3.2 SUB-BASE

3.2.1 Description

This work shall consist of furnishing, placing and compacting sub-base material on a prepared and accepted subgrade or improved subgrade 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.

3.2.2 Materials

The Contractor shall submit results of material tests on the proposed subbase material to the Engineer for his approval at least seven days in advance of its use. Fresh approval shall be required when the material is changed.

Material shall be natural or artificial aggregate material, free from vegetable matter, soft particles and excess clay. Natural and artificial materials may be mixed together provided they fully conform to all requirements of the Specification and the proportions are approved by the Engineer in writing. The material for sub-base shall conform to the requirements given below:

a) Grading. The grading shall conform to grading envelopes A, or B in Table 3.2-1 and the fraction passing the 0.075 mm sieve shall be not greater than three quarters of the fraction passing the 0.300 mm sieve.

b) Plasticity. The portion passing the 0.425 mm sieve shall, if it is plastic, have a liquid limit not greater than 25% and a plasticity index not greater than 6% (STP 3.2).

c) CBR. The material shall have a 4 day soaked CBR value not less than 25% when compacted to 98% of maximum dry density as determined by STP 4.5 (Vibrating Hammer).

d) Aggregate Crushing Value/Ten Percent Fines Value. Any material retained on the 10 mm sieve when sampled and tested in accordance with STP 7.7.1 and 7.7.2 shall have an Aggregate Crushing Value of not greater than 38% and the ten percent fines value shall not be less than 75 kN.

Table 3.2-1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Percentage by Weight Passing Sieves</th>
<th>Grading A</th>
<th>Grading B</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>85 - 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>55 - 95</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>35 - 75</td>
<td>70 – 100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>25 - 60</td>
<td>45 – 85</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>15 - 50</td>
<td>30 – 70</td>
<td></td>
</tr>
<tr>
<td>0.600</td>
<td>7 - 35</td>
<td>10 – 45</td>
<td></td>
</tr>
<tr>
<td>0.300</td>
<td>6 - 27</td>
<td>7 – 30</td>
<td></td>
</tr>
<tr>
<td>0.075</td>
<td>3 - 15</td>
<td>4 – 20</td>
<td></td>
</tr>
</tbody>
</table>
3.2.3 Construction Methods

3.2.3.1 Preparation of Subgrade or Improved Subgrade

The subgrade or improved subgrade shall be shaped and compacted in conformity with the provisions of Specifications Sections 2.7 and 2.8 and completed ahead of the placing of the sub-base material. Notwithstanding any earlier approval, any damage to or deterioration of the subgrade or improved subgrade, including any increase in moisture content above that permitted to achieve the specified compaction, shall be corrected at the Contractor's expense before sub-base is laid.

Preparation and surface treatment of the subgrade or improved subgrade shall be carried out only after completion of any specified subgrade drainage and unless otherwise agreed by the Engineer immediately prior to laying the sub-base. The sequence of operations shall be as follows:

a) The subgrade or improved subgrade shall be regulated and trimmed so that its finished profile shall not vary by more than 20 mm above or below the specified formation level at any point.

b) The trimmed formation shall be rolled by 1 pass of a smooth-wheeled roller having a load per 100 mm width of roll not less than 214 kg or a vibratory roller having a static load per 100 mm width of vibratory roll of not less than 71 kg or a vibratory plate compactor having a static pressure under the base plate of not less than 1,400 kg/m².

3.2.3.2 Spreading Sub-base

Sub-base shall be spread in layers of nearly equal thickness either by hand or by using a grader or paving machine, with an uncompacted thickness up to 150 mm, subject to the approval of the Engineer. Where sand and aggregates are combined together to meet the specified grading, care shall be taken to prevent segregation of the material into fine and coarse parts. All areas of segregated coarse or fine material shall be corrected, or removed and replaced with material, which conforms to the Specification.

Where the material for shoulders is the same as that used for the sub-base course, the material shall be evenly spread in layers, as herein specified, for the full width of the sub-base course and the shoulders simultaneously.

Where the shoulders are not of the same material as the sub-base course, then the sub base shall be spread to give the required compacted depth and the edge detail shown on the Drawings.

When the sub base is spread contiguous to concrete kerbs or gutters, extreme care shall be exercised not to damage them. Any damage of kerbs or gutters resulting from carelessness or negligent construction methods by the Contractor shall warrant their removal and replacement at the Contractor's sole expense.

3.2.3.3 Sprinkling, Rolling and Compacting

Immediately after each layer has been spread and shaped to the cross section required each layer shall be compacted with suitable and adequate 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.
If water is required, to bring the sub base to the correct moisture content, it shall be sprinkled on the surface. The contractor shall supply and sprinkle the necessary water at his own expense.

Sub-base material containing excess moisture shall be 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.

Each layer shall be compacted to at least 98% of the maximum dry density as determined in accordance with STP T4.5 (Vibrating Hammer). Moisture content at the time of compaction shall be the optimum moisture content ± 3%.

The Contractor shall carry out a field compaction trial at the start of constructing the sub-base to determine the optimum moisture content and the required number of passes of his particular compaction equipment to comply with the Specification. This trial will also determine the relationship between the loose and compacted thickness in controlling the loose thickness at the time of spreading the mix. The method will require to be approved by the Engineer and shall then be used for all subsequent compaction of sub-base material. Such agreement will not, however, relieve the Contractor of his responsibility and in the event that test results later show that the specified compaction is not being achieved all sub base work shall cease and not be resumed until a fresh trial has been undertaken and a revised compaction method approved by the Engineer.

3 No. in situ density tests in accordance with STP 6.2 (150 or 200 mm diameter) shall be taken for each 1,000 square metres of compacted sub-base, or as directed by the Engineer. If the test results show that the achieved dry density is less than that required, the Contractor shall carry out further compaction to obtain the minimum required dry density.

In order to ensure uniform bearing capacity at the finished sub-base level, CBR measurements may be ordered by the Engineer. The CBR shall be such that the laboratory value obtained from testing in accordance with STP 5.1 on samples compacted to the specified dry density and soaked for 4 days shall exceed 25%. In areas where these requirements are not met, correction shall be made by such measures, as the Engineer deems necessary.

The finished sub-base shall be checked for level and crossfall and at any point shall not vary more than 15 mm above or below the planned grade or adjusted grade. The thickness of the finished sub-base shall be on average

- not less than the required thickness when five thickness measurements are averaged in any 150m length of completed sub-base.

- not thinner than 10 mm less than the required thickness at any point

Sub-base which does not conform to the above requirements shall be corrected by scarifying the full depth of the affected areas, adding or removing materials and re-rolling, watering if necessary, until the entire surface conforms to the correct levels and cross-falls.

The prepared sub-base layer shall be protected against damage until covered by the base course.
3.2.4 Measurement

Sub-base as described in this Section shall be measured by the cubic metres of compacted material in place and accepted. Measurement shall be based on the thickness/cross-section of the sub-base shown on the Drawings and area/length measured on the surface of the road.

3.2.5 Payment

This work measured as provided above shall be paid for at the Contract unit rate per cubic metre for aggregate sub-base, as detailed below. The payment shall be full compensation for furnishing all materials, hauling, placing, compacting, sprinkling, finishing and shaping, and for all labour, equipment, tools and other incidentals necessary to complete the work specified.

Sub-base shall be paid for at the Contract unit rate irrespective of the sources of materials used for constructing the sub-base. All costs for excavating existing pavement, or removing existing structures, or savings to the Contractor from re-using materials excavated from existing pavements or structures shall be deemed already covered under pay items 2/2/3, 2/2/4, 2/2/5, 2/9/1 and 2/9/2.

Pay item shall be:

3/2/1 Sub-base Cubic Metre