PROJECT SPECIFICATIONS

PHASE 2 REPAIR & MAINTENANCE of BELL HOUSE VERANDA

1. SCOPE OF WORK FOR BIDDERS

1.1 To provide the infrastructure for the project "PHASE 2 REPAIR & MAINTENANCE of BELL HOUSE VERANDA".

1.2 To conduct site visit to familiarize with the on-site conditions and existing facilities.

1.3 To provide as-built plans for the Bell House Porch Flooring and Ceiling, one (1) set original CAD drawing in A3 size bond paper, three (3) photo copies, and electronic file.

1.4 As-built plans shall indicate the following drawings in any scale not less than 1:100 meters:

a. Actual layout of the foundation.
b. Actual connection details of the following:
    1. Pedestal to steel column connections
    2. Slab-on-fill to steel column connections
    3. Steel column to steel beam connections
c. Wood composite details.
d. Carpentry and jacketing details.
e. All other details of the project that may be required

1.5 To submit weekly accomplishment reports.

1.6 To properly and safely dispose all wastes generated from the construction.

1.7 To ensure that all workers are equipped with construction safety gear at all times.

1.8 To provide temporary site office/storage and portable toilets/latrines for the workers and do regular maintenance of the same throughout the duration of the project. The portable toilets/latrines shall be dismantled at the end of the project.

1.9 To shoulder all costs for power and water utilities used for the duration of the construction.

1.10 To provide first aid requirements for workers throughout the duration of the project.

1.11 To report immediately to JHMC all unearthed hazardous materials, buried treasures or artifacts. JHMC shall coordinate with concerned agencies to handle the same. Activities in said area shall cease until such time that the hazardous materials, treasures have been properly dealt with.

2. DPWH STANDARDS and SPECIFICATIONS

The scope of work shall be in conformity with of the DPWH standards and specifications.

ITEM 102 - EXCAVATION, BACKFILLING AND DISPOSAL

102.1 Description

The Contractor shall perform all earthworks both for roadway, structures, drainage and borrow excavation and the disposal of material in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the JHMC Representative.

102.2 Construction Requirements

102.2.1 General

When there is evidence of discrepancies on the actual elevations and that shown on the Plans, a pre- construction survey referred to the datum plane used in the approved Plan shall be undertaken by the Contractor under the control of the JHMC Representative to serve as basis for the computation of the actual volume of the excavated materials.

All excavations shall be finished to reasonably smooth and uniform surfaces. No materials shall be wasted without authority of the JHMC Representative. Excavation operation shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to excavation, all necessary clearing and grubbing in the area shall have been performed in accordance with Item 100, Clearing and Grubbing.

The Contractor shall furnish, place and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching or other approved measures for the removal or exclusion of water, including taking care of storm water and waste water reaching the site of the work from any source so as to prevent damage to the work or adjoining property.

102.2.2 Conservation of Topsoil

Where provided for on the Plans or in Special provisions, suitable topsoil encountered in the excavation and on areas where embankment is to be placed shall be removed to such extent and to such depth as the JHMC Representative may direct. The removed topsoil shall be transported and deposited in storage piles at locations approved by the JHMC Representative. The topsoil shall be completely removed to the required depth from any designated area prior to the beginning of excavation or embankment work in the area and shall be kept separate from other excavated materials for later use.

102.2.3 Utilization of Excavated Materials

All suitable material removed from the excavation shall be used in the formation of the embankment, subgrade, shoulders, slopes, bedding and backfill for structures, and for other purposes shown on the Plans or as directed.

The JHMC Representative will designate as unsuitable those soils that cannot

be properly compacted in the embankments. All suitable materials shall be disposed-off as shown on the Plans or as directed without delay to the Contractor.

Only approved materials shall be used in the construction of embankments and backfills. All excess material, including rock and boulders that cannot be used in embankments shall be disposed-off as directed. Materials encountered in the excavation and determined by the JHMC Representative as suitable for topping, road finishing, slope protection, or other purposes shall be conserved and utilized as directed by the JHMC Representative.

102.2.4 Removal of Unsuitable Materials

Where the Plans show the bottom portion of the disposal cell bed to be selected, all unsuitable materials shall be excavated to the depth necessary for replacement of the selected clay liner to the required compacted thickness.

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable soil, the JHMC Representative may require the Contractor to remove the unsuitable material and backfill to the finished graded section with approved material. The Contractor shall conduct his operations in such a way that the JHMC Representative can take the necessary cross-sectional measurements before the backfill is placed.

102.3 Method of Measurement

The cost of excavation of material which is incorporated in the works or other areas of fill shall be deemed to be included in the Items of work where the material is used.

For measurement purposes, surplus suitable material shall be calculated as the difference between the net volume of suitable material required to be used in embankment or cover material corrected by applying a shrinkage factor or swell factor in case of rock excavation, determined by laboratory tests to get its original volume measurement, and the net volume of suitable material from excavation in the original position. Separate pay items shall be provided for surplus common, unclassified and rock material.

The Contractor shall be deemed to have included in the contract unit prices all costs of obtaining land for the disposal of unsuitable or surplus material.

102.4 Basis of Payments

The accepted quantities, measured as prescribed in Section 102.3, shall be paid for the contract unit price for each of the particular pay items listed below that are included in the Bill of Quantities which price and payment shall be full compensation for the removal and disposal of excavated materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this item.

Pay Item Number	Description	Unit of Measurement
102 (1)	Unsuitable Excavation	m^3
102 (2)	Surplus Common Excavation	m^3

ITEM 403 – METAL STRUCTURES (RAILINGS)

403.1 Description

This section shall include miscellaneous metal works.

403.2 General

Connections for which details are not indicated shall be designed in accordance with the American Institute of Steel Construction, "Manual of Steel construction', and shall be welded or bolted, except as specified otherwise. Welding shall be done on a manner that will prevent permanent buckling and all welds exposed in the finished work shall be ground smooth. Steel and iron shall be standard well-finished shapes. All finished and/or machined faces shall be true to line and level.

403.2 MATERIALS for RAILINGS

1. HAND RAILS shall be 150mm x 50mm x 1.2mm tubular and 50mm x 50mm x1.0 mm tubular.
2. BALUSTRADES shall be 50mm x 50mm x 1.0mm tubular.
3. All handrails and balustrades shall be Galvanized Iron.

403.3 WORKMANSHIP and FINISH

Workmanship and finish shall be equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish, sharp, and well-defined lines. Section shall be well framed to shape and size with sharp lines and angles, curved work shall be sprung evenly to curves. All necessary rabbets, lags and brackets shall be provided so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable. Thickness of metals details of assembly and supports shall provide ample strength and stiffness. Joints exposed to the water shall be formed to exclude water. Metal work shall be provided with the proper clearances. Work shall be fabricated and installed in a manner that will provide expansion and contraction, prevent the shearing of bolts, screws and other fastenings, insure rigidity and provide close fitting of sections.

403.4 SHOP PAINTING

All steel works, except for galvanized surfaces, and items and steel work to be embedded in concrete shall be shop-painted with a metal primer zinc-chromate.

ITEM 409 – WELDED STRUCTURAL STEEL

409.1 Description

This work shall consist of the joining of structural steel members with welds of the type, dimensions, and design shown on the Plans and in accordance with the Specifications.

It is the intent of this Specification to provide for work of a quality comparable to that required under the Standard Specifications for Welded Highway and Railway Bridges of the American Welding Society. In case of dispute or for situations not adequately provided for in this Specification, those designated Standard Specifications shall be considered as the final authority and shall govern except as amended by the Special

Provisions.

Welding of Structural Steel shall be done only when shown on the Plans or authorized in writing by the Engineer.

409.2 Materials Requirements

Steel base metal to be welded shallbe open-hearth or electric furnace steel conforming to AASHTO M 183.

All arc-welding electrodes shall conform to the requirements of American Welding Society Specifications. Electrodes shall be of classification numbers E7016, E7018 or E7028 as required for the positions, type of current and polarity, and other conditions of intended use, and to conform to any special requirements indicated on the Plans.

Filler material to be used in the repair or strengthening of old structures or for joining new parts to existing steel members, shall be adopted to the material to be welded and may depart from the foregoing requirements only if agreed by the Engineer.

409.3 Construction Requirements

409.3.1 Equipment

409.3.1.1 General

All items of equipment for welding and gas cutting shall be so designed and manufactured and in such condition as to enable qualified welders to follow the procedures and attain the results prescribed in this Specification.

409.3.1.2 Arc-Welding Equipment

Welding generators and transformers shall be designed expressly for welding. They shall be capable of delivering steady currents adjustable through a range ample for the work requirements. They shall respond automatically and quickly to changes in power requirements due to variations in arc length and shall deliver full current promptly on striking an arc.

Welding cable shall have sufficient conductivity to avoid overheating and inadequate current at the arc and shall be effectively insulated against welding circuit voltage. Earth or ground connections and circuits shall be secured and adequate to carry the welding currents.

Electrode holders shall grip the electrode firmly and with good electrical contact.

Approved automatic welding heads may be used, with suitable auxiliary handling equipment to provide automatic instead of manual control of electrode and welding arc.

409.3.1.3 Gas-Cutting Equipment

Torches and tips shall be of proper size and type of the work at hand. Suitable regulators shall afford the welder complete control over the pressure

and rate of flow of each gas.

409.3.1.4 Protective Equipment

All personnel protective equipment shall conform to the American Standard Association Code for such equipment.

The Contractor shall enforce the use of approved accessories necessary for the protection and convenience of the welders and for the proper and efficient execution of the work.

Suitable protection against the light of the arc shall be maintained by the Contractor when arc-welding operation might be viewed within harmful range by persons other than the actual welders and inspectors.

409.3.2 Welding

409.3.2.1 General

Welding shall be performed by the metal-arc process, using the electrodes specified with either direct or alternating current.

Surfaces to be welded shall be smooth, uniform and free from fins, tears, and other defects which would adversely affect the quality of the weld. Edges of material shall be trimmed by machining, chipping, grinding, or machine gas-cutting to produce a satisfactory welding edge wherever such edge is thicker than: 13 mm for sheared edge of material; 16 mm for toes of angles or rolled shapes (other than wide flange sections); 25 mm for universal mill plate or edges of flange sections.

The width of root face used, shall be not more than 1.5 mm for parts less than 10 mm in thickness nor more than 3 mm for parts 10 mm or more in thickness.

Butt welds shall be proportioned so that their surface contours will lie in gradual transition curves. For butt welded joints between base metal parts of unequal thickness, a transition shall be provided on a slope or level not greater than 1 in 2.5 to join the offset surfaces. This transition may be provided by sloping the surface of the weld metal or by beveling the thicker part or by combination of these two methods.

Surfaces to be welded shall be free from loose scale, slag, rust, grease or other material that will prevent proper welding. Mill scale that withstands vigorous wire brushing or a light film of drying oil or rust inhibitive coating may remain. Surfaces within 50 mm of any weld location shall be free of any paint or other material that would prevent proper welding or produce objectionable fumes while welding.

No operation or actual welding or gas-cutting shall be performed on a member while it is carrying live load stress or while subject to shock and vibration and from moving loads. Welding and gas-cutting shall cease in advance of the application of such loads.

409.3.2.2 Welders

All welding shall be done by approved competent and experienced and fully qualified welders.

409.3.2.3 Preparation of Materials for Welding

Dimensional tolerance, straightness and flatness of the structural shapes and plates shall be within the limits prescribed in this Specification.

Structural steel which is to be welded shall preferably not be painted until all welding is completed.

Preparation of edges by gas-cutting shall, wherever practicable, be done by machine gas-cutting. Machine gas-cutting edges shall be substantially as smooth and regular as those produced by edge planning and shall be left free of slag. Manual gas cutting shall be permitted only where machine gas-cutting is not practicable and with the approval of the Engineer.
The edge resulting from manual gas-cutting shall be inspected and smoothed with special care. All re- entrant corners shall be filleted to a radius at least 19 mm. The cut lines shall not extend beyond the fillet and all cutting shall follow closely the line prescribed.

409.3.2.4 Assembly

The parts to be joined by fillet welds shall be brought into a close contact as practicable, and no event shall be separated more than 5 mm. If the separation is 1.5 mm or greater, the leg of the fillet weld shall be increased by the amount of separation. The separation between faying surfaces of lap joints and of butt joints landing on a backing structure shall not exceed 1.5 mm. The fit of joints which are not sealed by welds throughout their length shall be sufficiently close to exclude water after painting. Where irregularities in rolled shape or plates, after straightening, do not permit contact within the above limits, the procedure necessary to bring the material within these limits shall be subject to the approval of the Engineer.

Cutting parts to be joined by butt welds shall be carefully aligned. Where the parts are effectively restrained against bending due to eccentricity or alignment, a maximum offset of 10 percent of the thickness or the thinner part joined, but in no case more than 3 mm, may be permitted as a departure from the theoretical alignment. In connecting alignment in such cases, the parts shall not be drawn into a greater slope than two degrees (1 in 30). Measurement of offset shall be between centerline of parts unless otherwise shown on the Plans.

When parts abutting edge to edge differ in thickness, the joint shall be of such form that the slope of either surface through the transition zone does not exceed 1 in 2.5, the thicker part being beveled, if necessary.

Members to be welded shall be brought into correct alignment and held in position by bolts, clamps, wedges, guy lines, struts, other suitable devices or tack welds until welding has been completed. The use of jigs and fixtures

is recommended where practicable. Such fastening devices as may be used shall be adequate to insure safety.

Plug and slot welds may be used to transmit shear in a lap joint or to prevent the buckling or separation of lapped parts.

The diameter of the hole for a plug weld shall not be less than the thickness of the part containing it plus 8 mm nor shall it be greater than 2.25 times the thickness of the weld.

The minimum center spacing of plug welds shall be four times the diameter of the hole.

The length of the slot for a slot weld not exceed ten times the thickness of the weld. The width of the slot shall not be less than the thickness of the part containing it plus 8 mm nor shall it be greater than 2.25 times the thickness of the weld.

The ends of the slot shall be semicircular or shall have the corners rounded to a radius not less than the thickness of the part containing it, except those ends which extend to the edge of the part.

The minimum spacing of lines of slot welds in a direction transverse to their length shall be 4 times the width of the slot.The minimum center to center spacing in a longitudinal direction on any line shall be 2 times the length of the slot.

The thickness of plug or slot welds in material 16 mm or less in thickness shall be equal to the thickness of the material. In material over 16 mm in thickness, it shall be at least one-half the thickness of the material but not less than 16 mm.

Tack welds, located where the final welds will later be made, shall be subject to the same quality requirements as the final weld. Tack welds shall be as small as practicable and where encountered in the final welding, shall be cleaned and fused thoroughly with the final weld. Defective, cracked or broken tack welds shall be removed before final welding.

Members or component parts of structures shall be assembled and match marked prior to erection to insure accurate assembly and adjustment of position on final erection. Painted assembly marks shall be removed from any surface to be welded.

409.3.2.5 Control of Distortion and Shrinkage Stresses

In assembling and joining parts of a structure or a built-up member and in welding reinforcing parts to existing members, the procedure and sequence of welding shall be such as will avoid distortion and minimize shrinkage stresses.

As far as practicable, long parallel lines of welding on a part or member shall be executed concurrently, and all welds shall be deposited in a sequence that will balance the applied heat of welding on various sides as

much as possible while the welding progresses.

Before the commencement of welding on a structural member in which severe shrinkage stresses or distortion are likely to occur, a complete program for welding sequence and distortion control shall be submitted to the Engineer and shall be subject to his approval.

The direction of the general progression in welding on a member shall be from points where parts are relatively fixed in position, with respect to each other, toward points which have a greater relative freedom of movement.

Where part or member is to be welded on both ends into a rigid structure or assembly, the connection at which the greatest shrinkage will occur in the direction of the length of the part or member, shall be made while the part or member is free to move in the direction of the shrinkage; and the connection involving the least shrinkage shall be made last.

A weld designed to sustain tensile stress shall be made in such a way that their welding is being performed at any point, all parts that would offer restraint against shrinkage can shrink, deform or move enough to preclude serious shrinkage stresses.

In welding of built-up members of heavy sections, particularly those T or H- shapes where the flanges are considerably heavier than the stems or webs, and in any case where the component parts are 38 mm or greater in thickness, special care shall be exercised during welding to avoid weld cracking. In the welding of members of such heavy section, the temperature of contiguous areas about a welding operation shall be equal, and not less than $55^{o}C$. If necessary, the lighter parts shall be heated while the weld is cooling, to keep the temperature of contiguous parts substantially equal.

In the fabrication of cover-plated beams and built-up members, all shop splices in each component part shall be made before such component part is welded to other parts of the member.

In making all butt-welded splices in rolled shapes and in making butt-welded field splices in built-up sections (such as in H or I-sections) the sequence and procedure of welding shall be such as to take into account unequal amounts of expansion or contraction in the parts being welded. The procedure and sequence shall be such that while the weld and the heated base metal are contracting at any point, any part of the member that would furnish restraint against such contraction can move or shrink enough to prevent the shrinkage of the heated metal from producing harmful internal stresses. The procedure and sequence that is used for making such splices shall be planned in advance in full detail and submitted to the Engineer and shall be subject to his approval.

The ends of all butt welds in flanges of beams and girders shall be made with extension bars regardless of the thickness of such flanges.

Welding shall not be done when surfaces are wet from condensation or rain

which is falling on the surfaces to be welded; nor during periods of high winds unless the welding operator and the work are properly protected.

409.3.2.6 Technique of Arch-Welding

The welding current shall conform with respect to voltage and current (and polarity, of direct current is used) to the recommendations of the manufacturer of the electrode being used, as indicated in the instructions that are included with each container of electrodes.

Arc lengths and electrical potential and current shall be suited to the thickness of material, type of groove and other circumstances attendant to the work.

The maximum size of electrode permitted shall be 5 mm with the following exceptions:

1. The maximum size for flat position welding of all passes except the root pass shall be 8 mm.

2. The maximum size for horizontal fillet welds shall be 6 mm.

The electrode for the single pass fillet weld and for the root passes of all multiple layer welds in all cases shall be of the proper size to insure thorough fusion and penetration with freedom from slag inclusions.

A single layer of the weld metal, whether deposited-in one pass or made up of several parallel beads, shall not exceed 3 mm in thickness except that the bead at the root may be 6 mm in thickness if the position of welding and the viscosity of the weld metal permit control of the latter so that it does not over flow upon unfused base metal.

The maximum size of fillet weld which may be made in one pass shall be 8 mm except that for vertical welds made upward the maximum size made in one pass shall be 13 mm.

In vertical welding the first root pass shall be formed from the bottom upward. Succeeding passes may be formed by any technique that will fulfill the requirements of the Specification and Plans.

The electrode manipulation during welding shall insure that:

1. Complete fusion between the base metal and the deposited weld metal is obtained.

2. The melted base metal is replaced by weld metal so that no undercut remains along the edges of the finished weld.

3. The molten weld metal floats all slag, oxide and gases to the surface behind the advancing arc.

Each time the arc is started, either to begin a weld or to continue partly completed weld, the arch shall be manipulated to obtain complete fusion

of the deposited weld metal with the base metal and with any previously deposited weld metal, before any progression of the arc along the joint.

At the completion of a pass or weld, the arc shall be manipulated so as to fill the crater with sound metal.

Before welding over previously deposited metal, the slag shall be removed and the weld and adjacent base metal shall be brushed clean. This requirement shall apply not only to cratered areas but also when welding is resumed after any interruption. It shall not, however, restrict the making of plug and slot welds, in accordance with the following paragraphs.

In making plug welds the following techniques shall be used:

1. For flat welds, the arc shall be carried around the root of the joint and then weaved along a spiral path to the center of the hole, fusing and depositing a layer of weld metal in the root and bottom of the joint. The arc shall then be carried to the periphery of the hole, and the procedure repeated, fusing and depositing successive layers to fill the hole to the depth required. The slag covering the weld metal shall be kept molten, or nearly so, until the weld is finished. If the arc is broken, except briefly for changing electrodes, the slag must be allowed to cool and shall be completely removed before restarting the weld.

2. For vertical welds, the arc shall be started at the root of the joint, at the lower side of the hole and carried upward on the zigzag path, depositing a layer about 5 mm thick on the exposed face at the thinner plate and fused to it and to the side of the hole. After cleaning the slag from the weld, other layers shall be similarly deposited to fill the hole to the required depth.

3. For overhead welds, the procedure shall be the same as for flat welds except that the slag shall be allowed to cool and shall be completely removed after depositing each successive layer until the hole is filled to the required depth.

   Slot welds shall be made with a technique similar to that specified above for plug welds, except that if the length of the slot exceeds three times the width, or if the slot extends to the edges of the part of the technique specified above for making plug welds shall be followed for the type of flat position welds.

409.3.2.7 Details of Welds

The following tabulation shows that the relation between weld size and the maximum thickness of material on which various sizes of fillet welds may be used:

Size of Fillet Weld	Maximum Thickness of Part
5 mm	13 mm
6 mm	19 mm
8 mm	32 mm
10 mm	51 mm
13 mm	152 mm
16 mm over	152 mm

Size of fillet weld that may be used along the edge of material 6 mm or more in thickness shall be 1.5 mm less than the thickness of the material.

The minimum effective length of fillet weld shall be four times its size and in no case less than 38 mm.

Fillet welds terminating at the corners of parts or members shall, wherever practicable, be turned continuously full size around the corners for a distance not less than twice the nominal size of the weld.

Intermittent fillet welds, preferably, shall not be used. They shall be permitted only where the required weld area is less than that of a continuous fillet weld of the minimum size. If used on main members, they shall be chain intermittent welds. In all other cases, chain intermittent welding is preferable to staggered intermittent welding.

Spacing of intermittent fillet welds shall be measured between the center of the weld segments.

The spacing shall conform to the following requirements unless calculated stresses between the parts require closer spacing:

1. At the end of members, there shall preferably be continuous longitudinal fillet welds at least as long as the width of the element or member being connected.

2. The clear spacing in the direction of stress of stitch welds that connect plates to other plates or to shapes shall not exceed:

   a. For compression members ….10 times the thickness of the thinner part but not more than 300 mm.
   b. For tension members ….. 14 times the thickness of the thinner part but not more than 300 mm.

   The spacing transverse to the direction of stress shall not exceed 24 times the thickness of the thinner part connected.

3. For members composed of two or more rolled shapes in contact with one another, the longitudinal spacing of stitch welds shall not exceed 600 mm.

Fillet welds in holes or slots may be used to transmit shear in lap joints or to prevent the buckling or separation of lapped parts. The fillet welds in a hole or slot may overlap.

Seal welding shall preferably be accomplished by a continuous weld combining the function of sealing and strength, changing sections only as the required strength may necessitate.

Exposed faces of welds shall be made reasonably smooth and regular, shall conform as closely as practicable to the design requirements and shall not at any place be inside the intended cross-section. Weld dimension in excess of the design requirements shall not be a cause for rejection, but in case excess weld metal involves serious malformation, such work shall be rejected.

All fillet welds shall be of acceptable types. All fillet welds that carry reversed stresses running in a direction perpendicular to their longitudinal axis shall be of the concave type or the 0-gee type when the fillet weld is flushed with the edge of a member. When one of these types is specifically indicated on the Plans for a weld, it shall be of that type.

Butt welds shall preferably be made with a slight reinforcement, except as may be otherwise provided, and shall have no defects. The height of reinforcement shall be not more than 3 mm.

All butt welds, except produced with aid of backing material, shall have the root of the initial layer chipped out or otherwise cleaned to sound metal and welded in accordance with the requirements of the Specification.

Butt welds made with the use of a backing of the same materials as the base metal shall have the weld metal thoroughly fused with the backing materials.

Ends of butt welds shall be extended past the edges of the parts joined by means of extension bars providing a similar joint preparation and having a width not less than the thickness of the thicker part jointed; or for material 19 mm or less in thickness, the ends of the welds shall be chipped or cut down to solid metal and side welds applied to fill out the ends to the same reinforcement as the face of the welds. Extension bars shall be removed upon completion and cooling of the weld and the ends of the weld made smooth and flush with the edges of the abutting parts.

409.3.2.8 Quality of Welds

Weld metal shall be solid throughout except that very small gas pockets and small inclusions of oxide or slag may be accepted if well dispersed and if none exceeds 1.5 mm in greatest dimension, and if the sum of the greatest dimensions of all such defects of weld metal area does not exceed 15 mm in an area of 10 cm^2.

There shall be complete fusion between the weld metal and the base metal and between successive passes throughout the joint.

Welds shall be free from overlap and the base metal free from undercutting. All craters shall be filled to the full cross-section of the welds.

409.3.2.9 Correction

In lieu of rejection of an entire piece of member containing welding which is unsatisfactory orindicates inferior workmanship, the following corrective measures may be permitted by the Engineer whose specific approval shall be obtained for making each correction:

1. Removal of part or all of the welds shall be affected by chipping, grinding or gas-gouging.

2. Defective or unsound welds shall be corrected either by removing and replacing the welds, or as follows:

    a. Excessive convexity – Reduce to size by removal of excess weld metal.
    b. Shrinkage crack in base metal, craters and excessive porosity – Remove defective portion of base and weld metal down to sound metal and deposit additional weld metal.
    c. Undercutting, undersize and excessive concavity – Clean and deposit additional weld metal.
    d. Overlapping and lack of fusion – Remove and replace the defective length of weld.
    e. Slag inclusion – Remove those parts of the weld containing slag and fill with weld metal.
    f. Removal of adjacent base metal during welding – Clean and form full size by depositing additional weld metal.

3. Where corrections require the depositing of additional weld metal, the electrode used shall be smaller than the electrode used in making the original weld.

4. A cracked weld shall be removed throughout its length, unless by the use of acid etching, magnetic inspection or other equally positive means, the extent of the crack can be ascertained to be limited, in which case sound metal 50 mm or more beyond each end of the crack need not be removed.

5. In removing defective parts of a weld, the gas-gouging, chipping or grinding shall not extend into the base metal any substantial amount beyond the depth of the web penetration unless cracks or other defects exist in the base metal.

6. Where the work performed subsequent to the making of a deficient weld has rendered the weld inaccessible or has caused new conditions which would make the correction of the deficiency dangerous or ineffectual, the original condition shall be restored by renewal of welds or members, or both before making the necessary corrections, or else the deficiency shall be compensated by additional work according to a revised design approved by the Engineer.

7. Caulking of welds shall not be done.

8. Before adding weld metal or re-welding, the surfaces shall be cleaned thoroughly. Where incomplete fusion is disclosed by chipping, grinding or gas gouging, to correct defects, that part of the weld shall be removed and re-welded.

409.3.2.10 Stress Relieving

Peening to reduce residual stress of multi-layer welds may be used only if authorized and ordered by the Engineer. Care shall be exercised to prevent over peening which may cause overlapping, scaling, flecking or excessive cold working of weld and base metal.

409.3.2.11 Cleaning and Protective Coatings

Painting shall not be done until the work has been accepted and shall be in accordance with the Specification. The surface to be painted shall be cleaned of spatter, rust, loose scale, oil and dirt. Slag shall be cleaned from all welds.

Welds that are to be galvanized shall be treated to remove every particle of slag.

409.3.2.12 Identification

The operator shall place his identification mark with crayon, or paint, near the welds made by him.

409.3.2.13 Inspection

On completion of the welding work, inspection shall be carried out by an Inspector appointed by the Engineer.

The size and contour of welds shall be measured with suitable gauges. The inspector shall identify with a distinguishing mark all welds that he has inspected and accepted.

The Contractor shall remove and replace, or correct as instructed, all welds found defective or deficient. He shall also replace all methods found to produce inferior results, with methods which will produce satisfactory work.

In the event that fault welding or the removal for re-welding of faulty welding shall damage the base metal, the Contractor shall remove and replace the damaged material.

409.4 Measurement and Payment

Unless otherwise provided in the Special Provisions, welded structural steel structures shall not be measured and paid for separately, but the cost thereof shall be considered as included in the contract price for other items.

ITEM 414 FORMS AND FALSEWORKS

414.1 Description

This Item shall consist of constructing and removing forms to temporarily support concrete until the structure is completed to the point it can support itself.

414.2 Material Requirements

414.2.1 Formwork

The materials used for smooth form finish shall be plywood, tempered concrete-form-grade hardboard, or other acceptable materials capable of producing the desired finish for form-facing materials. Form-facing materials shall produce a smooth, uniform texture on the concrete. Form-facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of concrete surfaces shall not be permitted. No form-facing material shall be specified for rough form finish.

414.2.1.1 Formwork accessories

Formwork accessories that are partially or wholly embedded in concrete, including ties and hangers shall be commercially manufactured. The use of non-fabricated wire form ties shall not be permitted. Where indicated in the Contract, use form ties with integral water barrier plates in walls.

414.3 Method of Measurement

When the Contract stipulates that payment will be made for forms on lump-sum basis, the pay item will include all materials and accessories needed in the work.

Whenever the Bill of Quantities does not contain an item for form, the work will not be paid directly but will be considered as a subsidiary obligation of the contractor under other Contract Items.

414. 4 Basis of Payment

The accepted quantities measured as prescribed in subsection 414.4, shall be paid for at the Contract lump-sum price for Forms and Falsework which price and payment shall be full compensation for designing, constructing and removing forms, all materials and accessories needed and for furnishing all labor equipment tools and incidentals necessary to complete the item.

Payment will be made under:

Pay Item Number	Description	Unit Measurement
SPL 2	Forms and Falsework	Lump Sum

ITEM 900 - REINFORCED CONCRETE

900.1 Description

This item shall consist of furnishing, placing and finishing concrete in buildings and related structures, flood control and ports, and water supply structures in accordance with this specification and conforming to the lines, grades and dimension shown in the plans.

900.2 Materials Requirements

900.2.1 Portland Cement

This item shall conform to the requirement of ITEM 700, Hydraulic Cement, Volume I.

Concrete Aggregates

The concrete aggregates shall conform to the requirement of Subsection 311.2.2 and 311.2.3 under ITEM 311 of Volume I and ASTM C 33 for lightweight aggregates, except that aggregates failing to meet these specifications but which have been shown by special that or actual service to produce concrete of adequate strength and durability maybe used under method (2) of determining the proportion of concrete, where authorized by the Engineer.

Except as permitted elsewhere in this section, the maximum size of the aggregate shall be not larger than one-fifth (1/5) of the narrowest dimensions between size of forms of the member for which the concrete is to be used nor later than three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars or pretensioning strands.

Aggregate Test

Samples of the fine and coarse aggregates to be used shall be selected by the Engineer for tests at least 30 days before the actual concreting operations are to begin. It shall be the responsibility of the contractor to designate the source or sources of aggregate to give the Engineer sufficient time to obtain the necessary samples and submit them for testing.

No aggregates shall be used until official advice has been received that it has satisfactory passed all test, at which time written authority shall be given for its use.

900.2.3 Water

Water used in mixing concrete shall conform to the requirement of Subsection 311.2.4 under ITEM 311, Part D of Volume 1.

900.2.4 Metal Reinforcement

Reinforcing Steel bars shall conform to the requirements of the following

Specifications; Deformed & Plain Billet Steel	ASTM A 6151
Bars for concrete reinforcement	AASHTO M 31

If reinforcing bars are to be welded, these ASTM specifications shall be supplemented by requirements assuring satisfactory weldability.

Bars and rod for concrete	
Reinforcement	ASTM A 187
For concrete reinforcement	AASHTO M 55

900.2.5 Storage of Materials

Cement and aggregates shall be stored in such a manner as to prevent their deterioration or intrusion of foreign matter. Cement shall be stored immediately upon arrival on the site of the work, in substantial waterproof bodegas, with a floor raised from the ground sufficiently high to be free from dampness. Aggregates shall be stored in such a manner as to avoid the inclusion of foreign materials.

900.3 Construction Requirements

Notations: The notations used in these regulations are defined as follows:

f'c = compressive strength of concrete

Fsp = ratio of splitting tensile strength to square root compressive strength

900.3.1 Concrete Quality

All plans submitted for approval or used for any project shall clearly show the specified strength, f'c', of concrete of the specified age for which each part of the structure was designed.

Concrete that will be exposed to sulfate containing or other chemically aggressive solutions shall be proportioned in accordance with "Recommended Practice for Selecting proportions for Concrete (ACI 613)" and with "Recommended Practice for Selecting proportions for Structural Lightweight Concrete (ACI 613A)."

900.3.2 Methods of Determining the Proportions of Concrete

The determination of the proportions of cement, aggregate, and water to attain the required strengths shall be made by one of the following methods, but lower water-cement ratios may be required for conformance with the quality of concrete.

Method 1. Without preliminary test

Where preliminary test data on the materials to be used in the concrete have not been obtained the water- cement ratio for a given strength of concrete shall not exceed the values shown in Table 900.1.

Where previous data are not available, concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (or cement content in the case of lightweight aggregates) which will produce a range of strength s encompassing those required for the work. For each water-cement ratio (or cement content) at least three specimens for each age to be tested shall be made, cured and tested for strength in accordance with ASTM C 39 and C 192.

The strength test shall be made at 7, 14 and 28 days at which the concrete is to receive load, as indicated on the plans. A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The maximum permissible water-cement ratio for the concrete to be used in the structure shall be that shown by the curve to produce an average strength to satisfy the requirements of the strength test of concrete provided that the water-cement ratio shall be no greater than that required by concrete quality when concrete that is to be subjected to the freezing temperature which weight shall have a water-cement ratio not exceeding 6 gallon per bag (50 kgs.) and it shall contain entrained air.

Where different materials are to be used for different portions of the work, each combination shall be evaluated separately.

Table 900.1 Maximum Permissible Water-Cement Ratios for Concrete (Method 1)

Specific Compressive strength at 28 days, psi fc'	Maximum permissible Water-Cement Ratio			
	Non Air-entrained Concrete		Air-entrained Concrete	
	U.S. gal. per 42.5 kg. bag of cement	Absolute Ratio by weight	U.S. gal. per 42.5 kg. bag of cement	Absolute Ratio by weight
2500	7 ¼	0.642	6 ¼	0.554
3000	6 ½	0.576	5 ¼	0.465
3500	5 ¾	0.510	4 ½	0.399
4000	5	0.443	4	0.354

900.3.3 Concrete Proportions and Consistency

The proportion of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles on the form and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work.

900.3.4 Sampling and Testing of Structural Concrete

As work progress, at least one (1) set of sample consisting of three (3) concrete cylinder test specimens, 150 x 300 mm. shall be taken from each class of concrete placed each day, and each set to represent not more than 75 cu. m. of concrete.

900.3.5 Consistency

Concrete shall have a consistency such that it will be workable in the required position. It shall be such a consistency that it will flow around reinforcing steel but individual particles of the coarse aggregate when isolated shall show a coating or mortar containing its proportionate amount of sand. The consistency of concrete shall be gauged by the ability of the equipment to properly placed it and not by the difficulty of mixing water shall be determined by the Engineer and shall not be varied without his consent. Concrete as dry as it is practical to place with the

equipment specified shall be used.

900.3.6 Strength Test of Concrete

When strength is the basis of acceptance, each class of concrete shall be represented by at least five test (10 specimens). Two specimens shall be made for each test at a given age, and not less than one test shall be made for each 150 cu. m. of structural concrete, but there shall be at least one test for each days concreting.

The Engineer may require a reasonable number of additional tests during the progress of the work. Samples from which compression test specimens are molded shall be secured in accordance with ASTM C 172. Specimens made to check the adequacy of the proportions for strength of concrete or as basis for acceptance of concrete shall be made and laboratory-cured in accordance with ASTM C 31. Additional test specimens cured entirely under field conditions may be required by the Engineer to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with ASTM C 39.

The age for strength tests shall be 28 days or, where specified, the earlier age at which the concrete is to receive its full load or maximum stress. Additional test may be made at earlier ages to obtain advance information on the adequacy of strength development where age-strength relationships have been established for the materials and proportions used.

To conform to the requirements of this Item:

1. For structures designed in accordance with the Working Stress Design (WSD) method of this chapter, the average of any five consecutive strength tests of the laboratory-cured specimens representing each class of concrete shall be equal on or greater than the specified strength, fc', and not more than 20 percent of the strength test shall have values less than that specified.

2. For structures designed in accordance with the Ultimate Strength Design (USD) method of this chapter, and for prestressed structures the average of any three consecutive strength test of the laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified strength, fc' and not more than 10 percent of the strength tests shall have values less than the specified strength.

   When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Engineer, the strengths of the job-cured specimens, the Contractor may be required to improve the procedures for protecting and curing the concrete, or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM Specification C 42 or order load test as outlined in the load tests of structures for that portion of the structure where the questionable concrete has been placed.

900.3.7 Splitting Tensile Test of Concrete

To determine the splitting ration, Fsp, for a particular aggregate, test of concrete shall be made as follows:

1. Twenty four (24) 15 cm. diameter by 30 cm. long (6 in. dia. by 12 in. long) cylinders shall be made in accordance with ASTM C 192, twelve at compressive strength level of approximately 210 kilograms per square centimeter (3000 psi) and twelve at approximately 280 kilograms per square centimeter (4000 psi) or 350 kilograms per square centimeter (5000 psi). After 7 days moist curing followed by 21 days at 23 ºC (73 ºF) and 50% relative humidity, eight of the test cylinders at each of the two strength levels shall be tested for splitting strength and four for compressive strength.

2. The splitting tensile strength shall be determine in accordance with ASTM C 496, and compressive strength in accordance with ASTM C 39.

The ration, Fsp, of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile test and all 8 compressive tests.

Minimum Strength, Concrete other than fill, shall have a minimum compressive strength at
28 days of 140 kilograms per square centimeter (2000 psi).

900.3.8 Batching

Batching shall conform to the requirements of ITEM 405, Structural Concrete.

900.3.9 Mixing and Delivery

Mixing and delivery shall conform to the requirements of ITEM 405, Structural Concrete.

900.3.9.1 Concrete Surface Finishing : General

This shall be in accordance with ITEM 407, Concrete Structures.

900.3.9.2 Curing Concrete

This shall be in accordance with ITEM 407, Concrete Structures

900.3.9.3 Acceptance of Concrete

The strength of concrete shall be deemed acceptable if the average of three (3) consecutive strength test results is equal to or exceed the specified strength and no individual test result falls below the specified strength by more than 15%.

Concrete deemed to be not acceptable using the above criteria may be rejected unless Contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area, cured and tested in accordance with AASHTO T24. Concrete in the area represented by the cores will be deemed

acceptable if the average of cores is equal to or at least 85% and no sample core is less than 75% of the specified strength otherwise it shall be rejected.

900.4 Method of Measurement

The quantity of concrete to be paid shall be the quantity shown in the Bill of Quantities schedule, unless changes in design are made in which case the quantity shown in the Bill of Quantities will be adjusted by the amount of the change for the purpose of payment. No deduction will be made for the volume occupied by the pipe less than 101 mm. (4") in diameter nor for reinforcing steel, anchors, weep holes or expansion materials.

900.5 Basis of Payment

The accepted quantities measured as prescribed in Sub-Section 900.7 shall be paid for at the appropriate contract unit price for the pay item listed below as shown in the Bill of Quantities, which price and payment shall be full compensation for furnishing all materials, including metal water stops, joints, joint fillers, weep holes, and rock backing and timber bumpers; for all form and false work; for mixing, placing, furnishing, and curing the concrete; and for all labor, materials, equipment, tools and incidentals to complete the item, except that reinforcing steel shall be paid for at the contract unit price per kilogram for reinforcing steel metal pipes and drains, metal conduits and ducts, and metal expansion angles shall be paid for as structural steel that when the proposal does not include an item for Structural Steel these miscellaneous metal parts shall be paid for as reinforcing steel.

Pay Item No.	Description	Unit of Measurement
900 (1)	Reinforced Concrete	cubic meter (cu.m.)

ITEM 1003 CARPENTRY AND JOINERY WORKS

1003.1 Description

The work under this Item shall consist of furnishing all required materials, fabricated wood work, tools equipment and labor and performing all operations necessary for the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and this Specifications.

1003.2 Material Requirements

1003.2.1 Lumber

Lumber of the different species herein specified for the various parts of the structure shall be well seasoned, sawn straight, sun dried or kiln dried and free from defects such as loose unsound knots, pitch pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

1003.2.1.2 Lumber Species and Usage

Unless otherwise specified on the Plans, the following lumber species shall be **Apitong** (common grade) for roof framing supporting light roofing materials such as galvanized iron, aluminum or PVC sheets, for wall framing, ceiling joist, hangers and nailers.

1003.2.1.3 Moisture Content

Rough lumber for framing and siding boards shall be air-dried or sun-dried such that its moisture content shall not exceed 22 percent. Dressed lumber for exterior and interior finishing, for doors and windows, mill work, cabinet work and flooring boards shall be kiln-dried and shall not have a moisture content in excess of 14 percent at the time of installation in the structure.

1003.2.1.4 Substitution in Lumber Specie

Any lumber equally good for the purpose intended may be substituted for the specific kind subject to the prior approval of the Engineer, provided the substitution shall be of equal or better specie acceptable to the Engineer. In case of substitution with better specie, no additional cost therefore shall be allowed to the Contractor.

1003.2.5.3 Fasteners

Nails shall be provided and used where suitable for fixing carpentry and joinery works. All fasteners shall be brand new and of adequate size to ensure rigidity of connections.

a. Nails of adequate size shall be steel wire, diamond-pointed, ribbed shank and bright finish.

1003.3 Construction Requirements

1003.3.1 Quality of Materials

All materials to be incorporated in the carpentry and joinery works shall be of the quality specified under Section 2. Before incorporation in work, all materials shall have been inspected/ accepted by the Engineer or his authorized representative.

1003.3.2 Storage and Protection of Materials

Lumber and other materials shall be protected from dampness during and after delivery at the site. Materials shall be delivered well in advance of actual need and in adequate quantity to prelude delay in the work. Lumber shall be piled in orderly stack at least 150 mm. above ground and at sheltered place where it will be of least obstruction to the work.

1003.3.3 Shop Drawings

Shop drawings complete with essential dimensions and details of construction, as may be required by the Engineer in connection with carpentry and joinery work, shall be submitted for approval before proceeding with the work.

1003.4 Method of Measurement

All carpentry actually installed shall be measured and determined by Subsections 1003.3.3 and 1003.3.5 as provided in the Bill of Quantities accepted to the satisfaction of the Engineer.

1003.5 Basis of Payments

The Items measured and determines as provided in subsection 1003.4 shall be paid for at the unit bid price which payment constitute full compensation of material, labor and incidentals

necessary to complete this item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1003 (a)	Rough carpentry (framing, Roof, flooring, partition, ceiling)	square meter (sq.m.)

ITEM 1013 CORRUGATED METAL ROOFING

1013.1 Description

This Item shall consist furnishing all plant, equipment, tools, materials and labor required to properly perform and complete the corrugated metal roofing, together with related accessories such as ridge/ hip rolls, valley, gutters and flashing, when called for on Plans all in conformity with this Specifications.

1013.2 Material Requirements

1013.2.1 Corrugated and Plain Galvanized Iron Sheets

Corrugated galvanized iron (G.I.) sheets, including plain G.I. sheets for roofing accessories shall be cols- rolled meeting ASTM A 153 and with spelter coating of zinc of not less than 0.381 kg/sq. m. (1.25 ounces/ sq.ft.), conforming to ASTM A 525 or PNS 67:1985. Unless otherwise specified or shown on Plans roofing sheets shall be gauge 26 (0.48 mm. thick) and provided in long span sizes to minimize end laps.

Sheets shall weigh not less than 3.74 kg/sq.m. and shall be marked or stamped showing gauge, size, amount of zinc coating, brand and name of manufacturer. Test specimens shall stand being bent through 180 degree flat on itself without fracture of the base metal and without flaking of zinc coating.

1013.2.2 Strap Fasteners

Strap fasteners shall be gauge 26 G.I. 25 mm. wide and sufficiently long to bend around up to the opposite face of purlin, with corners chipped off at the riveting ends

1013.2.3 Rivets, Washers and Burrs

Rivets and washers shall be galvanized mild iron. Rivets shall not be less than 5 mm. in diameter and 10 mm. in length. Washers shall not be less than 1.5 mm. thick and 20 mm. in outside diameter. Washer's inside diameter shall provide snug fit to the rivet.

1013.2.3 Soldering Lead

Soldering lead shall have a composition of 50 percent tin and 50 percent

lead, conforming to ASTM B 32. Rivets and burrs for lap joints of gutters, downspout and flashing shall be copper not less than 3.175 mm. in diameter (No.8).

1013.2.4 Fabricated Metal Roofing Accessories

Ridge/hip rolls, valleys, flashing and counter flashings, gutters and downspouts, whenever required, shall be fabricated from plain G.I. sheets. Ridge/hip rolls, flashings and counter flashings shall be gauge 26. Valleys, gutters and downspout shall be gauge 24 unless otherwise specified on Plans. Wire basket strainers shall be galvanized, gauge 24.

Roof ventilators, whenever required shall be fabricated from gauge 26 plain G.I. sheets and constructed to the dimensions and details shown on Plans.

1013.3 Construction Requirements

1013.3.1 Preparatory Work

Preparatory to the installation of the corrugated G.I. roofing, purlins should have been placed and spaced properly to fit the length of roofing sheets to be used such that the centerline of the purlins at end lap are 150 mm. from the bottom line of end laps and intermediate purlins are placed equidistantly. Top of purlins should be at the same plane.

1013.3.2 Installation of Corrugated G.I. Sheets

Installation of corrugated G.I. sheets with end laps shall start at the lower part of the roof and proceed towards the direction of monsoon wind with side laps of two-and-a-half (2 ½) corrugations. End laps shall be 250 mm. minimum. Each sheet shall be fastened temporarily by 1.83 mm. diameter by 25 mm. long galvanized flat head nails at valleys of corrugations covered by side or end laps.

Succeeding upper rows of corrugated G.I. sheets shall be installed in the same manner until the entire roof area is covered.

Valleys, ridge/hip rolls and flashing when require, shall be installed before fastening the roofing sheets with galvanized straps and rivets. One strap shall be riveted at each alternate corrugation at the gutter line, the ridge line and at the end laps and the straps bent around and nailed to the purlins. Riveting at intermediate purlins between end laps shall be done at every fourth corrugation. Rivet shall be provided with a galvanized mild iron washer below and one lead and one galvanized iron washer above the sheet. Rivet shall be sufficiently long to permit forming a hemispherical head. Riveting shall be done such that the lead washer shall be compressed to provide a watertight fit around the rivet.

1013.3.3 Installation of Roofing Accessories

a. Ridge and Hip Rolls

Ridge and hip rolls shall lap at least 250 mm. over roofing sheets and, together, shall be riveted at every second corrugation.

b. Valleys

Valleys shall lap at least 450 mm. each way under the roofing sheets and shall be secured to the framework with galvanized nails, such nails placed below the roofing sheets. Rivets alongside of the valley shall be at every second corrugation.

c. Flashing

Flashing, of gauge 26 plain G.I. sheets, unless otherwise specified, shall be installed along intersections of roof, with concrete or masonry walls in accordance with details shown on Plans. Flashing running parallel to sheet corrugation shall lap at least two corrugations with edge turned down. Flashing across sheet corrugation or at an angle thereto, shall lap at least 250 mm. and the edge of flashing adjoining wall shall be at least 200 mm. wide and provided with counter flashing.

d. Counter Flashing

Counter flashing sheets of gauge 24 plain G.I. shall be built into preformed wedge-shape groove of concrete or masonry wall. The edge to be built into wall groove shall have a 25 mm. strip bent 45 degrees and shall be sealed in the groove with cement mortar or caulking compound.

e. Reglets

Reglets, when required per plans in connection with counter flashing, shall be fabricated products approved by the Engineer, complete with fittings. Reglets shall be located not less than 200 mm. or more than 40 mm above roofing. Reglets plugs shall be spaced not more than 300 mm. on centers. Open-type reglets shall be filled with fiber board or other suitable separator to prevent crushing of the slot during installation. The counter flashing shall be inserted into the full depth of reglet and the reglet lightly punched every 300 mm. to crimp the reglet and the counter flashing together.

f. Gutters

Gutters, from gauge 24 plain G.I. sheets shall be fabricated to the shape and dimensions indicated on the Plans. The rear side of the gutter shall have a 12.5 mm strip bent 30 degrees and shall be not less than 12.5 mm. higher than the opposite side. Gutter joints shall be flat seam folded in direction of flow and soldered evenly. Otherwise gutter joints shall be lapped at least 25 mm. fastened together with 3.175 mm. diameter (No.8) copper rivets and burrs, and sealed by soldering along both exposed edges of lap.

Gutter shall be attached to facia board or roof nailer with galvanized nails or screws spaced at not more than 900 mm on centers and at a point slightly higher than leading edge of gutter. As additional support, gutter shall have plain G.I. strap hangers 25 mm. wide fastened to roof nailers by screw shank-type nails and riveted to the gutter's leading edge. Strap hangers shall be spaced at not more than 900 mm. on centers. When shown on plans that gutter is not fixed to facia board or purlin,

gutter shall be supported by wrought iron (W.I.) hangers not less than 4.75 mm. thick and 19 mm. wide spaced at not more than 900 mm. on centers. W.I. hanger shall be fabricated to fit configuration of the gutter and attached to fascia or purlin with two (2) No. 8 flat head wood screws.

Gutter shall be installed with a pitch of 1 in 100 slope to downspout.

g. Downspouts

1. Downspouts

Unless specified otherwise, downspouts shall be plain G.I., thickness fabricated to the dimensions shown on the Plans and installed at indicated locations. Downspout shall be secured to the wall with G.I. straps 25 mm. wide, spaced at more than 1000 mm. and anchored with concrete nails. Inlets of downspouts shall be fitted with gauge 14 wire basket strainers.

2. Unplasticized Polyvinyl Chloride Downspouts

When shown on Plans that downspouts are other than G.I. sheets, downspouts shall be unplasticized polyvinyl chloride (UPVC) pipes and fittings with dimensions indicated and conforming with ASTM D3033 and D 3034. Joints shall be made with either solvent cement or rubber "O-rings" depending on the design of fitting for the joints. Rubber "O-rings" shall be neoprene type, heat and oil resistant, complying with ASTM F-477. Downspout shall be secured to adjoining wall with plain G.I. straps 25 mm. wide and spaced at not more than 1000 mm.

h. Roof Ventilators

Roof ventilators, whenever shown on Plans shall be firmly secured to the roofing or roof structure by means of rivets. Roof ventilators installed on the roof at places other than the ridge shall be provided with adequate flashing around intersection with roofing to ensure watertight joints.

1013.3.4 Joints of G.I. Roofing Accessories

a. Soldered Joints

Joints made by tapping coupled with riveting shall be rendered watertight by soldering. All edges of uncoated sheet metal to be soldered shall be pre-tinned before soldering. Soldering shall be done slowly with well heated iron in order to thoroughly heat the seam and sweat the solder completely through the full length of the seam. Upon completion of soldering, acid shall be neutralized by washing thoroughly with water.

b. Non-soldered Joints

Non-soldered joints of G.I. gutters, downspouts and flashing shall be

done by flat lock seams. Two adjoining edges of lock seam shall be bent 90 degree. One bent strip shall be at least 15 mm. wide and the connecting piece shall have a bent strip twice in width which shall be bent down over the upturned narrower strip and pressed together. Once properly interlocked, the joint shall be flattened such that the edge of the wider strip b concealed.

1013.3.5 Roof Installation on Metal Purlins

Installation on metal purlins shall follow the same procedure as that on wood purlins, except that fastening shall be done with thread-cutting, zinc-coated steel screws, No.12 by 50 mm. having hexagonal heads and provided with neoprene washers. Screw holes shall be drilled using 5 mm. (13/64") diameter bit.

1013.3.6 Water Leak Test

The completed roofing shall be tested for water tightness at side and end laps at joints of roofing sheets with ridge/hips rolls, valleys and flashings by means of water-spray system. The water-spray system shall have nozzle which will deliver water pressure of 2 kg/cm² directly to the joint being tested in such manner and for a duration directed by the Engineer. All defective works as determined by this test shall be remedied by the Contractor at his expense and the test shall be repeated until the work is found satisfactory.

1013.4 Method of Measurement

Roofing sheets shall be measured and paid for on an area basis in square meters or part thereof, such roofing sheets including all laps, fasteners and rivets as installed complete and accepted.

Ridge/hip rolls, flashing, valleys, gutters and downspouts shall be measured in linear meter of completed and accepted work such measurement shall include necessary straps and fixings required for complete installation.

Roof ventilators shall be measured and paid for per unit completely installed and accepted.

The different pay items under roofing work shall be designated the following number, description and unit of measure:

1013.5 Basis of Payment

The accepted quantities measured as prescribed in Sub-Section 403.10 shall be paid for at the appropriate contract unit price for the pay item listed below as shown in the Bill of Quantities, which price and payment shall be full compensation for placing all materials, labor, equipment, tools and incidentals to complete the work.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
403.3 (1a)	Truss & Purlins	Square Meter

403.3 (1b)	Water Tank	Lot
403.7.2 (2)	Prepainted Long Span Roofing, Siding and Bending Accessories	Square Meter
403.5 (3)	Ceiling & Siding Accessories	Square Meter
403.9 (4)	Membrane Waterproofing	Square Meter

ITEM 1032 PAINTING

1032.1 Description

This Item shall consist of furnishing all paint materials and other related products, labor, tolls, equipment and plant required in undertaking the proper application on painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

1032.2 Material Requirements

1032.2.1 Paint materials

All types of paint material and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, DPWH or the National Institute of Science and Technology. (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller O Brien, or any approved equal).

1032.2.2 Tinting Colors

Tinting color shall be first grade quality, pigment ground in alkyd resin that disperses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

1032.2.3 Schedule

Exterior Finishes

a. Plain cement plastered finish to be painted	3 coats Acrylic base masonry paint
b. Concrete exposed aggregate and/or tool finish	1 coat water repellant
c. Ferrous metal	1 coat primer and 2 coats enamel paint

1032.3 Construction Requirements

The Contractor prior to commencement of the painting, varnishing and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting varnishing and related works.

1032.3.1 Surface Preparation

All surfaces shall be in proper condition to receive the finish. Woodworks shall be hand-sanded smooth and dusted clean. All knot-holes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.

Interior woodworks shall be sandpapered between coats. Cracks holes of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound. After all defects are corrected apply the finish coats as specified on the Plans (color scheme approved).

Metal shall be clean, dry and free from millscale and rust. Remove all grease and oils from surfaces. Wash, unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with red lead primer same shall be approved by the Engineer.

In addition the Contractor shall undertake the following:

1. Voids, cracks, nick etc. will be repaired with proper patching material and finished flushed with surrounding surfaces.
2. Marred or damaged shop coats on metal shall be spot primed with appropriate metal primer.
3. Painting and varnishing works shall not be commenced when it is too hot or cold.
4. Allow appropriate ventilation during application and drying period.
5. All hardware will be fitted and removed or protected prior to painting and varnishing works.

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flawed out after application of paint.

Paints made for application by roller must be similar to brushing paint. It must be non-sticky when thinned to spraying viscosity so that it will break up easily droplets.

Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. This procedure changes the required properties of the paint.

1032.3.3 Mixing and Thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacture shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 pint of suitable thinner per gallon of the paint.

1032.3.4 Storage

All material to be used under this item shall be stored in a single place to be designated by the Engineer and such place shall be kept neat and clean at all time. Necessary precaution to avoid fire must be observed by removing oily rags, waste, etc. at the end of the daily work.

1032.3.5 Cleaning

All cloths and cotton waste which constitute fire hazards shall be placed in metal containers or destroyed at the end of daily works. Upon completion of daily work, all staging, scaffolding and paint containers shall be removed. Paint drips, oil, or stains on adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

1032.3.6 Workmanship in General

a. All paints shall be evenly applied. Coats shall be of proper consistency and well brushed out so as to show a minimum of brush marks.
b. All coats shall be thoroughly dry before the succeeding coat is applied.
c. Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required shall be applied to attain the desired evenness of surface without extra cost to the owner.
d. Where surface is not in proper condition to receive the coat the Engineer shall be notified immediately.
   Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the Engineer.
e. Hardware, lighting fixture and other similar items shall be removed or protected during the painting varnishing and related work operations and re-installed after completion of the work.

1032.4 Method of Measurement

The areas of concrete, wood and metal surfaces applied with varnish, paint and other related coating materials shall be measured in square meters as desired and accepted to the satisfaction of the Engineer.

1032.5 Basis of Payment

The accepted work shall be paid at the unit bid price, which price and payment constitute full compensation for furnishing all materials, labor, equipment, tools and other incidental necessary to complete this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1032 (a)	Painting works	square meter (sq.m.)

ITEM 1033 - METAL DECK (STEEL DECK)

1033.1 Description

This Item shall consist of furnishing and placing of metal deck panel acting as support and formworks, constructed in conformity with the lines, grades and dimensions shown on the plans or established by the Engineer and in accordance with this specification.

1033.2 Material Requirements

1033.2.1 Metal Deck Panel

1033.2.1.1 Structural metal for metal deck panel shall conform to ASTM A611 or ASTM A446 with a minimum yield strength (fy) of 40,000 psi (275 MPa). The finished metal deck panel is galvanized coated, conforming to ASTM A525 G90 with base metal thickness of 0.80, 1.00, 1.20, 1.40 and 1.60 mm as shown in Table 1.

TABLE 1. Section Properties Per Meter Of Width

Base Metal thickness (mm)	Weight Per Area (kg/m^2)	+I x 106 (mm^4)	-I x 106 (mm^4)	+S x 10^6 (mm^3)	-S x 10^6 (mm^3)	A (mm^2)
0.80	8.073	0.504	0.419	20.008	19.582	1033.7
1.00	10.093	0.631	0.613	24.938	24.568	1296.1
1.20	12.114	0.757	0.736	29.843	29.596	1560.9
1.40	14.1365	0.885	0.859	34.725	34.669	1828.6
1.60	16.1594	1.011	0.982	39.584	39.787	2099.6

+ I = positive moment of inertia +S = section modulus for positive region
- I = negative moment of inertia - S = section modulus for negative region

1033.2.1.2 Metal deck shall have a unit width of 846 mm with triangular ribs formed to a depth of 50 mm and a 32 mm width on the top.

1033.3 Construction Requirements

1033.3.1 Deck Placement

Place each metal deck unit on supporting structural frame. Adjust to final position with accurately aligned side laps and ends bearing on supporting members by a minimum of 50 mm.

1033.3.2 Side Lap Joints

Metal deck panels shall be side lapped with the female rib overlapping the male rib of the adjacent panel. Side lap joints should be fastened by a No. 12 x 20 mm self-drilling screw or its equivalent through the center of the side lap joint. Fastening should be as follows:

1033.3.2.1 For spans up to 1.80 m, fasten side lap joints at the ends and at midspan.

1033.3.2.2 For spans greater than 1.80 In, fasten at third points of span or at 1.20 m spacing, whichever is less.

1033.3.3 Cutting

Metal deck panels shall be cut using a power saw with a suitable disc. During cutting the panel should be turned over with the ribs downward. A hole saw or drill shall be used to cut holes for conduits, pipes and fittings. For cut-out of 200-700 mm diameter, adequate bar reinforcements around the perimeter of the opening must be provided prior to concrete pouring.

1033.3.4 Installation

1033.3.4.1 Structural Steel Framing

Metal deck panels shall be anchored to structural steel members by either welding or by mechanical fastening. A minimum of one fastener should be located adjacent to each female rib using 12 mm puddle welds, 4 mm diameter powder actuated drive nail, or 12 x 20 mm self-drilling screws.

1033.3.4.2 Concrete and Masonry Framing

Fastening of metal deck panels could be done by nailing directly to the beam formwork using 4rnm diameter powder actuated drive nails or masonry nails.

1033.3.4.3 Shear Studs

In a composite beam assembly, a composite floor slab and a steel beam are joined by shear connectors to create one structural unit which has greater strength than a separate slab and beam. Several types of shear connectors are available, but frequently used are either studs, joists or channels. Most commonly used is the headed stud with its body resisting horizontal shear and with its head providing adequate restraint to connect the concrete slab to the beam. Headed studs are readily welded to the metal deck panel and top flange of the beam before concrete is poured.

1033.3.5 Uses

1033.3.5.1 Parking Garages

Composite floor decks have been successfully used in parking structures; however the following precautions should be observed:

1033.3.5.1.1 Slabs should be designed as continuous spans with negative bending reinforcement over the supports.

1033.3.5.1.2 Additional reinforcement should be included to deter cracking caused by large temperature differences and to provide load distribution.

1033.3.5.2 Cantilevers

When cantilevers are encountered, the deck acts only as a permanent form; top reinforcing steel must be designed by the structural engineer.

1033.3.5.3 Dynamic Loads

Dynamic loading e.g. forklifts, can, over a long period of time, interfere with the mechanical bond between the concrete and deck which achieves its composite action w web shapes. Reinforcing steel running perpendicular to the span and placed on the

top of the deck ribs is often used with this type of loading to distribute concentrated loads.

1033.3.5.4 Other Criteria

Composite steel floor deck may be used in a variety of ways, some of which do not lend themselves to a standard "metal deck" analysis for span and loading. In these cases, other criteria must be considered. Make sure that this investigation starts with a review of the applicable codes and that any special conditions are included in the design.

1033.4 Method of Measurement

The quantity to be paid for shall be the number of linear meter measured center to center of the metal decking erected in place and accepted to the satisfaction of the Engineer.

1033.5 Basis of Payment

The quantity, as determined in subsection 1033.4 Method of Measurement, shall be paid for at the unit bid or contract unit price which price and payment shall be full compensation for furnishing and placing all materials and for all labor, equipment, tools and other incidentals necessary to complete this item.

1033.6 Payment will be made under:

Payment Item No.	Description	Unit of Measurement
1033	Metal Deck Panel	Linear Meter

ITEM SPL-1 WOOD PLASTIC COMPOSITE

SPL-1.1 DESCRIPTION

Wood-plastics composites (WPC) are a new group of materials that are generating interest in both the UK and overseas. The term ‘WPC’ covers an extremely wide range of composite materials using plastics ranging from polypropylene to PVC and binders/fillers ranging from wood flour to flax. These new materials extend the current concept of ‘wood composites’ from the traditional compressed materials such as particle-board and medium density fiberboard (MDF) into new areas and, more importantly, a new generation of high performance products.

The term WPCs relates to any composites that contain plant (including wood and non-wood) fibers and thermosets or thermoplastics. Thermosets are plastics that, once cured, cannot be melted by repeating. These include resins such as epoxies and phenolic, plastics with which the forest products industry is more familiar. Thermoplastics are plastics that can be repeatedly melted. This property permits other materials, such as wood fibers, to be mixed with the plastic to form a composite product. Polypropylene (PP), polyethylene (PE) and polyvinyl chloride (PVC) are the widely used thermoplastics for WPCs. Wood plastic composites (WPCs) are relatively new generation of composite materials and also the most promising sector in the field of both composite and plastic industries.

SPL-1.2 MATERIAL REQUIREMENTS

SPL-1.2.1 Wood Plastic Composite

Extruded composite decking board replacing chemically treated and/or tropical wood boards.

Natural fiber waste of wood, harvested crops and others of equal origin e.g. rice husks	50-75 %w.
Recycled and/or virgin thermoplastics such as PE, PP, PVC and ABS	45-20 %w.
Additives; processing aids, coupling agents, colors, UV-stabilators, minerals etc.	>5 %w.

SPL-1.2.2 Uses

- Covering outdoor terraces and patios at private homes, businesses, utilities and industries
- Pathways at national parks and equal recreational areas
- Municipal fencing, benches, flower boxes etc.
- Sound barrier walls for highways and railways

SPL-1.2.3 Sizes

Solid or hollow (with longitudinal cavities)
Widths: 100-200 mm
Thicknesses: 18-38 mm

SPL-1.2.4 Technical Data

SPL-1.2.4.1 Properties

WPCs are true composite materials and have properties of both materials. They have stiffness and strength between those for plastic or wood, but the density is generally higher than either. The properties of WPCs come directly from their structure: they are intimate mixes of wood particles and plastic. The plastic effectively coats the wood particle as a thin layer.

The high moisture resistance of WPCs (water absorption of 0.7% compared to 17.2% for pine) is a direct result of the structure. Moisture can only be absorbed into the exposed sections of wood and is not transmitted across the plastic boundaries. The result is that WPCs are extremely moisture resistant, have little thickness swell in water and do not suffer from fungal or insect attack.

The properties of WPCs can be tailored to meet the product requirements by varying the type of wood or the type of

plastic - the PE based products are cheaper and have a higher heat distortion temperature than the PVC based products but the PVC products are easier to paint and post treat.

Pigments, UV stabilizers and fire retardants can all be added to the WPC raw material before extrusion to improve specific properties. WPCs have:

1. Fade, Stain, and Scratch Resistant
2. Good stiffness and impact resistance
3. Enhanced Mold Resistance
4. Will Not Rot, Warp, or Splinter
5. Satin Finish ; Matte or Shiny
6. Aesthetics Finish by Embossing
7. No Sanding or Painting Required
8. Slip Resistant (Wet and Dry)
9. Easy to Work With Like Wood
10. Resistant to Termite Damage or Rot
11. Low Thermal Expansion
12. Low Moisture Absorption (<5%)

SPL-1.2.4.2 WPCs and Fire

General experience shows that WPCs have a fire behavior very similar to, or better, than that of comparable timber products.

Fire tests relate to either flammability or 'ignitability' which considers the ease with which a material will catch fire and sustain burning and 'spread of flame' which considers the propagation of fire by the material being tested.

Most of the fire testing of WPCs has been carried out in the USA using ASTM standards and these cannot be directly translated into the relevant British and European standards. This information is therefore provided for guidance only.

As a general rule, the presence of the plastic matrix appears to improve the fire performance of the wood component in WPCs. Many plastics, e.g. PVC-U, have good ignitability and spread of flame performance and this appears to be transferred to the WPC when they are used as the plastic component.

WPCs show good results in ignitability tests and these are similar to the results for wood with similar density.

WPCs show good results in spread of flame testing and the results can actually be better that those of wood with a
similar density.

The fire performance of WPCs can be modified and improved by the addition of flame and smoke retardants to the raw material before processing

SPL-1.2.4.2 Environmental Data

One of the main reasons for using WPCs is environmental. The environmental pressures on industry in terms of recycling and sustainability are growing daily. There is a clear need to extend the life cycle of traditional building materials such as wood. This resource efficient use of materials that are currently seen as waste supports the developing concept of sustainable development.

For users of plastics products there is a need to reduce the dependence on petrochemicals with their rising and cyclical raw materials costs.

For users of wood products there is a need to improve the resource efficiency and to recycle the raw materials waste that inevitably occurs. WPCs increase the efficiency of wood usage by up to 40% compared
to traditional wood processing.

WPCs provide other environmental benefits such as:

- There is negligible waste and any that is produced reused.
- WPCs contain no formaldehyde or volatile organic compounds.
- WPCs are recyclable and can be reground and reused after their service life.
- Non-toxic
- WPCs are considered nonhazardous waste and can be disposed of by standard methods. The basic material structure of WPCs means that leaching from WPCs is minimal to non-existent.

WPCs are environmentally friendly materials.

SPL-1.2.5 Warranty

Manufacturer 10 or 15 Year Limited Warranty

SPL-1.3 CONSTRUCTION REQUIREMENTS

WPCs can be processed using conventional woodworking tools and have similar to wood or MDF. The uniform density of the products even makes processing easier than with traditional wood products and the net shape extrusion means that many normal processes are not needed.

The effectiveness of welding with WPCs varies with the exact WPC used. If the wood content is low then radio frequency welding can give good results.

The table shows some of the finishing and treating options currently available.

Fastening	Machining	Finishing	Sealing & Filling
➢ Nail ➢ Screw ➢ Glue	➢ Turn ➢ Mill ➢ Drill	➢ Prime ➢ Paint ➢ Integral colour	➢ Silicone seal ➢ Acrylic seal ➢ Wood fillers

➢ Staple ➢ Dowel	➢ Sand ➢ Saw ➢ Mitre ➢ Rout ➢ Plane	➢ Emboss ➢ Veneer Wrap ➢ Laminate ➢ Varnish ➢ Lacquer	

SPL-1.4 Method of Measurement

The quantity to be paid for shall be the number of square meter measured center to center of the metal decking erected in place and accepted to the satisfaction of the Engineer.

SPL-1.5 Basis of Payment

The quantity, as determined in subsection 1033.4 Method of Measurement, shall be paid for at the unit bid or contract unit price which price and payment shall be full compensation for furnishing and placing all materials and for all labor, equipment, tools and other incidentals necessary to complete this item.

SPL-1.6 Payment will be made under:

Payment Item Number	Description	Unit of Measurement
SPL-1	Wood plastic Composite	Square Meter

MATERIAL SPECIFICATIONS

ITEM 700 – HYDRAULIC CEMENT

700.1 Portland Cement and Masonry Cement

Cement shall conform to the requirements of the following cited Specifications for the type specified or permitted.

Type	Specifications
Portland Cement	AASHTO M 85 (ASTM C 150)

When Types IV and V (AASHTO M 85), P and PA (AASHTO M 150) cements are used, proper recognition shall be given to the effects of slower strength gain on concrete proportioning and construction practices. Types S and SA cements will be permitted only when blended with Portland Cement in proportions approved by the JHMC Representative.

Unless otherwise permitted by the JHMC Representative, the product of only one mill of any one brand and type of Portland Cement shall be used on the project.

The Contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used.

ITEM 703 – AGGREGATES

703.1 Fine Aggregate for Concrete and Incidentals

703.1.1 Concrete

Fine Aggregate for concrete shall conform to the requirements of AASHTO M6, with no deleterious substances in excess of the following percentages:

Clay lumps	1
Coal and lignite	1
Material passing 0.075 mm sieve	4

Other substances – as shown in the Special Provisions

Lightweight aggregate, if required or permitted by the Special Provisions, shall meet the pertinent requirements of AASHTO M 195.

703.1.2 Granular backfill filter material for underdrains and filler for paved waterways shall be permeable and shall meet the requirements of AASHTO M 6, except that soundness tests will not be required and minor variations in grading and content of deleterious substances may be approved by the JHMC Representative.

703.1.3 Aggregate for minor concrete structures shall be clean, durable, uniformly graded sand and gravel, crushed slag or crushed stone, 100 percent of which will pass a 37.5 mm (1-1/2 inches) sieve and containing not more than 5 percent passing the 0.075 mm (No. 200) sieve.

703.2 Coarse Aggregate for Portland Cement Concrete

Coarse aggregate for concrete shall meet the requirements of AASHTO M 80. Lightweight aggregate, if required or permitted by the Special Provisions, shall conform to the requirements of AASHTO M 195, for the grading specified.

703.3 Aggregate for Portland Cement Treated and Stabilized Base Course

The crushed and uncrushed granular material shall consist of hard durable stones and rocks of accepted quality, free from an excess of flat, elongated, soft or disintegrated pieces or other objectionable matter. The method used in obtaining the aggregate shall be such that the finished product shall be as consistent as practical.

All materials passing the 4.75 mm (No. 4) mesh produced in the crushing operation of either the stone or gravel shall be incorporated in the base material to the extent permitted by the gradation requirements. The plasticity index shall not be less 4 nor more than 10.

703.4 Aggregate for Untreated Subbase, Base or Surface Courses

Aggregate shall consist of hard, durable particles or fragments of crushed stone, crushed slag or crushed or natural gravel. Materials that break up when alternately wetted and dried shall not be used.

Coarse aggregate is the material retained on the 2.00 mm (No. 10) sieve and shall have a percentage of wear of not more than 50 for subbase and not more than 45 for Base and Surface Courses as determine by AASHTO Method T 96.

Fine aggregate is the material passing the 2.00 mm (No. 10) sieve and shall consist of natural or crushed sand and fine mineral particles. The fraction passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two-thirds) of the fraction passing the 0.425 mm (No. 40) sieve. For base courses, the fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6, while for subbase course, the liquid limit shall not be greater than 35 plasticity index not greater than 12.

For surface courses, the fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and a plasticity index not less than 4 or greater than 9. All materials shall be free from vegetable matter and lumps or balls of clay. When crushed aggregate is specified, not less than 50 mass percent of the particles retained on the 4.75 mm (No. 4) sieve shall have at least one fractured face.

Gradation of each designated size of aggregate shall be obtained by crushing, screening and blending processes as may be necessary.

Materials otherwise meeting the requirements of this Section will be acceptable whenever such materials produce a compacted course meeting applicable density requirements as specified in Subsections 200.3.3, 201.3.3, 202.3.3 and 203.3.6.

ITEM 709 – PAINTS

709.1 Description

This Item covers all paint materials including Vehicles, Pigment, Pastes, Driers, Thinners and Mixed Paints for steel and wooden structures.

709.2 Material Requirements

709.2.1 General

Paint, except, aluminum paint, shall consist of pigments of the required fineness and composition ground to the desired consistency in linseed oil in a suitable grinding machine, to which shall be added additional oil, thinner and drier as required.

Aluminum paint shall consist of aluminum bronze powder or paste of the required fineness and composition to which shall be added the specified amount of vehicle.

The paint shall be furnished for use in ready mixed, paste or powder form. All paint shall meet the following general requirements:

a. The paint shall show no excessive settling and shall easily be redispersed with a paddle to a smooth, homogenous state. The paint shall show no curdling, livering, caking or color separation and shall be free from lumps and skins.

b. The paint as received shall brush easily, possess good levelling properties and shall show no running or sagging when applied to a smooth vertical surface.

c. The paint shall dry to a smooth uniform finish free from roughness grit, uneveness and other imperfections.

d. The paint shall not skin within 48 hours in three quarters filled closed container.

e. The paint shall show no thickening, curdling, gelling or hard caking after six (6) months storage in full, tightly covered container at a temperature of 21°C (70°F).

709.2.2 The paint shall conform to the requirements of the indicated specifications as follows:

Red Lead Ready-Mixed Paint Type I, II, III and IV	AASHTO M 72
Type I and II White & Tinted Ready-Mixed Paint	AASHTO M 70
Basic Lead Silicon Chromate, Ready- Mixed Primer	AASHTO M 229

709.2.3 The constituents parts of the paint shall meet the following specifications:

Red Lead (97% Pb_3O_4)	ASTM D 83
Iron Oxide (85% Fe_2O_3)	ASTM D 84
Aluminum Powder and Paste	ASTM D 962
Magnesium Silicate	ASTM D 605
Mica Pigment	ASTM D 607
Titanium Dioxide	ASTM D 476
Chrome Yellow	ASTM D 211
Calcium Carbonate	ASTM D 1199
Basic Lead-Silicon Chromate	ASTM D 1638
Basic Carbonate White Lead	ASTM D 81
Zinc Oxide	ASTM D 79
Chrome Oxide Green	ASTM D 263
Carbon Black	ASTM D 561
Lampblack	ASTM D 209
Prussian Blue	ASTM D 261
Boiled Linseed Oil	ASTM D 260
Raw Linseed Oil	ASTM D 234
Pale Heat Bodied Linseed Oil	Fed Spec. TT-0-367
Alkyd Resin	Fed. Spec. TT-R-266
Mineral Spirit	ASTM D 235
Driers	ASTM D 600
Turpentine	ASTM D 13

709.3 Proportion for Mixing

It is the intent of these Specifications to provide a paint of proper brushing consistency, which will not run, streak or sag and which will have satisfactory drying qualities.

709.4 Containers and Markings

All paints shall be shipped in strong, substantial containers plainly marked with mass, color and volume in litres of the paint content, a true statement of the percentage composition of the pigment, the proportions of the pigment to vehicle, the name and address of the manufacturers and the stencil of the authorized inspecting agency. Any package or container not so marked will not be accepted for use under this Specification.

ITEM 710 – REINFORCING STEEL

710.1 Reinforcing Steel

Reinforcing steel shall conform to the requirements of the following Specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement	AASHTO M 31 (ASTM A 615)

Bar reinforcement for concrete structures, except No. 2 bars shall be deformed in accordance with AASHTO M 42, M 31 and M 53 for Nos. 3 through 11.

Dowel and tie bars shall conform to the requirements of AASHTO M 31 or AASHTO M 42 except that rail steel shall not be used for tie bars that are to be bent and re-straightened during construction. Tie bars shall be deformed bars. Dowel bars shall be plain round bars. They shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the site of the work, a minimum of one half (1/2) the length of each dowel bar shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of an approved design to cover 50 mm (2 inches), plus or minus 6.3 mm of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 25 mm (1 inch) from the end of the dowel bar. Sleeves shall be of such design that they do not collapse during construction.

Plastic coated dowel bar conforming to AASHTO M 254 may be used.

ITEM 714 – WATER

714.1 Description

This Item covers criteria for acceptance of Questionable Water either natural or wash water for use in concrete.

714.2 Requirements

The mixing water shall be clear and apparently clean. If it contains quantities or substances that discolor it or make it smell or taste unusual or objectionable, or cause suspicion, it shall not be used unless service records of concrete made with it (or other information) indicated that it is not injurious to the quality, shall be subject to the acceptance criteria as shown in Table 714.1 and Table 714.2 or as designated by the purchaser.

When wash water is permitted, the producer will provide satisfactory proof or data of non-detrimental effects if potentially reactive aggregates are to be used. Use of wash water will be discontinued if undesirable reactions with admixtures or aggregates occur.

Table 714.1
Acceptance Criteria For Questionable Water Supplies

	Limits
Compressive strength, min. % Control at 7 days	90
Time of Setting deviation from control	from 1:00 earlier to 1:30 later
Time of Setting (Gillmore Test)	

Initial	No marked change
Final Set	No marked change
Appearance	Clear
Color	Colorless
Odor	Odorless
Total Solids	500 parts/million max
PH value	4.5 to 8.5

Table 714.2
Chemical Limitation for Wash Water

	Limits
Chemical Requirements, Minimum Concentration	
Chloride as $C1^{(-1)}$ expressed as a mass percent of cement when added to the $C1^{(-1)}$ in the other components of the concrete mixtures shall not exceed the following levels:	
1. Prestressed Concrete	0.06 percent
2. Conventionally reinforced concrete in a moist environment and exposed to chloride	0.10 percent
3. Conventionally reinforced concrete in a moist environment but not exposed to chloride	0.15 percent
4. Above ground building construction where the concrete will stay dry	No limit for corrosion
Sulfate as SO_4, ppm[A]	3000
Alkalies as (Na_2O + 0.658 K_2O), ppm	600
Total Solids, ppm	50000

[A] *Wash water reused as mixing water in concrete may exceed the listed concentrations of sulfate if it can be shown that the concentration calculated in the total mixing water, including mixing water on the aggregate and other sources, does not exceed that stated limits.*

Water will be tested in accordance with, and shall meet the suggested requirements of AASHTO T 26.

Water known to be of potable quality may be used without test.

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