may be deleterious to the mixture. Coarse aggregate shall satisfy the following physical characteristics when tested:

- Aggregate Crushing Value not greater than 30%
- Bulk specific gravity not less than 2.50
- Flakiness index not greater than 35% except where specially approved by the Engineer

The course aggregate shall have weight loss not more than 12% when subjected to 5 alternations of the sodium sulphate soundness test, AASHTO: T. 104.

Not less than 75% by weight of the particles of course aggregate shall have at least two fractured faces.

c. Fine Aggregate

The portion of the aggregate passing a 4.75mm sieve shall be known as fine aggregate and shall consist of natural sand, stone screenings, or a combination of both. Fine aggregate shall be composed of clean, hard durable particles, rough surfaced and angular, free from vegetable matter, soft particles, clay balls or other objectionable materials.

10.2 Overall Aggregate Grading

The mix of the coarse and fine aggregates shall comply with the following grading given in Table 10.1.

Table 10.1

Serve Size	For 25mm B.C.	For 40mm B.C.
	% By Weight Passing	% By Weight Passing
25mm	100	100
20mm	100	75-100
16mm	100	-
12.5mm	75-100	60-80
10mm	60-80	-
6.3mm	-	-
4.75mm	35-55	35-55
2.4mm	20-35	20-33
600 micron	10-20	6-18
75 micron	2-8	2-8
Bitumen Content % by weight of total mix.	5.5% ± 0.3% (5.2% to 5.8%)	5.2% ± 0.3% (4.9% to 5.5%)

Required bitumen content should be determined by trials.

10.3 Bituminous Mixture Requirements

The resultant density of the compacted bituminous mixture shall be between 2250 and 2400 kg/m^3. The bitumen content and stability of mixture shall be as per specification or as decided by the Engineer.

10.4 Construction Methods

a. Preparation of the road base

A prime coat shall be applied and cured to the surface of the granular base material in accordance with Section 8.0 before spreading the premixed aggregates, or a tack coat shall be applied to the existing bituminous surface.

b. Mixing of Bituminous Material

Prior to heating, the various sizes of aggregate shall be thoroughly mixed together to give a stockpile of aggregate of the required grading of sufficient quantity for at least one day's surfacing work.

The bitumen and the aggregates shall be separately heated (mechanical heating preferable) to a temperature between 140°C to 155°C and 150°C to 170°C for bitumen and aggregate respectively before mixing. The temperature of bitumen aggregate mixture should be within 140°C to 160°C. Bitumen, or bitumen aggregate mixture, which has been overheated at any time, shall be rejected. The percentage of bitumen in the mix shall be between 5.2% and 5.8% by weight of total mix for 25mm BC and between 4.9% and 5.5% by weight of total mix for 40mm BC.

The final combined grading shall be within the limits of the specification and the actual bitumen content shall be determined on the basis of laboratory tests by the Engineer and the final grading of the combined aggregates and the bitumen content shall be approved by the Engineer.

The laying temperature of the mixture shall not be less than l3O°C.

The mixed materials shall be laid to a uniform thickness. The thickness and proper camber shall be maintained by the use of steel angle screeds of the correct size. The sides of the angle shall be at least 25% greater than the compacted thickness specified and as shown on the drawings or as directed by the Engineer.

c. Rolling

After laying, the materials shall immediately be compacted using a power driven road roller. The initial pass of the roller on the bituminous premix shall be at temperatures specified above and shall be carried out with these steel angles in position. Subsequent passes of the roller may be made with these steel angles removed.

The bituminous premix shall be compacted using an approved roller (preferably a pneumatic tyre roller of 8-10 Ton) and a minimum of five passes shall be made, or as directed by the Engineer from time to time. Material that falls below the minimum working temperature of 90^{0}C, that has not been compacted as described, may be rejected and shall be replaced by new materials to the required specification and compaction by the contractor at his own expenses.

When the temperature of the bituminous premix falls below 90^{0}C no further compaction should be allowed.

The premix carpeting shall be fully compacted maintaining the proper grade and camber and after completion of compaction blinding of sand of F.M. 0.8 at the rate of 0.012 cubic meter per square meter of surface for blotting purpose shall be carried out. The compacted thickness as shown in the drawing and as provided in the Bill of Quantities shall be uniformly maintained all along the road surface.

Rollers and other mechanical plants shall not be allowed to stand on newly laid material that may be deformed thereby. Sections of newly finished work shall be protected from traffic of any kind until the mixture has cooled to ambient air temperature.

The finished surface shall be within a tolerance of ± 5mm or of the elevation shown on the drawings and it shall not vary at any place more than 5mm from the straight edge 3m long applied to the surface both longitudinally and transverse.

d. Open to Traffic

When the initial rolling is completed, commercial traffic could be allowed in the surfaced area. The speed of traffic shall be temporarily reduced to avoid the damage to the surface. Maximum speed limit of 30-40 km/hour shall, therefore, be enforced during the first month after construction (by speed breaker as an example or any other method approved by the Engineer.)

11.0 BITUMINOUS SEAL COAT 7MM THICK

a. Description

This work shall consist of premix bituminous seal coat applied to a prepared and primed granular base course or over the bituminous surfacing in accordance with these Specifications or as directed by the Engineer. The compacted thickness of premix bituminous seal coat shall be 7mm.

11.1 Materials

a. Bituminous Material

Bituminous material shall be of 60/70(Preferable) or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM AASHTO.

b. Aggregate

The aggregates shall consist of 6.33mm down graded stone or gravel free from any organic matter, clay and any other objectionable matter.

Where required to achieve the specified grading the aggregate shall be mixed with natural sand. Sand shall be non-plastic, clean and free from any deleterious substances. The minimum F.M. of sand for the sealing premix shall be between 2.00 to 2.80 and that of sand to be spread over the seal coat, as blotting material shall be within 0.80 to 1.00.

11.2 Overall Aggregate Grading

The mix of the aggregates and sand combined shall comply with the following grading given in Table-11.1

Table-11.1

Grading Requirements for 7mm Bituminous Seal Coat

Sieve Six	% By Weight Passing Sieve
6.3mm	100
4.75mm	80-100
2.4mm	70-95
600 micron	20-50
75 micron	5-15

11.3 Construction Methods

Bitumen and aggregates shall be heated separately at the following temperatures:

Only Bitumen	:	Within 140°C to 155°C (Max)
Only Aggregate	:	Within 150°C to 170°C
Mix of Bitumen & Aggregate	:	Within140°C to 160°C

Material that has been over-heated at any time shall be rejected. No mixing of pre-heated bitumen and aggregate should be done on fire, but on separate tray lay away from fire (if mixing manually). 0.01 M^3 of aggregate will be mixed with 1 liter of bitumen and mix shall be laid on 1 (one) square meter of road surface.

The aggregate mixed with bitumen shall be laid over the bituminous carpeting or over the primed granular base to a uniform thickness which shall be at least 25% greater than the compacted thickness and immediately compacted fully with a power driven road roller (8-10 Ton) to the satisfaction of the Engineer. Temperature of bitumen and aggregate mix at the time of starting of rolling should not be less than 130°C.

12.0 PREMIX BITUMINOUS SEAL COAT 12MM THICK

12.1 Description

The work shall consist of a premix bituminous seal coat applied to a prepared and primed granular base course or over bituminous surfacing in accordance with these Specifications or as directed by the Engineer. The thickness of the premix bituminous seal coat shall be 12mm.

12.2 Materials

12.2.1 Bituminous Material

Bituminous material shall be of 60/70 (preferable) or 80/100 penetration grade straight run bitumen complying with the requirements of ASTM/AASHTO.

12.2.2 Aggregate

The course aggregates shall consist of 10mm down graded stone chips free from any organic matter, clay and any other objectionable matter.

Where required to achieve the specified grading the aggregate shall be mixed with natural sand. Sand shall be non-plastic, clean and free from any deleterious substances. The F.M of sand for the sealing premix shall be between 2.00 and 2.80. The F.M of sand to be spread over the seal coat, as blotting material shall be between 0.80 and 1.00

12.2.3 Overall Aggregate Grading

The mix of the aggregates and sand combined shall comply with the following grading given in Table 12.1

Table 12.1

Grading Requirements for 12mm Premix Bituminous Seal Coat

Sieve Size	Percentage by Weight Passing Sieve
1omm	100
6.3mm	80-100
4.75mm	70-95
2.4mm	20-50
600 micron	5-15
75 micron	2-10

12.3 Construction Methods

Prior to heating the aggregate and sand shall be mixed together to give a stockpile of mixed aggregate of the required grading in sufficient quantity for at least one day's surfacing work.

Bitumen and aggregates shall be heated separately at the following temperatures:

Only Bitumen	:	Between 140°C to 155°C (Max)
Only Aggregate	:	Between 150°C to 170°C
Mix of Bitumen & Aggregate	:	Between 140°C to 160°C

Material that has been over-heated at any time shall be rejected. No mixing of pre-heated bitumen and aggregate should be done on fire, but on separate tray lay away from fire (if mixing manually). 0.016M3 of pea gravel will be mixed with 1.40 liter of bitumen and shall be laid on 1 (one) square meter of road surface.

The mixture shall be laid to a uniform thickness, which shall be at least 25% greater than the compacted thickness and immediately compacted fully with a power driven road roller (8-10 Ton) to the satisfaction of the Engineer.

13.0 IMPORTANT NOTES ON ROAD PAVEMENT CONSTRUCTION

a. Turfing or seedling with 'Durba' or 'Hikar' grass seed is a must at side slopes after dressing.

b. The approving authority in consultation with Design Unit shall determine thickness of improved sub-grade of the road segment where designed soaked CBR value (4%) of sub-grade can not be achieved with soil at site, even mixing any portion of sand with soil at site. In that case for increase of ISG thickness as per Table 12 approval from approving authority is a pre-requisite before preparation of scheme or commencing execution as applicable.

c. The approving authority in consultation with Design Unit shall determine thickness of sub-base of the road segment where designed soaked CBR value (8%) of improved sub-grade can not be achieved with locally available sand due to its F. M. is less than 0.8, but more than 0.5. In that case an increase in the sub-base thickness is to be designed depending on ISG CBR value before preparation of scheme or commencing execution as applicable. It is obvious that an increase in sub-base thickness will eventually result a proportionate decrease in thickness of improved sub-grade (ISG).

d. Compaction of any item of work in the road construction shall conform designated CBR value.

e. Initially applied bituminous carpeting (BC) shall have another overlay of 40mm thick BC with 7mm seal coat within 7 to 8 years after completion of construction for achieving durability of pavement for 10 years.

f. Special precautionary measures to be taken for drainage of surface run-off stagnant at depressions along longitudinal profile during construction as well as maintenance.

g. Earthen shoulder needs all-weather surfacing with bricks or concrete for road segment across market places and built up areas.

h. Run-off drainage along built-up areas may need special structural provision.

i. Drainage structure along hillock or hill-cut may be designed as per site condition.

j. Notwithstanding the test frequency specified in this document for any item of construction work, the test frequency specified in the Schedule of Rates of LGED (Current Version) shall prevail.

k. In absence of ACV testing equipment, LAA test of coarse aggregates shall be allowed, but in no case LAA value of coarse aggregates to be used in sub-base and base coarse shall be greater than 40 percent.