

## CHAPTER 6 APPURTENANT WORKS

### SECTION 6.1 ASPHALT CONCRETE PAVEMENT ROADS

#### 6.1.1 General Description

This work consists of fine asphalt surface course, coarse asphalt base course, lime stabilization sub-base course and/or crushed stone sub-base course, prime coat, and tack coat for construction of perimeter road, fire-fighting road, and GSE road in accordance with these specifications and the lines, grades, and typical cross sections shown on the Drawings.

#### 6.1.2 Asphalt Concrete Pavements

##### 6.1.2.1 Description

6.1.2-1.1 This item shall consist of surface and base courses composed of mineral aggregate and bituminous material mixed in a mixing plant and placed on a prepared sub-base course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the Drawings. Each course shall be constructed to the depth, typical section, or elevation required by the Drawings and shall be rolled, finished.

##### 6.1.2.2 Materials

###### 6.1.2-2.1 Aggregates

- a. Aggregates shall consist of crushed stone, crushed gravel, or crushed slag with or without sand or other inert finely divided mineral aggregate; shall be composed of sound, tough, durable particles, free from clay balls, organic matter, and other deleterious substances; and any content of flat or elongated pieces shall not exceed 8 percent, by weight.
- b. Coarse aggregates retained on No. 8 sieve shall show no more than 35 percent wear when tested in accord with AASHTO T 96 or JTJ 058-94; and shall show no signs of disintegration nor shall sodium sulphate soundness loss exceed 9 percent, or magnesium soundness loss exceed 12 percent, when tested in accord with AASHTO T 104 or JTJ 058-94.

The crushing of aggregates shall result in a product in which coarse aggregate retained on the No. 8 sieve shall have at least 75 percent by weight of particles

with at least two fractured faces and at least 90 percent by weight of particles with one or more fractured faces.

- c. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 1,200 kilograms per cubic meter when tested in accord with AASHTO T 19 or JTJ 058-94.
- d. Fine Aggregate including any blended filler, shall have a Plasticity Index of not more than 6 when tested in accord with AASHTO T 90, and a Liquid Limit of not more than 25 when tested in accord with AASHTO T 89 or JTJ 058-94.

**6.1.2-2.2 Bituminous Material**

- a. Types, grades, controlling specifications, and mixing temperatures for bituminous materials shall be as follows:

**Table Bituminous Material**

Type and Grade	Specification	Mixing Temperature
1) Straight Asphalt: 60 - 70	AASHTO M 20 or JT 1003-66	135 - 165 deg. C
2) Tar: RT-10, RT-11, RT-12	AASHTO M 52 or JT 1003-66	80 - 120 deg. C

- b. Bituminous mix shall have a swell of not more than 1.50 percent when tested in accord with AASHTO T 101 or JT 1003-66; and shall not show evidence of striping when tested in accord with AASHTO T 182 or JT 1003-66. Antistrip agents shall be used if necessary.

**6.1.2-2.3 Filler**

If filler, in addition to that naturally present in the aggregates is necessary it shall consist of stone dust, loess, Portland cement, or other approved mineral matter; and shall meet requirements of AASHTO M 17 or JT 1003-66.

### 6.1.2.3 Composition of Mixtures

6.1.2-3.1 Bituminous plant mix shall be composed of a mixture of aggregate, filler if required, and bituminous material; with aggregate fractions sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements for Job Mix Formula as specified herein.

6.1.2-3.2 Tabulated composition limits shall govern except closer controls appropriate to job materials shall be required for specific mixtures used; and final designated gradations shall produce a relatively smooth curve when plotted on a semilogarithmic gradation chart.

6.1.2-3.3 Mixtures shall meet requirements as follows in accord with ASTM or JT tests, plus stated limitations on voids, voids filled, and swell.

<u>Characteristic</u>	<u>Required</u>
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(1) Fine asphalt concrete surface course

ASTM D 1599 or JT [ ]

i) Number of Blows Each End of Specimen	:	50
ii) Stability, Not Less Than	:	500 kg
iii) Flow, Not Greater Than	:	40
iv) Flow, Not Less Than	:	20
v) Voids, Percent	:	3 to 6
vi) Voids filled with bitumen, Percent	:	70 to 85

<u>Characteristic</u>	<u>Required</u>
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a. Coarse asphalt concrete base course

ASTM D 1599 or JT [ ]

i) Number of Blows Each end of Specimen	:	50
ii) Stability, Not Less Than	:	500 Kg
iii) Flow, Not Greater Than	:	40
iv) Flow, Not Less Than	:	20
v) Voids, Percent	:	3 to 7
vi) Voids Filled with Bitumen, Percent	:	65 to 85

### 6.1.2.4 Job Mix Formula

- 6.1.2-4.1 Work shall not begin nor shall any mixture be accepted until Contractor has submitted samples of materials intended for use and the Engineer has approved a satisfactory job mix formula for each mixture to be used.
- 6.1.2-4.2 Job mix formula for each mixture shall not be changed or modified from those as approved unless otherwise authorized or directed by the Engineer in writing.
- 6.1.2-4.3 Job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, temperature at which mixture is to be delivered at point of discharge.
- 6.1.2-4.4 Gradations listed herein percent limits which shall determine suitability of aggregate for use from sources of supply. Final gradations decided on within limits as tabulated shall be well graded from coarse to fine and shall not vary from low limit on one sieve to high limit on adjacent sieves, or vice versa.

**Aggregate Gradations**

Sieve designation (square openings)	Percentage by weight passing sieves		
	A 25 mm maximum	B 19 mm maximum	C 13 mm maximum
25.0 mm	100	-	-
19.0 mm	82 - 100	100	-
12.5 mm	70 - 90	82 - 100	100
9.5 mm	60 - 82	68 - 90	82 - 100
No. 4	42 - 70	50 - 79	56 - 88
No. 10	30 - 60	36 - 67	40 - 75
No. 40	15 - 40	17 - 44	19 - 48
No. 80	8 - 26	9 - 29	10 - 32
No. 100	3 - 8	3 - 8	4 - 9
Bituminous Percent:			
Stone or gravel	4.5 - 7.0	5.0 - 7.5	5.5 - 8.0
Slag	6.0 - 9.0	6.5 - 9.5	7.0 - 10.0

- 6.1.2-4.5 Selection of any gradations tabulated shall be such that maximum size aggregate used shall be not more than one half thickness of any single layer of surface course being constructed.
- 6.1.2-4.6 Bituminous content of mixture shall be calculated on percentage basis by weight of total mix.

6.1.2-4.7 Percentage of straight asphalt and tar tabulated herein are given for stone, gravel, and slag aggregates.

- a. When total aggregate is composed of slag, percentages of bituminous material as tabulated shall be used.
- b. When only a part of aggregate is slag, increases in bituminous material shall be made in a corresponding proportion.

6.1.2-4.8 A sample of coarse and fine aggregates shall be washed to determine the percentage of total passing the No. 200 mesh sieve. Of the amount of the material passing No. 200 mesh sieve, at least one half shall pass No. 200 mesh sieve by dry sieving.

6.1.2-4.9 After job mix formula is established, all mixtures furnished for the Project shall conform thereto within the following tolerances, plus or minus:

- |   |             |
|---|-------------|
| a. Passing No. 4 and Larger Sieves:           | 7 percent   |
| b. Passing No. 8 to No. 100 Sieves, Inclusive | 4 percent   |
| c. Passing No. 200 Sieve:                     | 2 percent   |
| d. Bitumen:                                   | 0.4 percent |
| e. Temperature of Mix:                        | 5 deg. C.   |

6.1.2-4.10 Should a change in sources of materials be made, a new job mix formula shall be established before new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

6.1.2-4.11 Combined mineral aggregate for surface courses shall be of such size that percentage composition by weight, as determined by laboratory sieves, will conform to one of the gradations as tabulated, when tested in accord with AASHTO T 11 and AASHTO T 27 or JTJ [ ]. Percent by weight for bituminous material shall be within limits specified.

#### 6.1.2.5 Construction Requirements

##### 6.1.2-5.1 Weather Limitations

Surface courses shall be constructed only when underlying surfaces are thoroughly dry and when weather is not foggy or rainy.

##### 6.1.2-5.2 Bituminous Mixing Plant

Bituminous mixing plant required for Work herein shall be of a central type which is fully automated and stationary and comply with requirements specified under Chapter 8 of the General Provision of this Specification.

The plant shall be of only the batch mixer type. Continuous mixing type of a plant is not allowed.

#### 6.1.2-5.3 Hauling Equipment

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds; and to prevent mixtures from adhering to them, beds shall be lightly coated with minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect mixture from adverse weather.

#### 6.1.2-5.4 Bituminous Pavers

- a. Bituminous pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary; and shall be capable of spreading and finishing courses of bituminous plant mix material which will meet specified thickness, smoothness, and grade. Also shall be equipped with automatic line and grade controlling device.
- b. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in full widths shown.
- c. Pavers shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation; and hoppers shall be equipped with a distribution system to place mixture uniformly in front of the screed. Screed or strike-off assembly shall effectively produce a finished surface of required evenness, and texture without tearing, shoving, or gouging.
- d. Pavers shall be capable of operating at forward speeds consistent with satisfactory laying of mixture.

#### 6.1.2-5.5 Rollers

- a. Rolling equipment shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the bituminous mixture.
- b. Number, type, and weight of rollers shall be sufficient to compact mixtures to required density while mixtures are still in a workable condition.

- c. Use of equipment which results in excessively crushing aggregate will not be permitted.

#### 6.1.2-5.6 Preparation of Mineral Aggregate

- a. Mixture aggregates shall be dried and heated at paving plant before entering the mixer; and when introduced into mixer, combined aggregate shall contain not more than 0.5 percent moisture for asphalt mixtures or more than 1 percent for tar mixtures.
- b. Water in aggregates shall be removed by heating to extent that there is no subsequent foaming in mixture prior to placing and spreading.
- c. Aggregates shall be heated to temperature designated by job mix formula within job tolerance specified; with maximum temperature and rate of heating such that no permanent damage occurs.
- d. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating.
- e. Aggregates shall be screened to specified sizes and conveyed into separate bins ready for mixing with bituminous material.

#### 6.1.2-5.7 Preparation of Bituminous Mixture

- a. Before delivery, aggregate shall be mixed with bituminous material at a central mixing plant; and prepared at a temperature specified under Paragraph 2.2 herein.
- b. Dry aggregates, prepared as prescribed under paragraph 5.6 above, shall be combined in plant in proportionate amounts of each fraction of aggregate required to meet specified gradation; and quantity of aggregate for each batch shall be determined, measured, and conveyed into mixer. In case of volumetric proportioning, size of gate openings shall be determined, and gates locked in position.
- c. Quantity of bituminous material for each batch or calibrated amount for continuous mixer shall be determined by the Engineer; and shall be measured by weight and introduced into mixer at specified temperature, using lowest range possible for adequate mixing and spreading.
- d. For batch mixers, all mineral aggregates shall be in mixer before bituminous material is added. Exact temperature within specified range shall be fixed by the

Engineer. In no case shall aggregate be introduced into mixture at a temperature more than 5 deg. C. above temperature of bituminous material.

- e. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the interval of time between the introduction of bituminous material and the opening of the mixer gate.
- f. The timing control shall be flexible and shall be capable of settings of 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.
- g. The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

#### 6.1.2-5.8 Transportation and Delivery of Mixture

- a. Mixture shall be transported from mixing plant to point of use in vehicles described under Paragraph 5.3 herein.
- b. Mixture shall be placed at a temperature between 65 to 110 deg. C. when tar is used, and between 120 to 165 deg. C when straight asphalt is used.
- c. When mixture is being placed during warm weather and the Engineer has determined that satisfactory results can be obtained at lower temperatures, he may direct that mixture be mixed and delivered at lower temperatures.
- d. Loads shall not be sent out as to interfere with spreading and compacting mixture during hours without sufficient light unless artificial light, satisfactory to the Engineer, is provided.
- e. Mixtures shall be delivered at temperatures within tolerances required for Job Mix Formula.

#### 6.1.2-5.9 Spreading and Laying



a. Preparation and Placing:

- (1) Immediately before placing bituminous mixture, existing underlying course shall be cleaned of loose or deleterious material using a power sweeper equipped with a blower, supplemented with hand brooms if necessary, or removed by other means as directed by the Engineer.
- (2) Mixture shall be laid only on an approved underlying course which is dry and in suitable condition, and when weather conditions are favorable; and shall be placed only when air temperatures in shade and away from artificial heat is 5 deg. C or above, unless so directed by the Engineer.
- (3) The Engineer may permit work to continue when overtaken by sudden rains only to provide for laying that material which is in transit from plant, provided mixture is within temperature limits specified.
- (4) Grade control between edges of pavement shall be accomplished by grade stakes or steel pins placed in lanes parallel to pavement centerline and at intervals sufficiently close that string lines may be properly stretched between stakes or pins.
- (5) Hauling over material already placed shall not be permitted until material has been thoroughly compacted as specified, and allowed to cool to atmospheric temperature.

b. Machine Spreading:

- (1) Upon arrival, mixture shall be dumped into an approved bituminous paver and immediately spread to full width required; and struck off in a uniform layer of such depth that, when work is completed, it will have the required thickness and will conform to grade and surface contour required.
- (2) Paver spread shall be regulated to eliminate pulling and tearing of bituminous material.
- (3) Mixture shall be placed in strips not less than 3 meters wide.
- (4) To insure proper drainage, spreading shall begin along pavement centerline on a crowned section or on high side of pavement with a one-way slope.
- (5) After first strip or width has been compacted, second width shall be placed, finished, and compacted in same manner as first width. After second strip

has been placed and rolled, a 5 meter straightedge shall be placed across longitudinal joint to determine if surface conforms to grade and contour requirements.

- (6) Exposed vertical edges of paved strips shall be free from all accumulations of dirt or other foreign material before any mixture is spread in an adjacent lane; and should joint faces become dry or dusty, contact surfaces shall be given a brush coat of asphalt; except, in lieu of painting contact surface, the Contractor may use a joint heater approved by the Engineer.
- (7) Should spreading machine drift from an adjacent lane during construction, unfilled space shall be carefully filled with fresh not mixture obtained from truck or hopper of spreading machine. Stealing mixture from that already spread to fill up these areas shall not be permitted.
- (8) In areas where, because of irregularities or unavoidable obstacles, use of mechanical spreading and finishing equipment is impractical, mixture may be hand spread.
- (9) When hand spreading is permitted, mixture shall be dumped on approved dump sheets outside of area upon which it is to be spread, and then distributed into place immediately with hot shovels and spread with hot rakes in a uniformly loose layer to full width required and of such depth that, when work is completed, it will have the required thickness and will conform to grade and surface contour shown.

#### 6.1.2-5.10 Compaction of Mixture

- (1) After spreading, mixture shall be thoroughly and uniformly compacted with power rollers, as directed by the Engineer. Rolling shall begin as soon after spreading as mixture will bear roller without undue displacement or hair checking; and shall start in center of first strip spread and continue toward either edge. On subsequent strips laid, rolling shall start on edge adjacent to previously laid material and continue toward opposite edge.
- (2) Initial rolling shall be done longitudinally; and rollers shall overlap on successive trips. Alternate trips of roller shall be of slightly different lengths. Mixture shall be subjected to diagonal rolling, crossing the lines of the first two lanes after three or more lanes are constructed, but cross rolling shall not exceed more than one half total width of pavement on crowned sections.
- (3) Speed of roller shall, at all times, be slow enough to avoid displacement of hot mixture. Any displacement occurring as a result of reversing direction of

roller, or from any other cause, shall be corrected at once by rakes, and fresh mixture.

- (4) Sufficient rollers shall be furnished and operated to handle plant output; and rolling shall continue until all roller marks are eliminated, surface is of uniform texture and true to grade and cross section, and a density of at least 98 percent of specified laboratory density is obtained.
- (5) Field density tests shall be made at least twice daily.
- (6) To prevent adhesion of mixture to roller, wheels shall be kept properly moistened, but excessive water will not be permitted.
- (7) In areas not accessible to roller, mixture shall be thoroughly compacted with hot hand tampers.
- (8) Any mixture which becomes loose and broken, mixed with dirt, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to surrounding areas; all at the Contractor's expense.
- (9) Skin patching shall not be permitted.

#### 6.1.2-5.11 Joints

- a. General: Mixture at joints shall comply with the surface requirements and present same uniformity of texture, smoothness, etc., as other course sections.
  - (1) In formation of all joints, provision shall be made for proper bond with adjacent course for full depth of course.
  - (2) Joints shall be formed by cutting previously placed asphalt concrete to expose full depth of course; exposed edge given a light coat of asphalt or tar as specified by the Engineer; and fresh mixture raked against joint and thoroughly tamped and rolled.
- b. Transverse: Placing of course shall be as continuous as possible; and rollers shall not pass over the unprotected end of freshly laid mixture, except only when discontinuing work.
- c. Longitudinal:

- (1) Placing of course shall be specified in such a manner that joint is exposed for the shortest period possible.
- (2) Joint shall be positioned to offset not closer than 25 cm from any such joints in surfaces of base, binder or other course immediately below surface course.

#### 6.1.2-5.12 Shaping Edges

While surface is being compacted and finished, the Contractor shall carefully trim outside edges of pavement to proper alignment; and edges so formed beveled while still hot using back of a rake or a smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

#### 6.1.2-5.13 Surface Tests

- a. Tests for conformity with specified crown and grade shall be made by the Contractor immediately after initial compaction. Any variation shall be corrected by removal or addition of materials and by continuous rolling.
- b. After completion of final rolling, smoothness of course shall again be tested; humps or depressions exceeding specified tolerances or that retain water on the surface shall be immediately corrected by removing defective work and replacing with new material, as directed by the Engineer; all at the Contractor's expense.
- c. Finish surfaces shall not vary more than 2.4 mm in Standard Deviation Value when tested using 3 - meter profile meter.

#### 6.1.2-5.14 Thickness Tests

- a. Total thickness of each completed courses of fine and coarse asphalt concrete shall be determined by core tests for each completed layer taken at intervals so each test shall represent no more than 1,000 square meters.
- b. For fine asphalt concrete surface course, thickness tolerance shall not be less than minus 7 mm, or less than minus 2 mm for an average of ten tests.
- c. For coarse asphalt concrete base course, thickness tolerance shall not be less than minus 9 mm, or less than minus 3 mm for on average of ten tests.
- d. When deficiency in thickness exceeds the specified minus tolerance, the Contractor shall remove and replace surfacing with new material, as directed by the Engineer, all at the Contractor's expense.

#### 6.1.2-5.15 Sampling Pavement

- a. The Contractor shall remove suitable size samples of completed pavement from locations designated by the Engineer for determination of composition, compaction, and density of the pavement, and also for observation of the status of mixing by the Engineer.
- b. Samples for each day or fraction thereof shall be taken; and the Contractor shall replace the pavement as required and at no extra cost. When pavement is deficient in composition, compaction, or thickness, satisfactory correction shall be made at the Contractor's expense.

#### 6.1.2-5.16 Samples

Samples of bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted and approval by the Engineer be obtained before use of such material begins.

#### 6.1.2-5.17 Compaction Density

Sufficient rollers shall be furnished and operated to handle plant output; and rolling shall continue until all roller marks are eliminated, surface is of uniform texture and true to grade and cross section, and a density of at least 96 percent of specified laboratory density is obtained.

##### b. Thickness Tests

- (1) Total thickness of each completed courses of binder and surface asphalt concrete shall be determined by core tests for each completed layer taken at intervals so each test shall represent no more than 1,000 square meters.
- (2) For fine asphalt concrete surface course, thickness tolerance shall not be less than minus 7 mm, or less than minus 2 mm for an average of ten tests.
- (3) For coarse asphalt concrete binder course, thickness tolerance shall not be less than minus 9 mm, or less than minus 3 mm for an average of ten tests.

#### 6.1.2.5 Additional Provisions

##### a. Trial Mixing and Paving

Trial mixing and paving for fine asphalt concrete surface course and coarse asphalt concrete base course shall be carried out to technically confirm that requirements specified for the mixture are met and also to examine mixture's workability, compaction methods such as determination of extra placement thickness when spread, the numbers of passing of various kinds of rollers, etc. without additional cost to the Employer.

**b. Standard Density**

Standard Compaction Density of fine asphalt concrete surface course and coarse and coarse asphalt concrete base course mixtures shall be determined by the undermentioned procedure:

Each 3 Marshall specimens shall be made in both morning and afternoon works using the mixtures produced in the first 2 days after the commencement of the asphalt work in accord with job mix formula, and standard compaction density shall be of the average of the above 12 densities.

**6.1.3 Lime fly ash Stabilization Sub-base Course**

This item shall conform to Section 3.1.3 of this Special Provision.

**6.1.4 Crushed stone Sub-base Course**

This item shall conform to Section 3.1.1 of this Special Provision.

**6.1.5 Prime Coat**

**6.1.5.1 Description**

6.1.5-1.1 This item shall consist of an application of bituminous material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the Drawings.

**6.1.1.2 Materials**

6.1.1-2.1 **BITUMINOUS MATERIAL.** The types, grades, controlling specifications, and application temperatures for the bituminous materials are given in Table 1. The Engineer shall designate the specific material to be used.

**TABLE 1. BITUMINOUS MATERIAL**

Type and Grade	Specification	Application Temperatures*	
		Deg. F	Deg. C
Emulsified Asphalt	ASTM D 977	70 - 160	20 - 70
SS-1, SS-1h	ASTM D 977	70 - 160	20 - 70
MS-2, HFMS-1	ASTM D 2397	70 - 160	20 - 70
CSS-1, CSS-1h CMS-2	ASTM D 2397	70 - 160	20 - 70
Cutback Asphalt			
RC-30	ASTM D 2028	80+	30+
RC-70	ASTM D 2028	120+	50+
RC-250	ASTM D 2028	165+	75+

\* The maximum temperature for cutback asphalt shall be that at which fogging occurs.

**6.1.5.3 Construction Methods**

6.1.5-3.1 **WEATHER LIMITATIONS.** The prime coat shall be applied only when the existing surface is dry or contains sufficient moisture to get uniform distribution of the bituminous material, when the atmospheric temperature is above 15 C, and when the weather is not foggy or rainy. The temperature requirements may be waived, but only when so directed by the Engineer.

**6.1.5-3.2 EQUIPMENT.** The equipment used by the Contractor shall include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

**6.1.5-3.3 APPLICATION OF BITUMINOUS MATERIAL.** Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The bituminous material including solvent shall be uniformly applied with a bituminous distributor at the rate of 1.20 to 2.40 liters per square meter depending on the base course surface texture. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the primed surface shall be allowed to dry not less than 48 hours without being disturbed or for such additional time as may be necessary to permit the drying out of the prime until it will not be picked up by traffic or equipment. This period shall be determined by the Engineer.

The surface shall then be maintained by the Contractor until the surfacing has been placed. Suitable precautions shall be taken by the Contractor to protect the primed surface against damage during this interval, including supplying and spreading any sand necessary to blot up excess bituminous material.

**6.1.5-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY.** Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous materials to furnish material subject to this and all other pertinent requirements of the Contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.



The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

- 6.1.5-3.5 **FREIGHT AND WEIGH BILLS.** Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the Contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer.

Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

#### 6.1.6 Tack Coat

##### 6.1.6.1 Description

- 6.1.6-1.1 This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the Drawings.

##### 6.1.6.2 Materials

- 6.1.6-2.1 **BITUMINOUS MATERIALS.** The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.

**TABLE 1. BITUMINOUS MATERIAL**

Type and Grade	Specification	Application Temperature	
		Deg. F	Deg. C
Emulsified Asphalt SS-1, SS-1h CSS-1, CSS-1h	ASTM D 977	75 - 130	25 - 55
	ASTM D 2397	75 - 130	25 - 55
Cutback Asphalt RC-70	ASTM D 2028	120 - 160	50 - 70
Tar RTCB 5, RTCB 6	AASHTO M 52	60 - 120	15 - 50

**6.1.6.3 Construction Methods**

**6.1.6-3.1 WEATHER LIMITATIONS.** The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 15 C. The temperature requirements may be waived, but only when so directed by the Engineer.

**6.1.6-3.2 EQUIPMENT.** The Contractor shall provide equipment for heating and applying the bituminous material.

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

**6.1.6-3.3 APPLICATION OF BITUMINOUS MATERIAL.** Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or airblast to remove all loose dirt and other objectionable material.

Emulsified asphalt shall be diluted by the addition of water when directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.24 to 0.72 liters per square meter depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer.

The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

- 6.1.6-3.4 BITUMINOUS MATERIAL-CONTRACTOR'S RESPONSIBILITY.** Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the Contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.

The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance.

All such test reports shall be subject to verification by testing samples of material received for use on the project.

- 6.1.6-3.5 FREIGHT AND WEIGH BILLS.** Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the Contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

## **6.1.7 Method of Measurement**

- 6.1.7-1.1 Asphalt concrete pavement shall be measured by the number of square meters of surface or base course actually constructed and accepted by the Engineer as complying with the Drawings and these Specifications. The quantity of each course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, or at the rate of 1 depth test for each 420 square meters of surface or base course, or by means of average end areas on the complete work computed from elevations to the nearest 3 mm.
- 6.1.7-1.2 The quantity of each type of sub-base course to be paid for shall be the number of square meters of base actually constructed and accepted by the Engineer as complying with the Drawings and specifications except on-site hauling of sub-base course materials. The quantity of sub-base course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, or at the rate of 1 depth test for each 420 square meters of subbase course, or by means of average end areas on the complete work computed from elevations to the nearest 3 mm.
- 6.1.7-1.3 On-site hauling of sub-base course materials will be measured by the number of cubic meters
- 6.1.7-1.4 The bituminous material for prime coat or tack coat shall be measured by the number of square meters materials actually coated and accepted by the Engineer as complying with the Drawings and these specifications

## **6.1.8 Basis of Payment**

- 6.1.8-1.1 Payment for an accepted asphalt concrete pavement shall be made at the Contract unit price per square meter for bituminous mixture. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.1.8-1.2 Payment for each type of sub-base course shall be made at the Contract unit price per square meter. This price shall be full compensation for furnishing all materials, except hauling and curing; for all preparation, mixing, placing and compacting of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.1.8-1.3 Payment shall be made at the Contract unit price per cubic meter for on-site hauling of sub-base course materials. This price shall be full compensation for loading, hauling, and depositing; and for all labor, equipment, tools, and incidentals necessary to complete the item.

- 6.1.8-1.4 Payment shall be made at the Contract unit price per square meter for curing of sub-base course materials. This price shall be full compensation for spraying water on these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.1.8-1.5 Payment shall be made at the Contract unit price per square meter of bituminous material for prime coat or tack coat. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-1-1*	Fine asphalt concrete, surface course (T 3cm)	square metre
I-5-1-2*	Coarse asphalt concrete, base course (T 6cm)	square metre
I-5-1-3*	Lime fly ash stabilized crushed stone (up-base) (T 15~18cm)	square metre
I-5-1-4*	Lime fly ash stabilized crushed stone (lower-base) (T 15~18cm)	square metre
I-5-6-5	Crushed stone sub-base course	square metre
I-5-1-5*	Prime coat	square metre
I-5-1-6*	Tack coat	square metre
I-5-7-1	In-site hauling of sub-base course and base course materials	cubic metre
I-5-7-2	Curing of sub-base course and base course materials	square metre

Note: The items marked with \* represent items that reappear repeatedly within the B/Q. Here only the item No. firstly appears is shown.

## **SECTION 6.2 BRICK FENCE**

### **6.2.1 Description**

6.2-1.1 This item shall consist of construction of brick fences in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the Drawings or required by the Engineer.

### **6.2.2 Materials**

6.2-2.1 **BRICK.** The brick shall conform to the requirements of GB 5101-85 or ASTM C32, grade SM.

6.2-2.2 **MORTAR.** Mortar shall consist of one part portland cement and four parts sand. The portland cement shall conform to the requirements of GB 175. The sand shall conform to the requirements of JT 1003-66 or GB [ ].

6.2-2.3 **STONE BEDDING MATERIALS.** Macadam stone bedding materials shall conform to the requirements of Section 3.1.1 of this Special Provision.

6.2-2.4 **CONCRETE.** Plain concrete shall meet the requirements of Section 4.2 of this Special Provision.

### **6.2.3 Construction Methods**

6.2-3.1 **GENERAL.** The fence shall be constructed in accordance with the details on the Drawings and as specified herein using new materials, and all work shall be performed in a workmanlike manner satisfactory to the Engineer. Prior to the beginning of the work or upon the request of the Contractor, the Engineer shall locate the position of the work by establishing and marking the property line or fence line. The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail.

6.2-3.2 **CLEARING FENCE LINE.** The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the level ground. The fence line shall be cleared to a minimum width of 60 cm on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be placed a uniform distance above ground, as specified in the Drawings. All holes remaining after post and stump removal shall be refilled with suitable

soil, gravel, or other material acceptable to the Engineer and shall be compacted properly with tampers.

The work shall include the handling and disposal of all material cleared, excavated or removed, regardless of the type, character, composition, or condition of such material encountered.

### 6.2-3.3 BRICK STRUCTURES

- a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of plain concrete mixed, prepared, and placed on the crushed stones in accordance with the requirements of Sections 3.1.1 and 4.2 of this Special Provision.
- b. Laying Brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it which can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and relaid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.
- c. Joints. All joints shall be slushed with mortar at every course, but slushing alone will not be considered adequate for making an acceptable joint. Exterior faces shall be laid up in advance of backing. Exterior faces shall be back plastered or pargeted with a coat of mortar not less than 9 mm thick before the backing is laid up. Prior to pargeting, all joints on the back of face courses shall be cut flush. Unless otherwise noted, joints shall be not less than 6 mm nor more than 12 mm wide and whatever width is adopted shall be maintained uniform throughout the work.

- d. **Pointing.** Face joints shall be neatly struck, using the weather joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.
- e. **Topping.** The topping of the brick fence shall be plastered with 2 cm thick mortar inlaid with pieces of broken glasses shown on the Drawings.
- f. **Cleaning.** Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing down with water and, if necessary to produce satisfactory results, cleaning shall be done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of clean fresh water.
- g. **Curing and Cold Weather Protection.** In hot or dry weather, or when directed by the Engineer, the brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost in the brick or when the air temperature is below 10 C unless the Contractor has on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 15 C for the duration of the curing period.

6.2-3.4 **MACADAM STONE BEDDING.** Macadam stone bedding work shall conform to Section 3.1.1 of this Special Provision.

6.2-3.5 **CONCRETE WORK.** The forms for and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Section 4.2 of this Special Provision.

6.2-3.6 **BACKFILLING.** After the concrete has set sufficiently, the spaces adjacent to the brick fence shall be refilled to the required elevation with material specified on the Drawings.

Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the brick work involved.

6.2-3.7 **CLEANING UP.** The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction.



**6.2.4 Method of Measurement**

6.2-4.1 Brick work shall be measured by the number of cubic meters of brick materials in accordance with the dimensions shown on the Drawings or ordered by the Engineer. No measurements or other allowances shall be made for mortar, broken glasses for topping, excavation, and back-filling.

6.2-4.2 Concrete shall be measured by the number of cubic meters in accordance with the dimensions shown on the Drawings or ordered by the Engineer.

6.2-4.3 Macadam stone bedding or backfilling shall be measured by the number of cubic meters of materials compacted in place and accepted.

**6.2.5 Basis of Payment**

6.2-5.1 Payment shall be made at the Contract unit price per cubic meter for brick work or in-situ concrete or macadam stone bedding. These prices shall be full compensation for furnishing all materials and for all preparation, delivering, laying and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-2-1	Brick work	cubic metre
I-5-2-2	In-situ concrete (C15)	cubic metre
I-5-2-3	Macadam stone bedding	cubic metre

## **SECTION 6.3 STEEL FENCE**

### **6.3.1 Description**

6.3-1.1 This item shall consist of construction of steel fences in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the Drawings or required by the Engineer.

### **6.3.2 Materials**

6.3-2.1 **STEEL REINFORCEMENT.** Reinforcing bars shall conform to the requirements of applicable GB standards.

- a. Round bars specified as 10 mm or less  
GB 1498-91 or JIS G 3112 (Grade SR 24)
- b. Deformed bars specified as 10 mm or more  
GB 1499-91 or JIS G 3112 (Grade SD 30)

6.3-2.2 **STRUCTURAL STEEL.** All structural steel shall be new and shall conform to the following Specifications:

- a. Unless otherwise specified, structural carbon steel shall be furnished.
- b. Structural carbon steel shall conform to the specification for steel for bridges and buildings of GB 699-88.
- c. High-strength Structural Rivet Steel shall conform to the specification for steel of AASHTO M187 (ASTM A440).
- d. High-Strength Structural Rivet Steel shall conform to the specification for the High-Strength Structural Rivet Steel, AASHTO M228 (Grade 2).
- e. Bolts, nuts, and washers shall conform to requirements of the specification for Quenched and Tempered Steel Bolts and Studs, with suitable nuts and plain hardened washers, GB [ ]. Bolts manufactured to this specification are identified by marking on the top of the head with three radial lines.

6.3-2.3 **STONE BEDDING MATERIALS.** Macadam stone bedding materials shall conform to the requirements of Section 3.1.1 of this Special Provision.

6.3-2.4 **CONCRETE.** Plain concrete shall meet the requirements of Section 4.2 of this Special Provision.

### 6.3.3 **Construction Methods**

6.3-3.1 **GENERAL.** The fence shall be constructed in accordance with the details on the Drawings and as specified herein using new materials, and all work shall be performed in a workmanlike manner satisfactory to the Engineer. Prior to the beginning of the work or upon the request of the Contractor, the Engineer shall locate the position of the work by establishing and marking the property line or fence line. The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail.

6.3-3.2 **CLEARING FENCE LINE.** The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the level ground. The fence line shall be cleared to a minimum width of 60 cm on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be placed a uniform distance above ground, as specified in the Drawings. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other material acceptable to the Engineer and shall be compacted properly with tampers.

The work shall include the handling and disposal of all material cleared, excavated or removed, regardless of the type, character, composition, or condition of such material encountered.

6.3-3.3 **PLACING REINFORCEMENT.** All reinforcement shall be accurately placed, as shown on the Drawings, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

### 6.3-3.4 **STRUCTURAL STEEL WORK**

#### a. **Fabrication**

(1) Rolled material, before being laid off or worked, must be straight. If straightening is necessary, it shall be done by methods that will not injure the metal. Sharp kinks and bends shall be cause for rejection of the material.

(2) Portions of the work exposed to view shall be finished neatly. Shearing, flame cutting and chipping shall be done carefully and accurately.

(3) All connections shall be with bolts and as shown on the Drawing and as approved by the Engineer.

- i) Bolts shall be unfinished, turned, or an approved form of ribbed bolt. Bolted connections shall be used only as indicated by the plans or special provisions. Bolts shall have single self-locking nuts or double nuts. Beveled washers shall be used where bearing faces have a slope of more than 1 : 20 with respect to a plane normal to the bolt axis.

Except as otherwise provided in this article, construction shall conform to applicable specifications for riveted structures.

- ii) Unfinished bolts shall be standard bolts (ordinary rough or machine bolts).
- iii) Holes for turned bolts shall be carefully reamed and the bolts turned to a light driving fit with the treads entirely outside of the holes and a washer shall be used. Turned bolts shall be finished by a finishing cut. Heads and nuts shall be hexagonal.
- iv) Ribbed bolts shall make a driving fit with the holes. If for any reason the bolt twists before drawing tight, the hole shall be carefully reamed and an oversize bolt used as a replacement. Nuts shall be hexagonal.

(4) Connections using High-Tensile-Strength bolts:

- i) This specification covers the assembly of structural joints using ASTM A325 high strength steel bolts tightened to a high tension. The bolts are used in holes slightly larger than the nominal bolt size.

Construction shall conform to the applicable specification for riveted or welded structures of wrought iron, carbon structural steel and high strength steel, except as otherwise provided herein.

- ii) Bolts, nuts and washers shall conform to requirements of the current edition of the specification for Quenched and Tempered Steel Bolts and Studs with Suitable Nuts and Plain Hardened Washers, GB [     ], except as hereinafter provided.

Bolt dimensions shall conform to the current requirements for regular semi-finished hexagon bolts of GB [ ] except as hereinafter provided. Alternatively, bolts may be furnished meeting one of the following descriptions.

- 1) Hexagon head having same height as regular semi-finished hexagon bolt but having width across flats equal to corresponding heavy semi-finished hexagon bolt.
- 2) Interference-body bolts, with heads conforming to the dimensions for driven button heads of GB [ ] for larger rivets of the same nominal diameter, except that the head may be flattened to the same height as the head of the regular semi-finished hexagon bolt. Interference-bodies are not to be used in other than ASTM A7 and A373 Steel.

Nut dimensions shall conform to current requirements for heavy semi-finished hexagon nuts of GB [ ]. Alternatively, finished hexagon nuts, conforming to GB [ ] and meeting the requirements of ASTM Specification A194, Grade 2H, may be used instead of heavy semi-finished hexagon nuts.

Circular washers shall be flat and smooth, and their nominal dimensions shall be not less than those given in the following Table of Washer Dimensions with ASA Standard B27.2 Type A washer tolerances applied to these nominal dimensions. Beveled washers shall be square or rectangular, taper in thickness, and conform to the dimensions given in the Table.

**TABLE OF WASHER DIMENSIONS (Inches)**

Bolt size (Inch)	Circular Washers			Square or Rectangular Washer for American Standard Beams and Channels			
	Inside Dia. (Inch)	Minimum Outside Dia. (Inch)	Nom Thick Gage No.	Nom Thick (Inch)	Minimum Width (Inch)	Mean Thickness (Inch)	Slope in Taper in Thickness
1/2	9/16	1 3/8	12	0.109	1 3/4	5/16	1:6
5/8	11/16	1 1/2	10	0.134	1 3/4	5/16	1:6
3/4	13/16	1 3/4	9	0.148	1 3/4	5/16	1:6
7/8	15/16	2	8	0.165	1 3/4	5/16	1:6
1	1 1/16	2 1/4	8	0.165	1 3/4	5/16	1:6
1 1/8	1 1/4	2 1/2	8	0.165	2 1/4	5/16	1:6
1 1/4	1 3/8	2 3/4	8	0.165	2 1/4	5/16	1:6

1 3/8	1 1/2	3	7	0.180	2 1/4	5/16	1:6
1 1/2	1 5/8	3 3/4	7	0.180	2 1/4	5/16	1:6

\* Not to be increased if larger washers are used.

When necessary, washers may be clipped on one side to a point not closer than 7/8 of the bolt diameter from the edge of the hole in the washer.

- iii) Surfaces of bolted parts in contact with the bolt and nut shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material. Holes may be punched, sub-punched and reamed, or drilled, as required by the applicable specification and shall be of a nominal diameter not more than 1.5 mm. in excess of the nominal bolt diameter.

When assembled, all joint surfaces, including those adjacent to the washers shall be free of scale except tight mill scale. They shall be free of dirt, loose scale, burrs, and other defects that would prevent solid seating of the parts.

Contact surfaces within friction-type joints shall be free of oil, paint, or galvanizing.

- iv) Bolts shall be installed with a hardened washer under the nut or bolt head, whichever is the element turned in tightening. A hardened washers shall also be used under the head of regular semi-finished hexagon bolts and under finished hexagon nuts, even when these are not the elements turned in tightening. The washer may be omitted under the head of heavy semi-finished hexagon bolts and interference-body bolts and under heavy semi-finished hexagon nuts, when these are not the element turned. A flat washer may be used when the abutment surface adjacent to the bolt head or nut does not have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis, a smooth beveled washer shall be used to compensate for lack of parallelism.

All fasteners shall be tightened to give at least the required minimum bolt tension values shown in the following table on completion of the joint. Tightening shall be done with properly calibrated wrenches or by the turn of nut method.

## TABLE OF BOLT TENSION

Bolt Size (Inch)	Required Minimum Bolt Tension Kgs.
1/2	5,500
5/8	8,750
3/4	13,000
7/8	14,500
1	21,500
1-1/8	25,500
1-1/4	31,500
1-3/8	38,500
1-1/2	47,250

\* Equal to the proof load of bolt given in ASTM A325.

Calibrated wrenches: When calibrated wrenches are used to provide the bolt tension specified in the above Table of Bolt Tension, their setting shall be such as to induce a bolt tension slightly in excess of this value. These wrenches shall be calibrated by tightening, in a device capable of indicating actual bolt tension not less than three typical bolts from the lot to be installed. Power wrenches shall be adjusted to stall or cutout at the selected tension. If manual torque wrenches are used, the torque indication corresponding to the calibrating tension shall be noted and used in the installation of all bolts of the tested lot. Nuts shall be in tightening motion when torque is measured. When using calibrated wrenches to install several bolts in single joint, the wrench shall be returned to "touch up" bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the prescribed amount. Turn-of-nut: before final tightening of the bolts by this method, the several parts of the joint shall be properly compacted by bringing a sufficient number of bolts to snug tight condition such as can be produced by a few blows of an impact wrench, or by an ordinary spud wrench. All bolts shall be tightened in accordance with the provisions given in following table, progressing from the most rigid part of the joint towards the free edges, after being brought to a snug tight fit.

Bolt Diameter (Inches)	From snug tight rotate nuts*	
	<u>1/2 turn for grips</u>	<u>3/4 turn for grips</u>
3/4	5 in. and under	above 5 in.

7/8	5 in. and under	above 5 in.
1	8 in. and under	above 8 in.
1-1/8	8 in. and under	above 8 in.
1-3/4	8 in. and under	above 8 in.
1-3/8	8 in. and under	above 8 in.
1-1/2	8 in. and under	above 8 in.

- \* Permissible tolerance: 1/4 turn over, nothing under. Impact wrenches shall be of adequate capacity and sufficiently supplied with air to perform the required tightening in approximately ten seconds.

If required because of bolt entering and wrench operation clearances, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating, provided both bolt head and nut bear against surfaces having slopes not greater than 1:20.

- v) The Engineer shall satisfy himself that all requirements of this specification are met.

The Engineer shall approve the procedure for calibration wrenches and installation of bolts and shall further observe the field installation to determine that these procedures are followed.

Spot checks should be made with a manual torque wrench that has been calibrated as previously specified herein.

- (5) Sheared edges of plates more than 15 mm. in thickness and carrying calculated stress shall be planed to a depth of 6 mm. Re-entrant cuts shall be filleted before cutting.
- (6) Welding of steel structures, when authorized in accordance with the design criteria or required by the drawings shall conform to requirements for welding as covered in these specifications.
- (7) Finished members shall be true to line and free from twists, bends and open joints.
- (8) Cold-bent load-carrying rolled steel plates shall conform to the following:
  - a. They shall be so taken from the stock plates that the bendline will be at right angles to the direction of rolling.



- b. The radius of bends, measured to the concave face of the metal, shall not be less and preferably shall be greater than shown in the following table, in which "T" is the thickness of the plates:

Minimum Radius

61 degrees to 90 degrees	1.0T
91 degrees to 120 degrees	1.5T
121 degrees to 150 degrees	2.0T

- c. Before bending, the corners of the plate shall be rounded to a radius of 1.5 mm. throughout that portion of the plate at which the bending is to occur.

- (9) Pins shall be accurately turned to the dimensions shown on the drawings and shall be straight, smooth, and free from flaws.

Pins 18 cm. or less in diameter shall be either forged and annealed or cold-finished carbon-steel shafting.

- (10) The Contractor shall give the Engineer ample notice of the beginning of work at the mill or in the shop, so that inspection may be provided. The term "mill" means any rolling mill or foundry where material for the work is to be manufactured. No material shall be manufactured or work done in the shop before the Engineer has been notified.

- (11) The Contractor shall furnish facilities for the inspection of material and workmanship in the mill and shop, and the inspectors shall be allowed free access to the necessary parts of the work.

- (12) Inspectors shall have the authority to reject any material or work which does not meet the requirements of these specifications. In case of dispute the Contractor may appeal to the Engineer, whose decision shall be final.

- (13) The Contractor shall furnish the Engineer with as many copies of mill order as the Engineer directs.

- (14) Each member shall be painted or marked with an erection mark for identification and an erection diagram shall be furnished with erection marks shown thereon. Members shall also be properly marked to indicate the type of steel.

The Contractor shall furnish to the Engineer as many copies of material orders, shipping statements and erection diagrams as the Engineer may direct.

- (15) Inside to inside of holes in compression members shall not vary from that specified more than 0.8 mm. Boring of holes in built-up members shall be done after the riveting is completed.
- (16) The diameter of the pin hole shall not exceed that of the pin by more than 0.5 mm. for pins 12.5 cm. or less in diameter, or 0.8 mm. for larger pins.
- (17) Threads for all bolts and pins for structural steel construction shall conform to the American National Coarse Thread Series, Class 2, free fit, except that the pin ends having a diameter of 3.8 cms. or more shall be threaded six threads to the 2.5 cm. length.
- (18) Two pilot nuts and two driving nuts for each size of pin shall be furnished, unless otherwise specified.
- (19) The Contractor shall give the Engineer ample notice of the beginning of work at the mill or in the shop, so that inspection may be provided. The term "mill" means any rolling mill or foundry where material for the work is to be manufactured. No material shall be manufactured or work done in the shop before the Engineer has been notified.
- (20) The Contractor shall furnish facilities for the inspection of material and workmanship in the mill and shop, and the inspectors shall be allowed free access to the necessary parts of the work.

**b. Erection**

- (1) The Contractor shall erect all metal work to conform and do to the lines and elevations as shown on the Drawings and as directed by the Engineer.
- (2) Bearing plates shall be set level in exact position and shall have a full and even bearing upon the masonry.
- (3) The parts shall be accurately assembled as shown on the Drawings and any match-marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken, or otherwise damaged. Hammering which will injure or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.
- (4) The correction of minor misfits involving harmless amounts of reaming, cutting and chipping will be considered a legitimate part of the erection.

However, any error in the shop fabrication or deformation resulting from handling and transportation which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the inspector and his approval of the method of correction obtained. The correction shall be made in his presence. The Contractor shall be responsible for all misfits, errors and injuries and shall make the necessary corrections and replacement.

6.3-3.5 **MACADAM STONE BEDDING.** Macadam stone bedding work shall conform to Section 3.1.1 of this Special Provision.

6.3-3.6 **CONCRETE WORK.** The forms for and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Section 4.2 of this Special Provision.

6.3-3.7 **BACKFILLING.** After the concrete has set sufficiently, the spaces adjacent to the brick fence shall be refilled to the required elevation with material specified on the Drawings.

Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the concrete involved.

6.3-3.8 **CLEANING UP.** The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction.

**6.3.4 Method of Measurement**

6.3-4.1 Reinforcing steel shall be measured by the calculated theoretical number of tons placed, as shown on the Drawings, complete in place and accepted. The unit weight used for deformed bars shall be the weight of plain square or round bars of equal nominal size.

6.3-4.2 Structural steel shall be measured by the calculated theoretical number of tons placed, as shown on the Drawings, complete in place and accepted.

6.3-4.3 Concrete shall be measured by the number of cubic meters in accordance with the dimensions shown on the Drawings or ordered by the Engineer. No measurements or other allowances shall be made for excavation, stone bedding, and back-filling.

**6.3.5 Basis of Payment**

- 6.3-5.1 Payment shall be made at the Contract unit price per ton for steel reinforcement. These prices shall be full compensation for furnishing all materials and for all preparation, delivering, placing and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.3-5.2 Payment shall be made at the Contract unit price per ton for structural steel. These prices shall be full compensation for all labor, materials, transportation, erection, equipment, and incidentals necessary to complete the work as specified, including shop drawings, riveting, welding, shop and field paintings, anchor bolts and nuts, bearing and base plates, and pins, and all other incidentals required.
- 6.3-5.3 Payment shall be made at the Contract unit price per cubic meter for concrete. These prices shall be full compensation for furnishing all materials and for all preparation, excavation, stone bedding, backfilling and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-3-1	Reinforcement bar	ton
I-5-3-2	Structural steel	ton
I-5-3-3	In-situ concrete (C15)	cubic metre

## SECTION 6.4 GATE

### 6.4.1 Description

6.4-1.1 This item covers the requirements for furnishing materials and constructing gates with steel posts in accordance with the details included herein and as shown on the Drawings.

### 6.4.2 Materials

6.4-2.1 **STEEL REINFORCEMENT.** The steel reinforcement shall meet the requirements of Section 6.3 of this Special Provision.

6.4-2.2 **STRUCTURAL STEEL.** The structural steel shall meet the requirements of Section 6.3 of this Special Provision.

### 6.4-2.3 WIRE.

- a. **Woven Wire (Zinc-coated).** The woven wire fencing shall be 7-bar, 66 cm field fence with top and bottom wires No. 10 ASW gauge, and filler and stay wires No. 12 1/2 ASW gauge. Stay wires shall be spaced 150 mm apart. All wire shall be smooth galvanized steel wire conforming to Fed. Spec. RR-F-221, Type B. All wires shall be two-dip and spaced as shown on the Drawings.
- b. **Barbed Wire (Zinc-coated).** Zinc-coated barbed wire shall be 2-strand twisted No. 12 1/2 ASW gauge galvanized steel wire with 4-point barbs of No. 14 ASW gauge galvanized steel wire. All wire shall conform to Fed. Spec. RR-F-221, Type A or JIS G 3533. The barbs shall be spaced approximately 100 mm apart.
- c. **Barbed Wire (Copper-covered).** Copper-covered steel barbed wire shall conform to Fed. Spec. RR-F-221, Type A.
- d. **Barbed Wire (Aluminum-coated).** Aluminum-coated steel barbed wire shall be 2-strand twisted No. 12 1/2 ASW gauge. The 4-point barbs of No. 14 ASW gauge aluminum-coated steel wire shall be spaced approximately 125 mm apart. The steel wire shall have a tensile strength of between 41,340 and 55,120 kPa and the aluminum coating shall have a minimum weight of 0.07 kilogram per square meters of wire surface on the No. 12 1/2 ASW gauge line wire and 0.06 kg/square meter of wire surface on the No. 14 ASW gauge barbs.

- e. **Bracing Wire (Zinc-coated).** Wire used for cable for bracing shall be No. 9 smooth galvanized soft wire.

**6.4-2.4 POSTS, POST TOPS AND EXTENSIONS, RAILS, BRACES, AND ACCESSORIES.**

- a. These items, when specified, shall conform to the requirements of Fed. Spec. RR-F-191, or JIS G 3350, JIS G 3444. When these items are furnished for use in conjunction with zinc-coated steel fabric, they shall be of zinc-coated steel.
- 2) Gate posts shall be of tubular steel pipe, seamless or welded conforming to ASTM A 500 or A 501 of size, or JIS G 3350 weight and detail shown; and hot-dip galvanized after fabrication with coating weight not less than required for similar items specified above.
- 3) Miscellaneous fittings and hardware shall be to the design standards of the manufacturers, shall be zinc-coated steel wrought iron, or malleable iron, and shall be equal to materials specified in Fed. Spec. RR-F-183.
- 4) Welding shall be carried out by means of full automatic welding in a factory to the satisfaction of the Engineer. Welding rods shall conform to the requirements of JIS Z 3211 or JIS Z 3212.
- 5) Structural members of gates which are in contact shall be fully welded by a method that will procure a continuous weld on all sides and faces of joints at exposed edges.

**6.4-2.5 STONE BEDDING MATERIALS.** Macadam stone bedding materials shall conform to the requirements of Section 3.1.1 of this Special Provision.

**6.4-2.6 CONCRETE.** Plain concrete shall meet the requirements of Section 4.2 of this Special Provision.

**6.4-2.7 BRICK.** Brick and mortar shall meet the requirements of Section 6.2 of this Special Provision.

**6.4.3 Construction Methods**

**6.4-3.1 GENERAL.** The fence shall be constructed in accordance with the details on the Drawings and as specified herein using new materials, and all work shall be performed in a workmanlike manner satisfactory to the Engineer. Prior to the beginning of the work or upon the request of the Contractor, the Engineer shall locate the position of the work by establishing and marking the property line or fence line.

The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail.

- 6.4-3.2 **CLEARING FENCE LINE.** The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. The fence line shall be cleared to a minimum width of 60 cm on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be placed a uniform distance above ground, as specified in the Drawings. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other material acceptable to the Engineer and shall be compacted properly with tampers.

The work shall include the handling and disposal of all material cleared, excavated or removed, regardless of the type, character, composition, or condition of such material encountered.

- 6.4-3.3 **INSTALLING POSTS.** All posts shall be spaced as shown on the Drawings. Corner, brace, anchor, end, and gate posts shall be set in concrete bases as shown on the Drawings. The top of the base shall be slightly above the ground surface, trowel finished, and sloped to drain. Holes of full depth and size for the concrete bases for posts shall be provided even if blasting of rock or other obstructions is necessary. All line posts may be either driven or set in dug holes to a penetration of 3 feet (90 cm). All post setting shall be done carefully and to true alignment. Dirt removed for placing posts, anchor bars, flanges, etc., shall be replaced, tamped, and leveled. When posts are driven, care shall be exercised to prevent marring or buckling of the posts. Damaged posts shall be replaced at the Contractor's expense.

- 6.4-3.4 **BRACING.** All corner, anchor, end, and gate posts shall be braced as shown on the Drawings. Anchor posts shall be set at approximately 150 meters intervals and braced to the adjacent posts.

- 6.4-3.5 **INSTALLING WIRE.** All barbed wire and woven wire shall be placed on the side of the post away from the airport, or as directed, at the height indicated on the Drawings. The woven wire shall be carefully stretched and hung without sag and with true alignment. Care shall be taken not to stretch the wire so tightly that it will break in cold weather or pull up corner and brace posts. All horizontal wires shall be fastened securely to each post by fasteners or clips designed for use with the posts furnished. The woven wire shall be wrapped around end, corner, and gate posts, and the ends of all horizontal wires shall be tied with snug, tight twists. The wire shall be secured to prevent slipping up and down the post. Barbed wire strands shall be stretched and each strand secured to each post to prevent slipping out of line or

becoming loose. At end, corner, and gate posts the barbed wire shall be securely wrapped and anchored once about the post from outside and secured against slipping by tying the ends with snug, tight twists. However, on spans of less than 30 m both ends of the span need not be wrapped around the posts. The bottom wire of the woven wire fencing shall clear the ground by not more than 100 mm or less than 25 mm at any place.

6.4-3.6 **SPICING WIRE.** Splices in barbed and woven wire will be permitted if made with an approved galvanized bolt-clamp splice or a wire splice made as follows: The ends of each wire shall be carried 75 mm past the splice tool and wrapped around the other wire for at least six turns in opposite directions. After the tool is removed, the space occupied by it shall be closed by pulling the ends together. The unused ends of the wire shall be cut close to make a neat, workmanlike job.

6.4-3.7 **PLACING REINFORCEMENT.** All reinforcement shall be accurately placed, as shown on the Drawings, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

6.4-3.8 **INSTALLING GATES.** The gates shall be hung on gate fittings as shown on the Drawings. They shall be attached in such a manner that the gate cannot be lifted off the hinges. Gates shall be erected to swing in the direction indicated and shall be provided with gate stops, as specified or as shown on the Drawings. Gates shall be erected at locations shown on the Drawings.

6.4-3.9 **STONE BEDDING.** Stone bedding work shall conform to Section 3.1.1 of this Special Provision.

6.4-3.10 **CONCRETE WORK.** The forms for and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Section 4.2 of this Special Provision.

6.4-3.11 **BRICK WORK.** The brick work and mortar plastering shall conform to Section 6.2 of this Special Provision.

6.4-3.12 **BACKFILLING.** After the concrete has set sufficiently, the spaces adjacent to the brick fence shall be refilled to the required elevation with material specified on the Drawings.

Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the concrete involved.



6.4-3.13 **CLEANING UP.** The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction.

6.4.4 **Method of Measurement**

6.4-4.1 Gates shall be measured in units for each gate installed and accepted.

6.4.5 **Basis of Payment**

6.4-5.1 Payment will be made at the Contract unit price per each for gates. This price shall be full compensation for furnishing all materials and for all preparation, excavation, concreting, brick work, and backfilling erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-4	Gate	each

## **SECTION 6.5 BLAST FENCE**

### **6.5.1 Description**

6.5-1.1 This item shall consist of construction of a blast fence of reinforced concrete structure in accordance with these specifications, at the specified locations and conforming to the lines, grades, cross sections and dimensions shown on the Drawings or required by the Engineer.

### **6.5.2 Materials**

6.5-2.1 **STONE BEDDING MATERIALS.** Crushed stone bedding materials shall conform to the requirements of Section 3.1.1 of this Special Provision.

6.5-2.2 **CONCRETE.** Reinforced concrete shall meet the requirements of Section 4.2 of this Special Provision.

6.5-2.3 **STEEL REINFORCEMENT.** Reinforcing bars shall meet the requirements of Section 4.2 of this Special Provision.

### **6.5.3 Construction Methods**

#### **6.5-3.1 EXCAVATION.**

- a. Foundations for the blast fence shall be excavated to the lines and grades or elevations shown on the Drawings. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.
- b. The foundation base upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. When required, a layer of approved granular material, compacted to the thickness indicated on the Drawings, shall be placed to form a foundation base.
- c. When using equipment to excavate the blast fence foundation, care must be taken to ensure that no damage is caused to the soil structure for the bottom of the ditch. If it is difficult to accurately level or smooth the ditch based on the height of the bottom of the drain ditch, the equipment shall be used to excavate only to a depth that is 20 cm above the planned ditch height, and the remaining excavation must be performed manually.

d. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All satisfactory materials shall be hauled and placed in fills, and unsuitable materials shall be placed in spoil areas or as directed by the Engineer.

6.5-3.2 **MACADAM STONE BEDDING.** Macadam stone bedding work shall conform to Section 3.1.1 of this Special Provision.

6.5-3.3 **CONCRETE WORK.** The forms for and the mixing, placing, finishing, and curing of concrete and placement of reinforcement shall conform to the requirements of Section 4.2 of this Special Provision.

5.4-3.4 **BACKFILLING.** After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with material specified on the Drawings and compacted by mechanical equipment to at least 90% of the maximum density as determined by ASTM D 698 or JTJ 051-93. The in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 or JTJ 051-93.

6.5-3.5 **CLEANING AND RESTORATION OF SITE.** After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

**6.5.4 Method of Measurement**

6.5-4.1 Concrete shall be measured by the number of cubic meters in accordance with the dimensions shown on the Drawings or ordered by the Engineer. No measurements or other allowances shall be made for excavation, backfilling, formwork, or finishing of the concrete.

6.5-4.2 Macadam stone bedding or backfilling shall be measured by the number of cubic meters of materials compacted in place and accepted.

6.5-4.3 Reinforcing steel shall be measured by the calculated theoretical number of tons placed, as shown on the Drawings, complete in place and accepted. The unit weight used for deformed bars shall be the weight of plain square or round bars of equal nominal size.

**6.5.5 Basis of Payment**

- 6.5-5.1 Payment shall be made at the Contract unit price per cubic meter for each class of concrete. These prices shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling, formwork and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.5-5.2 Payment shall be made at the Contract unit price per cubic meter for crushed stone bedding. These prices shall be full compensation for furnishing all materials and for all preparation, delivering, placing and compacting of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.
- 6.5-5.3 Payment shall be made at the Contract unit price per ton for steel reinforcement. These prices shall be full compensation for furnishing all materials and for all preparation, delivering, placing and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-5-1	Blast wall concrete (C20)	cubic metre
I-5-5-2	Web concrete (C20)	cubic metre
I-5-5-3	Footing concrete (C20)	cubic metre
I-5-5-4	Leveling concrete (C10)	cubic metre
I-5-5-5	Macadam stone bedding	cubic metre
I-5-5-6	Reinforcement bar	ton

## SECTION 6.6 CABLE DUCT

### 6.6.1 Description

6.6-1.1 This item shall consist of cable ducts constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the Drawings or required by the Engineer.

### 6.6.2 Materials

6.6-2.1 **STONE BEDDING MATERIALS.** Macadam stone bedding materials shall conform to the requirements of Section 3.1.1 of this Special Provision.

6.6-2.2 **CONCRETE.** Plain concrete shall meet the requirements of Section 4.2 of this Special Provision.

6.6-2.3 **MOTAR.** Mortar for joint filling shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of GB 175. The sand shall conform to the requirements of ASTM C 144 or JT 1003-66 or GB [ ].

### 6.6.3 Construction Methods

#### 6.6-3.1 EXCAVATION.

- a. Foundations for cable ducts shall be excavated to the lines and grades or elevations shown on the Drawings. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown.
- b. The foundation base upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. When required, a layer of approved granular material, compacted to the thickness indicated on the Drawings, shall be placed to form a foundation base.
- c. When using equipment to excavate the cable duct foundation, care must be taken to ensure that no damage is caused to the soil structure for the bottom of the ditch. If it is difficult to accurately level or smooth the ditch based on the height of the bottom of the drain ditch, the equipment shall be used to excavate only to a depth that is 20 cm above the planned ditch height, and the remaining excavation must be performed manually.

d. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All satisfactory materials shall be hauled and placed in fills, and unsuitable materials shall be placed in spoil areas or as directed by the Engineer.

6.6-3.2 **MACADAM STONE BEDDING.** Macadam stone bedding work shall conform to Section 3.1.1 of this Special Provision.

6.6-3.3 **CONCRETE WORK.** The forms for and the mixing, placing, finishing, and curing of concrete and placement of reinforcement shall conform to the requirements of Section 4.2 of this Special Provision.

6.6-3.4 **MORAR JOINT FILLING.** The duct joints shall be filled with a 1.5 cm thick mortar (M 7.5) shown on the Drawings.

6.6-3.5 **BACKFILLING.** After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with sand specified on the Drawings and compacted by mechanical equipment to at least 90% of the maximum density as determined by ASTM D 698 or JTJ 051-93. The in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 or JTJ 051-93.

6.6-3.6 **CLEANING AND RESTORATION OF SITE.** After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

#### 6.6.4 **Method of Measurement**

6.6-4.1 The quantity of unclassified excavation to be paid for shall be the number of cubic meters, measured in original position, of material excavated and disposed in accordance with the Drawings, or as directed by the Engineer.

6.6-4.2 Concrete shall be measured by the number of cubic meters in accordance with the dimensions shown on the Drawings or ordered by the Engineer.

6.6-4.3 Macadam stone bedding or backfilling with sand shall be measured by the number of cubic meters of materials compacted in place and accepted.

6.6-4.4 Cement mortar shall be measured by the number of square meters of materials in place, completed, and accepted.

**6.6.5 Basis of Payment**

6.6-5.1 Payment for excavation shall be made at the Contract unit price per cubic meter. These prices shall be full compensation for excavation, hauling and disposing excavated materials, and for furnishing all labor, equipment, tools, and incidentals necessary to complete the item.

6.6-5.2 Payment shall be made at the Contract unit price per cubic meter for in-situ concrete, or macadam stone bedding or backfilling with sand; and at the Contract unit price per square meter for mortar. These prices shall be full compensation for furnishing all materials and for all preparation, delivering, placing and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-8-1	Excavation	cubic metre
I-5-8-2	Crushed stone bedding	cubic metre
I-5-8-3	Filling with sand	cubic metre
I-5-8-4	In-situ concrete (C20)	cubic metre
I-5-8-5	Cement mortar (M7.5)	square metre

## **SECTION 6.7 MISCELLANEOUS STEEL WORK**

### **6.7.1 Description**

This item shall consist of furnishing, bending and placing reinforcement bars of the type and size shown on the Drawings for lighting facilities, hydrant pits, anchoring, and earthing, and in accordance with these Specifications.

### **6.7.2 Materials**

#### **6.7-2.1 Reinforcement Ssteel and Wire Mesh**

- a. All reinforcing steel bars and steel mesh shall conform to the requirements of the following specifications except that the weights of the standard bar sizes will be taken as the Table, irrespective of the specification used in manufacture and shall be from an approved manufacturer. The Contractor shall submit mill certificates of the reinforcement prepared by the manufacturer to the Engineer for his approval.

(1) Round bars specified as 10 mm or less  
GB 1498-91 or JIS G 3112 (Grade SR 24)

(2) Deformed bars specified as 10 mm or more  
GB 1499-91 or JIS G 3112 (Grade SD 30)

b. Mesh Reinforcement

Material to be used for mesh reinforcement shall conform to JIS G 3111, JIS G 3112, or GB [ ], and standard mesh size is 125 mm as shown.

c. Welding Rod

Welding rod shall conform to the requirement of JIS Z 3211 or JIS Z 3212 and the usage of it shall be subject to the Engineer's approval.

d. Welding Equipment

Alternating current arc welding machine shall be used for welding operation.

e. Overlapping

Joint of mesh reinforcement shall be of overlapping joint method and the length



to be overlapped shall be one mesh or some 20 cm.

f. Bending

The Contractor shall satisfy himself as to the accuracy of any bar bending schedule supplied and shall be responsible for cutting, bending and fixing the reinforcement in accordance with the Drawings.

**6.7.3 Construction Requirement**

**6.7-3.1 Storage and Protection**

- a. All reinforcement shall be delivered to the Site either in straight lengths or cut and bent. No reinforcement shall be accepted in long lengths which have been transported while doubly bent.
- b. Reinforcement steel shall be protected at all times from damage by storing on blocking, racks, or platforms.
- c. Prior to placing concrete, reinforcing steel which is to be embedded, shall be free from rust, dirt, mud, loose scale, paint, oil, or any other foreign substance. If considered necessary by the Engineer, grit blasting shall be employed to clean bars at no extra cost to the Contract.
- d. Any reinforcement which is likely to remain in storage for along period shall be protected form the weather so as to avoid corrosion and pitting. All reinforcement which has become corroded or pitted to an extent which, in the opinion of the Engineer, will affect its properties and that of concrete shall either be removed from Site or may be tested for compliance with the requirements specified herein at the Contractor's expense.

**6.7-3.2 Bending**

All reinforcing bars requiring bending shall be bent cold and shall be bent in accord with American Concrete Institute procedures unless otherwise detailed. Bars partially embedded in concrete shall not be bent, except as shown or otherwise permitted.

**6.7-3.3 Placing and Fixing**

- a. Reinforcement shall be securely fixed in position within a dimensional tolerance of 20 mm in any direction parallel to the concrete face and within a tolerance of 5 mm at right angles to the face, provided that the cover is not thereby decreased

below the minimum shown on the Drawings, or if not shown, shall be not less than 25 mm or the diameter of the bar, whichever is the greater. Placement of the reinforcing steel in the horizontal work shall not deviate more than plus or minus 6 mm in the vertical direction from the position shown. Cover on the distribution steel, if not indicated on the Drawings, shall be not less than 15 mm or the diameter of the bar, whichever is lesser.

- b. Unless agreed otherwise by the Engineer, all intersecting bars shall either be tied together with a 1.6 mm diameter soft annealed iron wire and the ends of the wire turned into the body of concrete, or shall be secured with a wire clip of a type agreed by the Engineer.
- c. Spacer blocks shall be used for ensuring that the correct cover is maintained on the reinforcement. The blocks, placed at spacings not exceeding 1 m apart transversely or longitudinally, shall be as small as practicable and of a shape agreed by the Engineer. They shall be made of mortar mixed in the proportions of one part of cement to two parts of sand. Wires cast into the blocks for tying in to reinforcement shall be 1.6 mm diameter soft annealed iron wire. Alternatively, other types of spacer blocks may be used subject to the Engineer's agreement.
- d. Reinforcing shall be secured at alternate intersections unless this results in tie spacing more than 30 cm, in which case each intersection shall be tied.
- e. Supports for reinforcing steel shall be spaced not exceeding 1 m apart transversely or longitudinally.
- f. Placement of reinforcing steel in horizontal work shall not deviate more than plus or minus 6 mm in vertical direction from position shown, and in no case shall the cover be reduced below the minimum stipulated.
- g. Concrete shall not be placed in any member until reinforcement placement has been approved by the Engineer.
- h. Except where shown, splicing will not be permitted without approval of the Engineer.
- i. Welding of reinforcing steel will not be permitted unless authorized in writing by the Engineer; and, when so required shall conform to the requirements of GB J 10-65.
- j. Joints in reinforcing steel shall be as the Drawings or as directed by the Engineer.

- k. The length to be overlapped shall be not less than 25 times the diameters of reinforcing steel bars. In case of two different diameters, the greater diameter shall be applied.
- l. Where welded joints are applied on tensile steel bar, reduction of strength at the joint shall be confirmed by testing.
- m. Metal supports which extend to surface shall not be used. Placing bars on layers of fresh concrete as work progresses and adjusting bars during placing of concrete will not be permitted, except any bar accidentally dislocated shall be repositioned as required.
- n. Except where shown on the Drawings, splicing will not permitted without the approval of the Engineer. Main reinforcement bars carrying determinate stresses shall be spliced only where shown on the Drawings or in accordance with the approved shop drawings. In lapped splices, the bars shall be lapped by the required length shown on the Drawings. The bars shall be tied together at several points using the annealed iron wire specified herein above.
- o. The Contractor shall ensure that the reinforcement left exposed in the Works shall not suffer distortion, displacement or other damage. When it is necessary to temporarily bend the protruding reinforcement aside, the radius of the bend shall be not less than four times the diameter of the bar for mild steel bars or six times for high yield bars. Such bends shall be carefully straightened before the placement of concrete continues, without leaving residual kinks or damaging the concrete around the bars. In no circumstances will heating and bending of high yield bars be permitted.
- p. Before concrete is placed in any section of the works which includes reinforcement, the reinforcement shall be completely clean and free from all contamination including concrete and the reinforcement placement has been approved by the Engineer.
- q. Minimum spacing center-to-center of parallel bars shall be 2.5 times diameter of bar, but in no case shall clear distance between bars be less than 1.5 times maximum size of coarse aggregate.
- r. Bundle bars shall be tied together at not more than 1.8 m centers.
- s. All reinforcement shall have a clear coverage not less than that shown on the Drawings.

#### 6.7-3.4 Cooling of Reinforcement

Just prior to the placement of concrete, the reinforcing bars exposed to the sun shall be tested for temperature, and when the bars have become so hot that, in the opinion of the Engineer, the temperature of the fresh concrete shall be affected, the bars shall be covered with a water-soaked burlap or subjected to a spray of cold water by an approved method so that the temperature of the bar shall not exceed the local ambient temperature immediately before embedment in concrete.

#### 6.7.4 Measurement and Payment

Steel reinforcement incorporated in the concrete will be measured in ton based on the total computed weight for the sizes and lengths of bars, mesh or mats shown on the Drawings or authorized.

These weights are given in the following Table:

<u>Nominal Diameter</u> <u>(mm)</u>	<u>Weight (Kg/M)</u>	<u>Type of Bars</u>
6	0.222	Round
9	0.499	Round
10	0.617	Round
12	0.888	Round
13	0.995	Deformed
16	1.580	Deformed
19	2.250	Deformed
22	3.040	Deformed
25	3.980	Deformed
29	5.400	Deformed
32	6.230	Deformed
35	7.510	Deformed

The weight of mesh will be computed for the theoretical weight of plain wire. If the weight per square meter is given on the Drawings, that weight shall be used.

No allowance will be made for clips, wire, separators, wire chairs, and other material used in fastening the reinforcement in place. If bars are substituted upon the Contractor's request and as a result more steel is used than specified, only the amount specified shall be included.

When laps are made for splices, other than those shown on the plans, for the convenience of the Contractor, the extra steel shall not be included.

Payment for steel reinforcement, as determined under measurement, shall be made at the Contract unit price per ton, for all material satisfactory placed and accepted. These prices shall be full compensation for all labor, materials, equipment and incidentals required for furnishing proper installation and completion of the work.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
I-5-9-1	Re-bar for lighting facilities	ton
I-5-9-2	Re-bar for hydrant pits	ton
I-5-9-3	Anchor bar	ton
I-5-9-4	Steel work for earthing	ton

## SECTION 6.8 PRECAST CONCRETE PILE WORK

### 6.8.1 Description

This item shall consist of precast prestressed concrete piling furnished and driven in accordance with these Specifications and in conformity with the requirements on the Drawings or as directed by the Engineer.

The type of piling to be used shall be as indicated on the Drawings. The Engineer may give his approval for the use of alternative types of piling. The Contractor, in submitting an alternative type of pile shall provide design data, pile experience records and calculations supporting the pile design.

### 6.8.2 Materials

#### a. General

The precast pretensioned concrete piles shall be constructed in accordance with the size and cross section shown on the Drawings. They shall be new undamaged members which have not been previously rejected for any reason.

The Contractor shall be responsible for the design of the pile details, and shall submit such shop drawings for the approval of the Engineer at least one month before the Contractor initiates any pile casting operation.

The required pile carrying capacity in term of "allowable working load per pile", and the estimated pile tip elevation are shown on the Drawings.

The precast pretensioned concrete piles shall be so demensioned, constituted, prestressed, cast, cured, handled and driven as to resist without cracking the stresses induced by handling and driving as well as by the design loads as specified. They shall be designed for a two point pick up. Design bending moments shall be increased by a minimum of 50 percent to allow for impact during handling.

The pile shall be so straight that a line stretched from tip to butt on any face shall not more than 1/1000 of the length of the pile from the face of the pile at any point.

Piles shall in all cases be stored and handled in accodance with the recommendations of the pile manufacturer. Particular care shall be taken to avoid dropping or severe jarring while in a horizontal position.

b. Reinforcement

Prestressing reinforcement shall be uncoated stress-relieved wire or uncoated seven-wire stress relieved strand bars.

(1) Uncoated Stress-Relieved Wire:

Uncoated stress-relieved wire shall comply with the requirements of AASHTO M204-78 Type WA, with the following metric substitutions.

**TENSILE STRENGTH REQUIREMENTS**

Nominal Diameter millimeters	Minimum Tensile Strength Kg/cm <sup>2</sup>
5	17,500
7	16,500

**YIELD STRENGTH REQUIREMENTS**

Nominal Diameter millimeters	Initial Stress Kg/cm <sup>2</sup>	Minimum Stress at 1% extension Kg/cm <sup>2</sup>
5	2,050	14,000
7	2,050	13,200

In addition to satisfying the requirements of AASHTO M204-78 the steel wire must satisfy the following relaxation requirements;

Maximum Relaxation after 1,000 hours from	
70% Minimum tensile strength	80% Minimum tensile strength
5%	8.5%

(2) Uncoated Seven-Wire Stress Relieved Strand

Uncoated seven-wire stress relieved strand shall comply with the requirements of AASHTO M203-76, Weldless Grade 250, with the following metric substitutions.

### BREAKING STRENGTH REQUIREMENTS

Nominal Diameter ins	Diameter (mm.)	Breaking Strength Kg	Nominal Steel Area cm <sup>2</sup>	Nominal Mass of Strand Kg/m
1/4	(6.35)	4,100	0.23	0.182
5/16	(7.95)	6,600	0.37	0.293
3/8	(9.52)	9,100	0.52	0.405
7/16	(11.13)	12,300	0.70	0.546
1/2	(12.70)	16,400	0.93	0.729

In addition to satisfying the requirements of AASHTO M203-76 the strand must satisfy the following relaxation requirements;

Maximum Relaxation after 1,000 hours from	
70% Minimum Tensile Strength	80% Minimum Tensile Strength
7%	12%

#### c. Testing of Prestressing Reinforcement

- (1) The Contractor shall supply in the form required by the Engineer manufacturer's certificates of tests on samples taken from each parcel of steel to be used.
- (2) Where directed by the Engineer, the Contractor shall arrange for samples of the steel intended for use in the works to be tested at an approved independent testing laboratory.

### 6.8.3 Construction Requirements

#### a. Driving Equipment



Before any piling work is commenced the Contractor shall submit to the Engineer full details of the pile driving equipment and the method of carrying out the work he intends to use.

The Contractor shall demonstrate to the satisfaction of the Engineer that his driving equipment set-up is fitted with indicator or instrumentation which are capable of measuring reasonably accurately the driving energy imparted to the pile cap or the follower, and which will conveniently facilitate the inspection by the Engineer during pile driving. The equipment shall be in an operating condition, and shall be operated by an experienced operator, such that the driving energy can be properly controlled according to the operation norm of the particular type and make of the equipment. Failure to the above shall constitute the reason for rejection.

Piles shall be driven with gravity hammers; diesel, steam or air hammers.

When gravity hammers are used for driving concrete piles, the drop of the hammer shall not exceed 2.5 metres and the hammer shall have a weight of not less than half the weight of the pile. A certificate of the hammer weight shall be furnished to the Engineer. The equipment set-up shall be fitted with reference pointer, scale, etc.; from which the hammer drop height can be plainly and reasonably gauged by both the driving operator or the inspector.

The plant and equipment furnished for steam and air hammers shall have sufficient capacity to maintain under working conditions the pressure at the hammer specified by the manufacturer. The boiler or tank shall be equipped with an accurate pressure gauge, and another gauge shall be supplied at the hammer intake.

Driving caps and followers shall be capable of protecting the head of the pile can providing a uniform distribution of hammer energy to the pile head, and shall be designed to reduce the absorption of the energy of the hammer blow to a minimum.

Driving caps shall be of an approved design, having a suitable cushion next to the pile head and fitting into a casting which in turn supports a timber shock block. Driving caps shall not restrain the rotation of the piles during driving.

Followers of the approved design may be used to drive the tops of piles below the level of the ground surface at the time of driving to the cut-off grade. Followers shall consist of a cylindrical steel mandrel or wide flange section with cap plates at each end welded perpendicular to the axis on the follower.

**b. Driving**

The alignment of vertical piles shall be carefully checked by means of a carpenter's level, and a transit sighting at the axis of the pile against a string supporting a plumb bob.

The Contractor shall mark each pile at 10 cm intervals along its entire length, with the length figures shown every 50 cm intervals starting from the pile tip.

Driving of a pile shall be continuous without intermission until the pile has been driven to its final proper elevation.

All piles in any one pile group shall be driven before moving to other locations, unless otherwise approved by the Engineer.

The Contractor shall plan the line and direction of his sequence of pile driving such that the disturbance to adjacent driven piles can be kept to a minimum.

No piles shall be driven within eight meters of freshly poured concrete without the approval of the Engineer.

The hammer blow shall be so regulated as to prevent injury to the pile, shattered, crumpled or otherwise damaged pile heads shall be cut back to sound material before continuing the driving.

**c. Pile Driving Record**

The Contractor shall record the details of driving each pile, and so will the representative of the Engineer on site simultaneously. At the end of driving each pile the Contractor shall immediately furnish the representative of the Engineer on site with a copy of the Contractor's record.

The Contractor's record shall include, but not limited to: -

- (1) Pile group designation and pile number.
- (2) Pile type and size.
- (3) Type of equipment and hammer; strike energy of the hammer; weight, force and stroke of the hammer.
- (4) Number of blows per 10 cm throughout the entire driven length.

- (5) Pile top elevation, cut-off grade and tip elevation to the nearest 1 cm.
- (6) Length of pile, cut-off length, extension length, and final pay length to the nearest 1 cm.

The pile driving record form used by the Contractor shall receive the prior approval of the Engineer.

d. Proof Test of Working Piles

The Engineer may direct the Contractor to perform the proof test any time during the driving of working piles if found necessary. At least six proof tests shall be performed at the location designated by the Engineer. The Contractor shall start performing the proof test within two weeks after receiving the notification of the Engineer.

If the inadequacy of driven working piles indicated by the proof tests is found to be the result of improper execution on the part of the Contractor he shall at his expense redrive the piles to the proper deeper elevation or install additional piles as directed by the Engineer.

(1) Testing Apparatus Set Up.

The apparatus shall be so constructed as to allow the various increments of the load to be placed gradually without any shock loading to the piles. Suitable approved apparatus for determining accurately the load on the pile and the settlement of the pile under each increment of load shall be supplied by the Contractor.

The reaction to test loads may be provided by means of ballast or by means of reaction piles.

The hydraulic jack shall be of an approved make, and have a capacity of at least 2.5 times of maximum load, (b)c of this sections. The load measurement device and jack shall be calibrated as a unit by an approved testing laboratory, a certificate of the calibration record from which shall be submitted to the Engineer at least two weeks prior to the start of the load test.

Settlement of the top of the test pile shall be measured by means of at least three dial gauges graduated to at least 0.025 mm set up at 120 degrees apart around the pile.

The settlement reading gauges shall be mounted on reference beams rested on supports acceptable by the Engineer at sufficient distances from the test pile to preclude all possibility of disturbance.

One end of the reference beam shall be fixed, and the opposite end shall be supported on a roller or other support which will allow the beam to expand or contract in accordance with temperature variations.

The settlement of the test pile shall also be checked by means of a taut piano wire down across the face of a mirror mounted graduated scale divided to at least 0.500 mm. The wire shall be mounted between the ends of the dial gauge support beam, fixed at one end and threaded over a smooth pulley at the other end with a weight sufficient to maintain uniform tension.

The entire measurement set up shall be protected against direct sunlight, wind, and other disturbances that might affect its reliability.

## (2) Compression Load Test

Unless otherwise directed by the Engineer the test load shall be applied in the following sequence: -

- i) Apply a load of 2 ton.
- ii) Remove the above load and set all recording instruments to zero.
- iii) Increase the load in increments of about one twelfth of maximum load.

Where maximum load =  $1.5 \times$  allowable working load per pile as shown on the Drawings.

- iv) The deflection shall be read just after each load increment or decrement is applied and at 15 minute intervals thereafter. The next increment or decrement shall not be applied until the rate of settlement has decreased to 0.250 mm/hour or 2 hours minimum, whichever comes before.
- v) Loading shall continue until maximum load is reached.
- vi) The last load increment shall be maintained for twenty-four hours.
- vii) At the end of (vi) the pile shall be unloaded to zero ton in six approximately equal decrements. The rebound reading and testing time shall be the same as (iv).

All readings of deflection and rebound shall be referred to a constant elevation benchmark.

Temperature readings within the test pile enclosure shall also be taken to the nearest one half degree centigrade hourly during the load test.

For the working pile to be found acceptable the settlement load curve from the proof test shall show no sign of failure at the maximum load mentioned above.

**(3) Report**

The Contractor shall, within one day after the completion of each load test for either test pile or working pile, submit to the Engineer a detailed record of testing and, in addition, graphs showing:

- (i) Load and settlement plotted above and below a common base line of time.
- (ii) Settlement and recovery plotted vertically against a base line of load.

**(4) Failure of Working Piles to Pass the Proof Test**

If during the proof test of a working pile there appear sign of failure before or at the maximum load, the Engineer will direct the working piles to be driven to deeper elevation or additional piles to be installed. Verification tests may be required as seen appropriate by the Engineer.

**e. Extension and Cut-Off**

**(1) Pile Extension**

Extension of piles not yet driven shall in no case be permitted.

Extension of prestressed precast piles shall not be permitted, unless the piles have been designed to provide for extension.

**(2) Cut-Off**

Piles shall be cut-off, if required, at the elevations indicated on the Drawings.

Cut-off of piles without adequate prestressing provisions for cut-off shall not be permitted.

Piles inadequately cut-off shall be remedied to the satisfaction of the Engineer at the Contractor's expense.

#### 6.8.4 Measurement and Payment

The unit of measurement of piling shall be the linear meter of pile furnished, driven and accepted in the structure. The pay lengths of the satisfactorily driven piles shall be measured from the tip to the pile head or the cut-off. The cut-off length shall not be measured for payment.

The payment shall be full compensation for all materials, labor, tools and incidentals necessary for furnishing and driving piling.

Piling which is designated for proof tests shall be paid for as regular piling in place at the unit price per linear meter as shown below for the type and size of the piling furnished which price and payment thereof shall be full compensation for furnishing all labor, materials and equipment necessary for furnishing and driving the piling.

No payment will be made for unauthorized, deflection unsound or unsatisfactorily driven piles or for any costs incurred the Contractor for such piles.

Payment will be made under:

<u>Item No.</u>	<u>Description of Work</u>	<u>Unit of Measurement</u>
1-5-10	Precast concrete pile (0.45 cm x 0.45 cm x 25 m)	metre