

PART F

BRIDGE CONSTRUCTION

PART F - BRIDGE CONSTRUCTION**ITEM 400 PILING**

All provisions of this Item in connection with Pre-cast Concrete Piles are modified as follows:

400.1 Description**400.1.1 Scope**

This work shall consist of the furnishing, driving, splicing and cutting off of piles in accordance with these Specifications and in conformity with the Drawings and/or as designated by the Engineer. It also includes the construction of facilities for construction convenience, without which will either slow down the works or completely paralyze the operations relative to bridge construction.

400.1.2 Test Piles

Piles for pile driving tests which are shown on the Drawings shall conform to the requirements for piling as specified and designated by the Engineer. If ordered by the Engineer that driven test piles will not become part of the completed structure, test piles will be provided in addition to the permanent or regular piles. However, if so ordered by the Engineer to be part of the completed structure, test piles of the dimensions shown on the Drawings will be so correctly positioned, be properly driven to refusal or to such tip elevation or approximate bearing value as the Engineer may request. Test piles maybe cut-off at the elevation directed and approved by the Engineer. Piles driven by the Contractor for pile driving tests for his own use in determining the lengths of piles to be furnished maybe similarly located that they also maybe cut-off and become part of the completed structure provided that such test piles conform to the requirements for piling. Any driven pile, in which after serving the purpose as a test pile is found unsatisfactory for utilizations in structure, shall be removed if so ordered by the Engineer, or it shall be cut-off below the ground line and beams. Test piles shall generally be driven with the same equipment that is used for driving succeeding foundation piles.

In dynamic testing, when diesel hammers or other types of hammers are to be used for driving end bearing piles or friction piles, the bearing capacity shall be thoroughly checked by pile driving formula chosen by the Contractor and approved by the Engineer. The Contractor shall be in advance carry out test piling for calibration purposes so as to determine the energy developed by the hammer. The Contractor may elect one of the following methods for calibration.

- a) By test driving piles of the same type successively with diesel hammer, or by driving two different piles with diesel hammer and gravity or single acting hammer according to detailed instructions given by the Engineer. The test shall be made at site with homogeneous soil conditions.
- b) By driving test piles to a depth determined by the Engineer.

Calibration test shall be made at not less than two different sites until the results are satisfactory to the Engineer.

Calibration of diesel hammer may not be required if the hammer has been previously calibrated under similar soil conditions and for the same size and type of pile, provided that the calibration data is accepted by the Engineer.

Add the following to supplement this Sub-section:

400.1.2.1 Report

The report of the Test Pile shall include the following information:

A. General

- 1) Project identification
- 2) Project location
- 3) Test site location
- 4) Owner
- 5) Structural engineer
- 6) Geotechnical engineer
- 7) Pile contractor
- 8) Test boring contractor
- 9) Designation and location of nearest test boring with reference to location of the test pile and vertical control datum
- 10) Log of nearest test boring
- 11) Horizontal control datum
- 12) Vertical control datum

B. Pile Installation Equipment

- 1) Make, model, type, size, and recent service history of hammer
- 2) Weight of hammer and ram
- 3) Rated and actual stroke of ram
- 4) Rated energy of hammer
- 5) Rated capacity of boiler or compressor
- 6) Type, dimensions and stiffness values of cap-block and pile cushion
- 7) Weight and dimensions of drive cap
- 8) Detailed description and drawings of follower
- 9) Size of pre-drilling or jetting equipment
- 10) Type, size, length, weight and stress transmitting area of mandrel
- 11) Detailed specifications of any special arrangement for applying impact force.

C. Test Piles

- 1) Identification and location of test pile(s)
- 2) Working load of pile(s)
- 3) Type of pile(s)
- 4) Test pile material including basic specifications including strength
- 5) Tip and butt dimension of pile(s)
- 6) Date pre-cast test piles made
- 7) Concrete cylinder strengths when pile tested (approximate)
- 8) Description of internal reinforcement used in test pile (size, length, number of longitudinal bars, arrangement, spiral or tie steel)

- 9) Description, location, size, weight and where applicable catalogue data concerning splices
- 10) Condition of pre-cast piles including spalled areas, cracks, head surface and straightness of piles
- 11) Effective pre-stress
- 12) Which piles are vertical or batter
- 13) Degree of batter
- 14) Final elevation of test pile butt(s) referenced to fixed datum

D. Pile Installation

- 1) Date driven (installed)
- 2) Date concreted (cast-in place)
- 3) Volume of concrete or grout placed in pile
- 4) Grout pressure used
- 5) Description of pre-excavation or jetting (depth, size, pressure, duration)
- 6) Operating pressures for all hammers
- 7) Throttle setting-diesel hammer during testing
- 8) Fuel type diesel-hammer
- 9) Description of special installation procedures used such as piles cased off
- 10) Type and location of pile splices
- 11) Driving records
- 12) Final penetration resistance
- 13) Visual observations of stroke of ram during final driving and blow per drive of hammer
- 14) Penetration for last two series of five blows with the hammer
- 15) Penetration resistance during restrike
- 16) When cap-block replaced (indicate on log)
- 17) When pile cushion replaced (indicate on log)
- 18) Cause and duration of interruption in pile installation
- 19) Notation of every unusual occurrences during installation

E. Dynamic Testing

- 1) Description, calibration data and date of calibration of all components of the apparatus for obtaining dynamic measurements and apparatus for recording, reducing and displaying data
- 2) Data tested
- 3) Test pile identification
- 4) The modulus of elasticity, density, and wave speed of test pile and how it determined
- 5) Sequence in pile driving test, carried out such as end of initial driving and beginning of re-strike
- 6) Length of pile, as being driven, embedded, and below apparatus for obtaining dynamic measurements
- 7) Penetration resistance during dynamic testing
- 8) The range, average and standard deviation of the measurements of maximum and minimum compression force
- 9) The range, average and standard deviation of the impact velocity data
- 10) The range, average and standard deviation of the measurements of maximum acceleration

- 11) The range, average and standard deviation of the measurements of final penetration of the pile
- 12) The range, average and standard deviation of the maximum and final energy data
- 13) Which one-dimensional wave theory was used for the analysis of the pile driving, give reference
- 14) The variables entered into the wave theory, such as damping, quake and resistance
- 15) When applicable, the computed soil resistance acting on the pile at time of testing and how it computed
- 16) Comments on the integrity of the pile

Data and force, velocity, acceleration, penetration and energy can be recorded at any point of interest during the pile driving. The standard deviation of these values should be calculated for a minimum of 20 consecutive hammer blows.

400.2 Material Requirements

400.2.3 Concrete Piles

400.2.3.1 Pre-cast Concrete Piles

Pre-cast Concrete Piles shall be 400mm x 400mm and 450mm x 450mm with structural steel V-shape pile tip as shown on the drawings. Concrete Class AA and reinforcing steel for piles shall meet all the requirements as provided under Item 405, Structural Concrete and Item 404, Reinforcing Steel respectively or as indicated on the Drawings.

400.3 Construction Requirements

400.3.1 Location and Site Preparation

Piles shall be used where indicated on the Drawings or as directed by the Engineer. All excavations for the foundations on which piles are to be driven shall be completed before the driving is began, unless otherwise specified or approved by the Engineer. After driving is completed, all loose and displaced materials shall be removed from around the piles by hand excavation, leaving clean solid surface to receive the concrete coping of the foundations.

400.3.2 Determination of Pile Lengths

The criteria for pile length and bearing capacity will be determined by the Engineer according to the results from test piling. The pile shall be driven to such depths, that the bearing load indicated on the Drawings are obtained. The criterion for pile length maybe one of the following:

- a) Piles in sand and gravel shall be driven to a bearing value determined by the use of the pile driving formula or as decided by the Engineer.
- b) Piles in clay shall be driven to the depths ordered by the Engineer. However, the bearing value shall be controlled by the pile driving formula if called for by the Engineer.

- c) Piles shall be driven to refusal on rock or hard layer when so ordered by the Engineer.

The Contractor shall be responsible for obtaining the correct pile lengths and bearing capacities according to the criterion or criteria given by the Engineer.

400.3.3 Pile Driving

All piles shall be driven accurately to its vertical or to its batter position as shown on the drawings. All piles shall, after driving, be within 150 mm from the theoretical location underneath the pile cap or underneath the superstructure in the case of pile bents. All piles pushed up by the driving of adjacent piles or by any other cause shall be re-driven.

Piles shall be used in places where a recommended penetration of three (3) meters in firm materials is obtained or unless otherwise ordered by the Engineer. Where a soft upper stratum overlies a hard stratum, the piles shall penetrate the hard material a sufficient depth to fix the ends rigidly. The recommended penetration of three (3) meters shall be subject to change depending on the results of the pile test.

All pile driving equipment is subject to the Engineer's approval. The Contractor is responsible for sufficient weight and efficiency of the hammers to drive the piles down to the required depth and bearing capacity. Hammers shall be gravity hammers, single and double acting steam or pneumatic hammers or diesel hammers. Gravity hammers shall not weigh less than 60 % of the combined weight of the pile and driving head but not less than 2,500 kg. The fall shall be adjusted so as to avoid injury to the pile. The plant and equipment furnished for steam hammers shall have sufficient capacity to maintain, under working conditions, the pressure at the hammer specified by the manufacturer. The boiler or pressure tank shall be equipped with an accurate pressure gauge and other gauge shall be supplied at the hammer intake to determine the drop in pressure between the gauges. When diesel hammers are used, they shall be calibrated with test piling in accordance with pile driving test specified in Sub-item 400.1.2.

Water jets shall be used only when permitted in writing by the Engineer. When water jets are used, the number of jets and the nozzle volume and pressure shall be sufficient to erode freely the material adjacent to the pile. The jets shall be shut off at a depth not less than three (3) meters before final tip elevation is reached, and the piles shall be driven solely by hammer to final penetration as required by the Engineer.

Piles shall be supported in line and position with leads while being driven. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and shall be held in position by guys or steel braces to insure rigid lateral support to the pile during driving. The leads shall be of sufficient length to make the use of a follower unnecessary, and shall be so designed as to permit proper placing of batter piles, if required. The driving of piles with followers shall be avoided if practicable and shall be done only under written permission from the Engineer.

The method used in driving piles shall not subject them to excessive and undue abuse producing crushing and spalling of the concrete, injurious splitting, and splintering. Manipulation of piles to force them into proper position, if considered by the Engineer to be excessive, will not be permitted.

The pile tops shall be protected by driving heads, caps, or cushions in accordance with the recommendations of the manufacturer of the hammer and to the satisfaction of the Engineer. The driving head shall be provided to maintain the axis of the pile in line with the axis of the hammer and provide a driving surface normal to the pile.

Piles shall be driven to refusal in rock or hard material when directed by the Engineer. Practical refusal shall be considered attained when the blow count is 6 for the last 10 mm of driving as determined by the Engineer.

400.3.6 Pre-cast Concrete Piles

Pre-cast piles shall be made in accordance with the designed drawings and the reinforcements shall be placed accurately and shall be secured rigidly in such manner as to insure its proper location in the completed pile. The concrete cover as measured to the outside face of ties shall not be less than 100 mm unless otherwise shown on the drawings.

The piles shall be casted separately, and if alternate piles are casted in a tier, the intermediate piles shall not be casted until 4 days after the adjacent piles have been poured. Piles casted in tiers shall be separated by tar paper or other suitable separating materials. The concrete in each pile shall be placed continuously. The completed piles shall be free from stone pockets, porous spots or other defects and shall be straight and true to the form specified. A 20 mm chamfer strip shall be formed on all corners. Form shall be mortar tight. Piles shall be cured in accordance with the requirements of Item 405, Structural Concrete.

Piles shall not be moved until the test indicates a compressive strength of 80 percent (80%) of the designed 28-day compressive strength and they shall not be driven until the tests indicate such compressive strength. Pile tips shall be of the design as called for on the Drawings or as directed by the Engineer.

The Contractor, when engaging the services of a Subcontractor, the latter shall have the complete outfit in terms of equipment and experienced qualified personnel, all subject to the approval of the Engineer who shall evaluate the same. The Subcontractor shall be qualified in all aspects as to his legal, technical and financial standings before he is considered for this specialized job. Nevertheless, the Contractor shall remain fully responsible and liable for the works and other acts of his Subcontractor in connection with the subcontracted works.

400.3.11 Cutting of Piles

Modify the second paragraph with the following:

Concrete piles shall, when approved by the Engineer, be cut off at such a level that at least 150mm of undamaged pile can be embedded in the structure or as shown on the drawings. If a pile is damaged below this level, the Contractor shall repair the pile to the satisfaction of the Engineer. The longitudinal reinforcement of the piles shall be embedded in the structure to a length equal to at least 40 times the diameter of the main reinforcing bars or as shown on the drawings. The distance from the side of any pile to the nearest edge of the cap shall not be less than 200 mm.

400.3.12 Defective Piles

Modify this Sub-section with the following:

Any pile delivered with defects or damaged during driving or placed out of its proper location or driven below the elevation fixed by the Drawings or by the Engineer, shall be corrected at the Contractor's expense by one of the following methods approved by the Engineer for the pile in question:

- a) The pile shall be withdrawn and replaced by a new and, when necessary, a longer pile.
- b) A second pile shall be driven adjacent to the defective pile.

400.3.16 Pile Records

Modify this Sub-section with the following:

The Contractor shall keep records of all piles driven or installed. A copy of the record shall be given to the Engineer within two (2) days after each pile is driven. The record form to be used shall be approved by the Engineer. The pile records shall give full information on the following:

Driven Piles:

1. Pile type and dimension
2. Date of casting and date of driving
3. Driving equipment type, weight and efficiency of hammer, etc.
4. Depth driven and tip elevation.
5. Final set for the last 20 blows
6. For gravity and single-acting hammer: height of drop
7. For double-acting hammers: the frequency of blows
8. Details of any interruption in driving
9. Level of pile top immediately after driving and the level when all piles in the group are driven.
10. Details of re-driving.
11. Cut-off elevation and actual length of each pile section.

Add herein these two (2) Sub-sections to read as follows:

400.3.17 Granular Fill

After all foundation piles have been driven, cut-off to its desired top elevation, and have all necessary encasements, the designed elevation of the bottom of footing has been trimmed, excavated, filled and compacted, and made level. Placing of granular fill as bedding will be provided with the required thickness as shown on the drawings or as directed by the Engineer.

400.3.18 Lean Concrete

Upon completion of granular fill, lean concreting if required will be executed to the desired thickness shown on the Drawings or as directed by the Engineer. However, it is

necessary to check the actual elevation of the pouring guide prior to the commencement of concreting to avoid any possible mistakes.

400.4 Method of Measurement

1) Piles Furnished

The quantity to be paid for will be the sum of the lengths in meters of the piles of each type and size furnished and delivered to site and accepted by the Engineer. This will include all extensions that maybe necessary but excluding additional piles or test piles driven that maybe necessary to suit the Contractor's Method of Construction and were driven at his option.

Furnishing Length:

- a) The quantity to be paid for the furnishing of Regular Pile will be the total length in meters of the pile driven as regular pile required in the design drawings plus an allowance of 1.25 meters inclusive of the least embedment to the structure.
- b) The quantity to be paid for the furnishing of Test Pile will be the total length in meters of the pile driven as test pile required in the design drawings plus 1.25 meters chip-off portion plus an allowance of 2 meters.

2) Test Piles

The quantity to be paid for Test Piles will be measured by the total length in meters of the piles furnished and driven as test piles required in the design drawings inclusive of 1.25 meters chip-off portion and an allowance of 2 meters.

3) Piles Driven

The quantity to be paid for will be the sum of the lengths in meters of the piles of each type and size driven in the completed work and measured from the pile tip elevation to the bottom of pile caps, footings or bottom of concrete superstructure in the case of pile bents, and shall be accepted by the Engineer. This will not include additional piles or test piles driven that maybe necessary to suit the Contractor's Method of Construction and were driven at his option.

Unless otherwise provided for, pre-boring, jetting or other methods used to facilitate pile driving operations will not be measured directly but will be considered subsidiary to the pay items for which they were performed.

4) Pile Shoes

The quantity to be paid for pile shoes, including test pile shoes will be measured and paid for in the total number of pile shoes driven as shown on the Drawings. Pile shoes damaged or lost and replaced by the Contractor shall not be measured for payment. Pile shoes furnished by the Contractor at his own option and different from the required shall not be measured for payment.

400.5 Basis of Payment

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The accepted quantities, measured as prescribed in Item 400.4, Method of Measurement shall be paid for at the Contract unit price for each of the particular items that are listed below and included in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment tools and incidentals necessary to complete the work prescribed in these Item.

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
400 (4) a	Precast Concrete Piles (400 mm x 400 mm), Furnished	Linear Meter
400 (4) b	Precast Concrete Piles (450 mm x 450 mm), Furnished	Linear Meter
400 (13) a	Precast Concrete Piles (400 mm x 400 mm), Driven	Linear Meter
400 (13) b	Precast Concrete Piles (450 mm x 450 mm), Driven	Linear Meter
400 (15) a	Test Piles, (400 mm x 400 mm) Furnished and Driven	Linear Meter
400 (15) b	Test Piles, (450 mm x 450 mm) Furnished and Driven	Linear Meter
400 (19) a	Pile Shoes for 400 mm x 400 mm Piles	Each
400 (19) b	Pile Shoes for 450 mm x 450 mm Piles	Each

ITEM 401 RAILINGS

Modify this Item to read as follows:

401.1 Description

This Item shall consist of furnishing or fabricating and/or placing railings for bridges, and other structures, of concrete or steel materials or combination of the two materials according to its type as shown on the Drawings. Railings shall be constructed in conformity with the lines, grades and dimensions shown on the Drawings.

401.2 Material Requirements

All concrete materials to be used shall be Class C in accordance with the requirements of Item 405, Structural Concrete.

Reinforcing steel shall conform to the requirements of Item 710, Reinforcing Steel and Wire Rope.

Steel materials consisting of steel and iron plates, shapes, pipes and fittings and castings shall be in accordance with the requirements of Item 403, Metal Structures.

Paint materials shall conform to the requirements of Item 709, Paints.

401.4 Method of Measurement

The quantity to be paid for shall be the total net lengths of railings in linear meters measured from center to center of end posts according to its type, completely constructed and accepted by the Engineer.

401.5 Basis of Payment

The accepted quantity measured as provided in Section 401.4, Method of Measurement shall be paid for at the Contract unit price shown in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing materials, painting the erected railings, and it includes all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
401 (1) a	Concrete Railing Type A (Concrete Post and Precast Beam)	Linear Meter

ITEM 404 REINFORCING STEEL

404.3 Construction Requirements

Add herein this specification the following:

404.3.7 Rebar Fabrication and Installation

Rebar fabrication and installation shall be done by a competent steelmen to ensure good workmanship. There should be a proper supervision for the "cutting and bending" of reinforcing bars, frequent checking of bar schedule and clearances, from the beginning until or up to where the re-bars are to be installed. Thus, covering shall always be confirmed also to the designed drawings.

404.3.8 Bar bending, Splicing and Placing

The Contractor shall submit to the Engineer for approval, the shop Drawings indicating the bending, cutting, splicing and installation of all reinforcing bars.

Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent unless permitted by the Engineer.

Bar splicing not indicated on the Drawings shall be subject to the approval by the Engineer.

Welded splices, if approved by the Engineer shall develop in tension at least 125% of the specified yield strength of the bars.

Not more than 50% of the bars at any section shall be spliced.

Unless otherwise shown on the Drawings, the clear distance between parallel bars in a layer shall not be less than 1.5 times the nominal diameter of the bar nor less than 1.5 times the maximum size of the coarse. The clear distance between layers shall not be

less than 25 mm nor one bar diameter. The bars in the upper layer shall be placed directly above those in the bottom layer.

404.4 Method of Measurement

Supplement the following paragraph:

The quantity to be paid for shall be the calculated theoretical number of kilograms of reinforcing steel bars, mesh or mats as determined from the net length of the steel as shown on the drawings, incorporated in concrete and accepted. Reinforcing steel bars shall not be measured and paid separately where structures are paid in unit, as they are deemed to be included in the unit pay items of the structures.

The weight of plain or deformed bars or bar-mat will be computed from the theoretical weight of plain round bars of the same nominal size as shown on the following table:

Bar Designation	Size (mm)	Unit Weight (kg/m)
# 2	6	0.222
# 3	10	0.616
# 4	12	0.888
# 5	16	1.579
# 6	20	2.466
# 8	25	3.854
# 9	28	4.833
# 10	32	6.313
# 11	36	7.991

404.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
404 (1)	Reinforcing Steel (Grade 40)	Kilogram.
404 (2)	Reinforcing Steel (Grade 60)	Kilogram.

ITEM 405 STRUCTURAL CONCRETE

405.1 Description

405.1.2 Classes and Uses of Concrete

The first paragraph of this Sub-section is amended as follows:

Other than cement concrete pavement, concrete for bridge structures and except as otherwise stated in the Contract, the classes of concrete shall be designated as: Class A, B, C, P, Seal and Lean.

Lean concrete shall be used in thin layers underneath of footings, foundations and where shown on the drawings or as directed by the Engineer. Thickness shall be in conformance with the design Drawings.

As shown on the Drawings, the concrete class and strength for bridge shall be as follows:

Concrete Class	Structural Member Using
Class A	Steel sheet pile cap
Class AA	Pre-cast Reinforced Concrete Piles
Class AA1	Footings, pile cap, bored piles and approach slab
Class AA2	Cast-in-place girders, slabs, diaphragms, wingwalls, backwalls, copings, columns, slabs, shear keys, curb and sidewalk parapet/railing
Class B	Rubble concrete/concrete blocks for slope protection
Class C	Thin Reinforced Section such as railings and railpost
Class PP	Prestressed concrete members such as AASHTO girders, precast deck slab panels, cast-in-place post-tensioned slab, voided slab, integral coping beams, diaphragm

405.2 Material Requirements

405.2.3 Coarse Aggregates

Unless otherwise specified on the Drawings or as directed by the Engineer, the grading requirements for coarse aggregate shall be under Table 405.1 herein this Specification as follows:

TABLE 405.1 – Grading Requirements for Coarse Aggregate

Sieve Designation		Mass Percent Passing					
Standard (mm)	Alternate U.S. Std.	C L A S S					
		A	B	C	P	Seal	Lean
63	2 1/2"		100				
50	2 "	100	95-100				
37.5	1 1/2"	95-100	-				100
25	1"	-	30-70	100	100		95-100
19	3/4"	35-70	-	100	90-100	100	-
12.5	1/2"	-	10-30	90-100	-	90-100	25-60
9.5	3/8"	10-30	-	40-70	20-55	40-70	-
4.75	No. 4	0-5	0-5	0-15	0-10	0-15	0-10

405.4 Production Requirements

405.4.1 Proportioning and Strength of Structural Concrete

Add herein this Sub-section the following:

The maximum sizes of coarse aggregates shall be in accordance with the maximum sizes specified on the Drawings.

Table 405.2 Composition and Strength of Concrete for use in Structures

Classes of Concrete	Minimum Cement Content	Maximum Water/Cement Ratio	Consistency Range in Slump	Designated Size of Coarse Aggregate	Minimum Compressive Strength of 150x300 mm Concrete Cylinder Specimen @ 28 days
	Kg(bag**)	Kg/kg	Mm (inch)	Square Opening Std.	MN/m2 (psi)
A	360 (9 bags)	0.49	50 - 100 (2 - 4)	38 - 4.75 (1 1/2" - No. 4)	21 (3000)
A1	360 (9 bags)	0.49	50 - 100 (2 - 4)	20 - 4.75 (3/4" - No. 4)	21 (3000)
AA	380 (9.5 bags)	0.42	50 - 100 (2 - 4)	20 - 4.75 (3/4" - No. 4)	28 (4000)
AA1	380 (9.5 bags)	0.42	50 - 100 (2 - 4)	25 - 4.75 (1" - No. 4)	28 (4000)
AA2	380 (9.5 bags)	0.42	50 - 100 (2 - 4)	20 - 4.75 (3/4" - No. 4)	28 (4000)
B	320 (8 bags)	0.54	50 - 100 (2 - 4)	50 - 4.75 (2" - No. 4)	17 (2500)
C	380 (9.5 bags)	0.49	50 - 100 (2 - 4)	15 - 4.75 (1/2" - No. 4)	21 (3000)
P	440 (11 bags)	0.34	80 - 100 (3.2 - 4)	19 - 4.75 (3/4" - No. 4)	38 (5500)
PP	As per design mix	0.33	80 - 100 (3.2 - 4)	20 - 4.75 (3/4" - No. 4)	41 (6000)
Seal	380 (9.5 bags)	0.58	100 - 200 (4 - 8)	25 - 4.75 (1" - No. 4)	21 (3000)

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Lean	320 (8 bags)	0.54	50 - 100 (2 - 4)	50 - 4.75 (2" - No. 4)	17 2500
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** Based on 40 kg/bag

405.6 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
405 (1) a	Structural Concrete, Class "A" (fc'=21 MPa) For Heavily Reinforced Structure	Cubic meter
405 (1) b	Structural Concrete, Class "A" (fc'=21 MPa) For Small and Medium Bridges Substructure	Cubic meter
405 (1) c	Structural Concrete, Class "A1" (fc' = 21 MPa) For Small and Medium Bridges RCDG Superstructure	Cubic meter
405 (1) d	Structural Concrete, Class "A1" (fc' = 21 MPa) PCDG	Cubic meter
405 (2)	Structural Concrete, Class "B" (fc' = 17 MPa) For Plain and Lightly Reinforced Structures	Cubic meter
405 (3)	Structural Concrete, Class "C" For Thin Reinforced Members (fc' = 21 MPa)	Cubic meter
405 (6)	Lean Concrete (fc' = 17 MPa)	Cubic meter

ITEM 406 PRESTRESSED CONCRETE STRUCTURES

This Item is modified to read as follows:

406.1 Description

This Item shall consist of precast prestressed concrete structures constructed in close conformity with the lines, grades and dimensions shown on the Drawings or established by the Engineer. It shall include the furnishing and installation of any appurtenant items necessary for the particular prestressing system to be used, including but not limited to ducts, anchorage assemblies and grout used for pressure grouting ducts.

406.2 Material Requirements**406.2.1 Concrete and Grout****a) Concrete**

The material to be used for concrete shall conform to Item 405, Structural Concrete herein this Specification and it shall be class PP as shown in Table 405.2, Composition and Strength of Concrete for use in Structures.

b) Non-Shrink Grout

The epoxy resin grout to be used shall be a formulation specifically designed for bonding prestressing steel to polyethylene ducts and in providing an acceptable barrier to prevent corrosion of the prestressing steel. The type of epoxy resin proposed by the Contractor shall be approved by the Engineer.

The Contractor shall provide to the Engineer copies of manufacturer's literature describing the epoxy resin for use and examples of its application in previous projects.

The epoxy resin shall be formulated such that after injection into the duct, the resin does not harden (cure) until after all the prestressing steel is stressed and anchored for each precast concrete unit. As a minimum, the epoxy resin shall not cure for a minimum of four weeks after injection.

The epoxy resin shall have the following mechanical properties:

Table 406.2.1 (b) Physical Properties after Hardening

Property	Required Value
Compressive Strength	70 N/mm ²
Tensile Strength	23 N/mm ²
Modulus of Elasticity	5,800 N/mm ²
Shear Adhesive Strength to Strand	13 N/mm ²
Durometer Hardness	85 to 90
Shrinkage Rate During Hardening	Below 1.0%
Heat Decomposition Temperature	Above 300 °C

The Contractor shall either perform a pullout test of the proposed system or provide copies of certified pullout test results provided by the manufacturer and shall satisfy the Engineer that the requirements given below have been met by the system.

Table 406.2.1 (c) Physical Properties after Hardening

Property	Required Value
19 Wire Strand Diameter	21.8 mm
Embedment Length of Strand	100 cm
Minimum Pull Out Strength	451 kN
Bond Strength	4.7 N/mm ²

406.2.2 Prestressing Reinforcing Steel

Reinforcing steel shall conform to AASHTO M31 (ASTM 615), grades 40 and 60 deformed with minimum yield strength as follows:

Rebar Grade	Yield Strength F _y (MPa)	Size (mm)
40	276 (40 ksi)	16 mm dia. and below, unless otherwise noted
60	415 (60 ksi)	20 mm dia. and above

406.2.3 Prestressing Steel

Prestressing steel shall be either twelve-wire, seven-wire, or five-wire uncoated stress-relieved strands whichever is called for in the design Drawings and it shall conform to AASHTO M203 (ASTM 416) with minimum ultimate strength of $f_y = 1860$ MPa (270,000 psi).

PC stress bar shall be high tensile cold worked stress bar conforming to ASTM A722/ISO 6934 (SBPR 930/1180 with nominal tensile strength of 1176 MPa) as shown on the Drawing.

All prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting. Prestressing steel that has sustained physical damage at any time shall be rejected.

406.2.4 Packaging, Storing and Shipping

Add this paragraph to read as follows:

The Contractor must exercise extra care in handling prestressing steel, and any damage observed shall be replaced immediately at his own expense.

Add this Subsection to read as follows:

406.2.9 Structural Steel, Bolts and Welds

The structural steel bolts and welds to be used shall be in accordance with the requirements given below:

Materials	Unit Weight
Steel plates and rolled shapes	AASHTO M 183 (ASTM A 36)
Bolts	AASHTO M 164 (ASTM A 325)
Welds	AWS D1.1 – 183, E70XX Series

406.3 Construction Requirements

All prestressed concrete structure works shall be in accordance with the requirements of Item 405, Structural Concrete and Reinforcing Steel shall be placed in accordance with the requirements of Item 404, Reinforcing Steel, and may be subject to the modifications and amendments by the Engineer.

406.3.7 Pre-tensioning

Add this paragraph at the end of this Section.

No prestressing works shall be commenced without the consent and presence of the Engineer.

406.3.8 Placing of Concrete

Add the following paragraphs at the end of this Section:

Deflection of the structure during erection and after completion shall be controlled as described in the following:

The Contractor shall submit to the Engineer for approval the full details of camber calculation and deflection control method during erection and after completion of the bridge considering all factors such as:

1. Deflection due to the weight of concrete.
2. Deflection due to the prestressing force.
3. Deflection due the weight of pavement, sidewalks and railings, etc.
4. Deflection due to long creep and shrinkage in concrete.

The supports shall be placed at adequate locations to ensure the tendons to be placed in the right position along the prescribed curve.

During the concreting and within the 24 hours after concreting, the Contractor shall demonstrate that all PC cables and bars already installed before concreting are still completely free to move.

All ducts shall be checked for damage before concrete placing. Any damage found to ducts due to concrete placing, the Contractor shall be responsible for taking countermeasures with the Engineer's approval.

406.3.10 Post-tensioning

This Sub-section is supplemented as follows:

Tensioning of the prestressing reinforcement shall not be commenced until tests on concrete cylinders, manufactured of the same concrete and cured under the same conditions, indicate that the concrete of the particular structure to be prestressed has attained to its compressive strength of at least 28 MPa unless otherwise specified by the Engineer.

The proposed type of tendons which will be used in the post-tensioned designs and all necessary additional details including those for end anchorages, methods to be employed and procedures to be followed, shall be as approved by the Engineer. Portion of the tendons shall be draped longitudinal in parabolic portions. All tendons shall be placed so that their center of gravity will be at the position shown on the Drawings. The total post-tension force after losses required at mid-span shall be provided as called for in the various designs. The required forces after losses shall be obtained by applying initial tensile forces of sufficient magnitude to allow for all subsequent, including those for elastic shortening, shrinkage, creep, relaxation, friction, and efficiency of end anchorages. After securing the end anchorages, all tendons shall be pressure grouted in their conduits in accordance with

The Contractor shall submit full details of jacking force calculation, prestressing sequence and control method of each cable to the Engineer's approval not later than 2

months before any prestressing works will start. Post-tensioning works shall be carried out in the following manner:

1. Tensioning shall be carried out only in the presence of the Engineer or his representative unless written permission has been obtained to the Contractor.
2. Immediately before tensioning, the Contractor shall prove that all tendons are free to move between jacking points and that members are to accommodate the horizontal and vertical movements due to the application of prestress.
3. Unless otherwise described in related Specifications, concrete shall not be stressed until it has been reached to its design strength obtained from the result of average values of the concrete compression test using three cylinders. The test cylinders shall be made and tested in accordance with the concrete testing standards. The Contractor shall cast sufficient number of cylinders to demonstrate that the required strength of concrete is reached.
4. The Contractor shall add the forces described in approved tensioning method with an allowance for anchorage friction and jack losses. The total forces and calculated elongation shall be specified in the prestressing control system.
5. Immediately after tensioning, the stress in the prestressing tendons shall not exceed either 70 percent of their ultimate strength or 85 percent of yield strength whichever is lower. During stressing, the value shall not exceed either 80% of their ultimate strength or 90 percent of yield strength whichever is lesser.
6. The strength shall be stressed at gradual and steady rate. The force in the tendons shall obtained from readings on pressure gauges incorporated in the equipment. The average difference between calculated and measured elongation for a group of tendons in a structure should be as shown in the table below:

Number of Tendons	Allowable Difference Between Calculated and Measured Elongation
4	5%
6	4%
More than 10	3%

7. If the elongation cannot be reached, the jacking force may be increased to 80% of the ultimate strength or 90% of yield strength of the tendon whichever is lesser. If the difference between the measured and calculated elongation is still more than the allowed value, no further tensioning shall be made until the calculations and equipment are checked and the cause of the problem is determined. Stressing method and degree of stressing for tendons shall be modified with the Engineer's approval as necessary to provide the required pretensioning forces.
8. Unless otherwise specified on the Drawings, longitudinal main tendons shall be stressed from both ends. The pull-in at both ends shall be accurately measured and the required allowance shall be taken into consideration in the measured elongation.

9. Longitudinal stressing of the main tendons shall not from one end unless otherwise required on the Drawings or specified in the prestressing control system. Vertical and transverse stressing shall be made from one end.
10. When the prestressing has been applied according to the approved system, the tendons shall be anchored. The jack pressure shall then be released in such a way as to avoid shock to the anchorage or tendons.
11. If the pull-in of the tendons at completion of anchoring is greater than that of the approved by the Engineer, the load shall be released at a gradual and steady rate and tensioning is carried out fresh.
12. The Contractor shall submit, within the following day of the tensioning, full records and control graphs of all tensioning operations including the measured elongation, pressure gauge or load cell readings and the amount of the pull-in at each.

406.3.13 Handling

Extreme care shall be exercised by the Contractor in handling and moving the precast prestressed concrete girders and precast prestressed concrete slab. These girders and slabs shall be transported and maintained in an upright position and the points of support and directions of the reactions with respect to the member shall be approximately the same during transportation and storage as when the members are in their final position. If the Contractor deems it expedient to transport or store precast units in other than this position, it shall be done at his own risk after notifying the Engineer of his intention to do so.

Any precast prestressed concrete member shall not be transported until it has attained to its compressive strength equal to the specified design compressive strength of the concrete and has attained a minimum age of 14 days.

406.4 Method of Measurement

The quantity to be measured for payment shall be the actual number of Precast Prestressed Concrete Girders of designated types and sizes, installed in place, completed and accepted by the Engineer.

The quantities determined herein for precast prestressed concrete members shall include the furnishing of materials, fabrication, haulage and erection of precast PC members, preparation of the fabrication and storage yards with necessary equipment and facilities, concrete works, formworks, reinforcements, installation sheaths, prestressed concrete cables and anchorages, prestressing and all other related works and materials necessary to be included to complete the Item.

406.5 Basis of Payment

The accepted quantities as provided in Section 406.4, Method of Measurement shall be paid for at the Contract unit price shown in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing of all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
406 (1) a	Prestressed Structural Concrete Members (AASHTO Girder Type IV, L = 20 m)	Each
406 (1) c	Prestressed Structural Concrete Members (AASHTO Girder Type IV, L = 24 m)	Each
406 (1) f	Prestressed Structural Concrete Members (AASHTO Girder Type IV-B, L = 31 m)	Each
406 (1) j	Prestressed Structural Concrete Members (AASHTO Girder Type VI, L = 35 m)	Each

ITEM 407 CONCRETE STRUCTURES

Modify this Item to read as follows:

407.1 Description

This Item shall consist of the general description of the materials, equipment, workmanship, and construction requirements of concrete structure works conforming to the design, dimensions and details shown on the Drawings.

407.2 Material Requirements**407.2 (4) Elastomeric Bearing Pads**

Delete the sentence and replace with the following:

Elastomeric bearing pad shall be 100% virgin chloroprene (neoprene) pads with durometer hardness 60 and shall be laminated and non-corrosive mild steel sheets. It shall conform to the requirements prescribed in DPWH Department Order No. 25, Series of 1997 "Revised DPWH Standard Specifications for Elastomeric Bearing Pad".

Duro Hardness, Shore A (ASTM D-2240)	60 ± 5
Tensile Strength ASTM	D 412-175 kg/cm ² (min)
Ultimate Elongation %	350% (min)
Material	Neoprene

407.2 (8) Expansion Joint

The Expansion joint for carriageway of the short bridges shall satisfy the requirements of bridge deck movement caused by temperature change, shrinkage, creep and traffic load. Its metal plates and angles shall be corrosion proof. It shall be water tight,

durable, resistant to vehicle sliding, noiseless and smooth drive, capable of absorbing the vehicle load and the horizontal forces and it shall be easy to install. It shall have movement of $\pm 40\text{mm}$ as called for and shown on the Drawings. The steel components shall be manufactured in accordance with the requirements of ASTM A36. The rubber material shall be based on Neoprene rubber compound following to ASTM Test Method as follows:

Physical Properties	Test Method	Required Specification
Hardness (Shore A)	D 2240	50 ± 5
Tensile Strength (MPa)	D 412	13 Min.
Elongation at Break	D 412	400 Min.
Low Temperature Brittleness (30 min. at -40°C)	D 746	No Brittle
Compression Set (After 22 hours at 70°C)	D 395	20 % Max.
Ozone Resistance, (After 72 hours at 40°C , 20% strain 100 pphm)	D 1149	No Crack
Oil Resistance in ASTM No. 3 oil (168 hours at 25°C , volume change)	D 471	15% Max.
Flame Resistance	C 542	Must not propagate flame

For bridge sidewalk, expansion joint shall be 30mm x 50mm premolded joint filler as shown on the Drawings.

Joint sealer shall conform to AASHTO M 173 hot poured elastic type or equivalent and be installed as shown on the Drawings.

Sealant shall be guaranteed against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion for a period of 5 years from the date indicated on the Acceptance Certificate of the Works.

The expansion joint material shall have a 15-year warranty period. Damages on the joint within this period shall be replaced by the Contractor.

The Contractor is required to submit the manufacturer's brochure and specifications to the Engineer for approval.

Add this Sub-section to read as follows:

407.2 (11) Bridge Drainage

Bridge drain shall be of standard galvanized iron pipe with the diameter of 150 mm or as shown on the Drawing.

407.3 Construction Requirements

407.3.1 Handling and Placing Concrete: General

Add the following paragraph:

Prior to concreting works, it is necessary for the Contractor and the Engineer to closely work together to check all related elevations, installation of reinforcements and the stability of formworks and falsework to avoid unusual problems during and after the execution of work. Proper scheme during concrete placing shall be properly defined on the drawings and working platform must be provided as necessary. In the concreting scheme, the manpower, materials, and equipment set up will be properly indicated on the drawings in order to maximize the working efficiency at the same time maintaining the safety working environment.

407.3.10 Falsework Construction

The following paragraphs shall be supplemented to read as:

Falsework which includes formworks and scaffoldings shall be designed correctly by the Contractor according to his construction methodology and his falsework drawings shall be submitted to the Engineer for review and approval. Falsework shall be so designed in order to carry the maximum loads imposed on it and in order to prevent deformation, deflections and deviations due to loads and vibrations during concrete placing. No falsework construction shall start until the Engineer has reviewed and approved the design.

Inner forms surface shall be coated with the quality form oil prior to placing of concreting and must be mortar tight with sufficient strength and rigidity in order to maintain its shape according to Drawings after concreting work. Forms to be utilized must have a smooth surface in order to attain a true concrete surface finished product.

Add the following paragraphs to read as follows:

407.3.15 Expansion Joint Installation

Installation for expansion joints for both long bridges and short bridges shall be in accordance with the manufacturer's installation procedures.

The position of expansion joint and all anchor bolts cast into concrete shall be accurately determined from the template or other materials. During the placing and hardening of concrete or mortar under expansion joint components, relative movement shall be prevented between them and support to which they are being fixed.

407.4 Method of Measurement

a) Elastomeric Bearing Pad

The quantity to be paid for shall be measured by the total number of bearing pads of its dimensions and thickness shown on the Drawings, completely installed and accepted by the Engineer. The payment includes the cost for anchorages, mortar bed, grouting and all other necessary works to complete the work.

b) Expansion Joint

The quantity to be paid for shall be measured by the total length in linear meters of its type and total movement shown on the Drawings, completely installed and accepted by

the Engineer. The payment includes the cost for anchorages, provision of base, grouting, sealing and all other necessary works to complete the work.

a) G.I. Drain Pipe

The quantity to be paid for shall be measured by the total lengths of drain pipe installed. The payment includes cost for all appurtenances necessary to complete the work.

407.5 Basis of Payment

The accepted quantity as provided in Section 407.4, Method of Measurement shall be paid for at the Contract unit price shown in the Bill of Quantities which price and payment shall be full compensation for furnishing materials, labor, tools, equipment and other incidentals necessary to complete the particular work.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
407 (1) c	Elastomeric Bearing Pad (600x350x50mm), Duro 60	Each
407 (1) g	Elastomeric Bearing Pad (550x300x50mm), Duro 60	Each
407 (2)	Expansion Joint, \pm 40 mm Movement	Linear Meter
407 (2) g	Expansion Joint, 30mm width, Premolded Joint Filler for Bridge Sidewalk	Linear Meter
407 (4)	G.I. Drain Pipe, dia.=150mm for Bridge Drainage	Linear Meter

PART G

DRAINAGE AND SLOPE PROTECTION

ITEM 500 - PIPE CULVERTS AND STORM DRAINS**500.1 Description**

Modify this Item with the following:

This Item shall consist of the construction or reconstruction of reinforced concrete pipe culverts in accordance with this Specification and in conformity with the lines and grades shown on the Drawings or as established by the Engineer.

The works also include but not limited to the following:

- a) Installation or extension of new RCP culverts to augment existing ones.
- b) Replacement of existing RCP culverts due to excessive wear.
- c) Cleaning and desilting of existing pipe culverts designated to remain.

500.2 Material Requirements

Unless otherwise specified on the Drawings or in the Bill of Quantities, reinforced concrete pipe culverts shall be of class and strength specified in AASHTO M 170.

Steel reinforcement shall be in accordance with the Specifications in Item 404, Reinforcing Steel.

Joint mortar for concrete pipe culverts shall be one part, by volume of Portland Cement and two parts of approved sand with water as necessary to obtain the required consistency and it shall be used within 30 minutes after its preparation. Portland Cement and sand shall conform to the requirements of Item 405, Structural Concrete.

Materials for ordinary pipe culvert bedding shall be granular backfill selected from excavation or from the source of the Contractor's choice as approved by the Engineer. If concrete cradle is used for bedding as the Engineer may direct, it shall be of Class A conforming to the requirements of Item 405, Structural Concrete. Bedding thickness shall be as shown on the Drawing.

500.3 Construction Requirements**500.3.1 Excavation**

In the second line of the first paragraph, replace "Item 102, Excavation" with "Item 103, Structural Excavation".

500.3.8 Add this Sub-section after Sub-section 500.3.7

In the above conditions, the existing inlets and outlets shall be investigated in conformity with the designed levels as indicated on the Drawings. The existing culverts which, in the opinion of the Engineer after investigation, determined to be still serviceable and in satisfactory conditions and consistent with the design requirements without the necessity of further modification and improvement maybe allowed to remain with the Engineer's approval. Culverts with deficient lengths or with elevations not in accordance

with the Drawings shall be augmented with the required length or adjusted to the correct levels to conform in all respects with what is specified on the Drawings. However, the Engineer may allow or order some deviations from what are shown on the Drawings if such deviations are unavoidable to suit actual site requirements. All new pipe culverts to be constructed shall be in accordance with the plans unless adjustments are to be made with the Engineer's approval.

Where existing culverts are to be extended as indicated on the Drawings, the ends of the existing pipes shall be exposed sufficiently to facilitate jointing and the placement of the joint collars. The end of the old pipes shall be thoroughly cleaned of dirt or any extraneous matter for effective jointing and bonding of the new pipes. The width and depth of excavation at the extended length shall be such as to provide enough working space and to accommodate the required thickness of the bedding materials.

The existing culverts, if allowed to remain and extended shall be cleaned of accumulated silt, debris or other extraneous matter which obstructs the smooth flow of water through the culvert openings. Such materials obtained from cleaning of culverts shall be disposed of to the area directed by the Engineer.

Existing culverts or pipes which in the opinion of the Engineer are non-functional, which obstruct or encroach upon the excavation operation, shall be removed by the Contractor and shall be disposed to the proper area directed by the Engineer.

500.4 Method of Measurement

Supplement this Item with the following:

The quantities to be paid for, for each class and diameter of new pipe culverts, shall be the lengths of pipes between the outside faces of the headwalls, measured along the axis of the pipes as ordered, installed in place, completed and accepted.

Cleaning and reconditioning of existing culverts intended to remain or to be extended later will be measured and paid for under Item 503, Cleaning and Reconditioning Existing Drainage Structures.

Excavation will be measured in cubic meter and paid for under Item 103, Structure Excavation.

Granular backfill for pipe culvert bedding will be measured in cubic meter and paid for under Item 103, Structure Excavation.

Concrete cradle for pipe culvert bedding will be measured in cubic meter and paid for under Item 405,

The removal of existing culverts or pipes which obstruct or encroach upon the excavation and other existing culverts which in the opinion of the Engineer are non-functional will not be measured for direct payment under this Item but shall be paid for under Item 103, Structure Excavation.

500.5 Basis of Payment

Modify this Section to read as follows:

The accepted quantities of pipe culverts, determined in Section 500.4, Method of Measurement shall be paid for at the Contract unit price per linear meter furnished and placed including all labor, equipment, tools and incidentals necessary to complete the item.

At the end of the 2nd paragraph, replace "Item 102, Excavation" with "Item 103, Structure Excavation".

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
500(1) b4	Reinforced Concrete Pipe Culvert 610mm diameter, Class II	Linear meter
500(1) c6	Reinforced Concrete Pipe Culvert 910mm diameter, Class IV	Linear meter
500(1) c7	Reinforced Concrete Pipe Culvert 1070mm diameter, Class IV	Linear meter
500(1) c8	Reinforced Concrete Pipe Culvert 1220mm diameter, Class IV	Linear meter

ITEM 502 - MANHOLES, INLETS AND CATCH BASINS**502.1 Description**

This item shall consists of the construction, reconstruction or adjustments of manholes, inlets and catch basins in accordance with the lines, grades and dimensions shown on the Drawings or as determined by the Engineer. It shall also include placing and compacting of gravel base for catch basin to the required thickness shown on the Drawings.

In addition, this Item also consists of the construction of lined and unlined ditches and concrete ditches in which cross-sections, lines and grades are shown on the Drawings.

502.2 Material Requirements

Specification herein this Section is modified to read as follows:

All concrete used for these structures shall be Class "A" and shall be in accordance with the requirements of Item 405, Structural Concrete.

Reinforcements shall conform to the requirements of Item 404, Reinforcing Steel.

Steel steps shall be 20mm diameter gray iron or steel bar.

Mortar to be used shall be one (1) part by volume of Portland Cement and two (2) parts of approved sand with water as necessary to obtain the required consistency.

Material for metal frames and gratings to the dimensions shown on the Drawings shall be hard and durable, pre-painted and corrosion free as specified by the Engineer.

Gravel for foundation fill shall be in accordance to the requirements of Item 201, Aggregate Base Course or as selected and approved by the Engineer.

Stones to be laid on the lined and unlined ditches shall be sound, tough, durable and resistant to the action of water. Unless otherwise specified on the Drawings or selected by the Engineer, stones shall be Class A conforming to Item 504, Riprap and Grouted Riprap.

502.3 Construction Requirements

Modify the last paragraph to read as follows:

Excavation and backfilling work shall be executed in accordance with Item 103, Structure Excavation and it shall be in conformance with the lines, grades, depths and dimensions indicated on the Drawings or as required and approved by the Engineer. Surplus material shall be disposed to the area directed by the Engineer and this work will also be under Item 103, Structure Excavation.

Add the following Specifications:

All concrete construction shall conform to the requirements in Item 405, Structural Concrete. Concrete Hollow Blocks at the first two (2) meters from the top shall be provided to Manholes with the height ranging from three (3) to eight (8) meters as indicated on the Drawings. All holes in concrete hollow block structures shall be filled with cement mortar specified in Section 502.2 of this Specification. Inside surfaces and outside surfaces of all masonry shall have a plaster coat of 1/2" thick.

When the height of manhole exceeds 1.22 m, steps or ladder shall be provided at 0.40 m interval and it shall be gray iron steel.

Positions, sizes and number of sewer or storm drain conduits entering manhole shall be in accordance with the designed Drawings or as determined by the Engineer to suit field condition.

Ditches shall be constructed, reconstructed, realigned or restored as to the type, lines, shape and dimensions shown on the Drawings. Stones shall be laid properly by hand with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. Interstices between stones shall be filled with small broken fragments firmly rammed into place. The spaces between the stones shall then be filled with sufficient cement mortar leaving the surface of the stones to be exposed or as directed by the Engineer.

502.4 Method of Measurement

Modify the following to read as:

Special manholes to be constructed and paid for will be measured by the unit shown in the Bill of Quantities inclusive of concrete work, fabrication and installation of reinforcing steel, provision of CHB and reinforcements, steel rung or ladder, precast concrete cover, metal frames and gratings completed and accepted by the Engineer.

Ditches constructed, reconstructed, realigned or restored along the roadway or as indicated on the Drawings will be measured and paid for by the total length in meter inclusive of stone laying, mortar jointing and compaction, completed and accepted by the Engineer.

502.5 Basis of Payment

The accepted quantities, determined as provided in Section 502.4, Method of Measurement, of the Pay Items in the Bill of Quantities will be paid for at the Contract unit price which shall constitute full compensation for furnishing and placing of all materials and for all labor, equipment, tools and incidentals necessary to complete the item.

Payment for excavation, backfilling and disposal work for special junction box manhole and ditches will be measured and paid for separately and shall be provided under Item 103, Structure Excavation.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
502 (2) b14	Special Junction Box Manhole for RCPC (1-910mm dia. x 1-610mm dia.)	Each
502 (2) b15	Special Junction Box Manhole for RCPC (1-1070mm dia. x 1-610mm dia.)	Each
502 (2) b16	Special Junction Box Manhole for RCPC (1-1220mm dia. x 1-610mm dia.)	Each
502 (2) b17	Special Junction Box Manhole for RCPC (1-1520mm dia. x 1-610mm dia.)	Each
502 (2) b36	Special Junction Box Manhole for RCPC (2-1220mm dia. x 1-610mm dia.)	Each
502 (4) a1	Concrete Lined Ditch, U-Shaped (500mm x 500mm)	Linear Meter
502 (6) b	Concrete Lined Ditch, V-Shaped (H=500mm; 1:1.00)	Linear Meter
502 (7) a	Concrete Lined Ditch, Trapezoidal (450mm x 500mm)	Linear Meter

ITEM 504 - RIPRAP AND GROUTED RIPRAP

504.1 Description

This Item shall consist of furnishing and placing of riprap with grout in accordance with this Specification and to the lines, grades and dimensions shown on the Drawings. The work also include construction of weep holes.

504.2 Material Requirements

Modify this Section as follows:

504.2.1 Stones

Stones for riprap shall be hard, durable, bank or river stones, resistant to weather action and free from seams or other defects. The stones for grouted riprap Class "A" shall be round natural stones of sizes ranging from 200mm - 300mm in diameter as shown on the Drawings. Adobe stones and lime rocks shall not be used for riprap works.

504.2.2 Filter Material at Weep-hole

Polyester non-woven plastic cloth, sewed like a bag and filled with 20mm gravel will be used as filter material at each weep-hole as shown on the Drawings.

504.2.3 Mortar

Mortar for grouted riprap shall be one (1) part cement to three (3) parts sand by volume and enough water to obtain the required consistency and shall conform to the requirements of Item 405, Structural Concrete.

504.3 Construction Requirements

Modify this Section to read as follows:

504.3.1 Excavation

The bed for grouted riprap shall be excavated to the required depths and to the desired slope properly compacted, trimmed and shaped as shown on the Drawings.

The slope protection shall be founded in a toe trench dug below the depth of scour as shown on the Drawings or as ordered by the Engineer. The toe trench shall be filled with stones of the same class as that specified for the slope protection, unless otherwise specified.

504.3.2 Placing

The stones shall be laid by hand or individually by machines. They shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. Each stone shall be laid with adjacent stones. The slope protection shall thoroughly be rammed into place as construction progresses and the finished surface shall present an even, tight surface. Interstices between stones shall be filled with small broken fragments firmly rammed into place. The spaces between the stones shall then be filled with cement mortar as specified in Sub-section 504.2.3. Sufficient mortar shall be used to completely fill all voids, except that the face surface of the stones shall be left exposed.

504.3.3 Grouting

Grout shall be placed from bottom to top of the surface swept with a stiff broom. After grouting is completed the surface shall be cured as specified in Item 405, Structural Concrete for a period of at least three days. Hardened grout left during the previous days' operation and shall be cleaned thoroughly from earth or dust and other unnecessary materials with water and broom before another layer of stone and grout is added.

504.4 Method of Measurement

Riprap and grouted riprap shall be measured by the cubic meter in place, completed and accepted by the Engineer in accordance with the Drawings. Only accepted work will be measured for payment and the computation of the quantity thereof will be based on the volume within the limiting dimensions designated on the Drawings.

504.5 Basis of Payment

This Section is entirely deleted and substituted with the following:

The quantities measured as provided under Item 504.4, Method of Measurement shall be paid for at the Contract unit price as listed in the Bill of Quantities, which price and payment shall be full compensation for excavation and preparation of the bed, for furnishing and placing all materials including backfill and additional fill to bring the riprap bed to the line, grades and dimensions as shown on the Drawings, for all labor equipment, tools and incidentals necessary to complete the work item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
504(5)	Grouted Riprap, Class A	Cubic Meter

ITEM 505 - STONE MASONRY**505.2 Material Requirements****505.2.1 Stone**

The first and second paragraph shall be amended with the following:

Stones shall be clean, hard and durable and shall be subject to the approval of the Engineer. Unless otherwise specified on the Drawings or directed by the Engineer, stones for masonry shall be Class A as described in Item 504, Riprap and Grouted Riprap. Stones more or less will have roughly similar blunted ends.

505.2.2 Mortar

Add at the end of this Sub-section with the following:

The binder for stone masonry shall be mortar Class A and composed of one (1) part Portland cement and two (2) parts of sand by volume and shall conform to the requirements of materials under Item 405, Structural Concrete. Mortar that is not used within 90 minutes after water has been added shall be discarded. Retempering of mortar will not be permitted.

505.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
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505 (1) Stone Masonry Cubic Meter

ITEM 506 - HAND-LAID ROCK EMBANKMENT

506.1 Description

Modify this Item as follows:

This Item shall consist of hand-laid rock apron as designated in the Bill of Quantities, constructed in conformance to the lines and grades shown on the Drawings or as established by the Engineer.

506.2 Material Requirements

Modify the first paragraph of this Section to read as follows:

Boulders to be used shall be sound, clean, hard, and durable and furnished in a well-balanced range of sizes that would meet the requirements needed and shall be approved by the Engineer. Adobe shall not be used for the construction of Apron.

Unless otherwise specified on the Drawings or by the Engineer, boulders shall be more than 0.015 cubic meter in volume and not less than 75 percent of the total volume of rock embankment and shall consist of stones 0.03 cubic meter in volume. Stones obtained from excavation performed under this Contract may be used and shall be approved by the Engineer.

506.4 Method of Measurement

The quantities to be measured and paid for shall be the number of cubic meters of hand-laid rock apron as indicated in the Bill of Quantities including of stones furnished, placed and laid in position, completed and accepted by the Engineer.

506.5 Basis of Payment

The quantities determined in Section 506.4, Method of Measurement will be paid for at the Contract unit price per cubic meter which price and payment include excavation and preparation of bed, selecting and transporting of stones, placing stones by hand, backfilling or filling and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under.

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
506(1)	Hand-Laid Rock Embankment (Loose Boulder Apron)	Cubic Meter

ITEM 507 - SHEET PILES

507.1 Description

Modify this Item as follows:

Upgrading Inter-Urban Highway System
Along The Pan-Philippine Highway
Cabanatuan Bypass, Contract Package No. II
(Sta. 109 + 920.00 - Sta. 118 + 350.00)

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This Item shall consist of furnishing the steel sheet pile and fittings, driving in place, jointing, cutting the top, etc. to complete the work as specified.

507.2 Material Requirements

507.2.3 Steel Sheet Piles

Steel Sheet Piles shall be 400 x 85 x 8mm as shown on the Drawings and shall conform to the requirements of AASHTO M202 (ASTM A328), or AASHTO M223. Painting shall conform to the requirements of Item 411, Paint, Sub-section 411.6.2, Painting Structural Steel.

507.3 Method of Measurement

The quantity accepted and paid for shall be measured in linear meter of accumulated net length of sheet piles furnished, driven, completely constructed and accepted by the Engineer.

507.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
507(1) b	Steel Sheet Piles, (400 x 85 x 8mm) Furnished and Driven	Linear Meter

ITEM 509 - GABIONS

509.1 Description

Modify this Item and substitute the following:

This work shall consist of constructing wire-mesh gabions or gabion mattresses, furnished, placed and filled in with rocks in accordance with the Specification and at the specified locations and in conformity with the lines and grades shown on the Drawings or as ordered by the Engineer.

509.2 Material Requirements

509.2.1 General

Add the following after the last paragraph:

Mattresses are special gabion baskets having smaller wire size and mesh opening than that for gabions as hereinafter specified. The length shall be 3.0 m to 6.0 m., the width is 2.0m., and the height is 0.17m or 0.23m or 0.30m or as shown on the Drawings.

509.2.2 Wire

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The wire mesh shall be made of galvanized steel and shall conform to the following requirements:

Wire	<u>Requirements</u>	
	Gabions	Mattress
Body Wire Diameter	3.4 mm (min.)	2.7 mm
Selvedge or Perimeter Wire Diameter	3.4 mm (min.)	3.4 mm
Tying and Connecting Wire Diameter	3.4 mm (min.)	2.2 mm
Tensile Strength	413.7 – 586.10 MPa	413.7 – 586.10 MPa
Minimum Weight of Zinc Coating	22.7 g/0.0929 sq.m. of uncoated wire surfaces	244 g/sq.m. of coated wire surface
Elongation; 200 mm gage length		12% (min.)

Wire should be triple twisted.

509.2.3 Rock Fill

Rocks to be used in the gabions shall consist of hard, durable rock pieces that will not deteriorate when submerged in water or exposed to severe weather conditions. Rock pieces shall be generally and uniformly graded having sizes ranging from 100 to 200 mm. Filled gabions shall have a minimum density of 1,400 kg/cu.m. and the voids shall be evenly distributed. Rocks shall meet the requirements of AASHTO M 63 except that the sodium sulfate soundness loss shall not exceed 9% after 5 cycles.

509.4 Method of Measurement

Delete method of measurement and substitute with the following:

The quantities to be measured shall be the number of cubic meter of gabions installed in placed, completed and accepted by the Engineer.

509.5 Basis of Payment

Basis of Payment is deleted and modified as follows:

Quantities determined as provided under Item 509.4, Method of Measurement shall be paid for at the Contract unit price shown in the Bill of Quantities, which price and payment shall constitute full compensation for all necessary excavation, subgrade preparation, for furnishing, placing of wire baskets and fill rocks and for all labor, equipment, accessories, tools and incidentals necessary to complete the Item.

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
509 (1)	Gabions	Cubic Meter

ITEM 510 - RUBBLE CONCRETE SLOPE PROTECTION

510.1 Description

This item shall consist of the construction of rubble concrete slope protection in accordance with this specification and in conformity with the lines, grades, slopes and dimensions shown on the Drawings or established by the Engineer. This item is in accordance with the DPWH Department Order No. 203, Series of 1999.

510.2 Material Requirements**510.2.1 Stone**

The stone shall be of clean, hard and durable and shall be subject to the Engineer's approval. Adobe stone shall not be used unless otherwise specified. Stones to be used shall be more than 0.015 cubic meter in volume and not less than 75 percent of the total volume of rock embankment and shall consist of stones 0.03 cubic meter in volume as described in Item 506.2. Stones obtained from excavation performed under this contract may be used.

510.2.2 Concrete Class "B"

Concrete to be used shall be Class "B" in accordance with "Item 405, Structural Concrete".

510.3 Construction Requirements**510.3.1 Preparation of Foundation Bed**

The foundation bed shall be excavated to the lines and grades as shown on the Drawings as directed by the Engineer, and shall be thoroughly compacted in accordance with Item 104.3.3.

510.3.2 Falsework and Formwork Construction

Falsework/Formwork shall be constructed so as to withstand the stresses imposed. Formwork used shall be constructed with sufficient strength, rigidity and shape as to leave the finished works true to the dimensions shown on the Drawings and with the surface finished as specified.

510.4 Method of Measurement

The quantities to be measured for payment shall be the number of cubic meters of rubble concrete including stones placed, laid in position, completed and accepted by the Engineer.

510.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
510 (1)	Rubble Concrete Slope Protection	Cubic Meter

SPL ITEM 511 - REINFORCED CONCRETE BOX CULVERT

SPL 511.1 Description

This item shall consist of the construction of single, double and triple barrel reinforced concrete box culverts in accordance with this specification and in conformity with the lines, grades, slopes and dimensions shown on the Drawings or established by the Engineer.

SPL 511.2 Material Requirements

Unless otherwise specified on the Drawings or in the Bill of Quantities, concrete to be used for box culverts shall be Class "A" in accordance with the Specifications described in Item 405, Structural Concrete.

Steel reinforcement shall be in accordance with the Specifications described in Item 404, Reinforcing Steel.

Lean concrete used as leveling concrete for box culverts shall be Class B having thickness of 50 mm as shown on the Drawings or as specified by the Engineer.

Unless otherwise specified on the Drawings, material for foundation fill shall be granular conforming to the requirements and approval by the Engineer.

SPL 511.3 Construction Requirements**SPL 511.3.1 Preparation of Foundation Bed**

The foundation bed shall be excavated to the lines and grades shown on the Drawings or as directed by the Engineer, and shall be thoroughly compacted in accordance with Sub-section 104.3.3, Compaction of the DPWH Standard Specifications.

SPL 511.3.2 Concrete Work

All concrete works under this Sub-section shall be in accordance with the requirements of Item 405, Structural Concrete.

SPL 511.3.3 Formworks

Formworks shall be constructed so as to withstand the stresses imposed. Formwork used shall be constructed with sufficient strength, rigidity and shape as to leave the finished works true to the dimensions shown on the Drawings and with the surface finished as specified. It shall be constructed in accordance with Sub-section 407.3.13, Formwork Construction of the DPWH Standard Specifications. It shall be constructed with close supervision by the Engineer.

SPL 511.3.4 Steel Reinforcements

Reinforcing steel shall be bended, cut, spliced, placed and fastened in accordance with Item 404, Reinforcing Steel.

SPL 511.3.5 Compaction

Foundation fill shall be compacted to the required thickness shown on the Drawings and it shall be in accordance with the requirements of Sub-section 104.3.3, Compaction of the DPWH Standard Specifications as approved by the Engineer.

SPL 511.4 Method of Measurement

The quantities determined herein this Section shall be measured and paid for in accordance with the following:

- A. The volume of excavation will be measured in cubic meter and paid for under Item 103, Structure Excavation.
- B. The volume for foundation fill will be the number of cubic meters measured in final position and paid for under Item 103, Structure Excavation.
- C. Reinforcements will be measured in kilogram and paid for under Item 404, Reinforcing Steel.
- D. All concrete works inclusive of formworks and weepholes will be measured in cubic meter and paid for under Item 405, Structural Concrete.

SPL 511.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
103 (1)	Structure Excavation	Cubic Meter
103 (3)	Foundation Fill	Cubic Meter
404	Reinforcing Steel	Kilogram
405 (1)	Structural Concrete, Class A	Cubic Meter
405 (2)	Structural Concrete, Class B (lean concrete)	Cubic Meter

SPL ITEM 512 - WINGWALLS, HEADWALLS AND APRON**SPL 512.1 Description**

This item shall consist of the construction of wingwalls for reinforced concrete box culvert, reinforced concrete headwall for reinforced concrete pipe culvert, concrete apron in accordance with this Specification and in conformity with the elevations and dimensions shown on the Drawings or established by the Engineer.

SPL 512.2 Material Requirements

Unless otherwise specified on the Drawings or in the Bill of Quantities, concrete to be used for wingwalls, headwalls and apron shall be Class "A" in accordance with the Specifications described in Item 405, Structural Concrete.

Steel reinforcement shall be in accordance with the Specifications described in Item 404, Reinforcing Steel.

Lean concrete used as leveling concrete shall be Class B having thickness of 50 mm as shown on the Drawings or as specified by the Engineer.

SPL 512.3 Construction Requirements

SPL 511.3.1 Preparation of Foundation Bed

The foundation bed shall be excavated to the lines and grades shown on the Drawings or as directed by the Engineer, and shall be thoroughly compacted in accordance with Sub-section 104.3.3, Compaction of the DPWH Standard Specifications.

SPL 512.3.2 Concrete Work

All concrete works under this Sub-section shall be in accordance with the requirements of Item 405, Structural Concrete.

SPL 512.3.3 Formworks

Formworks shall be constructed so as to withstand the stresses imposed. Formwork used shall be constructed with sufficient strength, rigidity and shape as to leave the finished works true to the dimensions shown on the Drawings and with the surface finished as specified. It shall be constructed in accordance with Sub-section 407.3.13, Formwork Construction of the DPWH Standard Specifications. It shall be constructed with close supervision by the Engineer.

SPL 512.3.4 Steel Reinforcements

Reinforcing steel shall be bended, cut, spliced, placed and fastened in accordance with Item 404, Reinforcing Steel.

SPL 512.4 Method of Measurement

The quantities determined for this Section shall be measured and paid for in accordance with the following:

- A. The volume of excavation will be measured in cubic meter and paid for under Item 103, Structure Excavation.
- B. Reinforcements will be measured in kilogram and paid for under Item 404, Reinforcing Steel.
- C. All concrete works inclusive of formworks will be measured in cubic meter and paid for under Item 405, Structural Concrete.

SPL 512.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
103 (1)	Structure Excavation	Cubic Meter
404	Reinforcing Steel	Kilogram

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405 (1)	Structural Concrete, Class A	Cubic Meter
405 (2)	Structural Concrete, Class B (lean concrete)	Cubic Meter

PART H

MISCELLANEOUS STRUCTURES

MISCELLANEOUS STRUCTURES

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PART H - MISCELLANEOUS STRUCTURES

ITEM 600 CURB AND/OR GUTTER

600.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
600 (3) a	Combination Concrete Curb and Gutter (Type A)	Linear Meter

ITEM 602 MONUMENTS, MARKERS AND GUIDE POSTS

602.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
602 (1)	Right-of-Way Concrete Monuments	Each
602 (2)	Maintenance Marker Posts (For Drainage Structure)	Each
602 (3)	Kilometer Posts	Each

ITEM 603 GUARDRAIL

603.5 Basis of Payment

Modify this Item to read as:

The accepted quantities of guardrail, determined in Section 603.4, Method of Measurement shall be paid for at the Contract unit price per linear meter for the type specified complete in place, which price and payment shall be full compensation for furnishing and placing all materials including labor, equipment, concrete post, tools and incidentals necessary to complete the work item. When so specified, end anchorage and terminal sections will be paid at the Contract unit price for each of the kind specified and completed in place.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
603 (3) a	Metal Guardrails (Metal Beam) Type A	Linear Meter

ITEM 605 ROAD SIGN

605.1 Description

This item is supplemented with the following:

Upgrading Inter-Urban Highway System
Along The Pan-Philippine Highway
Cabanatuan Bypass, Contract Package No. II
(Sta. 109 + 920.00 – Sta. 118 + 350.00)

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The number and exact locations of the road signs required in this Project are shown and indicated on the Drawings. The quantities of each kind of the different types of road signs as reflected in the Bill of Quantities were determined based on the requirements made on site inspection where such signs are deemed necessary and therefore, are approximate which may increase or decrease depending on the actual requirements as determined by the Engineer. Road signs will be provided at, but not limited to the following locations:

- a) At bends, left or right
- b) Schools and church zones
- c) Road intersections
- d) Bridge sites
- e) All other locations the Engineer may designate

These road signs include the standard signs which are called warning signs, regulatory signs, and informatory signs wherein the designation, sizes, shapes and dimensions are shown on the Drawings. The other road signs are called special signs of size, shape, and dimensions shown on the Drawings.

605.2 Material Requirements

Materials to be used for road signs shall conform to the standard materials specified in the DPWH Standard Specifications or as prescribed on the Drawings or as specified by the Engineer.

605.3 Construction Requirements

The manufacturer and method of construction/installation of road signs shall be as outlined on the Drawings and all with the direction and approval of the Engineer.

605.4 Method of Measurement

The quantities of road signs whether they are standard or non-standard signs shall be measured by the number of such signs of sizes, shapes and dimensions specified inclusive of materials, earthworks, concrete foundation, embedding posts, fixing signs, painting and other incidentals to complete the work. All shall be completely erected and accepted by the Engineer.

605.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
605 (1) a	Warning Signs, Triangular (900 mm)	Each
605 (2) b	Regulatory Signs (Octagonal, 600 mm dia.)	Each

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605 (2) c	Regulatory Signs (Circular, 600 mm dia.)	Each
605 (2) d	Regulatory Signs (Rectangular, 450 x 750 mm)	Each
605 (3) c	Informatory Signs, Type B, Double Post	Each
605 (3) d	Informatory Signs, Type C, Double Post	Each

ITEM 607 REFLECTIVE PAVEMENT STUDS

607.2 Material Requirements

607.2.1 Reflective Studs

The first three (3) paragraphs of this Sub-section are amended to read as follows:

Reflective studs shall have the following characteristics:

1. The stud shall be of aluminum alloy.
2. It shall have anchorage portion or shank which will be set below the road surface to fix the device to its position on the pavement.
3. Dimensions shall be as shown on the Drawings but shall be governed by minimum requirements as follows:
 - a) Double face reflective stud – shall measure no less than 100 mm x 100 mm x 22 mm. Its shank shall be no less than 75 millimeters.
 - b) Single face reflective (chatter bar) stud – shall measure no less than 120 mm x 330 mm x 45. Its shank shall be no less than 100 millimeters.

The reflector shall attain the standard for their photometric and physical properties.

607.5 Basis of Payment

The whole text of this Section is amended to read as follows:

The quantities measured as described in Section 607.4, Method of Measurement shall be paid for at the exact Contract unit price of the Pay Items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and placing all materials, excavating cavities, preparation of surfaces, applying adhesive and mortar and for all labor, equipment, tools and incidentals necessary to complete the work item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
607 (2) b	Reflectorized Pavement Studs (2-Face Reflective)	Each
607 (3)	Chatter Bars (1-Face Reflective)	Each

ITEM 608 TOPSOIL

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608.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
608 (1)	Furnishing and Placing Topsoil	Cubic Meter

ITEM 610 SODDING

610.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
610	Sodding	Square Meter

ITEM 611 TREE PLANTING

611.5 Basis of Payment

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
611 (1) c	Trees (Furnishing and Transplanting) High Tree (Young Tree) 1.50 m <H ≤ 3.00 m	Each

ITEM 612 REFLECTORIZED THERMOPLASTIC PAVEMENT MARKINGS

Add the following to read as follows:

612.8 Thermoplastic Pavement Markings

a) Preparation of Road Surface

The materials should be applied only on the surface which is clean and dry. It shall not be laid into loose detritus, mud or similar extraneous matter, or over an old paint marking, or over an old thermoplastic marking which is faulty. In the case of smooth, polished surface stones such as smooth concrete, old asphalt surfacing with smooth polished surface stones and/or where the method of application of the manufacturer of the thermoplastic materials shall be recommended shall be with the approval of the Engineer.

b) Preparation of Thermoplastic Materials

The materials shall be melted in accordance with the manufacturer's instruction in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic and such the local overheating shall be avoided. The temperature

of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously as possible and for thermoplastics which have natural resin binders or otherwise sensitive to prolong heating the materials shall not be maintained in a molten condition for more than 4 hours.

c) Laying

Center lines, lane lines and edges shall be applied by approved mechanical means and shall be laid to regular alignment. Other markings may be applied by hand-screed, hand propelled machine or by self-propelled machine approved or directed by the Engineer. After transfer to the laying apparatus the materials shall be maintained within the temperature range specified by the manufacturer and stirred to maintain the right consistency for laying.

In the case of screen application the material shall be laid to a thickness of not less than 3mm (approx. 1/8 inch) or more than 6mm (1/4 inch) unless specifically authorized by the Engineer when laid over an existing marking. In the case of sprayed application the material shall be laid to the thickness of not less than 1.5 mm unless specifically authorized by the Engineer. In all cases the surface produced shall be uniform and appreciably free from bubbles and steaks. Where the Contractor Documents require or Engineer direct that ballotini shall be applied to the surface of the markings, these shall be applied uniformly to the surface of hot thermoplastic immediately after laying such that the quality of ballotini firmly embedded and retained in the surface after completion complies with the requirements of Sub-item 606.2.2 of the DPWH Standard Specifications.

Road markings of a repetitive nature, other center lines, lane lines, etc. shall unless otherwise directed by the Engineer be set out with stencils which comply with the size and spacing requirements shown on the Drawings.

d) Re-use of Thermoplastic Materials – At the end of the day as much as possible, the remaining material in the heater and/or laying apparatus shall be removed. This may be broken and use again provided that the maximum heating temperature has not been exceeded and such re-using of material shall be approved by the Engineer.

e) Defective Materials or Workmanship

Materials which are defective shall be replaced by a new one, satisfactory and approved by the Engineer. If in case pavement marking has been applied in an unsatisfactory manner or in incorrect dimensions or in a wrong location, it shall be removed right-away and shall be corrected by the Contractor at his own expense. The road pavement shall be made good to the satisfaction and approval of the Engineer.

612.9 Method of Measurement

The quantity of payment markings to be paid for shall either be the length as shown on the Drawings of painted traffic line of the stated width or the area as shown on the Drawings of symbols, lettering, hatching and the like, completed and accepted.

The quantity shown in the Bill of Quantities represents the approximate quantity in square meter of pavement markings, with width as shown applied at the centerline of the road pavements to which may be increased or decreased depending on the Engineer's decision whether to require additional markings or delete parts of it. Other markings representing symbols, lettering, hatching and others in locations where they maybe required by the Engineer shall, likewise, be implemented by the Contractor using reflectorized thermoplastic pavement markings as approved and directed.

612.10 Basis of Payment

The quantities measured as determined in Item 612.9, Method of Measurement, shall be paid for at the appropriate Contract unit price for the Pay Items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
612 (1) a	Reflectorized Thermoplastic Pavement Markings (White)	Square Meter
612 (1) b	Reflectorized Thermoplastic Pavement Markings (Yellow)	Square Meter

SPL ITEM 620 STREET LIGHTING SYSTEM**SPL 620.1 Description**

This Item shall consist of furnishing and installing of street lighting system required as indicated on the Drawings and as described in this Specification. The work shall include the following:

- a) Electrical services, including all conduits, junction boxes, fittings, and wiring from service entrance to light poles with luminaries.
- b) Lighting and contactor panels
- c) Complete street luminaries
- d) Steel poles and concrete foundations
- e) Undercarriage luminaries
- f) Photo electric switches
- g) Grounding system for luminaries

SPL 620.2 Material Requirements**SPL 620.2.1 General Requirements**

All materials and requirement to be used and to be installed hereunder shall be new of the approved type bearing the stamp of approval of the Underwriter's Laboratories, Inc.

No substitute will be accepted, unless the materials and equipment specified herein are not available. Locally manufactured and/or any other substitute materials and equipment may be accepted, provided that they are better or the full equivalent in the design, quality and size of materials and workmanship, and provided further, that they carry the written approval of the Engineer before they are installed.

a) Fungus Control

All electrical equipment and materials except otherwise specified shall be treated to resist moisture and fungus. Electrical component such as switches, breakers, fuses, contacts, and heater elements shall not be treated.

Other materials and components, which are inherently fungus-resistant or protected by hermetically sealing, need not be treated. All other circuit elements, which have a temperature rise of not more than 75 degree F when operating full load shall be coated with fungus-resistant varnish. Circuit elements include but are not limited to cables, wires, contactors, panels, terminals and terminal junction blocks, capacitors and coils.

b) Corrosion Protection

Fasteners, hardwares, conduit clamps, bolts, nuts, washers, and similar materials used for the assembly of electrical equipment and for the support of the conduit and equipment shall be either of a non-ferrous metal or coated steel.

SPL 620.2.2 Lighting Contactor Panel (Control Panel)

Lighting Contactor panel shall be designed and fabricated for pole mounting as indicated on the Drawings. Enclosures shall be fabricated in accordance with NEMA requirements and shall be watertight and dust-tight, suitable for outdoor installation and shall be rated as specified in the Drawings.

a) Circuit Breakers

The molded case circuit breakers shall be of the thermal-magnetic type having inverse-time tripping characteristic on overload and instantaneous trip on short circuits, shall be equipped with arc quenchers, shall have a quick-make and quick-break toggle mechanism, and shall have trip-free operating handles. Each multi-pole breaker shall have a common trip so that an overload on one pole will automatically cause all poles of the breakers to open. The circuit breakers shall have an interrupting rating of not less than 10,000 symmetrical amperes at 220 volts. Brand shall be "Square D" or approved equal.

b) Solderless-type Connectors

Solder-type connector shall be furnished on the load side of breakers for conductors size 30 sq. mm and smaller.

c) Lighting Contactor

NEMA ICS 2, electrically held contactor rated as indicated. Provide as conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts and coil clearing contacts and shall require no arcing contacts. Provide contactor with hand-off-automatic selector switch. Contactor shall be hermetically sealed and shall be rated as specified in the drawings. Lighting contactor shall be "Square D", "Telemecanique" or approved equal.

d) Terminal Blocks

Terminal blocks for wiring shall be rated at least 600 volts and 25 amperes for control and 50 amperes for the power and shall be molded-block type to accommodate ring lugs, furnished with binding head or washer-head screw having serrated or grooved contact surfaces, having lock washers and insulating barriers between terminals.

Each terminal block shall have a removable cover and marking strip. Arrangement and location of the block shall be such that incoming and outgoing cables can be supported. Grommets shall be provided at all holes furnished for wires and cables. Adjacent rows of terminal block shall be separated at least 150-mm edge to edge.

Where wires are terminated at terminal blocks, circuit designation, as shown on the schematic and wiring diagrams, shall be machine lettered, stamped, engraved, or neatly marked with permanent ink on side of the terminal strips. One spare blank marking strip shall be furnished with each terminal block. The terminal arrangements shall group the conductors in each cable. Conductors shall be marked at each end with clip-on marking sleeves.

SPL 620.2.3 Street Lighting Poles and Luminaires

a) Poles

Provide steel poles designed for wind loading of 250 kilometers per hour determined in accordance with AASHTO LTS-2 while supporting luminaires having effective projected areas indicated. Poles shall be anchor-based types designed for use with underground supply conductors.

Provide galvanized steel poles having minimum 4.5-mm thick steel with minimum yield/strength of 227 MPa and hot-dipped galvanized finish.

Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire.

Provide anchor bases with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Galvanizing shall be in accordance with the requirements of ASTM A-120 for the poles and A-153 for the fittings.

b) Brackets and Supports

NEMA SH 5. Pole brackets shall not be less than 50mm steel secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to the luminaires provided, and all brackets for use with one type of luminaire shall be identical.

Brackets for pole-mounted streetlights shall correctly position the luminaire not lower than the mounting height indicated. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with the luminaire head.

c) Anchor Base Assemblies

Anchor bolts shall be steel rods having minimum yield strength of 345 MPa; the top 300-mm of the rod shall be galvanized per ASM A 153. Anchor bases for steel poles shall be structural quality hot rolled carbon steel plates having a minimum yield strength of 248 MPa.

d) Luminaires

UL 1572. Provide luminaires as indicated. Provide luminaires complete with lamps of the number, type and wattage indicated. The details, shapes and dimensions are indicative of the general type desired but are not intended to restrict selection to luminaires of any particular manufacturer. Luminaires of similar designs and equipment, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved. Luminaires for streetlights shall be pole mounted, with 250-watt high-pressure sodium lamps. The housing shall be die-cast aluminum with electro coat gray paint finish, with a charcoal-filtered optics. Light distribution shall be M-S-III. Luminaires shall be similar to General Electric M-250A2 POWR/DOOR with Photometric ID No. 7262, or approved equal.

e) Lamps

Provide the type and wattage indicated in the drawings. High Pressure Sodium Lamps. 400-watt, 250-watt and 70-watt conforming to ANSI C78-1351 (50,000, 26,000 and 6,000 lumens, respectively).

f) Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and ANSI C82.4, and shall be constant wattage transformer CWA or regulator, high power factor type. Ballast shall be designed to operate on the voltage system to which they are connected. Provide single lamp ballasts with a minimum starting temperature of minus 30 degrees Celsius (C). Ballast shall be constructed so that open circuit operation will not reduce their average life. High Pressure Sodium (HPS) ballasts shall have a solid state ignitor/starter with an average life in the pulsing mode of 10,000 at an ignitor/starter case temperature of 75 degrees C. Average life is defined as the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

SPL 620.2.4 Fluorescent Lighting Fixture

SPL 620.2.4.1 Luminaire.

Ceiling luminaire, surface mounted, IP 56 (minimum). Housing shall be made from glass fibre reinforced polyester resin. Patterned cover shall be made of polycarbonate diffuser. Inserted profile gasket shall be made from elastomer plastic material that is non-ageing as well as weathering and chemical resistant

SPL 620.2.4.2 Fluorescent Lamp

Provide the number, type, and wattage indicated.

SPL 620.2.4.3 Fluorescent Ballast

Ballast shall be UL listed, rapid start high power factor type and shall be designed to operate on the voltage system to which they are connected. Ballast shall be Class P and shall sound rating "A" unless otherwise noted. Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees centigrade when installed in an ambient temperature of 40 degrees centigrade. Ballast shall be "Magnetek" or approved equal.

SPL 620.2.5 Photocell Switch

Unless otherwise specified, all photocontrols furnished under this specification shall meet the design and testing requirements of the latest applicable ANSI standards. If equivalent internationally accepted standards are used, these standards and other supplementary standards shall be explicitly stated in the proposal.

The photocontrol shall provide reliable switching of high pressure sodium vapor lamps under the following environmental conditions:

- | | | |
|---------------------------------|---|--|
| Ambient temperature range | - | - 40 to 65 ° C |
| Moisture level | - | 90 % relative humidity @ 40° C |
| Specific corrosive contaminants | - | saltwater, dust, fumes and/or soot at site |

Operating Conditions. The photocontrol shall turn on at a nominal light level of 10.76 lux (1 foot-candle) which is within the limits of 5.38 to 21.52 lux (0.5 to 2.0 footcandles) at rated voltage of 240 volts AC, 60 Hz. It shall be adaptable for calibration up to 107.64 lux (10 footcandles). The ratio of the turn-off to the turn-on light level shall not exceed 5.

Electrical Features. The photocontrol shall be rated at 240 volts AC, 60 Hz., and shall have a minimum load rating of 1800 VA.

Dielectric Withstand. The electric insulation of the photocontrol shall withstand for one minute a 60 Hz Dielectric Withstand Test of 2.5 kV rms minimum(dry) between current-carrying components and any metallic portion of the enclosure or receptacle with its mounting.

Surge Protection. The photocontrol shall be provided with an MOV arrester capable of at least 160 joules energy dissipation and a clamping voltage of not greater than 1000 volts.

Power Consumption. The power consumption of the photocontrol unit shall be below 1.5 watts, average, at either daytime or nighttime operation.

Construction Features. The photocontrol shall be mechanically robust to withstand reasonable abuses of handling and shall be designed and constructed to minimize the effects of moisture in the air.

The photocontrol skirt shall have a minimum diameter of 76.4 mm (3"). Any condensation falling on it will be led away from the terminals. There shall be no cavities on the exterior where moisture can collect.

The 3-terminal locking type plug of the photocontrol shall be accordance with ANSI C136.10. These shall fit correctly and snugly into its corresponding ANSI C136.10 twist-lock type receptacle.

Housing and Sealing. The housing shall be made of high impact strength and flame retardant material preferably fastened to its base by screws. The housing shall be sealed tight, preventing penetration of moisture, dust, and other contaminants inside the photocontrol.

The housing shall be provided with means of marking the date of installation and removal of the photocontrol. The light source window for the photocell shall be of a clear, UV stabilized acrylic material designed for maximum protection against weather and life shortening effects of direct sunlight. A compressible gasket or sealing means shall be provided as part of the photocontrol to form a weatherproof seal on the required seat of the receptacle. All non-current carrying metal parts shall be protected from corrosion.

Photocell. The photocell shall be a phototransistor or a silicon junction dev for long term, drift-free light sensing. It shall be encased in an enclosure with an internal cavity which prohibits the passage of moisture, air, gas and contaminants through its envelope.

Hermeticity of the photocell sealing shall be determined by Method C of ASTM F98-72 (Standard Recommended Practices for Determining Hermeticity of Electron Devices by a Bubble Test) or equivalent standard of testing hermeticity of electron devices.

Switching Device. The photocontrol shall be equipped with an electromagnetic relay as means of switching load. The relay contacts shall be of sufficient current capacity and shall make and break its load by a snap action. The relay contacts shall have a low resistance to prevent heating.

Current-carrying Components. All current-carrying metal parts shall be of good conductor quality and shall be corrosion resistant.

Terminals. The three-terminal locking type plug of the photocontrol shall be rigidly connected to the base without possibility of being displaced from the base. Terminals necessary for installation shall be readily accessible and shall be clearly identified.

SPL 620.2.6 Conduit

a) Rigid Steel Conduits

Rigid steel conduit shall be galvanized and shall conform to ANSI Standard C-80. Fittings of types approved by the Engineer shall be provided as required for connection to junction, pull and outlet boxes and to equipment. Brand shall be "Matsushita" or approved equal.

b) Rigid Plastic Conduit

Plastic duct for concrete encased burial shall be PVC schedule 40 and shall conform to NEMA TC6 type. EB fittings shall conform to NEMA TC9. Brand shall be "Neltex " or approved equal.

SPL 620.2.7 Outlet Bodies

Outlet bodies for pull boxes and junction boxes shall be cast or malleable iron for exposed locations and stamped galvanized steel where embedded in concrete.

SPL 620.2.8 Wires and Cables

Wires and cables shall meet the applicable requirements of Philippine Electrical Code for the type of insulation, jacket and conductor specified. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be used.

Conductors shall be stranded copper with an insulation of type THW, 600-Volt, except that grounding wire may be type TW. All types shall be PSA approved and shall conform to NEMA Standard Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

Color coding shall be provided for all service, branch and control circuit conductors. Color shall be green for grounding conductors. The color of the ungrounded conductors shall be as follows:

- a) 240-Volt, single-phase
 - Phase A- black
 - Phase B- red

Wires and cables shall be " Phelps Dodge" or approved equal

SPL 620.2.9 Splices and Termination Components

Provide solderless connectors on all splices.

SPL 620.2.10 Grounding Installation

All street lighting poles and lighting contactor panels shall be effectively grounded. Conductor and ground wires shall be bare copper with size as shown in the drawings. All connection shall be mechanically and electrically sound and secured by insulating tape of approved type. Ground rods shall be made of copper-clad steel and shall be driven full length into the earth, sizes of which shall be as indicated on the drawings.

SPL 620.2.11 Light Pole Concrete Footings

All electrical light pole footings shall be of reinforced concrete with dimensions as indicated in the Plans. Concrete shall be Class A and together with the requirements of the DPWH Standard Specification for Public Works and Highways.

SPL 620.3 Construction Requirements

SPL 620.3.1 Codes and Regulations

All works shall be done in accordance with the requirements of the latest editions of the PHILIPPINE ELECTRICAL CODE and the NATIONAL SAFETY CODE, with the applicable ordinances of the local government, and with the requirements of the Power Company that will eventually furnish the service.. Nothing contained herein or shown on the plans shall be construed as to conflict with the requirements of these codes, which are hereby made part of the work of this item.

SPL 620.3.2 Contractor Submittals

Data, shop drawings, and report shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.

SPL 620.3.2.1 Manufacturer's Data

When data that describe one type, size, model, or item is submitted, clearly mark the data to indicate which type, size, model, or item is being provided. Data shall be sufficient to show conformance to specified requirements.

- a) Luminaires, including lamps and ballast
- b) Poles and brackets
- c) Photocell Switch
- d) Lighting Contactor
- e) Circuit Breakers
- f) Conduit and fittings
- g) Conductors
- h) Ground Rods

SPL 620.3.2.2 Shop Drawings

- (a) Luminaires: Include dimensions, accessories, and installation and construction details. Photometric data, including Zonal lumen data, average and minimum ratios, aiming diagram and candle power distribution data shall accompany shop drawings.
- (b) Poles: Include dimensions, wind load determined pole deflection, pole class and other applicable information.
- (c) Lighting Contactor Panel: Include dimensions and arrangement of circuit breakers, contactors, hand-off-automatic switches and other accessories. Submit wiring diagram to show interconnection of each electrical components including photocell switch.

SPL 620.3.2.3 Sample

- a) One Sample for each type of luminaire complete with lamp and ballast.

SPL 620.3.3 Installations

SPL 620.3.3.1 Service Entrance

The service entrance pedestals, the control panels and the concrete foundations shall be constructed as shown in the plans or as required by the local utility company and as directed by the Electrical Engineer. The rigid steel conduit with THW conductors shall run down from the utility line and into the box. Electrical components shall be mounted to the back panels or control panels with machine screws and wired as shown in the plans or as directed. Forms for the footings shall not be removed until the concrete has hardened properly not less than 24 hours after the concrete had been placed.

SPL 620.3.3.2 Lighting Control Panels

The Contractor shall install the panel boards at the locations indicated in the plans. Electrical components shall be installed in the enclosures in proper position and shall be completely wired and ready for operation. All power and control wires and cables shall enter the control equipment enclosure through conduits.

SPL 620.3.3.3 Wiring Method

Wiring method shall be insulated conductors installed in conduit, except where specifically indicated otherwise, or required by PEC to be installed otherwise. An insulated equipment grounding conductor shall be provided in all branch circuits. Provide insulated, green-colored conductor for grounding conductors installed in conduits or raceways.

Service Entrance Conduit	: Rigid Steel Conduit
Conduit in Floor slabs/concrete structure:	Rigid Steel Conduit
Exposed Conduit	: Rigid Steel Conduit
Underground Conduit	: PVC Schedule 40 with concrete encasement

SPL 620.3.3.4 Conduits

Electrical Conduits and fittings shall be installed in their correct position and locations as shown on the Drawings.

Conduit and fittings to be embedded in concrete shall be held securely in position while the concrete is being placed. All threaded conduit connections shall be painted with red-lead sealing compound or glyptical varnish.

Conduit emerging from concrete surfaces shall be terminated with conduit couplings and pipe plugs.

Exposed conduits shall be supported by pipe straps, wall brackets or hangers fasten by concrete inserts or expansion bolts on concrete or brick; fasten by machine screws, welded threaded studs, or spring-tension clamps on steel work.

Underground PVC duct lines shall be encased with concrete. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least

76mm of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 50mm. The top of concrete envelope shall not be less than 0.46m below grade except that under roads and pavement, it shall be not less than 0.60m below grade.

All conduit bends shall be of standard radii bent without heating and shall be free from kinks, indentation, or other deformations, which reduce the cross-sectional area. Burrs and sharp edges at the end of each piece of conduit shall be removed with a taper reamer. Bushing shall be installed on the ends of the conduit at boxes of cabinets to protect conductors from abrasion. Locknuts and bond nuts shall be installed to provide tight grounded connection between rigid steel conduit and boxes.

During construction, the ends of conduit terminating at cabinets control boards or outdoor boxes shall be sealed with an approved sealing material to keep the conduit dry and to prevent the entrance of foreign matter into the conduit.

SPL 620.3.3.5 Splices

Make splices in accessible locations. Make splices with a solderless connector and cover with an insulation material equivalent to the conductor insulation.

SPL 620.3.3.6 Electrical Conductors and Grounding

Electrical conductors and grounding wires shall be furnished and installed by the Contractors. All insulating tape and compounds, solder, flux and connectors for making grounding connections shall be made with approved type solderless connectors, and all connections shall be mechanically and electrically tight and secure. The Contractor shall furnish all grounding connectors. The Contractor shall install Electrical conductors and shall make all required connections as shown on wiring diagrams to be furnished or as directed by the Engineer. The conductor shall be installed so that there will be no cuts or abrasions in the installation or protective covering of the conductor. No splices shall be made in conductors, except at boxes, outlets or cabinets.

SPL 620.3.4 Test and Guarantee

When the installation is reported as completed and ready for acceptance, test as directed shall be made by the Contractors at his own expense in the presence of the Engineer. The Contractor shall provide electric power required for field test

SPL 620.3.4.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least three times, demonstrating satisfactory operation each time.

SPL 620.3.4.2 Test on 600-Volt Wiring

Test all 600-volt wiring to verify that no short circuits or accidental ground exist. Perform insulation resistance test on all wirings using an instrument which applies a voltage of approximately 500 volts to provide a direct reading of resistance. Minimum resistance shall be 250,000 ohms.

SPL 620.3.4.3 Grounding System Test

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Test the grounding system to assure continuity and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making any connections to the rod; then tie entire grounding system together and test for resistance to ground. Make resistance measurements in normally dry weather, not less than 48 hours after rainfall. Submit written result. The maximum resistance to ground of the grounding system shall not exceed 25 ohms. Where the resistance obtained exceeds 25 ohms, contact the engineer for further instructions.

Submit written results of each test to the Owner/Engineer for approval and acceptance.

The contractor shall at once remedy the defects and any part of the work not satisfactory to the Engineer, free of cost to the Government.

The contractor shall furnish a guarantee covering all labor and materials for period of one (1) year from the date of final acceptance of his work and shall agree to repair and make good all defects at his own expense, which may develop during that time, if in the opinion of the Owner/Engineer such defects arise from defective workmanship or materials.

Unless otherwise specified in the Drawings or as directed by the Engineer, concrete to be used for foundations shall be Class "A" in accordance with "Item 405, Structural Concrete". Reinforcements shall be in accordance with "Item 404, Reinforcing Steel".

SPL 620.4 Method of Measurement

The quantities determined under this Item or as shown in the Bill of Quantities include the total number of designated type of traffic signals, street lighting poles, street lighting service poles, street lighting panels, etc. as completely installed and tested.

SPL 620.5 Basis of Payment

The quantities measured as determined in Item 620.4, Method of Measurement, shall be paid for at the Contract unit price for the Pay Items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and placing all materials and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 620 (1) a	Traffic Signal Pole, Type A (Mast Arm Post, H=6.7m)	Each
SPL 620 (1) b	Traffic Signal Pole, Type B (H=6.0m)	Each
SPL 620 (1) c	Traffic Signal Pole, Type B (114.3mm dia. x 4.2m)	Each
SPL 620 (1) d	Traffic Signal Pole, Type C (114.3mm dia. x 3.4m)	Each
SPL 620 (1) e	Traffic Signal Pole, Type D (114.3mm dia. x 3.0m)	Each
SPL 620 (2) a	Traffic Signal Lamps, Type A (6 Vehicle Lamps)	Each

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SPL 620 (2) b	Traffic Signal Lamps, Type B (3 Vehicle Lamps)	Each
SPL 620 (2) c	Traffic Signal Lamps, Type C (2 Pedestrian Lamps)	Each
SPL 620 (4) a	Street Lighting Poles (Single Lamp)	Each
SPL 620 (4) b	Street Lighting Poles (Dual Lamp)	Each
SPL 620 (4) d	Street Lighting Service Pole with Panel	Each
SPL 620 (4) e	Fluorescent Lighting for Underpass Culvert	Each

PART J

MOBILIZATION AND DEMOBILIZATION

(SPL) PART J - MOBILIZATION AND DEMOBILIZATION**SPL 800.1 Description**

This item shall consist of the mobilization and demobilization of the required minimum equipment for the project as listed in the Proposal Book. It also consists of establishment and withdrawal of temporary site office and yards, transportation of equipment and materials to and from the site, and other necessary works to start the construction.

SPL 800.2 Method of Measurement

Payment for complying with the provision of this item shall be as certified by the Engineer that all the required minimum equipment have been delivered at the site and at the time the same have been removed from the project site.

For purposes of estimates, the Contractor shall calculate the cost of this item based on the following:

- a) Total cost of Mobilization/Demobilization shall not exceed one (1%) percent of the total estimated direct cost of the civil works. This shall be paid in a Lump Sum basis as herein specified.
- b) Payment for this item shall be made in two (2) installments: eighty percent (80%) after the contractor has totally mobilized his equipment and ready for use and the remaining twenty percent (20%) after the Contractor has finally completed his demobilization work.

SPL 800.3 Basis of Payment

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
SPL 800 (1)	Mobilization and Demobilization	Lump Sum

PART K

PROVISIONAL SUMS

PART K - PROVISIONAL SUMS

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions for the work to be executed by the Contractor, and the Contract Price shall be adjusted accordingly. The total sum to be paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed and it shall be in accordance with Sub-clause 13.5 of the Conditions of Contract.

SPL 900 (1) PROVISIONAL SUM FOR TRAFFIC MANAGEMENT DURING CONSTRUCTION

The Contractor shall employ a Traffic Management Engineer or Supervisor and necessary staff under him for the overall control of traffic management including the coordination with the national and local traffic authorities with jurisdiction over the project area, so as to minimize traffic obstruction and facilitate the flow of traffic through the construction area and through appropriate and approved diversion roads.

The construction area shall be bounded by steel fence as shown on the Drawings or as directed by the Engineer so that traffic can be more manageable. Informatory, regulatory and warning signs with proper lightings shall be installed wherever necessary. The contractor shall coordinate his traffic management with the concerned government agencies and concerned private parties.

SPL 900 (1).1 TRAFFIC CONTROL DEVICES AND THE CONSTRUCTION AREA AND ITS VICINITY**SPL 900 (1).1.1 General**

The Contractor shall furnish, install and maintain at all times for the duration of the Contract, necessary traffic signs, barricades, lights, signals and other traffic control devices and shall provide flagging and other means for guidance of traffic through the work zone. Traffic control shall be conducted in accordance with the prevailing government rules and regulations and where applicable, in accordance with the design details included in the Drawings.

All traffic signs and control devices furnished and installed by the Contractor shall be reviewed by the Engineer as to location, position, visibility, adequacy and manner of use under specific job conditions.

All traffic control devices necessary for the initial stage of construction shall be properly placed and in operation before any construction shall be allowed to start. When work of a progressive nature is involved, the necessary signs shall be moved to adjust to advancing operation.

If at any time, the Engineer determines that proper provisions for safe traffic control are not being provided or maintained, he may restrict construction operations affected by such defective signs or devices until proper satisfactory adjustments shall have been made. The Engineer may also suspend the entire work until the proper level of compliance is achieved.

In cases of serious or willful disregard of the Contractor for safety of the public or his employees, the Engineer may take appropriate corrective measures and deduct the cost thereof from moneys due or to become due to the Contractor.

The Contractor shall provide personnel to undertake continuous surveillance over his traffic control operations. Such personnel shall be available day and night to respond to calls involving damage to barricades, lights, signs, etc., either thru vandalism or traffic accident. The Contractor shall identify such personnel to both the Engineer and local traffic authorities at the work zone.

The Contractor shall provide on the site the towing equipment to move stalled vehicles out of the traveled way to locations with no interference to traffic and the possibility of an accident.

SPL 900 (1).1.2 Flaggers

Flaggers while on duty and assigned to traffic control or to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment subject to the approval of the Engineer. The equipment shall be furnished and kept clean in good repair by the Contractor at his own expense.

SPL 900 (1).1.3 Traffic Handling Equipment and Devices

All devices used by the Contractor in the performance of the work shall conform to the requirements of this Special Sub-item. Traffic handling equipment and devices damaged from any cause during the progress of the work shall be repaired, including painting if necessary or replaced by the Contractor at his own expense.

When traffic control devices furnished by the Contractor are no longer needed for controlling traffic, they shall be removed from the site of work.

SPL 900 (1).1.3.1 Barricades

Barricades shall conform to the details shown on the Drawings and these shall be constructed of lightweight commercial quality materials as approved by the Engineer. "A"-frame designs shall not be rigid.

Markings for barricades rails shall be alternate orange and white stripes. Reflective sheeting shall be replaced on rail surfaces in such a manner that no air bubbles or voids are present between the rail surface and reflective sheeting. The predominant color for barricade components other than rails shall be white, except that unpainted galvanized metal or aluminum may be used.

Ballasting shall be by means of sand filled bags placed on the lower parts of the frame or stays, but shall not be placed on top of the barricade nor over any reflectorized barricade rail face facing the traffic.

If the barricades are displaced or are not in an upright position, from any cause, said barricades shall immediately be replaced or restored to their original location, in an upright position at the Contractor's own expense.

SPL 900 (1).1.3.2 Flashing Arrow Signs

Flashing arrow signs shall be finished with commercial quality flat black enamel and shall be equipped with yellow or amber lamps that form arrows or arrowheads are required. Each lamp shall be provided with a visor and the lamps shall be controlled by an electronic circuit that will provide between 30 to 45 complete operating cycles per minutes in each of the displays and modes specified. The control shall include provisions for dimming the lamps by reducing the voltage to 50 percent, ± 5 percent, for night time use. Type I signs shall have both manual and automatic photoelectric dimming controls. Dimming in both modes shall be continuously variable over the entire dimming range.

Flashing arrow signs shall conform to the following legibility requirements. The minimum legibility distance is the distance at which flashing arrow signs shall be legible at noon on a cloudless day and at night by persons with vision of or corrected to 20/20.

Type	Minimum Size	Min. Number of Panel Lamps	Min. Legibility Distance
I	1220 mm x 2440 mm	15	1600 m
II	610 mm x 1220 mm	13	1200 m

Flashing arrow signs shall be capable of being operated in 4 different display modes as follows. The display to be used shall be as directed by the Engineer.

1. Pass Left Display
2. Pass Right Display
3. Simultaneous Display
4. Caution Display

Flashing arrow signs shall also be capable of operating in one or both of the following modes, at the option of the Contractor:

1. Flashing Arrow Mode
2. Sequential Mode

In the flashing arrow mode, all lamps forming both the arrowhead and shaft shall flash on and off simultaneously.

In the sequential mode, either arrowheads or arrows shall flash sequentially in the direction indicated.

In the simultaneous display mode, the lamps forming both right and left arrowheads and the lamps of the arrow shaft (center 3 on Type I signs) shall flash simultaneously. On Type II signs, the lamps forming the right and left arrowhead, except the center lamp, may be continuously illuminated while the lamps forming the shaft and the center lamp of the arrowheads flash on and off simultaneously.

In the caution display mode, a combination of lamps not resembling any other display or mode shall flash.

Each flashing arrow sign shall be mounted on a truck or on trailer and shall be capable of operating while the vehicle is moving and shall be capable of being placed and

maintained in operation at locations as shown on the Drawings, or as directed by the Engineer.

Flashing arrow signs shall be mounted to provide a minimum of 2.10 meters between the bottom of the sign and the roadway.

Trailers on which flashing arrow are mounted shall be equipped so that they can be leveled and plumbed.

Electrical energy to operate the sign shall be obtained from the vehicle on which the sign is mounted or from a generating plant mounted on said vehicle. Regardless of the sources, the supply of electrical energy shall be capable of operating the sign in the manner specified.

SPL 900 (1).1.3.3 Portable Delineators

Portable delineators, including the base, shall be composed of a material that has sufficient rigidity to remain upright when unattended and shall be either flexible or collapsible upon impact by a vehicle. The base shall be of such shape as to preclude roll after impact.

The base shall be sufficient weight or shall be anchored in a manner such that said delineator shall remain in an upright position. Ballast if used for the bases of portable delineators shall be sand or water.

If the portable delineators are displaced or are not in an upright position, from any cause said delineators shall immediately be replaced or restored to their original location, in an upright position, by the Contractor.

The vertical portion of the portable delineators shall be of a fluorescent orange or predominantly orange color. The posts shall be not less than 76 mm in width or diameter. The minimum height shall be 910 mm above the travelled way or as shown on the Drawings.

A minimum of 2 reflective bands each not less than 76 mm wide, shall be mounted a minimum of 38 mm apart and at a height on the post so that one reflective band will be between 0.76 m and 0.91 m above the roadway surface.

Reflective bands shall be white and shall be fabricated from flexible reflective sheeting as specified in the special provisions. The reflective bands shall be visible at 305 m at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Only one type of portable delineator shall be used on the project. The type of portable delineator proposed for use on the project shall be submitted to the Engineer for approval prior to replacement on the project.

SPL 900 (1).1.3.4 Portable Flashing Beacons

Each portable flashing beacon unit shall consist of a lighting unit, a flasher unit, a standard, a battery power source and a base. The units shall be assembled to form a

complete, self-contained, flashing beacon which can be delivered to the site of use and placed in immediate operation.

The lens for the beacon lightning unit shall have a visible diameter of 300 mm. The lens shall be glass or plastic conforming to the provisions in ANSI Standard: D-10 for yellow traffic signal lens.

The beacon lighting unit shall be provided with a 200 mm minimum length of visor and a back plate. Visors will not be required during the hours of darkness.

The flasher unit shall provide 50 to 60 flashes per minute with 250 to 350 milliseconds dwell time.

The standard shall be adjustable to provide a variable mounting of the lighting unit between 1.8 and 3 meters measured from the bottom of the base to the center of lens, with provisions for securing the standard at the desired height. The standard shall be securely attached to the base and a sufficient length of multi-conductor, neoprene jacketed cable as required for full vertical height shall be provided.

The base shall be large enough to accommodate a minimum of two 12 volt, automotive type storage batteries and shall be of such shape and weight that the beacon will not roll in the event it is struck by a vehicle or pushed over.

The lamp shall be rated at 25 watts for operation on 12-volt battery current.

The flashing beacon assembly shall be weatherproof and shall be capable of operating a minimum of 150 hours between battery recharging and other routine maintenance.

The standard and base shall be finished with 2 applications of commercial quality orange enamel. The interior of the visor and the front face of the back plate shall be finished with 2 applications of commercial quality flat black enamel.

SPL 900 (1).1.3.5 Construction Area Signs

The term "Construction Area Signs" shall include all temporary signs required for the direction of public traffic through or around the work during construction.

Construction area signs shall be installed at the locations shown on the Drawings or as directed by the Engineer.

Construction area signs designated as stationary mounted on the Drawings shall conform to the provisions in Section SPL 900(1).1.3.5A, "Stationary Mounted Signs" and construction signs designated as portable signs on the Drawings shall conform to the provisions in Section SPL 900(1).1.3.5B, "Portable Signs".

Construction area signs not designated as stationary mounted nor as portable on the plans shall be, at the Contractor's option, either stationary mounted or portable signs conforming to the provisions in said Sections SPL 900 (1).1.3.5A or SPL 900 (1).1.3.5B.

All construction area signs shall conform to the dimensions, color and legend requirements of the Drawings and these specifications. All sign panels shall be the product of a commercial sign manufacturer, and shall be as specified in these specifications.

Sign panels for all construction area signs shall be visible at 150 meters and legible at 90 meters at noon on a cloudless day and at night under illumination of legal low beam headlights, by persons with vision of or corrected to 20/20, except that the night time requirement shall not apply to fabric sign panels for portable signs.

The Contractor may be required to cover certain signs during the progress of the work. Covers for construction area signs shall be of sufficient size and density to completely block out the message so that it is not visible either during the day or at night. Covers shall be fastened securely to prevent movement caused by wind action.

The Contractor shall clean all construction area sign panels at the time of installation and as often thereafter as the Engineer determines to be necessary, but at least once every 4 months.

Use signs with the specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and colors conform to the requirements as directed by the Engineer. A significant difference between day and nighttime reflective color will be grounds for rejecting signs.

To properly provide for changing traffic conditions and damage caused by public traffic or otherwise, the Contractor shall be prepared to furnish on short notice additional construction area sign panels, posts and mounting hardware or portable sign mounts. The Contractor shall maintain an inventory of the commonly required items at the jobsite or shall make arrangements with a supplier who is able, on daily basis, to furnish such items on short notice.

SPL 900 (1).1.3.5A Stationary Mounted Signs

Stationary mounted signs shall be installed on wood posts in the same manner shown on the Drawings or as directed by the Engineer for installation of roadside sign, except as follows:

1. Back braces and blocks for sign panels will not be required.
2. The height to the bottom of the sign panel above the edge of travelled way shall at least 1.50 meters except when the sign is located in the path of pedestrians or bicycles the height to the bottom of the sign panel above the edge of the travelled way shall be at least 2.10 meters.
3. Construction area sign posts may be installed on above ground temporary platform sign supports as approved by the Engineer, or the signs may be installed on existing lighting standards or other supports as approved by the Engineer. When the construction area signs are installed on existing lighting standards, holes shall not be made in the standards to support the sign.
4. The post embedment shall be 0.76 meter if post holes are backfilled around the posts with Portland cement concrete produced from commercial quality aggregates and cement with not less than 168 kilograms of cement per cubic meter.

Post size and number of posts shall be as shown on the plans, except that when stationary mounted signs are installed and the type of sign installation is not shown on the plans, post size and the number of posts will be determined by the Engineer. Posts shall be good sound wood post, suitable for the purpose intended.

Sign panels for stationary mounted signs shall consist of reflective aluminum sheeting. Sign panels shall conform to the requirements specified in Item 605.

Legend and border may be applied by a screening process or by use of pressure sensitive cut-out sheeting. Size and spacing of letters and symbols shall be as depicted on the sign specification sheets published by the Department.

All rectangular sheet aluminum signs over 140 centimetres measured along the horizontal axis and all diamond-shaped sheet aluminum signs 152 centimetres and larger shall be framed unless otherwise specified. Frames shall be constructed in accordance with Item 605. Sign panel fastening hardware shall be commercial quality.

SPL 900 (1).1.3.5B Portable Signs

Each portable sign consist of a base, standard or framework and a sign panel. The units shall be capable of being delivered to the site of use and placed in immediate operation.

Sign panels for portable signs shall conform to the requirements of sign panels for stationary mounted signs in Section SPL 900 (1).1.3.5A, "Stationary Mounted Signs" or shall be cotton drill fabric, flexible industrial nylon fabric, or other approved fabric.

Fabric signs shall not be used during the hours of darkness. Size, color and legend requirements for portable signs shall be as described for stationary mounted sign panels in said Section SPL 900 (1).1.3.5A.

The sign standard or framework shall be capable of supporting a sign panel of 120 centimetres by 120 centimetres maximum dimension, in an upright position with the center of the sign panel a minimum of 1.50 meters above the pavement.

All parts of the sign standard or framework shall be finished with 2 applications of orange enamel which will match the color of the sign panel background. Testing of paint will not be required.

If portable signs are displaced or overturned, from any cause, during the progress of the work, the Contractor shall immediately replace the signs in their original locations at his own expense.

SPL 900 (1).1.3.6 Telescoping Flag Trees

Telescoping flag trees shall be of good commercial quality material, suitable for the purpose intended and shall be capable of maintaining an upright position at all times while in use.

SPL 900 (1).1.3.7 Traffic Cones

Traffic cones shall be fluorescent and of good commercial quality, flexible material suitable for the purpose intended. The outer section of the portion above the base of the cone shall be translucent and be of a highly pigmented fluorescent orange polyvinyl compound. The overall height of the cone shall be at least 710 millimetre and the bottom inside diameter shall be not less than 267 millimetre. The base shall be of sufficient weight and size or shall be anchored in a manner such that the traffic cone will remain in an upright position.

During the hours of darkness traffic cones shall be affixed or covered with a minimum 330 millimetre flexible reflective cone sleeve, placed a maximum of 76 millimetre from the top of the cone. The sleeves shall be white and shall be fabricated from the reflective sheeting. The reflective sheeting shall be visible at 305 meters at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Traffic cones to be in place during daylight hours shall not be affixed or covered with reflectorized cone sleeves.

SPL 900 (1).2 MEASUREMENT AND PAYMENT

Provisional Sum under this item has been provided in the Bill of Quantities for this purpose. Measurement and Payment will be made in accordance with Clause 13.5 of the Conditions of Contract.

SPL 900 (1).3 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (1)	Provisional Sum No.1 (For Traffic Management During Construction)	Provisional Sum

SPL 900 (2) PROVISIONAL SUM FOR RELOCATION OF EXISTING UTILITIES

SPL 900 (2).1 GENERAL

Removal, relocation and inclusion of public utilities and site facilities are essential to the Works under the Project Contract and such works shall be strictly coordinated by the Contractor with the respective owners of the utilities. The Contractor is instructed to recognize the following stipulations:

- a) The Work Program to be submitted, as required by Sub-clause 13.5 of the Conditions of Contract, shall be the basis, reference or factor that will determine for any negotiations and arrangements to be made by the DPWH to the respective owner of water supply, communications, electrical and gas supply utilities and other facilities such as ports, piers, markets, etc.. It is essential for the Contractor to provide the details on the priorities and sequences of his construction activities and operations and any particulars may be required by the Engineer on the said program.

- b) No work shall commence on any parts, portions or sections of the site of the Works that may affect or disturb the functions or the original conditions of public utilities and site facilities unless the permission has been first secured from the Engineer.

SPL 900 (2).2 MEASUREMENT AND PAYMENT

Provisional Sum under this item has been provided in the Bill of Quantities for this purpose. Measurement and Payment will be made in accordance with Clause 13.5 of the Conditions of Contract.

SPL 900 (2).3 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (2)	Provisional Sum No. 2 (For Relocation of Existing Public Utilities (Electric Lines/ Posts, Communication Lines/Manholes, Water Mains/Pipes affected by the Project))	Provisional Sum

SPL 900 (3) PROVISIONAL SUM FOR GEOTECHNICAL INVESTIGATION**SPL 900 (3).1 CONTRACTOR'S RESPONSIBILITY FOR SOIL INVESTIGATIONS**

The geological and geotechnical data issued or made available to the Contractor by the Employer before submission of the Contractor's bid has been given in good faith and for information only. The Employer does not warrant that such data fully covers the range of existing conditions on the Site or that designation of rock or other naturally occurring materials shown on any Drawings or in reports, maps, geotechnical or other similar information made available to the Contractor for bidding purposes are correct. Neither does the Employer warrant the correctness of any interpretation, deduction or conclusion shown in such data, notwithstanding that such interpretation, deductions and conclusions may have been relied upon for design purposes. The Employer shall therefore not be held responsible or liable for any inaccuracies in or omissions from such data.

Should the Contractor consider it necessary to conduct additional soil investigations or carry out tests for whatever purpose (for example, for confirmation of the suitability of construction methodologies or in order to establish likely pile lengths for ordering purposes), such additional investigations shall be undertaken entirely at the Contractor's cost.

All soil investigation and testing work specifically requested by the Engineer shall be carried out in the presence and under the supervision of the Contractor's Geotechnical Engineer, who is required to be well experienced in such work and who must be fully conversant with the relevant international Standards. The Contractor shall submit details of the qualifications of all proposed soil investigation and testing personnel to the Engineer for approval, prior to allowing them to commence the soil investigation work.

SPL 900 (3).2 SPECIFIC SOIL INVESTIGATIONS AND TESTS INSTRUCTED BY THE ENGINEER

Notwithstanding the above, the Engineer shall be at liberty to issue an instruction requiring certain specific soil investigations and tests to be carried out.

In respect of the specific soil investigation work referred to above, the Contractor shall submit in advance for the Engineer's approval full details of the method to be employed, the equipment to be used and the time frame allocated.

The anticipated method for testing of the specific soil and geotechnical investigations are as follows:

SPL 900 (3).2.1 Bridge Sites Geotechnical Investigation for Bridge Foundation Design**1) Drilling Work**

- a) The drilling shall be continued up to 5 meters after reaching to rock and/or hard strata which is greater than 50 blows per 30 centimeters in the Standard Penetration Test (SPT).

When depth of the bearing strata is confirmed for about 5 meters, the Contractor shall inform the matter to the Engineer and obtain the approval of terminating the drilling operation for the hole.

- b) Some drillings must be performed in the middle of a river with water depth of over 2 meters, therefore, proper platform for drilling operation must be prepared.
- c) Pictures shall be taken at each drilling site to show procedure of drilling operation.
- d) Sketch of each drilling site shall be prepared to show exact location of a drilling site, and elevation of top of bore hole shall be surveyed from the nearest Temporary Bench Mark (TBM).

2) Standard Penetration Test

The Standard Penetration Test (SPT) shall be carried out at one (1) meter interval, except for a portion where undisturbed sample is to be collected.

3) Disturbed Sampling

Disturbed samples shall be collected for every one (1) meter, except for a portion where undisturbed sample is to be collected.

4) Collected Samples

Collected disturbed samples shall be arranged in sample box for each hole to show underground soil profile. A picture of samples arranged in a sample box shall be taken.

5) Undisturbed Sampling

Undisturbed sampling shall be undertaken for soft clay layers (SPT of 4 or less) when encountered, in accordance with AASHTO Specification T-207.

6) Following laboratory tests, four (4) samples per hole shall be performed except undisturbed samples in accordance with the AASHTO/ASTM test method. Four samples to be tested shall be determined by the Engineer.

Laboratory Tests of Disturbed Samples	AASHTO/ASTM Designation
a) Soil Classification	D-2487
b) Natural Moisture Content	T-265
c) Specific Gravity	T-100
d) Sieve Analysis	T-88
e) Unit Weight	T-233
f) Atterberg Limits	T-89 & T-90
Laboratory Tests of Undisturbed Samples	AASHTO/ASTM Designation
a) Unconfined Compression	T-208
b) Consolidation Test	T-216

- 7) The results of drilling and soil tests shall be presented in a form of boring log with graphical plots of SPTs with the description and the depth of each soil layer.
- 8) The laboratory test results shall be summarized in tables which shall be attached with the calculation sheets.
- 9) Drilling and laboratory test results shall be compiled and a geotechnical investigation report shall be prepared.

SPL 900 (3).2.2 Soils Investigation by Cone Penetration Test**SPL 900 (3).2.2.1 Scope of Work**

Soils investigation shall be undertaken along the proposed bypasses at 200 meter interval. Major objective of the investigation is to determine the depth of unsuitable soils to be removed and the trafficability for earthwork.

SPL 900 (3).2.2.2 Location of Investigation

Exact location of the beginning and end points for each bypass shall be determined by the Engineer.

SPL 900 (3).2.2.3 Method of Investigation

Investigation shall be undertaken in accordance with the Specifications of JGS 1431-1995 (JGS: Japanese Geotechnical Society), Method for Portable Cone Penetration Test. Data obtained from the field shall be processed in accordance with JGS 1431-1995.

SPL 900 (3).2.3 Borrow Material Sources Investigation

SPL 900 (3).2.3.1 Scope of Work

All existing and possible borrow material sources shall be identified and the quantities of borrow material at each site shall be estimated by the Contractor.

The Engineer shall select one borrow material source for each bypass where the Contractor shall undertake the investigation.

SPL 900 (3).2.3.2 Location of Investigation

Exact location of test pitting shall be determined by the Engineer.

SPL 900 (3).2.3.3 Method of Investigation

1) Test Pitting

Test pitting shall be done to a depth of 1 meter at the location determined by the Engineer. One disturbed samples shall be collected from each test pit. Quantities of samples shall be good enough to be used in necessary laboratory tests.

2) Laboratory Tests

Laboratory tests shall be undertaken in accordance with AASHTO/ASTM/Specifications as follows:

Laboratory Tests	AASHTO/ASTM Designation
a) Soil Classification	D-2487
b) Specific Gravity	T-100
c) Unit Weight	T-233
d) Natural Moisture Content	T-265
e) Sieve Analysis	T-88
f) Atterberg Limits	T-89 & T-90
g) Compaction Test	T-99
h) CBR Test	T-193

SPL 900 (3).3 LABORATORY TESTING

In respect of tests specifically requested by the Engineer, the following shall apply:

- (a) The Contractor shall perform such tests in a laboratory suitably equipped with the necessary testing apparatus and staffed by experienced technicians under the

control of the Contractor's Geotechnical Engineer. The facilities will be subject to prior inspection and approval by the Engineer.

- (b) The Contractor may be required to carry out additional testing after the results of the tests become available to the Engineer. The Contractor shall ensure that the portions of the samples still remaining after the tests have been carried out are properly sealed and preserved.
- (c) The Engineer shall be informed of any inadequacy of samples identified in the laboratory and shall issue his instructions in regard thereto. Such samples shall not be tested until a definite instruction has been given by the Engineer.

SPL 900 (3).4 REPORTS

Where the Engineer has requested that specific boring work shall be carried out, the following shall apply:

- (a) The Contractor shall prepare a daily report for each borehole and it shall be submitted to the Engineer at the beginning of the next working day. Information to be included in the report shall cover the following items:
 - borehole number, date (day) and type of plant;
 - ground level, elevation of each stratum and ground water table with reference to the Chart Datum Level;
 - diameter and depth of borehole and casing;
 - type of drilling fluid;
 - depth, description and symbolic legend of each stratum;
 - color, condition and depth of any loss of the return drilling fluid and cuttings;
 - type of the samples and depth of the sample recovery;
 - depth and full details of all in-situ tests;
 - depth of hard strata and time spent on drilling penetration;
 - details of time spent other than in advancing the borehole;
 - type of core barrel and bit used;
 - depth of start and finish of each core run;
 - core diameters and depth of changes in the diameter;
 - total core recovery and percentage of recovery with field notes;
 - any other useful information.
- (b) The Contractor shall prepare a preliminary log of each borehole in a form acceptable to the Engineer. The logs shall be submitted to the Engineer in duplicate within seven (7) working days after the completion of each borehole.
- (c) The Contractor shall submit laboratory test results to the Engineer in duplicate at the completion of each weekly batch of testing.
- (d) Within seven days after the completion of the entire soil investigation work and the attendant laboratory tests, or at such time as directed by the Engineer, the Contractor shall submit five (5) copies of the soil investigation report in English. The report shall cover at least the following information:

- description of the work carried out;
- exploratory borehole logs;
- in-situ and laboratory test records;
- plan of borehole locations;
- soil profiles along the selected sections;
- photographs of the field activity and samples.

The presentation of the test results shall be consistent with the relevant Standards, including the formatting of the data sheets. The Contractor may be requested to provide additional data to the Engineer. Such additional data may include a comparison of the test data with the previously available data and/or further analysis of the new data for more detailed engineering examination purposes.

SPL 900 (3).5 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (3)	Provisional Sum No. 3 (For Geotechnical Investigation)	Provisional Sum
SPL 900 (4)	PROVISIONAL SUM FOR MAINTENANCE AND REPAIR OF EXISTING ACCESS ROAD	

SPL 900 (4).1 GENERAL

Existing roads used as access to the project site which are not passable prior to the commencement of work shall be repaired by the Contractor under this provision and if damaged by the Contractor's equipments during his construction operation shall be maintained by him and it shall be approved by the Engineer.

If the existing road to be used as access road is currently in good condition, whether it is in concrete cement pavement, in asphalt surface or in gravel surface, the Contractor, all throughout his operation and use of the road, shall be liable of any damage caused by his construction equipments. The Contractor shall be totally responsible for any repair and maintenance of such road at his own expense and it shall be in close coordination with the Engineer. The Engineer, all throughout the operation and use of the existing road, must take his responsibility to inspect from time to time the repair and maintenance work of the Contractor. Repair and maintenance work of the Contractor shall be approved by the Engineer to his satisfaction.

If in case there is an existing bridge along the access road, the Contractor shall take into consideration the strength of the structure prior to his use. If the bridge of its type cannot withstand the load of any of the Contractor's equipments, it shall be repaired immediately and be maintained by him at his own expense under the close supervision by the Engineer. Repair and maintenance work of the Contractor shall be approved by the Engineer to his satisfaction.

If repair and maintenance work will include excavation, backfilling, filling of materials, concreting, gravel surfacing, asphalt surface, compaction and etc., all the requirements shall be in accordance with the DPWH Standard Specifications.

SPL 900 (4).2 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (4)	Provisional Sum No. 4 (For Maintenance and Repair of Existing Access Road)	Provisional Sum
SPL 900 (5)	PROVISIONAL SUM FOR ENVIRONMENTAL COMPLIANCE REQUIREMENTS	

SPL 900 (5).1 GENERAL

The Contractor is required to perform his contractual obligations to undertake the Works in such a manner that it will prevent any adverse effect to the environment and to conform to the requirements of the Environmental Compliance Certificate (ECC) issued by the Regional Ecology Center and the Department of the Environment and Natural Resources (DENR). In particular, the Contractor shall perform his operations and activities in accordance with the latest Philippine Environmental Rules and Regulations, and to comply with the international conventions that have been ratified by the Government of the Philippines.

The Contractor shall be responsible for monitoring the environmental impact of the execution of the Works during the whole of the construction period, up to the date of issuance of the Taking-Over Certificate for the whole of the Works, and for ensuring that the existing natural and social environments are not adversely affected by the execution of the Works.

Where a certain amount of environmental degradation is unavoidable, the Contractor shall apply mitigation measures in order to keep to an absolute minimum level any adverse impact on the surrounding area caused by the carrying out of the Works.

Notwithstanding any more particularized requirements set out in the Specifications, the Contractor shall be entirely responsible for monitoring by observations and measurement the following areas of possible pollution and contamination on a continual basis throughout the execution of the Works and for reporting and taking preventive and corrective measures as necessary to protect and preserve the existing natural and social environments:

- number and variety of trees and shrubs removed;
- construction dust;
- air pollution caused by construction equipment and vehicle exhaust fumes;
- noise and vibration caused by construction equipment;
- debris on public roads caused by the large volume of earthwork or demolition materials being taken into and out of the Site;
- groundwater pollution;

- socio-economic impacts and other possible problems for people residing and working in the locality; and
- waste oils, fuel spillage, sewage discharge, and any other discharges, pollution and contamination arising from the Contractor's operations and activities.

SPL 900 (5).2 MITIGATION MEASURES TO OVERCOME ADVERSE ENVIRONMENTAL IMPACTS

The Contractor shall report to the Engineer any adverse effects on the environment caused by the carrying out of the Works as soon as such situations arise, at the same time taking whatever steps are necessary to overcome such adverse environmental problems, whether or not the fault of the Contractor.

If the Contractor's operations and activities are found to have contributed to pollution and contamination, he shall take quick and effective action to stop such situation from continuing or being repeated, operating in full consultation and under the supervision of the Engineer, particularly in respect of the following:

- accidental fire;
- unapproved disposal of waste;
- accidental contamination of waterways;
- inadequate dust control

The Contractor shall take the following environmental conditions into account in the formulation of the proposed construction methodology and environmental mitigation measures to be adopted:

(a) Disposal of all Rubbish, Demolition Waste etc.

The Contractor shall be entirely responsible for and ensure the safe and hygienic collection, transportation and disposal of all rubbish, tires, liquid/solid waste material off-site arising from construction activities and from site offices, canteen and etc., and for disposal of demolition waste that cannot be recycled.

Fires and burning of rubbish and waste on the Site will not be permitted, nor the burying of rubbish and waste.

Particular care shall be taken in identification and safe disposal of hazardous materials such as asbestos, etc.

(b) Traffic Congestion and associated Noise, Dust and Emissions Etc.

Transport of heavy equipment and construction materials and goods to and from the Site through the narrow access roads will create traffic congestion, noise pollution, dust and vibration. The Contractor shall program his activities on public roads to minimize such adverse effects, and if necessary shall arrange for certain trucks to move by night. The Contractor shall arrange the transport of large objects to the Site (such as piles) at night.

The Contractor shall clean the access roads of any spillage and repair any damage caused by construction equipment and delivery vehicles. In addition, wheel washing

facilities shall be set up to clean the wheels of all vehicles prior to leaving the Site, and a special team shall be available at all times to ensure that tarpaulins are fixed in place properly before any vehicle carrying loose materials is allowed to leave the Site.

(c). Removal or Preservation of Trees and Shrubs

The Contractor shall remove trees and shrubs in areas to be cleared for the Works as indicated on the Drawings. The Contractor shall as far as possible limit the further removal of or damage to trees and shrubs.

The Contract requires that trees and shrubs cleared for the Works be replaced by new planting, as indicated on the Drawings. The trees shall be cultivated and maintained by the Contractor for a period required on the Contract. Should the Contractor further remove or damage trees, additional trees shall be planted and cultivated by him as required on the Contract.

(d) Other Adverse Environmental Impacts

Other adverse environmental impacts may be expected to occur in the site during construction. Should the Contractor identify or encounter such adverse effects, he shall notify the Engineer accordingly.

SPL 900 (5).3 PROPOSALS FOR ENVIRONMENTAL MONITORING

The Contractor shall submit proposals to the Engineer for approval before commencement of monitoring, describing the equipment and methodology to be employed. The proposals should cover, but not be limited to, the following topics:

- (a) measuring tools/instruments;
- (b) methods of sampling and analysis;
- (c) laboratories/analysis agencies;
- (d) precise monitoring locations;
- (e) precise timing of measurements; and
- (f) contents of reports, timing of submission, number of copies, etc.

SPL 900 (5).4 ENVIRONMENTAL IMPACT MONITORING PROCEDURES

The Contractor shall carry out the monitoring in accordance with the following table:

Requirements for Environmental Impact Monitoring during Construction

Categories	Monitoring or Measuring Parameters*	Monitoring Areas and Locations	Monitoring Periods and Timing

Air quality	NO ₂ SO ₂ Total Suspended Particulates (TSP)	At points within each separate work area as indicated by the Engineer.	Upon commencement of construction work. Weekly during the progress of construction work; daily for TSP. Upon completion of construction work.
Noise and vibration	Acoustic level Frequency	At points within each separate work area as indicated by the Engineer.	Upon commencement of construction work. Weekly during the progress of construction work. Upon completion of construction work.
Waste management	Checking weekly that the manner of waste collection, transportation and disposal complies with the waste management plan.		

* Measurements to be in mg/l unless otherwise stated

Notwithstanding the specific locations for monitoring set out above, environmental monitoring shall extend outside the Site boundary to areas where the effects of the carrying out of the Works could reasonably be expected to impact.

Should additional monitoring be required by the conditions of the ECC, the Contractor shall comply accordingly.

SPL 900 (5).5 ENVIRONMENTAL MONITORING REPORTS

The Contractor shall prepare weekly environmental reports containing the results of the environmental monitoring and submit them to the Engineer by the Monday of the following week. Such reports shall encompass, but not be limited to, the following:

- (a) dates of measurements;
- (b) locations of measurements;
- (c) weather conditions during measurement;
- (d) types of measurements;
- (e) measurement methods and instruments employed;
- (f) photographic records;
- (g) measurement records/results.

Upon completion of the construction work, the Contractor shall prepare and submit a Final Environmental Report summarizing the results of the environmental monitoring, highlighting problem areas, the causes thereof and the remedial actions taken.

SPL 900 (5).6 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (5)	Provisional Sum No. 5 (For Environmental Compliance Requirements)	Provisional Sum
SPL 900 (6)	PROVISIONAL SUM FOR HEALTH AND SAFETY REQUIREMENTS	

SPL 900 (6).1 GENERAL

Safety provisions shall be taken by the Contractor to prevent accidents and ensure safety of his staff and workers. He shall have on his staff a health officer on the site to take care of the questions regarding safety and protection against accidents of all staff and workers. All safety provisions shall be in accordance with the DOLE Department Order No. 13 Series of 1998, GUIDELINES GOVERNING OCCUPATIONAL SAFETY AND HEALTH IN THE CONSTRUCTION INDUSTRY, and the Article "SAFETY AND HEALTH MANAGEMENT".

The Officers shall be well trained in accordance to the abovementioned guidelines, qualified for the work and shall be given authority to issue instructions and to take necessary measures to prevent accidents.

SPL 900 (6).2 CONSTRUCTION WORK CLOTHES AND PROTECTIVE EQUIPMENT

The Contractor's employees and men shall wear proper working clothes, with safety helmet, and safety shoes at all time whenever they are inside the working area.

The Contractor, in accordance with this Specification and at his own expense, shall furnish his workers with protective equipment for eyes, face, hands and feet, lifeline, safety belt/harness, protective shields and barriers whenever necessary by reason of the hazardous work process or environment, chemical or radiological or other mechanical irritants or hazards capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical agent.

SPL 900 (6).3 CONSTRUCTION SAFETY SIGNAGES

The Contractor, at the strict direction of the Engineer, shall provide safety signages during the entire construction period to warn the workers and the public of hazards existing on the workplace. Signages shall be written legibly and be posted in prominent positions at strategic location and, as far as practicable, be in the language understandable to all of the workers employed.

Signages shall be regularly inspected and maintained in good condition. If they are damaged or illegible or that are no longer be applicable should be removed and replaced by the safety officer, as necessary.

SPL 900 (6).4 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (6)	Provisional Sum No. 6 (For Health And Safety Requirements)	Provisional Sum

SPL 900 (7) PROVISIONAL SUM FOR DAYWORK

SPL 900 (7).1 DESCRIPTION

This Item shall consist of labor, materials, plant and equipment rates, and be subjected to the provisions of Clause 13.6 of the Conditions of Contract.

SPL 900 (7).2 METHOD OF MEASUREMENT

The Contractor will be paid for daywork schedule carried out during the course of the contract at the rates set down in the Proposal Book. Unless specified otherwise, payments for daywork schedule shall be subject to price escalation adjustment in accordance with the provisions in the Conditions of Contract.

Daywork rates quoted for labor shall be the amounts payable, and shall include allowances for complying with the labor law, for use and waste of hand tools and for all ordinary non-mechanical plant including stagings, scaffoldings, etc., where not erected especially for the execution of a daywork item, use of electric light and all special inducement for working.

The rates of material used on daywork schedule shall include for delivery to the immediate working area and for unloading should any material be required for use on dayworks which are not included in the proposal book, the lowest current net market price shall apply, plus the cost of loading and unloading and 15% allowance for overhead and profit. Should the Engineer instruct that materials be ordered from abroad, then the lowest current net manufacture's C.I.F. price shall apply, plus the cost of customs and handling charges and transporting to the immediate working area and unloading and 15% allowance for overhead and profit. All rates shall include for adequately storing and additional handling costs and taxes.

Plant and equipment shall include the wages of drivers, attendants and operators, maintenance in proper working order at all times, attendance in starting up and shutting down, all fuel and power, oils, greases and cleaning materials. Replacement and/or sharpening of tools and provisions of tools, charges for depreciation insurance, taxes and the like and all other ancillary items including consumables stores. Rates for craft shall include crews, mooring and anchoring.

SPL 900 (7).3 BASIS OF PAYMENT

PROVISIONAL SUMS

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Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (7)	Provisional Sum No. 7 (For Daywork)	Provisional Sum

SPL 900 (8) PROVISIONAL SUM FOR OVERSEAS DEVELOPMENT ASSISTANCE (ODA) RECOGNITION PLATE

SPL 900 (8).1 GENERAL

The Contractor shall secure the department order from the employer regarding the provision and installation of ODA recognition plate. He shall install the recognition plate at the exact location approved by the Engineer. The design, dimensions, layout and wording shall be approved by the Engineer prior to installation. All signboards shall display the title of the project, the name of the Employer, the funding agency and the consulting engineering company, and the funding Loan Agreement Reference Number. The recognition plate shall be maintained in good condition throughout the duration of the Contract, and shall be removed upon completion of the project as directed by the Engineer.

SPL 900 (8).2 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (8)	Provisional Sum No. 8 (For Overseas Development Assistance (ODA) Recognition Plate)	Provisional Sum

SPL 900 (9) PROVISIONAL SUM FOR CONTINGENCY

SPL 900 (9).1 GENERAL

Under this special item, the provisional cost for contingency shall be considered to cover up the costs for unpredicted or unforeseen works which are necessary for the Contractor to undertake in order to complete the project. These works may be also due to the changes of the site conditions, natural conditions or environmental circumstances. The provision for contingency may also be for economical and financial reasons that may arise during the construction duration.

SPL 900 (9).2 BASIS OF PAYMENT

Payment will be made under:

<u>Pay Item No.</u>	<u>Description</u>	<u>Unit of Measurement</u>
SPL 900 (9)	Provisional Sum No. 9 (For Contingencies)	Provisional Sum