

## ***Section VI - Technical Specifications***

# Specifications

## Repair of Welcome Arch, Gate, Guardhouse, Fence and Covered Walk, Port of Cawit, Marinduque

### 1. EARTHWORKS

#### 1.1 GENERAL

This Item shall consist of the necessary excavation for foundations of rock bedding, buildings, culverts, underdrains, and other structures not otherwise provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated materials, shall be in accordance with these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

This Item shall include necessary diverting of live streams, bailing, pumping, draining, sheeting, bracing, and the necessary construction of cribs and cofferdams, and finishing the materials therefore, and the subsequent removal of cribs and cofferdams and the placing of all necessary backfill.

It shall also include the furnishing and placing of approved foundation fill material to replace unsuitable material encountered below the foundation elevation of structures.

#### 1.2 CONSTRUCTION REQUIREMENTS

##### 1.2.1 Clearing and Grubbing

Prior to starting excavation operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Clearing and Grubbing.

##### 1.2.2 The Specification of Excavation

(l) General - all structures. The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation so that cross-sectional elevations and measurements may be taken on the undisturbed ground. The natural ground adjacent to the structure shall not be disturbed without permission of the Engineer.

Trenches or foundation pits for structures or structure footing shall be excavated to the lines and grades or elevations shown on the Plans or as staked by the Engineer. They shall be of sufficient size to permit the placing of structures or structure footing of the full width and length shown. The elevations of the bottoms of footing as shown on the Plans, shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary, to secure a satisfactory foundation.

Boulders, logs, and other objectionable materials encountered in excavation shall be removed.

After each excavation is completed, the Contractor shall notify the Engineer to that effect and no footing, bedding material or pipe culvert shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

(2) Structures - Other than Pipe Culverts. All rocks or other hard foundation materials shall be cleaned of all loose materials, and cut to a firm surface, either level, stepped, or serrated as directed by the Engineer. All seams or crevices shall be cleaned and grouted. All loose and disintegrated rocks and thin strata shall be removed. When the footing is to rest on material other than rock, excavation to final grade shall not be made until just before the footing is to be placed.

When the foundation material is soft or mucky or otherwise unsuitable, as determined by the Engineer, the Contractor shall remove the unsuitable material and backfill with approved granular material. This foundation fill shall be placed and compacted in 150mm (6 inches) layers up to the foundation elevation.

When foundation piles are used, the excavation of each pit shall be completed before the piles are driven and any placing of foundation fill shall be done after the piles are driven. After the driving is completed, all loose and displaced materials shall be removed, leaving a smooth, solid bed to receive the footing.

(3) Pipe Culverts - The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe.

When a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, such unstable soil under the pipe and for a width of at least one diameter on each side of the pipe shall be removed to the depth directed by the Engineer and replaced with approved granular foundation fill material properly compacted to provide adequate support for the pipe, unless other special construction methods are called for on the Plans.

The foundation surface shall provide a firm foundation of uniform density throughout the length of the culvert and, if directed by the Engineer, shall be cambered in the direction parallel to the pipe centerline.

When pipe culverts are to be placed in trenches excavated in embankments, the excavation of each trench shall be performed after the embankment has been constructed to a plane parallel to the proposed profile grade and to such height above the pipe as shown on the Plans or directed by the Engineer.

All excavated materials, so far as suitable, shall be utilized as backfill or embankment. The surplus material shall be disposed off in such manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the structure. No excavated material shall be deposited at any time so as to endanger the partly finished structure.

- 1.2.3 Backfill and Embankment for Structures other than Pipe Culverts.  
Excavated areas around structures shall be backfilled with free draining granular material approved by the Engineer and placed in horizontal layers not over 150mm (6 inches) in thickness, to the level of the original ground surface. Each layer shall be moistened or dried as required and thoroughly compacted with mechanical tampers.

In placing backfills or embankment, the material shall be placed simultaneously insofar as possible to approximately the same elevation on both sides of an abutment, pier, or wall. If conditions require placing backfill or embankment appreciably higher on one side than on the opposite side, the additional material on the higher side shall not be placed until the masonry has been in place for 14 days, or until test made by the laboratory under the supervision of the Engineer establishes that the masonry has attained sufficient strength to withstand any pressure created by the methods used and materials placed without damage or strain beyond a safe factor.

Backfill or embankment shall not be placed behind the walls of concrete culverts or abutments or rigid frame structures until the top slab is placed and cured. Backfill and embankment behind abutments held at the top by the superstructure, and behind the sidewalls of culverts, shall be carried up simultaneously behind opposite abutments or sidewalls. All embankments adjacent to structures shall be constructed in horizontal layers and compacted to the required compaction. Special care shall be taken to prevent any wedging action against the structure and slopes bounding or within the areas to be filled shall be benched or serrated to prevent wedge action. The placing of embankment and the benching of slopes shall continue in such manner that at all times there will be a horizontal beam of thoroughly compacted material for a distance at least equal to the height of the abutment or wall to be backfilled against except insofar as undisturbed material obtrudes upon the area.

Broken rock or coarse sand and gravel shall be provided for a drainage filter at weep holes as shown on the Plans and/or necessary.

## 2 REINFORCED CONCRETE

### 2.1 GENERAL

All works falling under this category shall include reinforced concrete for all kinds and parts of any reinforced concrete structure.

### 2.2 MATERIALS

#### a.) Cement

Cement used shall be Type I Portland conforming to the requirements of the latest revision of ASTM C 150 "Standard Specifications for Portland Cement".

b.) Coarse Aggregates

Coarse Aggregates shall be washed, well graded, hard pieces of gravel, crushed gravel or rock conforming to the requirements of ASTM C 33 "Standard Specification for Concrete Aggregates".

c.) Fine Aggregates

Fine Aggregates shall be washed sand, stone screenings or other inert materials of same characteristics, or any combination thereof composed clean, hard, strong, uncoated grains and free from injurious amount of dust, lumps of clay, shale, alkali, and organic matter. It shall conform to the requirements of ASTM C33 "Standard Specifications for Concrete Aggregates". Beach sand shall not be used unless approved by the Engineer.

d.) Admixtures

Unless otherwise required by field conditions admixtures may be used subject to the expressed approval of the Engineer. The cost thereof shall be considered as already included in the unit cost bid of the Contractor for the concrete.

## 2.3 STORAGE OF MATERIALS

- a.) Cement shall be stockpiled as closely as possible in weatherproof storage sheds, stacks suitably elevated above ground to prevent cement absorption of moisture.
- b.) Aggregates shall be placed in stockpile in a manner preventing segregation thereof and contamination with foreign materials.
- c.) Reinforcing steel bars shall be stored properly, covered and protected from humidity to prevent rusting and contamination with oil, dirt or other objectionable matters.

## 2.4 DESIGNED STRENGTH OF CONCRETE

Concrete for structural parts or members such as bearing piles or columns shall develop a minimum 28-day compressive cylinder strength of 4,500 psi., and for deck or floor slabs, beams and girders of the structure shall develop a minimum 28-day compressive cylinder strength of 3,500 psi., unless otherwise indicated in the drawings.

Concrete for non-structural parts or members such as partition walls and slab on fill shall develop a minimum 28-day cylinder strength of 3,000 psi., unless otherwise indicated in the drawings.

## 2.5 TRIAL BATCH FOR CONCRETE

Thirty (30) calendar days before the start of concreting works, the Contractor shall submit design mixes and the corresponding test result made on sample thereof. Sampling and testing shall be in accordance with the ASTM Standard procedures for sampling and testing, for the particular design strengths) required.



The particulars of the mix such as the slump and the proportionate weights of cement, saturated surface dry aggregates and water used shall be stated. Test results shall show 28-day strengths) fifteen (15) percent higher than the ultimate strength(s) required.

The design mix for concrete to be used shall be submitted together with at least three (3) standard cylinder samples for approval at least one (1) month prior to the start of each concreting schedule. Such samples shall be prepared in the presence of the Engineer.

Standard laboratory strength test for the 7, 14 and 28 days periods shall be taken to all concrete samples in addition to routine field tests, at cost to the Contractor. Only design mixes represented by test proving the required strength for 7, 14 and 28 days tests shall be allowed.

The cost of sampling, handling and transporting samples from jobsite to the laboratory and the cost of subsequent tests made until the desired mix is attained shall be for the account of the Contractor.

## 2.6 CONCRETE PROPORTION AND CONSISTENCY

Concrete proportion should produce mix consistencies that will work readily into angles and corners of the forms and around reinforcements irrespective of the method of placing employed, without permitting the materials to segregate or excess water to collect on the surface of the concrete and with separated individual particles of aggregates showing coating of mortar with proportionate amount of sand. The total aggregate in the proportion used shall be such that when sieved, the weight passing the No.4 standard sieve shall be thirty percent (30) of the total.

The methods used for measuring materials going into the concrete mix shall permit easy checking and control of proportions at any time during the work.

## 2.7 MIXING OF CONCRETE

All concrete used shall be machine-mixed at the site. Each batch shall be mixed at the mixer's design speed, for at least 1-112 minutes after all concrete materials are simultaneously placed in the mixer. The ideal rotation speed of the mixer shall be between 14 and 20 rpm.

All mix contents of the mixer shall be thoroughly removed before any succeeding batch is placed.

The materials for the first batch shall contain sufficiently excess cement, sand and water to coat the inside walls of the mixer without reducing the required mortar content of the mix.

The mixer shall be provided with devices for accurately measuring and controlling the amount of water used in each batch and for automatically recording the number of revolutions of the mixer.

Hand mixing of concrete will only be allowed in case of mixer breakdown, in which case it shall be stopped as soon as pouring for the particular section is completed, or at a construction joint as directed by the Engineer.

Re-tempering or remixing of partially hardened concrete with the addition of water will not be permitted.

## 2.8 PLACING OF CONCRETE

- a.) Concrete shall be placed in the presence of the Engineer only after the forms, reinforcing bars and other spaces to receive the concrete have been inspected and approved by him.
- b.) Concrete shall be placed only when wind and weather conditions will allow proper placement and curing of the concrete. Notice of any concreting operations shall be served to the Engineer at least three (3) days ahead of each schedule.
- c.) Mixed concrete shall be deposited in its final position within a practicable time. Each succeeding fresh deposit for particular structural member shall be placed at a practicable rate to prevent cold joints. Each successive fresh deposit of concrete shall be vibrated vertically at uniformly spaced points and levels, of such duration and intensity to compact the concrete thoroughly but shall be discontinued the moment segregation of materials is noticed.
- d.) Where concreting operations involve a fall more than 1.50 meters (4.92 feet), the fresh concrete shall be poured through approved sheet metal conduit or pipes. The pipes shall be kept full of concrete and its lower end kept below the surface of concrete throughout the pouring operations.
- e.) Deposition of concrete shall be in such a way as to prevent segregation of the materials and the displacement of the reinforcement. Placing shall be done preferably with the use of buggies, buckets or wheel-borrows. Troughs, conveyors and pipes and the manner of use of each one shall be with the expressed permission of the Engineer.
- f.) Each layer of concrete shall be placed approximately normal as possible in uniform layers not exceeding 0.30 meter, unless otherwise ordered. The rate of placing concrete in the forms shall preferably be 0.025 meter (0.082 feet) vertical rise per minute.

## 2.9 CONSTRUCTION JOINT

During stoppage of concrete pouring operations, and when jointing of old concrete becomes necessary, the following point should be observe:

- a.) Construction joint not indicated in the drawings shall be located as to least affect the strength of the structure. Such locations will be as pointed out by the Engineer.

## 2.10 FORMS AND FALSEWORK

All forms and falsework to be used in the work must be designed, and constructed by the Contractor, for rigidity and adequacy for carrying the loads of the fresh concrete and/or additional superimposed construction loads. The Authority may from time to time verify the adequacy and safety of such temporary works and may require the Contractor to submit detailed designed drawings of forms and falseworks proposed to be used. Approval of such drawings or design of forms, however, shall not relieve the Contractor of his liability on resulting imperfections or damages to the finished concrete, or other damages which may directly result therefrom.

Forms may be re-used but shall be scrapped by a wire brush of all clinging mortar. Bulges should be planed and realigned prior to its use.

Prior to placing concrete form surfaces should be oiled for easy form removal. However, the oil coating should not be so thick as to stain and soften the concrete surface. Oil coatings should be applied before rebars are placed.

## 2.11 CURING AND WATERPROOFING

All concrete shall be cured for at least 14 days after the date of placing in accordance with the approved and accepted methods.

## 2.12 FINISHING OF CONCRETE SURFACES

Concrete surfaces shall conform accurately to the form, alignment, grades and sections shown in the drawings or as prescribed by the Engineer. It shall be free from bulges, ridges, honeycombing or roughness of any kind, and shall be of a reasonably smooth wood float finish.

## 2.13 TREATMENT OF SURFACE DEFECTS

All irregular concrete surfaces, voids, holes, honeycombs exposed after removal shall be repaired by the Contractor in such a way that the repaired surface will be acceptable under paragraph 21.12 above.

## 2.14 ARCHITECTURAL FINISH

All exposed concrete exterior surfaces shall be given an architectural finish as directed by the Engineer.

## 2.15 PLACING OF REINFORCEMENT

Metal reinforcement shall be placed as accurately detailed on drawings and properly secured by approved means.

All bars shall be cold bent unless approved otherwise by the Engineer. Minimum distance between parallel bars shall be one and one half (1 1/2) times the diameter for round bars and twice the side dimension for square bars. The clear distance between bars shall not be less than 2.54 cm. (1 in.) nor is less than one and one third (1 1/3) times the maximum size of the coarse aggregate, whichever bigger.



All reinforcing steel shall be cleaned of all rust or scale and deleterious materials which tend to destroy the bond between the concrete and the steel.

## 2.16 REINFORCING BAR SPLICES

Generally, splice/s of reinforcement at points of maximum stress specially in slabs, beams and girders shall be avoided. Such splice/s may however be approved by the Engineer in writing provided the lap if bonded or butt welded is sufficient to transfer tensile stress between bars by at least 125 of the specified yield strength of the reinforcing bar. For adjacent bars splices shall be staggered.

## 2.17 READY-MIXED CONCRETE

Where ready-mixed concrete is used, the requirements specified for batching, mixing and transporting shall be in accordance with the requirements set forth in ASTM C94 Specifications for Ready-Mixed Concrete unless otherwise specified.

- a.) The Contractor shall notify the Engineer seven (7) days in advance before any continuous phase of concreting operations is started. Upon notification, the Engineer shall have the right to inspect the ready-mixed concrete supplier's plant/equipment and all materials and/or sources thereof. The Contractor must coordinate with the supplier and must provide safe and adequate guidance for the Engineer or his representative in conducting such examinations.
- b.) For all ready-mixed concrete delivered to site of work, discharge shall be completed within one hour after the addition of cement to the aggregates or before, the drum is revolved 25 times, whichever comes first. Under conditions contributing to the stiffening of concrete especially during hot weather, the time required between the introduction of cement to the aggregates and discharge of the mix may still be reduced by the Engineer.
- c.) Truck mixers shall be equipped with counters indicating the number of revolutions of the drums which shall be automatically actuated at the time of starting mixers at mixing speed.
- d.) Each batch or truck delivery of concrete shall be mixed inside the drum for not less than 70 revolutions of the drum at the rate of rotation designated by the equipment manufacturer. Additional mixing if ordered by the Engineer shall be at the speed designated as agitating speed by the manufacturer of the equipment.
- e.) Concrete for individual batches or deliveries should be of uniform consistency, mix and grading. If slump tests of a minimum 2 samples taken within 15 minutes of each other at approximately 15 and 85 discharge load give values differing more than 2.54 cm. (1 in.) when the specified slump is 76 mm. (3 in.) , use of the particular mixer in the work shall be stopped until corrections are made to prevent such conditions, which shall be confirmed by further slump tests.

- f.) Every batch of ready-mixed concrete delivered at the job site shall be accompanied by a ticket furnished in accordance with Section 15 of ASTM 94. The time when the materials were batched shall also be indicated.
- g.) Non-agitating equipment or combination truck and trailer equipment for transporting concrete will not be permitted.
- h.) The Authority reserves the right to verify from time to time the quality and quantity of materials used in every cement batch from the batching plant. The Contractor shall be aware of this provision and make the proper arrangement with the concrete supplier.

## 2.18 TEST ON CONCRETE

Test on concrete shall be in accordance with the following:

- a.) Concrete samples for tests shall be secured and molded in accordance with ASTM C 172 - "Method of sampling Concrete", and ASTM C31 - "Method of making Curing, Concrete Compression and Flexure Test specimens in the field".
- b.) Strength tests on samples shall be made in accordance with ASTM C39 - "Standard Method of Test for Compressive Strength of Molded Concrete Cylinder".

Not less than four (4) cylindrical specimens shall be made for each test of which at least two (2) shall be reserved for 28-day test. Not less than one (1) test shall be made for every fifty (50) cubic meters of concrete but in no case less than one (1) test for each day's concreting.

Samples shall be taken by the Contractor under close supervision of the Engineer; and shall be delivered as soon as practicable for testing, at his expense, to the designated laboratories.

The average strength of test samples representing any definite class of concrete used as well as the average of any five (5) consecutive strength tests representing the class of concrete shall be equal to or greater than the specified strength and not more than one (1) strength test in ten (10) shall have an average value less than 90 of the specified strength.

If the test results indicate strength values less than the required, the Project Manager shall have the right to order a change in the concrete proportion used for the remaining work, or in the procedure of curing the concrete.

## 2.19 LIQUIDATED DAMAGES

For failure to meet the specified strength required for concrete, designed, prepared and laid by him, the Contractor shall pay the AUTHORITY a liquidated damages, not as penalty or forfeiture the following, to be applied only to the quantity of concrete which the particular sample/s represent.

- a.) Payment of 30 percent contract unit cost per cubic meter of concrete affected, for test resulting to strength between 90 to 100 percent of specified strength;

All horizontal and vertical reinforcing bars shall be anchored into the concrete walls, columns or slabs as shown on the plans or as directed by the Engineer. Dowel bars shall be properly spaced and placed into the walls, columns or slabs, hooked to the vertical and horizontal reinforcing bar.

All units shall be laid with a mortar composed of one part cement and three parts of sand. Unless otherwise required by the Engineer, horizontal and vertical joints shall be 10 mm thick with full mortar coverage on the face shells and on the web surrounding the cells to be filled. Joints shall be level or plumb and in alignment from top to bottom of wall, and shall be brushed to remove all loose and excess mortar.

Reinforcing bars shall be at least 12 mm in diameter, unless specified otherwise in the plans. Vertical bars shall be spaced 0.60 meter, and horizontal bars at every third course, unless shown otherwise on the plans. Reinforcing bars shall have a minimum lap of 40 bar diameter. All horizontal reinforcement must be tied to the vertical reinforcement at their intersection.

All exposed surfaces of concrete hollow blocks, unless otherwise specified on the plans, shall be finished with cement plaster. Cement mortar shall be mixed only in such quantities as are required for immediate use and mixture which has developed initial set shall not be used. Mixing shall be continued until a homogenous mixture of the required cement mortar which has partially hardened shall not be allowed. Bond shall be used where horizontal reinforcements are to be placed. At door and window opening, the jamb blocks and beam blocks over openings and below window sills shall be reinforced as shown on the plans or as directed by the Engineer.

#### **4. WATERPROOFING**

##### **4.1 SCOPE OF WORK**

This Item shall consist of furnishing all waterproofing materials, labor, tools, equipment and other facilities and undertaking the proper installation works required as shown on the plans and in accordance with this specification.

##### **4.2 MATERIAL REQUIREMENTS**

- a. Primer shall be of asphalt cold applied, free from water and other foreign matters, and shall conform to the specifications requirement defined in ASTM D-41.
- b. Built-up membrane shall be made of smoothly woven fibers that are impervious to acid, heat, dampness and totting. It should permit complete penetration of asphalt compound or bituminous coating in the woven glass fiber.
- c. Preformed membrane shall be self-sealing flexible cold applied bituminous sheets bonded to 0.15mm thick polyethylene film.
- d. Mopping Materials

- 1) Type A soft adhesive self-sealing asphalt for structure below ground level
- 2) Type B where asphalt is not exposed on temperature exceeding 51.7 Celsius structure above ground level.
- 3) Type C where asphalt is exposed on vertical surface in direct sunlight or above temperature of 51.7 Celsius structure above ground level.

#### 4.3 CONSTRUCTION REQUIREMENTS

Roof decks, balconies, toilet and bathrooms, gutters, parapet walls and other areas indicated on the plans to be waterproofed shall first be rendered with cement-based waterproofing before any type of waterproofing is applied.

##### a. Application Procedure

- 1) Prior to application of membrane concrete surfaces should be sound and cured without the use of curing compound. Apply a coat of concrete neutralized to remove oil dirt and other contaminants.
- 2) Apply asphalt primer at the rate of one gallon per 100 square feet evenly by spraying or by paint brush.
- 3) Application shall be done one direction strip by and overlapping each other to assure uniform thickness.
- 4) Allow primer to dry until it is ready to receive next coat or layer as specified in the manufacturing instructional manual.
- 5) As soon as primer coating is workable, lay a single layer of preformed or built-up membrane conforming to size and shape of the surface area to be covered.
- 6) Carefully lay side and end laps in order to assure an even thickness throughout the whole surface area to be covered.
- 7) When the whole surface area is completely covered apply a single coat of asphalt primer at the rate of 3 to 4 gallons per (100 square feet).
- 8) Meshes of treated woven glass fibers shall not be completely closed or sealed by the primer coat, but shall sufficiently open to allow successive moppings of the ply material to seep through.
- 9) Cover ply not more than the minimum amount of surfacing necessary to prevent sticking on ply.
- 10) After application surface shall be uniformly smooth, free from irregularities folds and knots.
- 11) Repeat the procedures until 5 plies has been satisfactorily installed or as many as may layers required or as specified in the plans.



- 12) Where weather disturbance interrupt the work and exposing the membrane to moisture remove the layer exposed to moisture and repeat procedure until completion of the process.

b. Protective Coating

- 1) Where laying of the built-up or preformed membrane conforms with the number of plies required as shown on the plans lay a mixture of sand mastic in the proportion of one part asphalt or bituminous material and four parts coarse screened sand by volume. With a steel trowel at an average of 3 mm thick over the surface of membrane.
- 2) Then at the rate of one gallon per (100 square feet) apply aluminum heat reflecting finish thoroughly over the dried sand mastic coating.

c. Metal Cap Flashing

- 1) Provide cap flashing gauge 24 G.I. where shown on the plans.
- 2) Where cap flashing is connected to preformed lock in through-wall form upper edge of cap flashing to engage in preformed lock. Mallet lock down tight to provide a spring action against base flashing.
- 3) Then at the rate of one gallon per (100 square feet) apply aluminum heat reflecting finish thoroughly over the dried sand mastic coating.
- 4) Where cap flashing is terminated in raked joints or in prepared masonry or stone reglet fasten flashing with wedge every 12 inches and fill reglet on vertical surfaces continuous with plastic cement and on horizontal surfaces, continuous with molten lead.

## 5. PAINTING AND COATING

### 5.1 GENERAL

The work included in this section consists of the furnishing of all labor, materials, tools and all appurtenant work in connection with painting and coatings in accordance with these specifications. All paints and coatings shall be applied by painting subcontractors and workmen approved by the Engineer.

### 5.2 SCOPE

The following surfaces to be painted except where otherwise specified or shown:

- a) Metal surfaces and above ground piping.
- b) All exposed concrete.
- c) All structural and miscellaneous metal.
- d) All equipment furnished without factory finished surfaces.

- e) All exposed steel mullions, tubular frames, door frames, steel sash and metal windows
- f) All sheet metal and ferrous metal trim.
- g) Interior and exterior surfaces of the building including all concrete block masonry.

The following surfaces are not to be painted:

- a) Ferrous metals having approved plating or factory paint finishes.
- b) Non-ferrous metals, unless otherwise specified or indicated; galvanized metal shall not be considered a non-ferrous metal.
- c) Equipment with factory finished surfaces unless otherwise specified.

No concrete, wood, metal or any other surface requiring protection shall be left unpainted even not specifically defined herein.

### 5.3 RIGHT OF REJECTION

Exterior painting or interior finishing shall be done under conditions which shall not jeopardize the appearance or quality of the painting or finishing in any way. The Engineer shall have the right, to reject all material or work that is unsatisfactory, and require the replacement of either or both at the expense of the Contractor.

### 5.4 PROTECTION OF THE WORK

The Contractor shall endeavor to protect the work of others during the time is in progress. The Contractor shall be responsible for any and all damage to any other work in the course of the painting job.

Protective coverings shall be used to protect floors, fixtures, and equipment while painting. Care shall be exercised to prevent paint being spattered onto surfaces which are not to be painted.

### 5.5 WORKMANSHIP

All painting work shall be first class and in accordance with the best standard practices of the trade.

The Contractor shall examine carefully all surfaces to be painted and before beginning any work, shall make sure that the work of other trades has been installed in a workman like condition ready to receive paint. Metal surfaces shall be clean, dry and free from mill scale, rust, grease, oil or any other substance which could affect the quality of the painting.

Paint shall be applied in the right consistency and each coat shall be brushed evenly free of brash marks, sags and runs.<sup>1</sup> Care shall be exercised to avoid lapping of paint on glass or hard wares. Paint shall be sharply applied to required lines. Finished paint surfaces shall be free from defects or blemishes. Surfaces from which such paint cannot be removed satisfactorily shall be painted or repainted, as required to produce a finish satisfactory to the Engineer.

Succeeding paint coating shall be applied only when the previous coat is hard and dry. All painting materials shall be used strictly in accordance with the manufacturer's directions, spread or flowed smoothly with proper film thickness and without runs, sags skips or other defects.

#### 5.6 STORAGE OF MATERIAL

All painting materials and equipment not for immediate use shall be stored in a room approved by the Engineer for that purpose. The receiving, opening and mixing of all paint materials shall be done in this room.

Necessary precautions shall be taken to prevent fire. Rags, waste, and other materials, soiled with paint shall be removed from the premises at the end of each day's work or stored in metal containers with metal covers.

#### 5.7 PREPARATION OF PAINT

Paint containers shall be delivered to the jobsite in manufacturer's unopened containers and shall be opened only when required for use. Paint shall be mixed only in the designated room or space in the presence of the Engineer or his representative. Paint shall be thoroughly stirred or agitated to uniformly smooth consistency suitable for proper application. Unless otherwise specified or approved, no materials shall be reduced, changed, or used except in accordance with manufacturer's label or tag on container. In all cases, paint shall be prepared and handled in a manner that will prevent deterioration and contamination with pollutants.

#### 5.8 CLEAN-UP

Upon completion of work, the Contractor shall remove all surplus materials. All paint spills shall be removed and entire premises shall be cleaned of all rubbish, and debris, caused by the work. Finished surfaces shall be presented clean and free from blemishes and is acceptable in every way. All glass shall be cleaned of paint spots and polished before the job is presented for acceptance by the owner.

#### 5.9 MATERIALS

- a) **Materials** - A complete list of materials proposed for use shall be submitted by the Contractor for the Engineer's approval. The Contractor may substitute other paint materials for those specified in Section 27.12 provided written approval from the Engineer is received stating that said proposed substitute materials are equal to that specified and are approved for use. The painting material shall be delivered to the job site in its original containers properly labeled without evidence of tampering, substitution of contents, or of deterioration.
- b) **Color and Samples** - All finish colors shall be as selected by the Owner. In multicoated work using color pigmented paints, each coat shall have sufficient variation of color to easily distinguish it from preceding coat.



Using specified or approved materials, 3 sample panels of each finish, including all coats thereof shall be prepared and submitted for the Owner's approval. Complete work shall match approved colors and samples.

#### 5.10 PREPARATION OF SURFACES

- a) General - Except as otherwise specified, surfaces to be painted shall be clean, smooth and dry. The Contractor shall report to the Engineer in writing any surface which cannot be properly prepared for painting. If work is commenced before defects have been reported and corrected, any resulting unsatisfactory finish shall be rectified at no cost to the PPA.
- b) Concrete and Masonry - All concrete and masonry surfaces shall be cured thirty days prior to painting. Dirt, dust, oil, grease, efflorescence and other deleterious matter shall be removed and surface roughened when necessary to insure good paint adhesion. The method of surface preparation shall be left to the discretion of the Contractor, but results obtained shall be satisfactory to the Engineer. Before application of resin emulsion paint, surfaces shall be prepared in accordance with manufacturer's directions. Before application of oil base or latex paints, surfaces shall be tested for presence of alkali; if alkali is present, neutralize as recommended by the manufacturer of the paint materials to be applied.
- c) Plaster - Dirt, dust, loose plaster and other deleterious matter which would prevent good paint adhesion shall be removed. All holes, cracks and depression shall be neatly filled with patching plaster, mixed and applied to match existing plaster. Patches shall be sanded flush and smooth and properly sealed before applying prime coat. After priming surfaces, suction spots shall be touched up with additional prime coat material until surfaces evidence a uniform coating. Enamel undercoats on smooth plaster shall be sandpapered by hand (with No. 00 sandpaper) and dusted clean before applying succeeding coat.
- d) Metal - Dirt, scale and rust shall be removed by scraping, wire brushing and sanding or sandblasting as required. Oil and grease shall be removed with mineral spirits or appropriate solvent. Before painting ferrous metal surfaces, including galvanized ferrous metal, surfaces shall be pre-treated with approved phosphoric acid etching cleaner in accordance with the manufacturer's direction to produce a chemically clean surface. Unless already performed in accordance with specifications of other sections, abrasions and bare spots in shop prime coatings shall be touched up with metal primer matching the shop coatings. Enamel undercoats shall be sandpapered by hand (with No. 00 sandpaper) and dusted clean before applying succeeding coat.
- e) Woodwork - Unless already properly sanded, woodwork shall be sandpapered smooth by hand. Before priming surfaces, knots, pitch pockets and sap streaks shall be thoroughly cleaned of residue and touched up with shellac varnish coating. After priming surface, nail holes, cracks and depressions shall be neatly filled with putty or other approved filler, colored to match required finish. Enamel undercoats shall be sanded by hand (with No. 00 sandpaper) and dusted clean before applying succeeding coat.



## 5.11 APPLICATION OF PAINT

- a) General - All painting and finishing shall be performed by skilled craftsmen. Each coat of paint shall be applied with the right consistency, evenly, free of laps, sags and runs and cut sharply to required lines. Paint shall be applied only under dry and dust free conditions that will insure properly finished surfaces, free of defects and blemishes unless otherwise directed by the engineer. Paint shall not be applied when temperature is likely to be above 90°F. Sufficient time shall be allowed between application of coats. All primer and intermediate coats shall be unscarred and completely integral at time of application of each succeeding coat. The Engineer shall be notified when each coat has been applied and is ready for inspection; until coat is inspected and approved by the Engineer, no succeeding coats shall be applied. Whenever the coats of a dark colored paint are specified the first coat shall contain sufficient powdered aluminum to act as an indicator for proper coverage when applying the second coat
- b) Method of Application - Paint should be applied by brush, spray, or other application method approved by the Engineer.
- c) Priming and Back painting
  1. Priming - Before installation, all surfaces of millwork which are to be painted shall be primed giving particular attention to sealing of cross-grained surfaces. In all cases, all work shall be primed as soon as possible after installation, as required, or in case of prefabricated items, at fabricators shop or mill before shipment, if practicable. Except as otherwise specified, priming shall consist of first coat herein after specified under "Finishes".
  2. Back-Painting - Woodwork, millwork and casework to be installed against concrete masonry or plaster shall be back painted with one coat of exterior oil paint.

## 5.12 PAINTING SYSTEMS

Williams/ Architectural Items No.	MANUFACTURER	
	Dutch Boy	Sherwin
	Number	Or Equivalent
a) Exterior Finishes		
1. On Concrete Walls Two Coats, Concrete Masonry Paint	A69EXZ	55BOO
2. Unprimed Ferrous Metal Including G.I. Roofing		

First coat:			
Rush inhibit Ferrous Metal primer	20724	B16RXI	
Second coat:			
Exterior Enamel	20-125	A71EX2	
3. On Concrete Blocked Walls			
First coat:			
Concrete block primer Sealer	103	B56WX3	
Second coat :			
Concrete Masonry Paint	55BOO	A69EX2	
Third coat:			
Concrete Masonry Paint	55BOO	A69EX2	
4. On Wood			
First coat:			
Exterior wood primer	25F	A71EX3	
Second coat :			
Exterior Enamel	10X	A71EX3	
Third coat:			
Exterior Enamel	10X	A71EX3	

b. Interior Finishes

Location of the various finishes are listed in the Finish Schedule on the drawings or else will be confirmed by the PP A.

1. On primer and coat metal two

Coats of interior semigloss Enamel or as indicated in the Schedule finish	22101	B7WX3
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2. On Plaster

First Coat: Pigmented sealer	103	B56WX3
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Second Coat :		
Enamel undercoater	103	A2WX2
Third Coat		
Interior flat enamel	22-101	B7WX3
3. On Wood		
First Coat:		
Enamel undercoater	.001	A2WX2
Second Coat:		
Enamel undercoater	.001	A2WX2
Third Coat:		
Interior flat enamel	23-001	B7WX3
4. Wood Stain Finish		
Oil Stain with filler	23-11	A48N2
Boiled on top coat	36-001	A38NX23
5. Wood Lacquer Finish		
Wood paste Filler w/ natural	23-11	A48N2
Oil top coat of lacquer	68-064	970EX0
c) Non-Architectural Items (Piping, Valves, equipment, etc.)		
1. Piping, valves equipment Etc. in rooms are to be painted		
2. Galvanized pipe and ducts		
Primer - one coat	70-56	B50ZX
Finish - one coat	22-101	B7WX3
3. Black Steel Pipes		
Primer - one coat	0.41	B16RX
Finish - one coat	22-101	B7WX3
4. Mechanical items		
a. Ungalvanized Ferrous Metal		
Primer - one coat	37-745	B16RX1
Finish - one coat	22-101	B7WX3
b. Galvanized Ferrous Metal		
Primer - one coat	70.56	B50AX1
Finish - one coat	22-101	B7WX3

- |    |   |  |         |
|----|---|--|---------|
| c. | Submerged Galvanized<br>Ferrous Metal<br>Primer - one coat  | 60-709   | C45NX19 |
| d. | Berried Miscellaneous<br>Ferrous surface, valves<br>and flange joints (excl. pipe)<br>Primer - one coat | Coal-tar enamel or match<br>Adjacent pipe coating (if any) |         |

## 6. STEEL AND METAL WORKS

### 6.1 GENERAL

Division 1, "General Requirements," contain provisions and requirements essential to these specifications; and apply to this Section, whether or not referred to herein.

#### 6.1.1 SCOPE OF WORK

The work includes the furnishing of all labor, materials, equipment and other incidentals necessary for the fabrication and installation of structural steel and miscellaneous metal works as specified in relevant items of these specifications and as indicated on the drawings.

#### 6.1.2 SUBMITTAL

1. Before placing orders for materials for the steel and metal works, the Contractor shall submit to the Engineer for approval shop drawings for all steelwork. All project shop drawings shall show the dimension of all parts, method of construction, bolts, welding sectional areas and other details.
2. The detail of connections shown on the shop drawings shall be such as to minimize formation of pockets to hold condensation, water or dirt. A minimum gap between abutting angles and the like shall be provided wherever possible to eliminate any traps and facilitate maintenance painting.
3. No materials shall be ordered nor fabrication commenced until the shop drawings are approved by the Engineer.

#### 6.1.3 STORAGE OF MATERIALS

Structural materials, either plain or fabricated, shall be stored above the ground upon platforms, skids, or other supports. Materials shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion.



## 6.2 MATERIAL REQUIREMENTS

1. Unless specified herein all steel structures and metals shall conform with the requirements of Section 3.15, "Steel and Metal Works." Connections where details are not specified or indicated herein, shall be designed in accordance with the American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.
2. Structural steel works consisting of channels, gusset plates and other structural steel shape shall be as indicated on the drawings and shall be structural carbon steel conforming to ASTM A 36. Shapes shall be as given in AISC, Manual of Steel Construction.
3. High strength structural bolts, shall conform to ASTM A 325, Types 1 or 2. Nuts shall conform to ASTM A 560, Grade A, heavy hex style, except nuts 38 mm (1-1/2 inch) may be provided in hex style. Washers shall conform to ANSI B 18.22.1, Type B.
4. Electrodes for arc welding shall be E70 series conforming to American Welding Society Specifications A5.1.
5. Tests are required under the ASTM Standards for steel to be used in the Works and shall be carried out in the presence of the Engineer and at least four (4) days notice must be given to him of the dates proposed for such tests. Four (4) calendar days notice on which fabricated steelwork will be ready for inspection in the Contractor's yard.
6. Standard bolt shall conform to ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.

## 6.3 EXECUTION

### 6.3.1 FABRICATION REQUIREMENTS

#### 1. Workmanship

Fabrication shall be performed within the permissible tolerance by the approved fabricator. All workmanship shall be of the best quality with respect to internationally recognized standards of practice.

#### 2. Cutting

Low-carbon structural steel may be cut by machine-guided torch instead of by shears or saw. Harmful notches, burrs, irregularities, etc., shall not be developed at the cut surface.

#### 3. Contact Faces

Contact surfaces between bases or other elements bearing directly upon bearing plates shall be ground or milled as necessary for full effective bearing. Edges for welding shall likewise be properly prepared.

4. Bolt Holes

Bolt holes shall be according to engineering practice and as specified in these specifications. Gas burning of holes will not be permitted.

5. High Strength Bolt Assembly Preparation

Surfaces of high strength bolted parts in contact with bolt heads and nuts shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the surface of a high strength bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for lack of parallelism. High strength bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces including those adjacent to washers shall be free of scale except tight mill scale, and shall be free from dirt, loose scale, burrs, and other defects that would prevent solid seating of parts. Contact surfaces of friction-type joints shall be free from oil, paint, lacquer or galvanizing.

6. Welding

All welding shall be done only by welders certified as to their ability to perform in accordance with accepted testing requirement. Welding of parts shall be in accordance with structural standards and the Standard Code for Arc and Gas Welding in Building Construction of AWS, and shall only be done where shown, specified, or permitted by the Engineer. Damage to galvanized areas by welding shall be thoroughly cleaned with wire brushing and all traces of welding flux and loose or cracked zinc coating shall be removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight. As an alternative to the above, the Contractor may submit for approval the use of a galvanizing rod or galvanizing solder to repair damaged areas. The welding machine shall be a stable welder, and have suitable functions for the dimension of materials to be welded. The auxiliary tools used for welding shall perform sufficiently and adequately. The welding machine used for field welding shall be of readily adjustable for electric current.

7. Shop Assembly

Structural units furnished shall be assembled in the shop. An inspection shall be made to determine that the fabrication and the matching of the component parts are correct. Jigs shall be used for the assembly of units as much as possible to maintain appropriate position of mutual materials. Approval of the Engineer shall be

required when drilling temporary bolt holes or welding temporary support to the assembled structure. The tolerances shall not exceed those allowed by codes and each unit assembled shall be closely checked to insure that all necessary clearances have been provided and that binding does not occur in any moving part. In order to maintain accurate finished dimensions and shape, appropriate reverse strain or restraint shall be provided as required. Assembly and disassembly work shall be performed in the presence of the Engineer, unless waived in writing by the Engineer any errors or defects disclosed shall be immediately remedied by the Contractor. Before disassembly for shipment, component parts of the structures shall be match marked to facilitate erection in the field.

### 6.3.2 FABRICATION TOLERANCES

#### 1. Dimensional Tolerances for Structural Work

Dimensions shall be measured by means of an approved calibrated steel tape at the time of inspection. Unevenness of plate work shall not exceed the limitation of the standard mill practice as specified in the American Institute . of Steel Construction, "Manual of Steel Construction".

#### 2. Camber

Reverse camber in any structural steel members in excess of 1/1,000 of the span length shall cause rejection. The minimum dead load camber for any structural steel member shall be as allowed by Code, or otherwise specified.

### 6.3.3 INSPECTION AND TEST OF WELDING

#### 1. Inspection of Welding

Inspection of welding shall be executed for the following work phases.

##### a. Before Welding

Scum, angle of bevel, root clearance, cleaning of surface to be welded, quality of end tab, drying of welding rod.

##### b. During Welding

Welding procedure, diameter of coil and wire, type of flux, welding current and voltage, welding speed, welding rod position, length of arc, melting, cleaning of slag of each level under surface chapping, supervision of welding rod.

c. After Execution of Welding

Assurance of bead surface, existence of harmful defects, treatment of crater, quality of slag removal, size of fillet, dimension of extra fill of butt welding, treatment of end tab.

2. Testing of Welding

Twenty percent (20%) of welds contributing in the overall strength of the structure and which will be inaccessible for the inspection in service shall be tested. Welding shall be tested by ultrasonic test to the extent specified herein or as directed by the Engineer. Where partial inspection is required, the ultrasonic test shall be located at random on the welds so as to indicate typical welding quality. If ten percent (10%) of the random ultrasonic tested indicate unacceptable defect, the remaining eighty percent (80%) of the welding shall be tested. Repair welding required shall be ultrasonic tested after the repairs are made.

6.3.4 CORRECTIONS

In lieu of the rejection of an entire piece or member containing welding which is unsatisfactory or which indicates inferior workmanship, corrective measures may be permitted by the Engineer whose specific approval shall be obtained for making each correction. Defective or unsound welds or base steel shall be corrected either by removing and replacing the entire weld, or as follows.

1. Excessive convexity or overlap shall be reduced by grinding.
2. Undercuts, lack of weld shall be repaired with necessary reinforcement of weld after removal of any foreign materials such as slag, dust, oil, etc.
3. Any defects such as slag inclusions, incomplete fusion, or inadequate joint penetration, shall be completely removed, cleaned and re welded.
4. Cracks in welds or base steel, shall be removed to sound steel throughout their length and 5cm beyond each end of the crack, followed by welding. The extent of the crack, depth and length, shall be ascertained by the use of acid etching, magnetic particle inspection or other equally positive means. The removal of welded steel shall be done by chipping, grinding, oxygen cutting, oxygen gouging, or air carbon arc gouging and in such a manner that the remaining welded steel or base steel is not nicked or undercut. Defective portions of the welding shall be removed without substantial removal of the base steel.



## 6.3.5 INSTALLATION

### 1. Installation Program

#### a. Prerequisite Condition

Prior to executing steel fabrication and field installation, the Contractor shall prepare a comprehensive installation program including engineering supervision organization, fabrication procedures, field installation procedures, material application, machinery applications, inspection procedure, scope and standard of quality judgment, and submit to the Engineer for approval.

#### b. Special Technical Engineering

Special technical engineering different from contract specifications can be applied upon receiving approval of the Engineer.

### 2. Installation Requirement

#### a. Setting of Anchor Bolt and Others

1. Anchor bolts shall be set in accurate position by using templates.
2. The setting method shall be proposed to the Engineer for his approval before setting starts.
3. The threads of bolt shall be cured with an appropriate method against rust and/or any damage before tightening.
4. Non-shrink mortar shall be placed under base plates, well cured to obtain the sufficient strength before bearing loads are applied to base plates.

#### b. Temporary Bracing

1. Temporary bracing shall be installed as necessary to stay assemblies and assume loads against forces due to transport, erection operations or other work.
2. Temporary bracing shall be maintained in place until permanent work is properly connected and other construction installed as necessary for support, bracing or staying of permanent work.
3. Extent and quality of temporary bracing shall be as necessary against wind and other loads, including seismic loads not less than those for which the permanent structure is designed to resist.

c. Adequacy of Temporary Connections

During erection, temporary connection work shall be securely made by bolting and/or welding for all dead load, wind and erection stresses.

d. Alignment

No permanent bolting or welding shall be done until the alignment of all parts with respect to each other shall be true within the respective tolerances required.

e. Field Welding

1. Any shop paint or surfaces adjacent to joints where field welding is to be executed shall be wire brushed to remove paint/primer.
2. Field welding shall conform to the requirements specified herein, except as approved by the Engineer.

f. High Strength Bolts

1. Final tightening of high strength bolts shall be done by using manufacturer's power operated equipment without any overstress to the threads.

g. Correction of Errors

1. Corrections of minor misfits by use of drift pins, and reaming, chipping or cutting will be permitted and shall be provided as part of erection work.
2. Any errors to be corrected or adjusted, preventing proper assembly, shall be immediately reported to the Engineer, and such corrections or adjustments shall be made as necessary and approved by the Engineer.
3. Cutting or alterations other than as approved will not be permitted.

h. Erection

1. Erection and installation shall be as per approved shop drawings.
2. Each structural unit shall be accurately aligned by the use of steel shims, or other approved methods so that no binding in any moving parts or distortion of any members occurs before it is finally fastened in place.

3. Operations, procedures of erection and bracing shall not cause any damage to works previously placed nor make overstress to any of the building parts or components. Damage caused by such operations shall be repaired as directed by the Engineer at no extra cost to the Employer.