



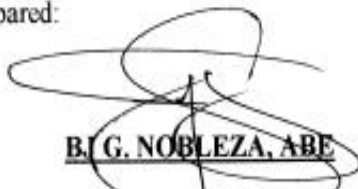
Republic of the Philippines
Department of Agriculture
Western Visayas
Iloilo City

CONSTRUCTION OF MASANAG DIVERSION DAM


Brgy. Masanag, Hamtic, Antique

TECHNICAL SPECIFICATIONS

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SECTION 1
GENERAL ITEM - SPL1
MOVEMENT OF EQUIPMENT

1.01 GENERAL

The Contractor shall mobilize and move into the Project Site (in accordance with his approved Construction Program and Equipment Moving-in and Utilization Schedule) the required construction equipment needed for the successful completion of the Contract Work immediately after receipt of the approved Construction Program. Notwithstanding the approved Equipment Moving-in and Utilization Schedule, the initial equipment required to be mobilized by the Contractor to the Project Site within twenty (20) calendar days after date of receipt of the approved Construction Program are listed below:

MINIMUM EQUIPMENT REQUIREMENT FOR DIVERSION DAM

| | | NUMBER | |
|----|--------------------------|--------|--------|
| | | OWNED | LEASED |
| 1. | Concrete Mixer 1 bagger | 1 unit | |
| 2. | Dump Truck | 1 unit | |
| 3. | Bar Cutter & Bender | 1 unit | |
| 4. | Backhoe | 1 unit | |
| 5. | Survey Instrument | | 1 unit |
| 6. | Water Pump | | 1 unit |
| 7. | Portable/Plate Compactor | | 1 unit |

If for the reasons or causes other than "major calamities", the Contractor fails to mobilize fully the initial equipment required within said period, and all other equipment listed in his approved Equipment Moving-in and Utilization Schedule, at the discretion of the Secretary/Director, he may be given an extension of time to mobilize them fully but in no case shall it exceed thirty (30) calendar days. Failure to fully mobilize the required construction equipment within said period will be a ground for contract rescission. During said extension period liquidated damages equivalent to the ACEL operated daily rental rate for eight (8) hours of the undelivered equipment per day of delay shall be imposed and collectible from any subsequent payment due the Contractor. Delays caused by "major calamities" will not be counted. Delays shall be reckoned starting at 12:00 o'clock noon of the succeeding day after the date scheduled for the mobilization of the programmed equipment. The Project Engineer shall certify to the date of actual mobilization of the programmed equipment to the site.

The DA Western Visayas shall check and verify the number, type and actual condition of the equipment moved into the Project Site. The DA Western Visayas reserves the right to order the removal of such equipment that are not in good working condition from the Project Site at the Contractor's expense and said equipment are not accounted for.

Construction equipment once moved into the Project Site, checked and accounted for the Project Engineer shall not be permitted, prior to the completion of the Contract Work, to be moved out or transferred by the Contractor to another Project Site without the written approval of the Project Engineer. Periodic check-up of the Contractor's equipment moved-in for the Contract Work shall be conducted by DA Western Visayas. The Contractor will pay to DA Western Visayas the amount equivalent to the ACEL Rental Rate of any equipment not accounted for during said check-up for the number of calendar days the equipment have been removed (without the written consent of the Project Engineer) from the Project Site until the said equipment have been returned. Such cases are grounds for disapproval of claims for contract time extensions by the Contractor.

Demobilization shall include dismantling and removal from the site of Contractor's Construction Plant, materials and equipment and all temporary facilities with the exception of some facilities which DA Western Visayas shall consider to remain and which shall be handled over to DA Western Visayas at the time of demobilization shall also include clean up of the site after completion of the Contract Work as approved by DA Western Visayas and transportation from the site of Contractor's employees.

SECTION 2
GENERAL ITEM - SPL4
DIVERSION OF WATER AND CARE OF CREEK AND REMOVAL
OF WATER FROM FOUNDATION

2.01 *GENERAL*

The Contractor shall construct and maintain all necessary cofferdams, channels, drains, sumps and/or other temporary diversion and protective works; shall furnish all materials, labor and equipment required therefore; and furnish, install, maintain and operate all necessary pumping and other equipment for removal of water. After having served their purpose, all cofferdams or other protective works downstream from the dam shall be removed or level to give a sightly appearance, so as not to interfere in anyway in the operation or usefulness of the reservoir, and in a manner approved by DA Western Visayas.

The Contractor shall be responsible for and shall repair at his expense any damage to the foundations. Structures or any other part of works caused by floods, water or failures of any part of the diversion or protective works.

**SECTION 3
ITEM 100(1)
CLEARING AND GRUBBING**

3.01 *SCOPE*

The work under this Section shall include clearing, grubbing and disposal, in a manner A Western Visayas, of all vegetation, trees, stumps, roots, brush, rubbish and all objectionable or undesirable matters within the entire dam site, construction camp site borrow areas, road surfacing materials sources, stockpile areas and elsewhere as may be directed by the Project Engineer; all in accordance with Drawings and this Specifications or as directed by the Project Engineer.

3.02 *METHOD OF CONSTRUCTION*

a. Clearing on Lightly Vegetated Areas

The areas over which the dam and appurtenances shall be constructed, side borrow areas, borrow haul areas, aggregate sources and stockpile areas shall be cleared of all vegetation, trees and all other matters, except such trees or shrubs which the DA Western Visayas may ordered to preserved. All trees or shrubs ordered to be preserved including all existing adjacent shall be protected from injury or damage resulting from the Contractor's operations. All combustible materials from clearing operations shall be burned thoroughly or removed from the site of work or otherwise disposed to designated areas as directed by the Project Engineer.

All materials to be burned shall be piled nearby and when in a suitable condition shall be burned thoroughly. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. The Contractor shall at all times take special precautions to prevent fire from spreading and shall have available at all times suitable equipment and supplies for use in preventing and fighting fires. No clearing shall be done on any areas where there are standing crops until such crops have been harvested or unless the Contractor shall have secured written permission from DA Western Visayas.

b. Clearing on Swampy Areas and/or Second Growth Forested Areas

Clearing on swampy areas and/or second growth forested areas where facilities will be constructed shall be started only when said areas are suitably dry or when directed by the Project Engineer. Clearing includes filling and buckling of trees using chain saws and cutting of tree branches extending over the entire right-of-way. Felled trees shall be cut into the longest usable lengths and shall be hauled and neatly stocked at designated stockpile areas. Small trees and stumps, branches, grass and litters shall be burned in accordance with the preceding paragraphs (a).

c. Grubbing

Grubbing shall consist of the removal of all trees, stumps, roots, brush and rubbish from the above-mentioned work areas It shall include to a surface to a depth not more than 10 cms by effective means to remove all objectionable materials or organic matters from the said work areas. Stripping beyond the 10 cm. limit shall be subject to approval by the Project Engr. And payment thereof shall be considered under Excavation.

3.03 *METHOD OF MEASUREMENT*

The area to be measured for payment shall be within the limit of the entire right-of-way as shown on the Drawings or as staked by the DA Western Visayas during construction operations. Measurement shall be made by the square meters and shall be computed based on the projection on a horizontal plane of the dimension of all acceptably cleared and grubbed areas.

3.04 *BASIS OF PAYMENT*

The cleared and grubbed areas measured as provided above shall be paid at the contract unit price per square meter in the Bill of Quantities which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and all incidentals or subsidiary works.

SECTION 4
ITEM 102
EXCAVATION AND FOUNDATION PREPARATION

4.01 SCOPE

The work under this Section shall include clearing removal, hauling and disposal of all excavated materials tamping and trimming of foundation bed required for the construction of permanent structure, dam foundation, irrigation canals, spillway structure including roadway and drainage excavation for access road. It shall also include whenever necessary all cofferdamming temporary diversions and protection works, pumping devalining operation, all necessary draining shellting storing and clean-up of sight after construction.

4.02 CLASSIFICATION

Excavations under this Section shall either be open or confined exaction. Furthermore, excavations shall be classified as follows:

- a. Rock Excavation. is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of excavating equipment larger than defined for common excavation or more as determined by physical measurements or visually by the Engineer.
- b. Common Excavation. All other materials not falling under the above classifications will be classified as “Common Materials”.

4.03 OPEN EXCAVATION

4.03.1 General

Open excavation denotes excavation to be carried out in the open air, in large quantities, with heavy or medium size equipment and without resorting to significant shoring. This consists of the loosening, hauling and satisfactory disposal of all materials within the lines and disposal of all materials within the lines and grades shown on the Drawings or as established by the DA Western Visayas Project Engineer. Excavated materials which are to be used later in cofferdams, in fill or backfill or in the manufacture of concrete aggregate shall be stockpiled in approve locations. Excavated materials to be wasted shall be disposed off properly in areas designated by the DA Western Visayas Project Engineer.

Any over-excavation performed by the contractor for any purpose or reason, except as maybe ordered by the Project Engineer, shall at the Contractor’s expense and any excess of excavation shall be refilled, where required, at the expense of the contractor.

Unsuitable materials, as determined by the DA Western Visayas Project Engineer, which maybe encountered below established grade, shall be removed to a depth as directed and accordingly replaced with suitable materials approved by the DA Western Visayas Project Engineer.

4.03.2 Grading Excavation

Where shown in the plans or as directed by the DA Western Visayas Project Engineer, the contractor shall perform grading excavation for the roadways, parking areas, switchyard, service yard, powerhouse ground, and other areas where grading work is required. Grading excavation shall be carried-out in such a manner that free drainage is maintained at all times and nowhere shall pondage be found in the work.

4.03.3 Final Grades and Lines

Subject to the approval by, and/or direction of the DA Western Visayas Project Engineer, foundation surfaces at the lines and grades shown on the Drawings consists of or containing unsuitable materials shall either be removed and the foundation carried down to a level with satisfactory bearing capacity, or replaced with suitable materials compacted to the required bearing capacity.

For those portions of the foundation surfaces to be covered with thick fills or massive concrete, isolated points on in-situ soil or undisturbed ledge rock extending not more than fifteen (15) cms within the prescribed lines, will be tolerated. For the foundation of concrete structures, heavy blasting, wherever needed, shall be stopped within seventy (70) centimeters of the required depth and the rest shall be completed by barring down and ripping. Soft blasting will be resorted only in case of hard massive rock or big boulders. For side slopes or walls of cuts in rock, pre-splitting maybe directed by the DA Western Visayas Project Engineer.

4.04 DISPOSAL OF EXCAVATED MATERIALS

4.05.1 Fills

Suitable materials for fills from required excavations may, at the Contractor’s discretion, be placed directly on the appropriate zones of the fills. The suitability and manner of placing of such materials shall meet the requirements of Section 5 of this volume.

4.05.2 Stockpiles

The Contractor may stockpile materials for his own and at his expense in areas approved by the DA Western Visayas Project Engineer. Where excavation work progresses at a faster rate than placement in the fills, such excavated materials shall be graded to blend with existing ground or removed from the stockpile used for stockpiling purposes and shall be properly sloped for effective drainage.

4.05.3 Spoil Areas

Excavated materials not suitable for fill or otherwise not needed shall be wasted in spoil areas indicated in the plans, in such areas approved by the DA Western Visayas Project Engineer. Spoil areas shall be cleared of all downed and standing timber prior to placing spoil thereon as specified in Section 3, Clearing and Grubbing. Depleted areas of borrow and quarries maybe used for disposing spoil materials. Spoil piles shall be constructed to the stable slopes of the materials being wasted. Any spoil pile exceeding ten (10) meters in height shall be provided with four meter wide berm for every ten (10) meters of height. Spoil materials shall be spread and graded so that the surface drainage will not be concentrated and will not cause or accelerate erosion.

4.06 *SLIDES*

When slides in open cut excavation occur along excavated slopes during the construction period, or after completion but prior to acceptance of the work, the contractor shall remove and dispose of such additional material, as in the opinion of the DA Western Visayas Project Engineer, is necessary to leave the slopes in a safe and neat condition, all at the expense of the contractor, unless the occurrence of such slides were occasioned by causes beyond the control of the Contractor.

4.07 *SAFETY REQUIREMENTS*

To prevent accidents, the Contractor shall adopt and maintain a satisfactory system of inspection and scaling for all temporary rock excavations. The Contractor shall maintain all berm barriers which might be required and constructed under this contract in satisfactory condition and shall keep the berm clear of material. Materials so removed shall be disposed in designated spoil areas and no payment will be made for the removal and disposal thereof. Such work shall be considered incidental to the items of work in this contract. Adequate lighting facilities for night time operations shall be installed and maintained throughout the duration of the entire work.

4.08 *FOUNDATION PREPARATION*

4.08.1 Fill on Earth

All horizontal and sloped earth surfaces shown in the drawings or specified by the DA Western Visayas Project Engineer, upon which embankment material is to be placed shall consist of undisturbed or well compacted material and shall be clean, damp, free from water and free from organic matter. They shall essentially be suitable as foundation for material to be placed upon them..

4.08.2 Fill on Rock

Foundation preparation shall consist of the completion of excavation to the surface upon which the fill material is to be placed. Where rock-fill is the specified fill material, sound rock or boulders meeting the requirements of the rock fill may be left in place. Foundation surfaces shall be cleaned with brooms and air and/or water jet under high pressure as directed.

For all embankments intended for retaining water, rock foundation shall be thoroughly inspected before any fill is placed. Open cracks shall be sealed with concrete or mortar, or provided with gravel grains and filters as approved by the DA Western Visayas Project Engineer.

4.08.3 Concrete on Rock

All rock surfaces upon or against which concrete is to be placed shall be prepared by drilling, barring, wedging, picking, light blasting, or similar methods which will live the surface clean and in the best practicable condition. No heavy blasting will be permitted. The rock surface shall be left clean and rough so as to bond well with the concrete placed upon it. Faults, fissures, and seams in rock subjected to this surface preparation shall be cleaned to a satisfactory depth and to firm rock on the sides. Rock shall be free from water. All installations necessary to produce rock surfaces free of water shall be installed and securely fastened in place by Contractor. All loose rock and other objectionable materials shall be removed and the surface thoroughly cleaned by air and/or water jetting or other satisfactory means as directed.

4.08.4 Concrete on Earth

Foundation on earth upon or against which concrete is to be placed shall be prepared in the same manner as mentioned on Sub-section 2.10.1 preceding this.

4.09 *METHOD OF MEASUREMENT AND BASIS OF PAYMENT*

4.09.1 Grading Excavation and Open Excavation

A survey of the areas to be excavated shall be made by the Contractor and confirmed by the DA Western Visayas Project Engineer prior to the start of the work. All measurements for excavations shall be based on this initial survey without regards to any change that may occur during the prosecution of the work. The quantity, in cubic meters to be paid shall be computed by the End-Area Method as determined from the original ground as surveyed and the final lines shown on the drawings or the lines directed in writing by the DA Western Visayas Project Engineer during the prosecution of the work.

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Slides, if any, shall be paid subject to the provisions set forth under Sub-section 4.08 and GC-16 of the Tender and Contract Provisions. Payments for grading and open excavation under this Contract shall be made at the corresponding contract unit bid prices for each class of material, which unit price includes all direct and indirect expenses connected with grading and open excavation, including cost of proper disposal of materials. The Contractor shall be responsible for making himself thoroughly knowledgeable of the physical conditions at the site. In no case shall the DA Western Visayas be held responsible for any discrepancy between the information supplied by the DA Western Visayas and the actual conditions met during the progress of excavations.

The final trimming, barring down, and cleaning of foundation surfaces shall not be paid for separately, being covered by the relevant unit bid prices for concrete or fill placement.

4.09.2 Foundation Preparation

No separate payment will be, made for all foundation preparation under this Section. The Contractor shall include his cost thereof in his unit bid price for the pertinent concrete or fill in the Bid Proposal.

SECTION 5
ITEM 100(2)
STRUCTURAL BACKFILL

5.01 SCOPE

Work under this Section shall consist of furnishing, placing, blending, conditioning and compaction of random fill, structural backfill, sand and gravel filters and drains, where required for the various structures included in the works.

1.02 MATERIALS

5.02.1 Sources

Materials for the various fills and backfills shall be obtained from required excavations and from borrow areas designated by the DA Western Visayas Project Engineer. There is no guarantee that all the materials in any borrow area will be suitable for use in the fills and the Contractor shall move or modify his operations, as directed, to avoid unsuitable material. The Contractor shall move or modify his operations, as directed to avoid unsuitable material. The Contractor shall maintain and operate sufficient excavating and hauling equipment so that an adequate amount of fill material from all sources will be available as required. Operations in borrow areas should not endanger roads, buildings and other existing structures. Borrow areas shall be graded to provide ready drainage from all parts of the excavated areas. When operations in a borrow area have terminated, the area shall be dressed to a neat appearance with adequate drainage to the satisfaction of the DA Western Visayas Project Engineer.

Materials for structural backfill shall consist of compactable soil taken from foundation or channel excavations. Any additional materials needed shall be obtained from borrow areas mentioned above.

5.02.2 Suitability

The suitability of fill or backfill materials shall be subject to the approval of the Project Engineer. Materials containing brush, roots, and others organic matter will not be considered suitable for fill or backfill. Unsuitable material to be wasted will be specifically designated by the DA Western Visayas Project Engineer at the time the material is excavated.

5.02.3 Types of General Fill and Backfill Materials Required in the Work

a. Structural Backfill. Materials for structural backfill shall consist of compactible soil approved by the DA Western Visayas Project Engineer. It shall not contain individual particles larger than ten (10) centimeters.

5.04 HAULING AND PLACEMENT

5.04.1 GENERAL

Placement of fill materials shall be in fill foundations, only after inspection and approval of the DA Western Visayas Project Engineer. Approved undisturbed earth foundations shall be stripped as directed to a depth of 20 to 30 cm. by means of approved bulldozer attended by water sprinkling when necessary and compacted at optimum moisture content to the density required or the fills to be placed on the foundations. The gradation and distribution of materials shall be such that the fills will be free from lenses, pockets, streaks and layer of material differing substantially in texture or gradation from surrounding material of the same class.

Equipment for hauling and placement shall be able to deliver the material without detrimental segregation. Truck and roller ruts in dumped layers shall be smoothed out before compaction. The contact surfaces shall be sacrificed and prepared so as to expose the dense undisturbed material of the embankment to produce a satisfactory bond between new materials and those already in place.

5.04.2 Structural Backfill

Excavated areas around the structures shall be backfilled with materials from the required excavations or from the borrow areas in horizontal layers, with each layer not exceeding fifteen (15) centimeters in loose volume thickness, and compacted as directed. No backfill material shall be placed until the concrete of the structure has been cured sufficiently.

5.05 COMPACTION

5.05.1 Fill or Backfill on or Against Concrete Structures

No fill or backfill shall be placed on or against concrete surfaces before a period of fourteen (14) days has elapsed after placing the concrete. Passage of hauling and rolling equipment over the top of the conduits or other structures will be allowed when the depth of fill or backfill over the concrete shall, as inspected and approved by the DA Western Visayas Project Engineer, be sufficient to permit such passage without inducing harmful stresses or vibration in the structure. Fill placed around and over the conduits or other structures not accessible to the roller shall be placed in thin layers and shall be compacted by hand vibratory plate compactor/tampers to a density equal to that specified for the rolled fill.

5.06 MOISTURE CONTENT

Moisture content of the random fill and structural backfill materials shall be the optimum practicable required for compaction as determined by the DA Western Visayas Project Engineer and shall be uniform throughout each layer.

All necessary tests for moisture content, composition and compaction shall be made continuously by the DA Western Visayas Project Engineer, and from which corrections, adjustments and modifications of methods, materials and moisture content will be made in order secure satisfactory density of the fill materials. The Contractor shall provide necessary skilled labor in obtaining and preserving samples.

5.07 SLIP-OUTS

In the event of slip-outs in any part of the fill prior, to final acceptance of the work, the Contractor shall remove the material from the slip area, and shall rebuild such portion of the fill. If the slip-out was caused through the fault of the Contractor, the removal and disposal of material and rebuilding of the fill shall be performed without cost to the DA Western Visayas; otherwise the reconstruction of the fill will be paid for based on the contract unit price for the pertinent items of Fill in the Bid Proposal.

5.08 METHOD OF MEASUREMENT

5.08.1 Structural Backfill

Measurement for payment of random fills will be based on the number of cubic meters of approved materials backfilled satisfactorily compacted and accepted. Measurement will be made in accordance with the following:

- a. Case I - Structural Backfill for Foundation Below Graded Surface in Cut.

The Volume to be measured for payment will be the compacted volume bounded by the graded surface, excavation slopes and the structures.

- b. Case II – Structural Backfill for Foundation Below Original Ground Surface.

The volume to be measured for payment will be the compacted volume bounded by the original ground surface after stripping, excavation slopes and the structures.

Any backfill materials placed outside the established pay lines for excavation to replace slides, cave-ins or over excavation will not be paid.

5.09 BASIS OF PAYMENT

Payment for structural backfill will be made at the contract unit price per cubic meter, backfill in the Bid Proposal, which payment shall constitute full compensation for furnishing all labor, equipment, and other incidentals necessary to complete the item.

SECTION 6
ITEM 201
LEVELING COURSE/SUB BASE COURSE

7.01 *SCOPE*

This item shall consist of approved granular fill material furnished and placed as required to replace unsuitable material encountered below foundation elevation of concrete structures, pipes, grouted riprap and concrete posts.

7.02 *MATERIALS*

Gravel blanket shall consist of natural or processed aggregates such as gravel, sand or stone fragments, which shall conform to the following grading requirements:

Requirements for Grading

| Sieve Size (mm) | Percent by Weight Passing | | |
|--------------------|---------------------------|-----------|-----------|
| | Grading A | Grading B | Grading C |
| 75.00 | 100 | 100 | 100 |
| 5.00 | 35-70 | 40-90 | 50-100 |
| 0.075 | 0.20 | 0.25 | 0.30 |

In addition, that portion of the material passing the 0.425 sieve shall have a liquid limit not exceeding 35 and a plastic index not exceeding 11.

7.03 *METHOD OF CONSTRUCTION*

After the unsuitable material has been removed as required by the DA Western Visayas Project Engineer, gravel blanket shall be placed in thoroughly compacted layers, not exceeding those specified in the Drawing or as directed by the DA Western Visayas Project Engineer.

7.04 *METHOD OF MEASUREMENT*

The volume to be paid for shall be the numbers of cubic meters, measured in its final position, and accepted, except that no volume will be included that is outside the vertical plans limiting the payment under excavation for structures.

7.05 *BASIS OF PAYMENT*

The volume measured as provided above shall be paid for at the contract unit price per cubic meter for gravel blanket which price and payment constitute full compensation for furnishing, hauling and placing of materials and for all labor, equipment, tools and incidentals necessary to complete the item.

SECTION 7
SPL 6
PVC DRAIN PIPE

8.01 SCOPE AND DESCRIPTION

The work under this Section shall consist of furnishing, transporting to the site, and installation of PVC Drain pipe of the size and dimensions as shown on the plans, in accordance with these specifications and in conforming with the lines and grades given.

This item include the furnishing and installation of five (5) mm. wire mesh with 15 mm x 15 mm slots to the pipe as required to complete this item.

8.02 MATERIALS

Pipes and Couplings – Pipes shall of Polyvinyl Chloride made from Class 12454-A or Class 12454-B virgin compounds as defined in ATSM D1784 (Hydrostatic-design-basis rating 4,000 psi).

8.03 CONSTRUCTION METHOD

Pipe shall be homogenous throughout; free from dents, cracks, inclusions and other defects. Pipe surfaces shall be free from nicks, scratches and other blemishes. The joints surfaces of pipe spigots and of integral-bell and sleeve reinforced-bell sockets shall be free from gauges and other imperfections that might cause leakage at joints.

Pipe, couplings, and solvent cements that do not comply with the applicable requirements of these specifications or that are damaged when received shall be replaced without extra compensation.

8.04 MEASUREMENT AND PAYMENT

Pipe in placed and accepted shall be measured by the linear meter along the axis of the pipe.

The quantity measured, as provided above, completely installed and accepted, shall be paid for at the contract unit bid price per linear meter indicated in the Bill of Quantities and shall constitute full compensation for furnishing and installing the pipe, for jointing and joint materials and for all materials, labor, equipment and tools and incidentals necessary to complete the work.

SECTION 8
ITEM 505
RUBBLE MASONRY

9.01 *SCOPE*

The work under this Section shall include construction of all necessary form work, placing rubble stone and concrete binder on an approved foundation and form work; the removal of forms and curing of the rubble masonry, all in accordance with the drawings and specifications or as directed by the DA Western Visayas Project Engineer.

9.02 *MATERIALS*

Rubble stones shall consist of field stones. They are clean, sound, durable, resistant to the action of water, and must have specific gravity of at least two and six tenths (2.6), in diameters ranging from 15 cm. to 30 cm., sixty percent (60%) of which comprises the bigger sizes. Stones shall have the prior approval of the DA Western Visayas Project Engineer before their use. Concrete binder shall be class A concrete with 1 ½ (37.5 mm) maximum size of aggregate.

9.03 *METHOD OF CONSTRUCTION*

The stone shall be thoroughly wet before they are installed in place. The entire surface of every stone shall be thoroughly covered with concrete binder, as specified in the drawing. Actual variation in this proportion will not entitle the Contractor to any price adjustment. The stones shall be well set such that no stone will project beyond the lines indicated on the drawings. The concrete binder shall be properly placed into the spaces between stones so that no void is left within the rubble masonry. Concrete layer of 10 cm shall be provided with 12 mm reinforcement or as shown in the detailed engineering design shall be placed as outer layer of cover of the rubble masonry as finishing to coincide with neat lines of the structure. In case reinforcements are placed, no stone shall be closer than 3 inches (7.5 cm) to the nearest reinforcing bars. Rubble masonry shall be cured by water for five (5) days.

9.04 *METHOD OF MEASUREMENT*

Rubble masonry will be measured by the number of cubic meters of materials acceptably placed and computed based on the neat lines of construction drawings prepared and approved by the DA Western Visayas Project Engineer.

9.05 *BASIS OF PAYMENT*

The volume measured as provided above will be paid for at the contract unit price per cubic meter, which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and materials and all incidentals or subsidiary works necessary for the successful completion of the work described under this Section.

SECTION 9
ITEM 504
GROUTED RIPRAP

10.01 *SCOPE*

The work under this Section shall include furnishing and placing appropriate sizes of stones or spalls for riprap and grouting the riprap with cement mortar, in accordance with these Specifications and as directed by the DA Western Visayas Project Engineer. The stones and spalls shall be obtained from quarry areas or stockpile areas designated by the DA Western Visayas Project Engineer and shall be placed at the road bank adjacent to the reservoir's normal water level limit. Specific areas to be protected with grouted riprap shall be determined by the DA Western Visayas Project Engineer first before the Contractor works on them.

10.02 *MATERIALS*

Stones for riprap shall be at least 15 cm. in diameter and shall be sound, tough, durable, dense and resistant to the action of air and water with a specific gravity of at least two and six tenths (2.6).

Mortar for grouted riprap shall consist of one (1) part cement to three (3) parts sand by volume and sufficient water to produce a thick and creamy mixture conforming to the provisions of Section 11, Concrete.

10.03 *METHOD OF CONSTRUCTION*

The bed for grouted riprap shall be excavated to the required elevation and then properly tamped and trimmed. The stones shall be well laid with close joints by hand. The stones shall be well arranged in such a manner that the stones can resist appreciable disturbances. If big spaces occur between stone and foundation bed, said spaces shall be filled with spalls of appropriate sizes of stones. The spaces between the stones shall be completely filled with grout from bottom to top and the surface swept with stiff broom. The grouted riprap shall be cured with water like concrete for a minimum period of three (3) days.

10.04 *METHOD OF MEASUREMENT*

Grouted riprap will be measured by the number of cubic meter of materials acceptably placed and computed based on the neat lines of construction drawings prepared by the Contractor and approved the Project Engineer.

10.05 *BASIS OF PAYMENT*

The volume measured as provided above will be paid for at the contract unit price per cubic meter, which price and payment shall constitute full compensation for furnishing all labor, tools, equipment, supplies and materials and all incidentals or subsidiary works necessary for the successful completion of the work described under this Section. Excavation involved under this item is not considered a subsidiary work, hence, it will not be measured for payment under this Section. Rather, it will be measured and paid for under Section 4, Excavation and Foundation Preparation.

SECTION 10
ITEM 405/SPL4
CONCRETE/SAFETY AND HEALTH

11.01 GENERAL

This section covers all the materials as cement, aggregates, water, admixtures and proportioning, mixing, transporting, placing, finishing, curing and protecting of concrete, including supplies, equipment, tools and all other incidentals necessary for concrete works.

All the applicable provisions of the latest revision of the ACI Building Code (ACI- 318 -85) and American Society for Testing Materials (ASTM) shall govern in all cases not specifically provided for herein.

11.02 SAFETY

Safety precautions shall be used at all times during the progress of the work. As appropriate, workmen shall be furnished with hard hats, safety shoes, respirators, and any other safety apparel that will reduce the possibility of injury from accidents. All Occupational Safety and Health Act requirements shall be observed.

11.03 CONCRETE COMPOSITION

Concrete shall be composed of Portland Cement, fine and coarse aggregates, water and if necessary, admixtures or agents approved by DA Western Visayas. The design of the concrete mixtures and consistency shall be as specified in this Section.

11.04 CEMENT

a. General. All cement requirements of concrete works for the contract shall contractor-furnished. The cement shall conform to the requirements of the standard specifications for Portland Cement (ASTM: C150 Type 1).

b. Storage. Contractor shall immediately upon delivery of cement to the jobsite store the same in a dry, watertight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture. All storage facilities shall be subject to the approval of DA Western Visayas and shall be such as to permit easy access for the inspection and identification. In order that cement may not become unduly aged after delivery, Contractor shall use cement stored at the project site for not over four months. Same shall not be used unless retest proves it to be satisfactory.

Sacked cement shall not be stocked higher than 14 sacks for storage for a period of not longer than 30 days and not higher than seven (7) sacks for longer period.

11.05 ADMIXTURES

In order to reduce the cement content and/or the amount of mixing water, and to improve the concrete workability, the Contractor may be allowed to use admixtures and as such he shall submit to DA Western Visayas for approval such admixture he proposes to use. However, no additional payment will be made by DA Western Visayas to the Contractor in view of this as the cost thereof is considered included in the contract unit price for the different classes of concrete.

The following type of admixtures will be given consideration by the DA Western Visayas provided that they conform to the provisions of this paragraph:

1. Air entraining agent
2. Water reducing admixtures
3. Water reducing and retarding admixtures
4. Water reducing and accelerating admixtures

Admixtures shall be furnished in a powder or liquid form. If furnished in a solution, it shall contain at least 50% solids and a mold inhibitor. The admixtures effect on the properties of Portland Cement concrete mixtures shall meet the requirements of ASTM: C- 494.

Admixtures shall be accepted on manufacturers certification of conformance with the specifications but permission to ship on certification shall in no way relieve the Contractor of responsibility for furnishing an admixture not meeting specification requirements. Where the DA Western Visayas has reason to believe that testing is necessary to prove compliance with the requirements of these specifications, it may order these admixtures to be sampled and tested anytime. The Contractor shall provide facilities satisfactory to the DA Western Visayas for readily procuring samples for test.

Air Entraining Agent. Concrete produced with water reducing agent shall contain four to six percent of entrained air by volume. The air entraining agent shall conform to the requirements of ASTM C – 260, and shall be tested in accordance with ASTM C – 233. The total calculated air content of the concrete discharged from the mixer shall be as follows:

| Coarse Aggregates Maximum Size | Total Air – Percent by Volume of Concrete |
|--------------------------------------|--|
| 3/4" (2 cm.) | 5 + 1 |
| 1 - 1/2" (3.8 cm.) | 4 + 1 |

The agent in solution shall be maintained at uniform strength and shall be added to the batch in a portion of the mixing water. This solution shall be batched by means of a mechanical batcher capable of accurate measurement. When a retarded dispersing agent is used in the concrete, the portion of the mixing water containing the air-entraining agent shall be introduced separately into the mixer.

The Contractor may be allowed to use an approved water reducing agent or water-reducing and set retarding agent in concrete. The ASTM designations for these mixtures are Type A and Type D respectively. The agent used shall be either suitable calcium, sodium or ammonium salts of lignosulfonic acids or of the non-lignin, hydroxylated carboxylic and acid groups. The agent shall be of uniform consistency and quality within each container and from shipment to shipment.

The amount of water reducing or water reducing and set retarding agent to be used in each concrete mix shall in general be within the following limits:

Lignosulfonic Acid Type : 0.27 to 0.37 percent of solid crystal-line lignin, by weight of cement

Hydroxylated Carboxylic : 0.25 to 0.50 percent of liquid, by Weight of cement

Water Reducing and Accelerating Admixture. The ASTM designation for this admixture is Type E. Water reducing and accelerating admixtures may be used by the Contractor for speeding up precasting and post-tensioning operations for precast and prestressed beams, girders, slabs and bearing pads if approved.

11.06 WATER

The water used in concrete, mortar and grout shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities. The recommendation of the seventh edition of the U.S. Bureau of Reclamation Concrete Manual for mixing water shall be followed.

11.07 FINE AGGREGATES

a. General. The term "Fine Aggregates" is used to designate aggregates in which the maximum size of particles is 3/16 of an inch (5 millimeters). Fine aggregates for concrete, mortar and grout shall be provided by the Contractor and shall consist of natural sand, manufactured sand or a combination of both. The different components shall be batched separately, or subject to the written approval of the Project Engineer, or blended prior to delivery to the batching plant. As a means of providing moisture control, the Contractor may be required to stockpile the fine aggregates over porous drain to get rid of excess water and to stabilize the moisture content.

b. Quality. Fine aggregates shall conform to the requirements of ASTM C-33 and shall consist of hard, tough, durable uncoated rock particles. The Contractor shall exercise every possible precaution in transporting, washing and screening operations to prevent contamination of sand particles. Fine aggregates shall conform to the following requirements:

c. Grading – It is assumed that the sand available in natural deposits will require processing to provide a suitable gradation. Regardless of the source, the fine aggregates shall be well graded from fine to coarse and the gradation as delivered to the mixers shall conform to the following requirements unless otherwise approved:

| Sieve Designation US Standard Square Mesh | Percent by Weight Passing Individual Sizes |
|---|---|
| 3/8" (9.50 mm) | 100 |
| No. 4 (4.75 mm) | 95 - 100 |
| No. 8 (2.36 mm) | 85 - 95 |
| No. 10 (1.18 mm) | 60 - 85 |
| No. 30 (600 um) | 25 - 60 |
| No. 50 (300 um) | 10 - 30 |
| No. 100 (150 um) | 2 - 10 |

In addition to the grading limits shown above, the fine aggregates as delivered to the mixer shall have the fineness modulus of not less than 2.30 or more than 3.00. The grading of the fine aggregates also shall be controlled so that the fineness moduli of at least 9 to 10 test samples of fine aggregates as delivered to the mixer shall not vary more than 0.10 from the average fineness modulus of all samples previously taken. The fineness modulus shall be determined by dividing by 100, the sum of cumulative percentages retained on U.S. Standard sieves Nos. 4, 8, 16, 30, 50 and 100. At the option of the Contractor fine aggregates may be separated into two or more sizes and classifications, but the resulting sand when combined before entering the concrete mixer shall be of uniform grading within the limits specified above.

Particle Shape – The shape of the particles shall be generally spherical or cubical and reasonably free from flat or elongated particles. A flat or elongated particle is defined as a particle having maximum dimension in excess of five times the minimum dimension. Rocks which break down into such shape, regardless of the type of processing equipment used, will not be approved for use in the production of fine aggregates.

Deleterious Substances – The maximum percentages of deleterious substances in the fine aggregates as delivered to the mixer shall not exceed the following values:

| | Percent by Weight |
|---|-------------------|
| Materials passing No. 200 screen (Designation 16)* | 3 |
| Shale (Designation 17) | 1 |
| Clay (Designation 13) | 1 |
| Total of other deleterious substances (such as alkali, mica, soft, flakey particles and loam) | 2 |

* The designation 1 parenthesis refers to methods of testing described in the seventh edition of the U.S. Bureau of Reclamation Concrete Manual and ASTM.

The sum of the percentages of all deleterious substances shall not exceed 5% by weight. Fine aggregates producing a color darker than the standard in the colorimetric test for organic impurity (USBR Design 14 or ASTM C-40) may be rejected. Fine aggregate having specific gravity (USBR Design 9 or ASTM C – 128, saturated surface dry basis) of less than 2.60 may be rejected. The fine aggregates may be rejected if the portion retained on No. 50 (300 um) screen when subjected to five cycles of sodium sulphate test for soundness (USBR Design No. 19 or ASTM C-88) shows an average loss of more than 18% by weight. Fine aggregates delivered to the batching plant may be rejected if it contains more than 0.15% soluble sulphate for any one sample or more than 0.10% for an average of at least 9 out of 10 consecutive test samples of finished sand, when samples are taken hourly. The percent soluble sulphate in fine aggregates shall be determined in accordance with the method of test prescribe in sub-paragraph.

2. Sampling – Sampling of fine and coarse aggregates shall be done in accordance with the appropriate requirements, of ASTM C-33. The source from which fine and coarse aggregates is to be obtained shall be selected well in advance of the time when the materials will be required in the work. Unless otherwise specified, all test samples shall be taken under the supervision of the Project Engineer in sufficient time as approved to permit adequate testing and examination of results sufficiently in advance of the time for use in concrete. Routine control test and analysis of the fine and coarse aggregates at various stages in the processing operation shall be made. The approval of a source shall not be construed as containing approval of all materials from the source, and the Contractor will be held responsible for the specified quality of all such materials used in the work.

c. Storage. Fine aggregates shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete. The storage or stockpiles shall be constructed so as to prevent segregation. Depositing of materials in storage and its removal there from shall be done in such a manner as to result in increasing the uniformity of the grading insofar as this is practicable. All fine aggregates shall remain in free drainage storage for at least seventy two (72) hours prior to use. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete.

d. Measurement and Payment. Fine aggregates will not be measured for payment. The cost of excavation, stockpiling, transporting, processing, blending, handling and other costs for providing fine aggregates shall be considered included in the unit price bid for the various items in the Bill of Quantities for which fine aggregates are use.

11.08 COARSE AGGREGATE

a. General. The term “Coarse Aggregate” is used to designate aggregates of such sizes as to fall within the range of 3/16 inch to 3 inches (0.5 cm to 7.5 cm.) or any size or range of sizes within such limits. The coarse aggregate shall be reasonably well graded within the nominal size ranges hereinafter specified. Coarse aggregate for concrete shall be furnished by the Contractor and shall consist of crushed rock or mixture of natural gravel and crushed rock as provided in paragraph 19.08. Coarse aggregate as delivered to the batching plant shall have a uniform and stable moisture content. Any rewashing found necessary to provide clean aggregates shall be done prior to finish screening. Rewashing shall not be performed in finish screens.

b. Quality. Coarse aggregates shall conform to the requirements of ASTM C-33 and shall consist of hard, dense, uncoated durable rock fragments.

c. Grading – The coarse aggregates shall be well graded from fine to coarse. It shall be separated into the following specific size groups. The grading of the aggregates within the separated size groups as delivered to the mixer shall be as follows:

| SIZE Sieve Sizes US Standard Square Mesh | GROUPS | | | | |
|--|-------------------|-----------|-------------------------|----------|----------|
| | Percent by Weight | | Passing Individual Size | | |
| | 1/2" Size | 3/4" Size | 1-1/2" Size | 2" Size | 3" Size |
| 6" (150 mm) | - | - | - | - | - |
| 3" (75 mm) | - | - | - | - | 100 |
| 2-1/2" (63 mm) | - | - | - | 100 | 90 - 100 |
| 2" (50 mm) | - | - | 100 | 95 - 100 | 35 - 70 |
| 1-1/2" (37.5 mm) | - | - | 90 - 100 | - | 0 - 15 |
| 1" (25 mm) | - | 100 | 20 - 55 | 35 - 70 | - |
| 3/4" (19 mm) | 100 | 90 - 100 | 0 - 15 | - | 0 - 5 |
| 1/2" (12.5 mm) | 90 - 100 | - | - | 10 - 30 | - |
| 3/8" (9.5 mm) | 40 - 70 | 20 - 55 | 0 - 5 | - | - |
| No. 4 (4.75 mm) | 0 - 15 | 0 - 10 | - | 0 - 5 | - |

Coarse aggregates shall contain not more than one and one-half (1-1/2%) percent of materials passing the No. 200 sieve by meshing nor more than 5 per cent of soft fragments.

It shall have an abrasion loss of not more than 45 percent of 500 revolutions.

Unless otherwise directed, the maximum sizes of the aggregates to be used in concrete for the various parts of the work shall be in accordance with the following:

| General Use | Maximum Aggregate Diameter |
|--|-------------------------------|
| Lean concrete to control water intrusion and other miscellaneous uses | 1-1/2 " (37.5 mm) |
| Concrete for footings, walls, slabs, beams, 0.22 to 0.75 meters thick | 1-1/2 " (37.5 mm) |
| Concrete for thin walls, slabs, beams, less than 0.22 meters thick | 3/4" (19 mm) |
| Concrete for reinforced concrete pipe | 1/2" (12.5 mm) |

In all cases, the diameter of the aggregate shall not exceed 1/2 the distance between the bars of reinforcing steel of the members being place.

a. Particle Shape – The particle shape of the crushed coarse aggregate shall be generally spherical or cubical and reasonably free from flat or elongated particles. A flat or elongated particle is defined as a particle having a maximum dimension in excess of five times the minimum dimensions. Rocks which break down into such shape will not be approved for the production of aggregate.

b. Deleterious Substances – The deleterious substances in any size of coarse aggregate, as delivered to the mixer, shall not exceed the following values:

| | Percent by Weight |
|--|-------------------|
| Materials passing No. 200 screen (Designation 16)* | 1/2 |
| Shale (Designation 18) | 1 |
| Clay (Designation 13) | 1/2 |
| Total of other deleterious substances (such as alkali, mica, soft, flakey particles and loam) | 1 |

The sum of the percentages of all deleterious substances in any size, as delivered to the mixer, shall not exceed 3%, by weight. Coarse aggregate may be rejected if it fails to meet the following requirements:

- a) Petrographic Examination – If more than 10% of poor aggregate particles can be identified in physical quality test and in case 20% of the particles would be classified with respect to the chemical quality (USBR Desig. 7 or ASTM C- 295).
- b) Sodium-sulphate test for soundness (USBR Desig. 9 or ASTM C-88) – If the weighted average loss, after five cycles is more than 10% by weight.
- c) Specific Gravity (USBR Desig. 10 or ASTM C-127) – If the specific gravity (saturated surface dry basis) is less than 2.60.

Sampling – All sampling of coarse aggregates shall be in accordance with paragraph 19.06 (b) 4.

- c. Storage. Coarse aggregate storage or stockpiles shall be built in such a manner as to avoid the inclusion of any foreign materials in the concrete and to prevent segregation and excessive breakage. Water sprayers shall be installed to keep that portion of the coarse aggregate stockpiles saturated which is intended for immediate use in the concrete. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete.
- d. Measurement and Payment. Coarse aggregates will not be measured for payment. The cost of excavation, stockpiling, processing, blending, handling and other cost for providing coarse aggregates shall be considered included in the unit price bid for the various items in the Bill of Quantities for which coarse aggregates are used.

11.09 PRODUCTION OF FINE AND COARSE AGGREGATES

- a. Source of Aggregates. Fine and coarse aggregates for concrete and fine aggregate for mortar and grout may be obtained by the Contractor from any approved source. Approval of deposit shall not be construed as constituting approval of all materials taken from the deposit, and the Contractor shall maintain the specified quality of all such materials used in concrete works. If the aggregates are to be obtained from deposits or quarry sources not previously tested and approved by DA Western Visayas, Contractor shall submit, for preliminary test and approval, a representative 90 kgs. (approximately 200 lbs.) sample of the fine aggregate and of the 3/16 inch (0.5 cm) to 3/4 inch (2 cm) size of coarse aggregate proposed for use in the work, at least 60 days before the materials are required for use.
- b. Developing Aggregate Deposit. The Contractor shall carefully clear the area, from which aggregates are to be taken, of trees, roots, brush, sod, soil unsuitable sand and gravel or aggregates and other objectionable matter. The portion of the deposit used shall be located and operated so as not to detract from the usefulness of the deposit or of any adjacent property and so as to preserve, insofar as practicable, the future usefulness or value of the deposit. Waste materials remove from the aggregate borrow areas shall be disposed of in approved locations.
- d. Processing Raw Materials. The Contractor shall employ processing equipment which will ensure well-shaped particle in all aggregate sizes and a minimum of particle which are flat or elongated. Processing of raw materials shall include screening, washing, and blending if necessary to produce fine and coarse aggregate meeting the requirements of paragraph 10.05 and 10.07. Processing of aggregates produce from any source shall be done at an approved site. Water used for washing aggregates shall conform to paragraph 10.05. To utilize the greatest practicable yield of suitable materials in the portion of the deposit being worked, the Contractor may crushed oversize material and any excess materials of the size of coarse aggregate to be furnished, until required quantity of each size has been secured, provided that the crushed aggregates shall be blended uniformly with the uncrushed aggregates. Crushing and blending operations shall at all times be subject to approval of the DA Western Visayas Project Engineer.

Aggregates, as delivered to the mixers, shall consist of clean, hard and uncoated particles. When required, dust shall be removed from the coarse aggregate by adequate washing.

- e. Moisture Control. The free moisture control of the fine aggregate and smallest size group of coarse aggregates as delivered to the mixers shall be controlled so as not to exceed the value of 6.0 and 1.5, respectively, expressed as a percentage by weight of the saturated, surface dry aggregates. The percent variation of free moisture content in fine aggregate and the smallest size of coarse aggregate shall not exceed 0.5% and 2.0%, respectively, during any one hour of mixing plant operation. The free moisture of the other sizes of coarse aggregates shall be the least amount when delivered to mixers and variations shall be the least practicable under all job conditions. Sand shall have uniform and stable moisture content. Under no conditions shall the other sizes of coarse aggregates be delivered to the mixing plant bind dripping wet. The Contractor may accomplish the required moisture control by use devices or any other satisfactory of free drainage storage, mechanical dewatering or any other means of dewatering.

11.10 AGGREGATE SAMPLING AND TESTING

Sampling of the aggregate materials approved for use in the work, shall be done in accordance with ASTM Sampling Method at 10 days in advance of the time when placing of concrete is expected to begin. It shall be the responsibility of the Contractor to designate the source(s) of aggregates early enough to give DA Western Visayas, sufficient time to validate. Aggregate sampling and testing shall be done by the contractor at his own expense in any DPWH accredited testing laboratory. The samples of aggregates shall be obtained and tested in accordance with the following ASTM standard methods:

| | Concrete |
|---|-----------------|
| Sampling aggregate | D 75 |
| Sieve analysis | C 136 |
| Amount of material finer than 200 sieve | C 117 |
| Organic impurities | C 40 |
| Mortar strength | C 87 |
| Soudness | C 88 |
| Soft particles | C 235 |
| Abrasion | C 131 |

No aggregate shall be used until official advice has been received that it has satisfactorily passed all tests, at which time written authority shall be given previously tested and shown satisfactory compliance with all the requirements given herein may be used without further testing upon written permission of DA Western Visayas. Test reports for previous test must be available before approval can be given.

During construction, aggregates will be sampled as delivered to the mixer to determine compliance with specification provisions. Test shall be made in accordance with the applicable ASTM Standards. Routine control test and analysis of aggregates at various stages in processing, transporting, stockpiling, redraining and batching, if used will be made by DA Western Visayas. The Contractor shall provide such facilities as may be considered necessary for the ready procurement of representative test samples. All test and supervision will be made by DA Western Visayas.

11.11 CLASSIFICATION & PROPORTIONING OF CONCRETE MIXTURES

- a. Classification and Design Mixtures. The mixtures for all classes of concrete shall be designed by the Contractor and approved by DA Western Visayas to obtain the compressive strength at the age of twenty-eight (28) days as specified below:
- b. Cement content. The minimum cement content per cubic meter of concrete for the different classes or gradation of aggregates shall be in accordance with the following:

| Class | Size of Maximum Dis. of Aggregate | Minimum Compressive Strength | Designated Size of Aggregate |
|-------|-----------------------------------|------------------------------|------------------------------|
| Y | 1/2" (12.5 mm) | 3,000 psi | 12.5 mm to 4.75 mm |
| AA | 3/4" (19 mm) | 3,000 psi | 19 mm to 4.75 mm |
| A | 1-1/2" (37.5 mm) | 3,000 psi | 37.5 mm to 4.75 mm |
| B | 2" (50 mm) | 2,400 psi | 50 mm to 4.75 mm |
| C | 3" (75 mm) | 2,400 psi | 75 mm to 4.75 mm |
| Z | 3" (75 mm) | 3,000 psi | 75 mm to 4.75 mm |

| Class and Gradation of Aggregate | Minimum Cement Content |
|----------------------------------|------------------------|
| Y with 1/2" | 400 kgs/cu.m |
| AA with 3/4" | 400 kgs/cu.m |
| A with 1/2" | 360 kgs/cu.m |
| B with 2" | 300 kgs/cu.m |
| C with 3" | 270 kgs/cu.m |
| Z with 3" | 340 kgs/cu.m |

- c. Aggregate Content. Concrete mixtures shall be designed to use the largest size and the maximum amount of coarse aggregate as practicable for the intended use of the concrete.
- d. Consistency. The amount of water to be used in the concrete shall be regulated as required to secure concrete of the proper consistency and to adjust for any variation the moisture content or grading of the aggregate as they enter the mixer.

It shall be such consistency that it will flow around reinforcing steel, but individual particles of the coarse aggregate when isolated shall have coating of mortar containing its proportionate amount of sand. The consistency shall be gauged by the ability of the equipment to properly place it and not by the difficulty in mixing or transporting. Addition of water to compensate for stiffening of the concrete before placing will not be permitted. Uniformity in concrete consistency from batch to batch will be required.

The slump of the concrete at the time of placing shall not exceed 5 cms (2 inches) in heavy concrete sections and at top of walls, piers and parapets, 10 centimeters (4 inches) for pumped or air placed concrete, and 7.5 centimeters (3 inches) for concrete elsewhere.

The DA Western Visayas reserves the right to require a lesser slump whenever concrete of lesser slump can be consolidated readily into place by means of the vibration specified in paragraph 19.17.

Notwithstanding the approval by DA Western Visayas of the design mixtures and the above specified minimum cement content for different classes or gradation of aggregates, the Contractor shall be responsible that all the concrete meet the desired strength.

11.12 MEASUREMENT OF MATERIALS

All materials from which the concrete will be manufactured shall be mechanically measured by weight, except as otherwise specified and/or authorized by the Project Engineer and admixture solutions which may be measured by volume.

Measuring devices shall be suitably designed and constructed for the purpose and shall be weighing separately the cement, fine and coarse aggregates. The accuracy of all weighing devices shall be such that successive quantities can be measured to one percent of the desired weights. Cement in standard bags (40 kgs) need not be weighed. The water measuring devices shall be of such type and made to be readily controlled to obtain an accuracy of one-half per cent of the desired quantity of water.

Whenever volumetric proportioning and measurement is permitted due to failure or malfunction of weighing devices, the equivalent volumetric proportions of weighed representative samples of the concrete ingredients shall be computed taking into consideration bulking effect of cement and variations of moisture content of the aggregates.

When sack or bag cement is used, the quantities of aggregates for each batch shall be for one or more full sack of cement. No batch requiring a fractional sack of cement will be tolerated.

11.13 MIXING CONCRETE

- a. General. Concrete shall be machined mixed. Hand mixing shall be allowed only in cases of emergency when there is machine breakdown or malfunction and in the construction of small structures where the total volume of concrete is less than 2 cubic meters. A written consent of the DA Western Visayas Project Engineer must be secured by the Contractor in both cases.
- b. Mixing Site. Concrete shall be thoroughly mixed in a batch mixer of an approved capacity and type which will ensure a uniform and homogenous mixing of the concrete materials.
The minimum mixing time for each batch, after all materials and water are introduced into the mixer shall be as follows:

| Capacity of Mixer | Mixing Time |
|------------------------|----------------|
| 0.60 cu. m. or smaller | 1-1/2" minutes |
| 0.60 to 1.20 cu. m. | 1-1/2" minutes |
| 1.50 to 2.30 cu. m. | 2 minutes |
| 3 cu. m. | 2-1/2" minutes |

Overmixing, requiring the introduction of additional water to preserve the required consistency, will not be permitted. Overmixed concrete shall be wasted.

- c. Truck Mixing. Truck mixing shall be of the revolving drum type, water-tight, and so constructed that the concrete can be mixed to ensure a uniform distribution of materials throughout the mass. All solid materials for the concrete shall be accurately measured at the proportioning plant before being charged into the drum. Except as subsequently provided, the truck mixer shall be equipped with a tank for carrying mixing water. Only the prescribed amount of water shall be placed in the tank unless the tank is equipped with a device by which the quantity of water added can readily be verified. The mixing water may be added directly to the batch in which case a tank shall not be required. Truck mixer must be provided with a device by which the mixing time can be readily verified by the DA Western Visayas Project Engineer.

11.14 RE-TEMPERING

Concrete, mortar and grout mixers which have developed initial set shall not be used. Concrete, mortar and grout which have partially hardened shall not be re-tempered or remixed.

11.15 SAMPLING AND TESTING OF CONCRETE

The Contractor shall provide the required samples of concrete to DA Western Visayas without cost. Sampling will, in all cases, be performed by or under the direct supervision of the Project Engineer and Contractor shall provide without cost to DA Western Visayas all available tools and labor as may be required. Concrete sampling shall be carried on during concrete operations at the rate of one standard sample for each 75 cubic meters of concrete or fraction thereof placed during each continuous placing operation but in no case shall there be less than one sample for each day concreting. Each standard sample shall consist of three (3) standard cylinders 6-inch high. The Contractor shall keep a record of the samples and the portion of the structures and volume represented which shall be available to DA Western Visayas on demand.

Sampling shall conform to ASTM Designations C-172, preparation, storage and curing to ASTM Designation C-31 and testing to ASTM Designation C-39. DA Western Visayas shall have the sample tested by an approved testing laboratory at the expense of the Contractor.

11.16 TIME OF HAULING AND PLACED MIXED CONCRETE

Concrete shall be place at its final position in the forms within forty-five minutes after the introduction of the mixing water to the cement and aggregates, or the cement to the aggregates.

11.17 DELIVERY

The rate of the delivery of concrete during concreting operation shall be such as to provide for the proper handling and placing of the concrete. The rate shall be such that the interval between batches shall not exceed 20 minutes. The method of delivering and handling the concrete shall be as such as to facilitate proper placing with the minimum of handling and without damage to the concrete structure.

11.18 CONVEYING AND PLACING CONCRETE

- a. General. Approval of the Project Engineer shall be obtained before starting any concrete pour, concrete placement will not be permitted when, in the opinion of the Project Engineer, conditions prevent proper placement and consolidation. Before concrete is placed, all saw dust, chips and other construction debris and extraneous matters shall be removed from the interior of forms. Struts, stays and braces serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their location, shall be removed when the concrete placing has reached an elevation rendering their services unnecessary as the case may be. These temporary members shall be entirely removed from the forms and not to be buried in concrete. Surfaces of existing concrete left after partial demolition against which new concrete is to be placed, shall be cleared thoroughly of all loose concrete coating or concrete dust by brushing or other effective means followed by thorough washing or jetting. Such surfaces shall be kept moist for at least 24 hours before pouring the new concrete.

Concrete shall be placed only in the presence of the DA Western Visayas Project Engineer or his duly authorized representatives. Any and all concrete placed in the absence of a Project Engineer and his duly authorized representatives will not be considered for measurement and payment, and shall be removed at the discretion of the Project Engineer with the Contractor assuming all losses.

Concrete shall be conveyed from mixers to forms, as rapidly as practicable, by methods which will prevent segregation, or loss of ingredients. In case of circular siphons, pump-crete shall be used. There shall be no vertical drop greater than 1.50 meters except where suitable equipment is provided to prevent segregation and where specifically authorized by the DA Western Visayas Project Engineer. Belt conveyors, clutch or similar continuously exposed flow, will not be permitted.

- b. Concrete on Earth Foundation. All concrete shall be placed on clean and damp surfaces free from standing or running water. Prior to placing concrete, the earth foundation shall be satisfactorily compacted in accordance with these Specifications.
- c. Concrete on Rock or Other Concrete. Rock surface or hardened concrete upon or against which concrete is to be placed shall be clean, free from oil, water, mud, objectionable coatings, debris, loose and semi-detached or unsound fragments. Fault, fissures and seams in rock shall be cleaned to a satisfactory depth and to firm rock on the sides. Immediately before concrete is placed, all surfaces shall be cleaned thoroughly by the use of high velocity air water jets, wet sand blasting or other satisfactory mean. When required by the Project Engineer, roughening by grooving with pneumatic tool of existing concrete surfaces against which concrete is to be placed is required. All surfaces shall be wetted before placing concrete and approximately horizontal surface shall be covered immediately, before the concrete is placed, with a layer of mortar not to exceed fifteen (15) millimeters in thickness and of the same cement-sand ratio as used in the concrete.
- d. Lift in Concrete. The permissible depth of concrete placed in one lift will be as shown in the detailed Drawings or as directed for each structure by the Project Engineer. Unless otherwise authorized or show, lifts of mass concrete shall not exceed 1.5 meters in height, and a minimum of seventy-two (72) hours shall elapse between the placing of each successive lifts. Lifts of three (3) meters will be permitted in piers and walls. Height of lift specified herein will not apply where the use of slip form has been approved. All concrete when placed and vibrated shall be approximately horizontal layers not to exceed fifty (50) centimeters in thickness unless otherwise specifically authorized. The placement of concrete shall be done at such a rate that all underlying layers concrete surfaces shall not have reached their initial set before additional concrete is placed thereon. Slabs shall general be placed in one lift unless the depth is so great that this procedure will produced objectionable result.
- f. Consolidation of Concrete. Consolidation of concrete shall be by the use of mechanical vibratory equipment. The vibrating equipment shall be of the interval type and shall at all times be adequate in number of units and the power of each unit shall be capable to consolidate all concrete. The frequency of vibration shall not be less than 6,000 revolutions per minute. Forms or surface vibrations shall not be used, unless otherwise specified in other Sections of this Technical Specifications. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. In consolidating each layer of concrete, the vibrator shall be operated in a near vertical position and the vibrating head shall be allowed to penetrate under the action of its own weight and vibrate the concrete in the upper portion of the underlying layer.
- g. Finishing of Concrete Lift Surfaces. The manipulation of the concrete adjacent to the surface of the lift placement shall be the minimum necessary to produce not only the degree of consolidation desired in the surface layer of concrete but also a surface with the desired degree of roughness for the bond with the next lift. Surface vibration or excessive surface working will not be permitted. All unfinished top surface not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade, as directed, and struck of by board finish.
- h. Placing Concrete through Reinforcement. In placing concrete through reinforcement, care shall be taken that no segregation of the coarse aggregates occurs. On the bottom of the beams and slabs, where the congestion of steel near the forms makes a placing difficult, a layer of mortar of the same cement-sand ratio as used in the concrete shall be first deposited to cover the surface.
- i. Depositing Concrete in Water. When specifically authorized, concrete may be deposited in water. The methods and equipments used shall be subject to the approval of the DA Western Visayas Project Engineer.

11.19 FORMS

- a. General. Forms shall be used whenever necessary to confine the concrete during vibration and to shape it to the required lines. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in position. The strength and rigidity of the forms shall be such that formed surfaces will conform to specification requirements relating to the surface irregularities and tolerances for concrete construction. Forms shall be tight to prevent loss of mortar from concrete.

Chamber strips shall be placed in the corners of the forms for exposed exterior corners so as to produce beveled edges. Interior corners and edges of formed joints shall not be beveled unless requirement thereof is shown on the Drawings.

The tolerance limits specified in paragraph 10.23 and the surface irregularity limits specified in paragraph 10.21 are the maximum permissive limits of misalignment or irregularity surface which may occur despite workmanlike effort to construct and maintain the forms

to the specified surfaces. These limits pertain only to inadvertent and occasional irregularities. Accordingly, these limits shall not be construed to be tolerances for aligning forms or determining acceptability of form materials.

Stub walls shall not be used, except that stub walls shall be used for walls having fillets at the bottom. Concrete in such stub walls shall be re-vibrated after adjacent floor concrete is placed.

Forms for finishes F2 and F3 shall be construed with grade strips at the horizontal construction joints, unless the use of groove strips is specified in the Drawings. Such forms shall be removed and reset from lift to lift and they shall be continuous from lift to lift. Sheathing of reset forms shall overlap the previous lift by not more than 1 inch. Forms shall be tightened against the concrete so that the forms will not spread and permit abrupt irregularities or loss of mortar or paste. Supplementary bolts or form ties shall be used as necessary to hold the rest forms against the concrete.

Forms of all wall openings shall be constructed so as to facilitate loosening.

b. Form Sheathing and Lining. Wood sheathing or lining shall be of such kind and quality and shall be so treated or coated that there will be no chemical deterioration or discoloration of the formed concrete surfaces. The type and condition of form sheathing and lining, and the fabrication of forms for finishes F2, F3 and F4 shall be such that the form surfaces will be even and uniform. The ability of forms to withstand distortion caused by placement and vibration of concrete shall be such that the formed surfaces will conform with applicable requirements of these specifications pertaining to finish of formed surfaces. Where finish F3 is specified, the sheathing or lining shall be placed so that the joint marks on the concrete surfaces shall be in general alignment, both horizontally and vertically.

Plywood used for sheathing or lining shall be high density overlaid plywood specially manufactured for use in construction concrete forms as approved. Materials used for sheathing and lining shall conform with the following requirements, or other materials producing equivalent results as approved by the Project Engineer.

| Required Finish of Formed Surface | Wood Sheathing or Lining** | Steel Sheathing of Lining* |
|-----------------------------------|---|---|
| F1 | Any grade, surfaced on two edges (S2E) with not limits to defects except imposed by other requirements of these specifications | Steel sheathing permitted Steel lining permitted |
| F2 | Selected lumber, surfaced on side and two edges (S1S2E) or plywood sheathing or lining | Steel sheathing permitted Steel lining permitted |
| F3 | Selected lumber, surfaced on sides (S4S) or plywood | Steel sheathing permitted Steel lining not permitted |
| F4 | For plane surfaces, selected lumber surfaced on four sides (S4S) T&G or plywood. For warped surfaces, the lumber shall be free from knots and | Steel sheathing permitted |

* Steel sheathing denotes steel sheets not supported by a backing of wood boards.

** The lumber shall be free from warp and knotholes and shall have no knots larger than 5 centimeters in diameter. All knots shall be sound and tight. There will be no pitch pockets, barb or lack of wood on the face of the lumber against the concrete is to be placed.

c. Form Ties. Embedded ties for holding forms shall remain embedded and, except for F1 finish, shall terminate within the concrete approximately two diameters or twice the minimum dimensions of the tie from the formed faces of the concrete. Embedded ties for F1 finish shall terminate within the concrete or shall be cut-off flush with the faces of the concrete. The ties shall be so constructed that ends and end fasteners can be removed by unskilled workmen without causing spalling at the faces of the concrete.

d. Cleaning and Oiling of Forms. The surfaces of the forms in contact with the concrete shall be free from encrustations of mortar, grout or other foreign materials when the concrete is placed. The surfaces of the forms to be in contact with the concrete shall be coated with an approved coating which will enable the ready release of the forms and will not contaminate the concrete surfaces. Except as provided below, forms for surfaces which are to be painted shall be coated with straight, refined, pale, paraffin mineral oil, or other approved coating, and the coating for steel forms shall consist of refined mineral oil suitably compounded for the purpose.

e. Forms of Curved Surfaces. Curved surfaces have been dimensioned at several sections. The Contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form lumber shall be built up to laminated splines cut to make tight, smooth form surfaces. The forms shall be constructed so that the joint marks on the concrete surfaces generally will follow the line of water flow. After

the forms have been constructed, all surface imperfections shall be corrected, and all surface irregularities at matching faces of form materials shall be dressed to the specified curvature.

f. Forms for Slopes or Battered Surfaces. Forms for sloped or battered surfaces shall be built so that the sheathing can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration, and inspection of the concrete. The sheathing shall be built so that the sheathing can be removed board-by-board from the bottom to top.

g. Forms for Open Channel Transitions. When the warped surfaces of transitions are not back formed, natural or compacted earth shall be shaped to the specified surface and covered immediately with a plaster coat of cement-sand mortar at least 0.95 cm.

Forms for the warped surfaces shall be tied securely to the floor slab and braced against spreading. In the upper surface, forms shall be butt and removed as specified in the subparagraph (j), so as to enable ready access for placement, vibration, inspection, and repair and finishing of the concrete.

h. Removal of Forms. Forms shall be removed as soon as possible to enable the earliest practicable repair of surface imperfections, but in no case shall they be removed before approval of the DA Western Visayas Project Engineer. Any needed repair of treatment shall be performed at once, and be followed immediately by the specified curing. Forms shall be removed with care so as to avoid injuring of the concrete and any concrete so damage shall be repaired.

In field operation that are not controlled by beam or cylinder test the removal of forms and supports shall be governed by the following:

| Type of Structure | Time of Removal After The Last Pouring |
|---|--|
| Arch, beam, girders and slabs | 14 days |
| Slab in close span of less than three (3) meters | 7 days |
| Side form of beams, railings, parapets, balustrade, walls and columns | Not less than 12 hours and more than 48 hours |

11.20 CONSTRUCTION JOINTS

a. General. After the top surface of a lift is finally compacted, it shall be immediately and carefully protected from direct rays of the sun, pedestrian traffic, materials being placed thereon, running water, heavy rains, or any activity upon the surface that in any manner will affect the setting of the concrete. Unless otherwise specified, vertical and horizontal joints on exposed surfaces shall be chambered as shown on standard detailed drawings and formed to produce a uniform and neat appearance.

b. Cleaning. Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving the next lift by either wet sand blasting or by cutting by all-water jet, as specified below. If the surface of the lift is congested with reinforcements, or is relatively inaccessible, or if for any other reason the Project Engineer considers it undesirable to disturb the surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted and the use of wet sand blasting or light brush marring will be required. After approved cleaning, the surface of the construction joints shall be kept continuously wet for at least twelve (12) hours immediately prior to placing concrete. A mortar coating of approximately one centimeter in thickness shall be applied to all approximately horizontal surfaces immediately prior to the next lift of concrete. Any free water on the joint surface shall be removed prior to placing the mortar.

1. Air-water cutting of construction joint shall be performed after initial set has taken place but before the concrete has obtained its final set. The surface shall be cut by a high pressure air-water jet to remove all laitance and expose clean, sound aggregate but not to undercut the edges of the larger particles of the aggregate. After cutting, the surface shall be washed and rinsed as long as there is a trace of cloudiness of the wash water.
2. Wet Sandblasting – When employed in the preparation of construction joints, wet sandblasting shall be performed immediately before placing the following lift. The operation shall be continued until all unsatisfactory concrete and laitance, coatings, stain, debris and other foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose materials.
3. Cleaning Vertical Construction Joint – The vertical construction joints shall be cleaned by wet sand blasting or by brush manner.

11.21 REPAIR OF CONCRETE

No repair of work or plaster finish of formed concrete in structures will be permitted, unless otherwise provided in these Specifications or directed by the DA Western Visayas Project Engineer. All defective concrete shall be removed and replaced with the Contractor assuming all expenses and losses. If directed, the Contractor shall notify the Project Engineer of the start of the repair work at least 24 hours in advance thereof and shall repair concrete only in the presence of DA Western Visayas representative, unless inspection of such repair work is waived.

Drypack shall be used for filling holes having at least one surface dimension little, if any, greater than the hole depth; for narrow slots cut for repair of cracks, for grout pipe recesses; and for tie-rod fastener recesses as specified. Drypack shall not be used for filling, behind reinforcement or for filling holes that extend completely through a concrete section. Mortar filling, placed under imposed by use of a mortar gun, may be used for repairing defects on surfaces designated to receive F1 and F2 finishes where the defects are too wide for

drypack filling and too shallow for concrete filling and no deeper than the side of the reinforcement that is nearest the surface. Concrete filling shall be used for holes extending entirely through concrete sections; for holes in which no reinforcement is encountered and which are greater in area than 900 square centimeters and deeper than 20 cm; and for holes in reinforced concrete which are greater in area than 400 sq. cm. and which extends beyond reinforcement.

Workmanship methods, preparation of concrete for repair, materials, and curing shall be as directed. Only workmen skilled in the repair of concrete shall perform such work. Repairs of defective concrete shall be made within 48 hours after removal of forms.

Surfaces to which concrete is to be bonded shall be clean and dry when coated with epoxy.

Surfaces of concrete to be repaired with sealing compound method shall be cured by the water curing method for one day before application of the sealing compound. All repairs shall be sound and free from shrinkage cracks and dummy areas after they have been cured and have dried 30 days.

Surfaces of repairs which will be exposed to view shall be blend inconspicuously with surrounding concrete surfaces.

Fins and encrustations shall be removed from surfaces which will be exposed to view.

11.22 FINISHES AND FINISHING

- a. **General.** Allowable deviations from established lines, grades and dimensions are set forth in paragraph 10.23. These allowable deviations are defined as “tolerance” and are to be distinguished from surface irregularities in finish as described herein. The class of finish and the requirements for finishing concrete surfaces shall be as specified in this paragraph.

Finishing of concrete surfaces shall be performed only by skilled workmen. The Contractor shall advise the DA Western Visayas as to when concrete will be finished. Unless inspection is waived in each specific case, finishing of concrete shall be performed only in the presence of the DA Western Visayas Project Engineer. Concrete surfaces will be tested the DA Western Visayas to determine that surface irregularities are within the limits hereinafter specified.

Surface irregularities are classified as “abrupt” or “gradual”. Offsets caused by displaced or misplaced form sheathing or lining or form sections or by loose knots in forms or otherwise defective form lumber will be considered abrupt irregularities, and will be tested by direct measurements. All other irregularities will be considered to be gradual irregularities and will be measured as the departure from the testing edge of an approved template held parallel to and in contact with the surface. The template shall consist of a straight-edge or the equivalent thereof for curved surfaces.

- b. **Formed Surfaces.** The classes of finish for formed concrete surfaces are referred to by symbols F1, F2, F3 and F4 faces. Grinding will not be required on formed surfaces except as necessary to reduce protrusions to specified limits. Recesses from removal of form ties shall be filled with drypack or epoxy mortar at the Contractor’s option; except that filling recesses in Finish F1 surfaces will be required only if the recesses are deeper than 2.5 cm. in walls less than 30 cm. thick or if unfilled recesses would reduce the required cover over reinforcements.

The filled recesses shall blend inconspicuously with the surrounding concrete surfaces or concrete that will be exposed to view.

The classes of finish and their application are as follows:

Finish F1 – Finish F1 applies to formed surfaces where fill material or concrete is to be placed. The surfaces require no treatment after form removal except for repair of defective concrete and specified curing. Correction of surface irregularities will be required only for depressions which exceed 2.5 cm. when measured as described in sub-paragraph (a).

Abrupt irregularities on surfaces to which premolded joint filler is to be applied shall not exceed 0.30 cm.

Finish F2 – Finish F2 applies to all formed surfaces not permanently concealed by fill materials or concrete, or not required to receive finish F3. Surface irregularities, measured as described in sub-paragraph (a) shall not exceed 0.60 cm. for abrupt irregularities and 1.20 cm. for gradual irregularities.

Finish F3 – Finish F3 applies to formed surfaces of the stoplog guides, exposed faces of abutments, wing walls, girders, curbs, parapet railings, and decorative features on bridges. Surface irregularities, measured as described in sub-paragraph (a), shall not exceed 0.60 cm. for gradual irregularities and 0.30 cm. for abrupt irregularities, except that abrupt irregularities will not be permitted at construction joints.

Finish F4 – Finish F4 applies to formed surfaces for which accurate alignment and evenness of surfaces are of paramount importance from the standpoint of eliminating destructive effects of high velocity flows. Formed surfaces to receive an F4 finish includes formed surfaces exposed to high velocity flowing water.

Except as hereinafter provided, abrupt irregularities on surfaces to receive F4 finish, when measured as described in sub-paragraph (a), shall not exceed 0.60 cm. for irregularities parallel to the direction of the flow and 0.30 cm. for irregularities not parallel to the direction of the flow. Gradual irregularities on surfaces to receive an F4 finish shall not exceed 1.60 cm.

Abrupt irregularities on formed surfaces exposed to high velocity flows shall be eliminated by grinding on a level of 1:20 ratio of height to length.

The Contractor will not be entitled to no extra payment for reducing or eliminating irregularities on formed concrete surfaces which do not meet specification limits.

- c. **Unformed Surfaces.** The classes of finish for unformed concrete surfaces are referred to by symbols U1, U2, U3 or U4. Exterior surfaces will be sloped for drainage where shown on the Drawings or as directed. Exterior surfaces which otherwise would be level shall be sloped for drainage. Unless the use of other slopes or level surfaces is indicated on the Drawings or directed narrow surfaces, such as

top of walls and burbs, shall be sloped approximately 3 cm. per meter of width; broader surfaces such as walks, roadways, platforms, and decks shall be sloped approximately 2 cm. per meter. These classes of finish and their applications are as follows:

Finish U1 – Finish U1 (screeded finish) applies to unformed surfaces that will be covered by fill material or by concrete. Finish U1 is also used as the first stage of finishes U2 and U3. Finishing shall consist of sufficient leveling and screening to produce even uniform surfaces. Surface irregularities measured as described in sub-paragraph (a) shall not exceed 0.60 cm.

Finish U2 – Finish U2 (floated finish) applies to unformed surfaces not permanently concealed by fill material or concrete, or not required to receive finish U3 and U4. Finish U2 is also used as the second stage of Finish U3, floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently, and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. If Finish U3 is to be applied, floating shall be continued until a small amount of mortar without excess water is brought to the surface, so as to permit effective trowelling. Surface irregularities measured as described in sub-paragraph (a), shall not exceed 0.60 cm.

Finish U3 – Finish U3 (troweled finish) applies to inside floors of buildings. When the floated surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel trowelling shall be started. Steel trowelling shall be performed with firm pressure, so as to flatten the sandy texture of the floated surface and produce a dense uniform surface, free from blemishes and trowel marks. Surface irregularities, measured as described in sub-paragraph (a), shall not exceed 0.60 cm.

Finish U4 – Finish U4 applies to canal lining. The finish surface shall be equivalent in evenness, smoothness and freedom from rock pockets and surface voids to the obtainable by effective use of a long-handled steel trowel. Light surface fitting and light trowel marks will not be considered objectionable. Surface irregularities measured as described in sub-paragraph (a), shall not exceed 0.60 cm. for bottom slabs and 1.20 cm. for side slopes.

d. **Moisture Control for Unformed Surfaces.** In warm, dry or windy weather the moisture control measures specified herein shall be taken to inhibit loss of moisture from the surface of the concrete. Such surfaces shall be fog-sprayed, covered completely with white polyethylene sheet, or otherwise treated as approved. The curing specified in paragraph 19.22 shall be started as soon as the concrete hardens, however, the surface of the concrete shall be kept wet during the change in curing methods.

If surfaces are fog sprayed, the fog spray shall maintain a sheet of moisture on the concrete but shall not displace cement or create a wet surface during finishing operations. Surfaces shall be fog sprayed during and immediately following finishing operations. Such interruptions shall be of minimum duration and shall occur only in the immediate area being finished.

Plastic shrinkage cracks which occur before the concrete hardens shall be closed. Shrinkage cracks shall be closed by working; cracks shall not be sealed by troweling only.

11.23 CURING

a. **General.** All concrete except interior surfaces, shall be cured for a period of not less than 14 consecutive days.

All horizontal slabs and surfaces shall be cured by water curing in accordance with sub-paragraph (c) and all inclined or vertical surfaces of concrete shall be applied with membrane curing immediately after removal of forms to prevent dehydration in accordance with sub-paragraph (b) except that membrane curing shall not be allowed for mass concrete and for construction joints. Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready for use before actual concrete placement begins. The curing medium and method or the combination of mediums used shall be subject to approval by DA Western Visayas.

i) Floors, stair threads, and horizontal construction joints shall be cured for 14 days by a covering of damp sand or curing mats, except that curing of construction joints surfaces may be discontinued in less than 14 days when the surfaces are to be covered with fresh concrete. The sand or curing mats shall not be kept so wet as to allow water to drain from it and stain concrete walls. The sand or curing mats shall be removed after the expiration of the curing period.

ii) Interior Surfaces – Concrete surfaces of interior walls, including ceilings and surfaces of construction joints and vertical construction joints will require no curing other than resulting from forms being left in place for at least 2 days. Interior walls shall be washed during and after completion of concrete operations at higher elevations. The washing shall be sufficient to keep the walls free from drips or runs of material that would cause streaking or staining of the concrete. Stair risers and large repairs on interior walls shall be cured for at least 4 days by damp mats but shall not be wet enough to cause dripping of water on to completed concrete. Small repairs and filled core holes on interior walls shall be cured for at least 4 days by masking tape or similar covering.

b. **Membrane Curing Method.** The concrete shall be sprayed uniformly with sealing compound and shall conform to AASHO Designation M-148, Type II. The component shall be of uniform consistency and quality within each container of each shipment and from shipment to shipment. Sealing compound used in confined spaces shall not be toxic to workmen. The Contractor shall furnish a manufacturer's certificate shall identify the batch and include certified test results covering all requirements of the specifications for the sealing compound material.

Sealing compound shall be applied to unformed concrete surfaces immediately upon completion of moisture control measures taken as specified in paragraph 19.18. Where such measures are not required, sealing compounds shall be applied as soon as the concrete is hard enough to preclude damage from application of the sealing compound. DA Western Visayas will require that the side slopes and bottom of the canal lining be sprayed separately unless the surfaces are ready simultaneously to receive the sealing compound.

The sealing compound shall be applied to formed concrete surfaces immediately upon removal of the forms as specified in paragraph 19.18. The moisture control measures shall be taken until the forms have been removed. Formed surfaces shall be sprayed with water immediately after sealing compound shall be applied as soon as the surface film or water has disappeared but while the surface is still damp.

Sealing compound shall be applied in one coat to provide a continuous uniform membrane. Special care shall be taken to ensure coverage of edges, corners and rough spots of formed surfaces. The compound shall be agitated continuously in the spray pressure tank.

Concrete repair work shall be performed after the sealing compound has been applied and is dry to touch. In the event that application of sealing compound is delayed or interrupted, water shall be applied, as approved, until application of sealing compound is started or resumed.

Any membrane that is damaged or is determined to be defective within 28 days after application shall be repaired or replaced without delay, as approved. If the Contractor's operations require traffic on coated surfaces, the membrane shall be protected from damage.

Payment for membrane curing shall be included in the contract unit price for concrete in the Bill of Quantities where they are required.

- c. Water Curing. Water curing shall start as soon as practicable after placement of the concrete and shall continue until completion of the specified curing period or until covered with fresh concrete. Concrete, if cured by water, shall be kept wet by ponding method or by covering with an approved water saturated materials, or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other methods, approved by DA Western Visayas, which will keep all surfaces to be cured continuously (not periodically) wet.

11.24 TOLERANCES FOR CONCRETE CONSTRUCTION

- a. General. Permissible surface irregularities for the various classes of concrete surface finish, specified in paragraph 10.21 are defined as "finishes" that are to be distinguished from tolerances that are consistent with modern construction practice, yet governed by the effect that permissible deviations will have upon the structural action or operational function of the structure. Deviations from the established lines, grades and dimensions will be permitted to the extent set forth herein.

Where tolerances are not stated in the Specifications or Drawings for any individual structure or feature thereof, permissible deviations will be interpreted in conformity with the provisions of this paragraph. Concrete works that exceeds the tolerance limits specified will be rejected and shall be corrected or removed and replaced, as ordered.

b. Tolerance for Canal Structure

1. Concrete Canal Lining:

Departure from establishment alignment

- 5 cm. on tangents
- 10 cm. on curves

Departure from establishment profile grade – 2.5 cm.

Reduction in thickness of lining:

10 percent of the specified thickness; provided that the average of all thickness measurements made in 40 meters of lining shall be not less than the specified thickness, and provided further that the quantity of concrete actually use in 40 meters of lining shall be not less than the theoretical quantity, based on the lines shown on the Drawings.

Variation from specified width of section at any depth ----- 3 cm.

Variation from established depth of lining ----- 3.7 cm.

Variation in surface:

Invert, in 3 meter ----- 0.60 cm.

Side slopes, in 3 meter -----1.20 cm.

2. Bridges, Inlets, Chutes and other Structures:

Departure from established alignment ----- 1.20 cm.

Departure from established grades ----- 1.20 cm.

Variation from the plump or the specified better in the lines and surfaces of columns, piers, walls and in rises:

Exposed in 3 meters ----- 1.20 cm.

Backfilled in 3 meters ----- 2.0 cm.

Variation in cross-sectional dimensions of columns, walls, piers, slabs, beams and similar parts:

Minus ----- 0.60 cm.

Plus ----- 1.20 cm.

3. Bridge Slabs:

Variation in thickness of slab:

Minus ----- 0.30 cm.
Plus ----- 0.60 cm.

Variations from specified width overcurbs ----- 0.60 cm.

Variations from specified grade of top of curb in cambered position--- 0.60 cm

4. Foundations:

Variations in dimensions in plan:

Minus ----- 2.50 cm.
Plus ----- 5.00 cm.

Variations from established grade:

Minus ----- 1.20 cm.
Plus ----- 5.00 cm.

Misplacement of eccentricity:

2 percent of the footing width in the direction of misplacement but not more than -----5.00 cm.

5. Bridge Seats:

Variation of any one bearing from established elevation ----- 0.30 cm.

Difference in elevations of bearings for adjacent spans, maximum-- 0.60 cm

Difference in elevations of bearings for same spans on any one pier, maximum----- 0.30 cm

Horizontal, misplacement for any one bearing, maximum ----- 0.70 cm.

Variations in the sizes and locations of slabs and wall openings –1.20 cm

6. Sills and side walls for radial gates and similar watertight joints:

Variation from the plumb level not greater than 0.30 cm. in 3 meters

7. Stop log Slots:

Variation from a common plane between the sealing surface of each pier of related stop log slots shall be no greater than ----- 0.15 cm.

Variation of widths of stop log guides:

Minus ----- 0.30 cm.
Plus ----- 0.60 cm.

c. Tolerances for Cast-in-Place Concrete Pipes:

Departure from established alignment or from established grade ----2.50 cm.
Variation in thickness at any point:

Minus 2-21/2 "or 0.60 cm. whichever is greater
Plus 5 % or 1.20 cm. whichever is greater

Variation from inside diameter ----- 0.5%
Variation in surface invert ----- 0.60 cm. in 3 meters

d. Tolerances for Placing Reinforcement Steel :

Variation from indicated protective cover:

For 5 cm. cover ----- 0.60 cm.
For 7.5 cm. cover ----- 1.20 cm.

Variation from indicated spacing ----- 2.50 cm.

11.25 *FAILURE TO CURE*

The DA Western Visayas shall have the authority to suspend the work wholly or impart, by written order, for such period as he may deem necessary for failure on the part of the Contractor to perform proper curing of the concrete work and to withhold payment for the corresponding work pending results of test, that shall subsequently be made on these concrete works. The Contractor shall immediately secure core samples of such members and from parts of the structure as shall be designated by the Project Engineer and shall have them tested in a Testing Laboratory approved by the DA Western Visayas. If the results of the tests are found satisfactory payment of the concrete in question shall be made and the work ordered resumed, but if the results of test are unsatisfactory to meet the structural requirements, the Contractor shall remove, wholly or partly, the concrete work in question at the discretion and upon written order of the Project engineer and the Contractor shall replace such parts at his own expense.

11.26 *FAILURE TO MEET CONCRETE REQUIREMENTS*

All concrete designed, prepared and placed by the contractor for bridges that fails to meet the specified shall be removed and replaced by the Contractor at his own expense. For other structures, concrete that fails to meet the specified strengths may be accepted provided the Contractor shall pay as liquidated damages the amount based on the following schedule:

| Percent (%) lower than the specified strength | Reduction in price per cu. m. of concrete |
|--|--|
| Up to -10 | Less 5% of Contract Unit Price |
| -11 to -20 | Less 10% of Contact unit Price |
| -21 to -30 | Less 15% of Contract unit Price |

Concrete for all structures other than bridges which are more than thirty percent (30%) lower than the specified strength shall be removed and replaced by the Contractor at his own expense.

11.27 *PROTECTION OF CONCRETE WORK*

The Contractor shall protect all concrete against injury until final acceptance by the DA Western Visayas. Final acceptance shall be construed to mean acceptance of the whole work after the Contract has been completed or satisfactorily terminated.

11.28 *METHOD OF MEASUREMENT*

Concrete of Class Y, AA, A, B, C, or Z shall be measured by the cubic meters of concrete completion place and accepted measurement will be of the actual number of cubic meters within the neat lines of the structures as shown in the drawings or revised plans as approved by the Agency. No deduction shall be made for the volumes of concrete displaced by steel reinforcement, floor drains or expansion joint material. Fillets, scoring or chambers of 600 square millimeters in cross-section area or less, shall be disregarded in the computations.

11.29 *BASIS OF PAYMENT*

The volume of concrete measured above shall be paid for at the contract unit price per cubic meter for the class of concrete specified. Such prices and payment shall be full compensation for furnishing all materials including water stops, joints, pipes, drains, conduits, expansion angles, miscellaneous metal items: and for all forms and falseworks, for mixing, placing, finishing and curing concrete and for all labor, materials, equipment, tools and incidentals necessary to complete the works.

SECTION 11 CONCRETE STRUCTURES

12.01 SCOPE

The Contractor shall construct all concrete structures shown on the Drawings.

Concrete shall be proportioned; mixed, placed, finished and cured as specified in Section 11, except as modified herein. The sequence of construction of the structures shall be subject to approval of the DA Western Visayas Project Engineer. Where the thickness of any portion of a concrete structure is variable, it shall vary uniformly between the dimensions shown. Cement mortar plastering is not allowed in the construction of structures, unless otherwise specified elsewhere in these Specifications.

All cement requirements for all concrete structures shall be furnished by the Contractor.

12.02 CONCRETE CONSTRUCTION

All concrete construction shall conform to the provisions of Section 11 and to detailed requirements of the following paragraphs. Concrete finishes shall conform to paragraph 11.21 and/or shall be as noted on the Drawings.

All structures shall be built to the specified lines, grades and dimensions. The location of all construction joints shall be shown on the Drawings. The Contractor shall place and embed or attach to each structure all timber, metal or other accessories necessary for its completion as shown on the Drawings.

The dimensions of each structure shown on the Drawings will be subject to change as may be found necessary by the DA Western Visayas Project Engineer to adopt the structures to actual field conditions and conditions disclosed by excavation.

12.03 CONCRETE FOR ALL STRUCTURES

- a. General. The item "concrete" in the Bill of Quantities includes separately concrete in spillway, stilling basin, diversion intake, outlet works including diversion conduit, tailrace gate, drop inlet and other structures not otherwise specified elsewhere in these Specifications.

Concrete for diversion works and other structures will be measured and paid for as specified in paragraph 20.06. Structures not full and acceptably completed will not be measured for payment. Precast structures installed and acceptably completed in place shall be paid for as specified in paragraph 20.06

All materials used like cement, admixture, aggregate and steel reinforcing bars shall conform to the provisions of Sections 11 and 14, respectively. Classes of concrete to be used shall be those specified in the Drawings.

- b. Curing and Joints. All concrete shall be cured in accordance with paragraph 11.22, except that concrete for the ogee shall be cured until the concrete test cylinders shall have attained a strength of at least 211.4 kg/sq.cm. (3,000 psi).

The Contractor shall construct expansion and construction joints at sections specified on the Drawings all in accordance with the provisions of paragraph 11.19 and Section 6 and elsewhere in these Specifications.

12.04 PRE-CAST CONSTRUCTION

- a. Scope and Description. Pre-casting of reinforced concrete maybe resorted to as an alternative to poured-in-place concrete. Should the Contractor choose to employ pre-cast construction on this structure, he must so inform the DA Western Visayas in writing, submitting in detail his proposed design, modifications of concrete sections, concrete specifications, reinforcements and schemes of construction of all pre-casts units. The DA Western Visayas may further require the Contractor to submit all other additional information as may be deemed necessary.

The DA Western Visayas may approve the construction proposed on pre-casting of concrete with or without corrections. The approval, however, does not relieve the Contractor of any responsibility is such work does not meet specified results.

For this purpose, standard reinforced concrete pipes may be considered pre-cast construction, hence, are included under this section.

- b. Transporting and placing. Extreme care should be observed in handling, storing, moving and erecting to avoid cracking, twisting or other distortions that would result to cracking or damage to the pre cast concrete. Pre-cast concrete members shall be handled, transported and erected in an upright position and points of support and directions of the reactions with respect to the members shall be approximately the same as when the member is in final position.
- c. Sampling and Testing. The individual components of pre-cast concrete structures shall conform to the applicable provision of Section 19 and will be subject to the usual test for reinforced concrete.
- d. Sampling and Testing. The individual components of pre-cast pipe will be measured by the lineal meter. It shall be measured to the neat lines as if these structures were constructed to the details shown on the Drawings.

12.05 METHOD OF MEASUREMENT

Measurement for payment of any and all classes of concrete structures will be by the cubic meter computed the neat line of the structure, unless otherwise specifically shown on the Drawings or as specified in these Specifications. No measurement for payment will be made for bid items on lump sum basis in the Bill of Quantities. In the event cavities resulting from careless excavation or from excavation performed to facilitate the Contractor's operations as determined by the Project Engineer, are required to be filled with concrete, such refilling will be made by and at the expense of the Contractor. In measuring concrete for payment, the volume within the concrete will be deducted.

12.06 BASIS OF PAYMENT

Payment for any and all classes of concrete in various parts of the work will be made at the applicable contract unit prices per cubic meter which price and payment shall include cost for furnishing all materials, equipment and labor, and all operations required in the construction as specified under Section 11, except that payment for reinforcing bars and joint materials will be made at the applicable separate contract unit prices in the Bill of Quantities.

SECTION 12 CONCRETE JOINTS AND JOINT MATERIALS

13.01 SCOPE

This Section covers details of construction of expansion and construction joints in concrete including joint materials. Concrete joints and joint materials shall be in accordance with the Drawings and Specifications.

13.02 JOINTS IN CONCRETE

- a. Construction Joints. Unless otherwise specified in these Specifications or shown in the Drawings, the location of all construction joints in concrete work shall be constructed in accordance with paragraph 10.19. To prevent feather-edges, construction joints which intercept surfaces at a relatively small angle shall be sloped, adjacent to the intersection, approximately normal to such surfaces to form a 15 to 20 centimeters offset.

Joints in concrete canal lining, if any, shall be constructed by using a wood strip, metal plate, or other suitable material, which will be subsequently removed. When removing the material, care shall be exercised to avoid chipping or breaking the corners of the concrete. The space between the concrete shall be at least 5 millimeters wide and shall be filled entirely with joint sealant. Joint sealant materials and placement shall be as specified in paragraph 10.03. The cost of constructing construction joints shall be included in the contract unit price of concrete where they are required.

In structures requiring water tightness and in which waterstops are specified for construction joints or as shown in the Drawings, construction joints introduced by the contractor, as approved, for the convenience of the Contractor shall be equipped with water stops at the expense of the Contractor.

- b. Contraction and Expansion Joints. Contraction joints of the types shown in the Drawings shall be constructed at the location indicated. The joints shall be made by forming the concrete on one side of the joint and allowing it to set before the concrete is placed on the other side of the joint. The surface of the concrete first placed at a contraction and expansion joint shall be cleaned and coated with sealing compound before the concrete on the other side of the joint is placed. The contractor shall furnish the sealing compound conforming to ASTM C-309. The cost of constructing contraction and expansion joints shall be included in the contract unit price of concrete where they are required.

13.03 JOINTING AND COATING MATERIALS

- a. Waterstops

1. General. The Contractor shall furnish and install polyvinylchloride or rubber waterstops in the shapes and dimensions as specified and in the locations as shown in the Drawings or as directed. For convenience of placement in forms, a waterstop utilizing a split flange may be used; however, prior to placement of final concrete, the split flange portion shall be joined in an approved manner such that no concrete or mortar can enter between the two split portions of the flange.
2. Workmanship. The Contractor shall furnish all materials, equipment and electric energy required for making field splices for water stops as required, heating the ends to the melting point and joining the splice ends shall be made by means of the splicing machine recommended by the water-stops manufacturer or by any other approved electric heating device.

3. Types of Waterstops

- a) Rubber Waterstops. Rubber water-stops shall be fabricated from natural or synthetic rubber and shall have the following characteristics.

| | |
|--|------------|
| Tensile strength, pounds per square inch, minimum | - 2,100 |
| Elongation at break, percent, minimum | - 450 |
| Shore durometer (Type A) | - 60 to 70 |
| Change in volume, water, water immersion Percent, maximum (2 days at 70° C) | - 5 |
| Ozone resistance (4 hrs at 90 + 5°F) | No cracks |
| Tensile strength after oxygen pressure test (48 hrs, 70°C, 300 pounds per square inch) Percent of tensile strength before aging, minimum | - 80 |

- a) Polyvinyl Chloride. Water-stops shall be manufactured by extrusions process from elastomeric plastic compound, the basis resin of which is 100 percent polyvinylchloride (PVC). The product shall be dense, homogenous and free from holes and other imperfections, and shall have the following physical characteristics:

| | |
|-------------------|---|
| Specific gravity | -1.33 + 0.03 at 73°F (ASTM: D792) |
| Tensile strength | -2,200 to 2,500 psi @ 73°F (ASTM: D412) |
| Brittleness temp. | - 55°F (ASTM: D746) |
| Durometer | - 65-75 (ASTM: D676) |

4. Inspection and Tests:

- a) Rubber Water-stops shall be tested in accordance with appropriate sections of Federal Test Method Standard No. 601. The ozone concentration when tested shall be 85 to a00 parts per million.
- b) Polyvinyl water-stop shall be tested in conformity with the requirements of Specifications CRD-C572 of the U>S> Army Corps of Engineers. It shall conform to the ozone resistance required for rubber water-stop.

5. Measurement and Payment. Measurement for payment of Rubber or PVC water-stops will be made for the number of linear meters water-stops acceptably placed and measured along the centerline of the water-stop.

Payment of water-stop will be made at the contract unit price per linear meter, which price and payment shall include all costs of furnishing, placing and testing of the rubber or PVC water-stop as described above.

b. Resilient-Type Joint Filler –

Preformed sponge rubber joint filler 25 millimeters in thickness shall be furnished and placed by the contractor in the joints where shown in the drawings or as described. The joint filler shall be preformed highly resilient-type sponge or cellular rubber conforming to STM D1058 SBE 15 or SBE 45 rubber.

The preformed filler shall be cut and placed as shown on the drawings. The filler material shall be held securely in place against the completed side of an expansion joint by copper or brass nails pre-cast in the first placed concrete; provided that an adhesive suitable for the purpose may be used when approved. Joints in the filler material shall be made tight and shall be taped so that mortar from the concrete will not seep into the joints or the joint filler material. The joint filler shall be handled carefully and stored under cover away from the direct rays of the sun in a manner to prevent damage to the materials.

Resilient-type joint filler will be measured by the lineal meters of fillers acceptably installed and measured along its centerline. Payment shall be made based on the contract unit price per linear meter which price shall include all necessary materials, labor and equipment used in placing and testing the joint filler.

c. Joint Sealer

1. General. Joints so designated on the drawings or where directed by the Project Engineer shall be sealed with Thioflex 600 polysulphide liquid polymer. Thioflex 600 is a tough, rubber like substance which will seal the joints against infiltration of water throughout repeated cycles of joint expansion and contraction. It is a combination of two materials, i.e., a base compound and a curing agent. Thioflex 600 is packed in dual container tins containing the correct proportions of base compound and curing agent. Thioflex 600 should be used as fresh as possible and must be used f=before the date of expiration as marked on each pack. Thioflex 600 should be stored under dry conditions at temperature not exceeding 27°C (80°F).
2. Inspection and Tests. Each pack of the base compound and curing agent shall be subject to inspection and approval by the DA before acceptance or shipment. The DA reserves the right to be present to observe the manufacturing process. Samples shall be submitted to the DA for testing at least thirty (30) days before use. Regardless of previous tests, material that has not been used after the expiry date as marked on each pack shall be rejected. The base compound and curing agent packed in dual container tins shall each identify the name of the manufacturer, the manufacturer's lot number, the date of manufacture, expiry date and shall bear instructions for mixing and application.
3. Materials. Materials shall conform the American Standards Association Specification A-116. 1-1960.
4. Placing. Joints so designated on the drawings or s directed by the Project Engineer that are to be sealed with Thioflex 600 polysulphide liquid polymer shall be formed to the correct dimensions and thoroughly cleaned to the satisfaction of the Project Engineer. All dirt, dust, mortar, laitance, scale, oil, loose materials must be removed by wire brushing and where possible, the joints shall be blown out with compressed air. Wet joist must be thoroughly dried by means of a hot air blower or a propane gas torch. Where so designated, these joints shall be primed with the approximate Thioflex primer applied strictly in accordance with the manufacturer's printed instructions prior to sealing. Thirty six (36) liter of Thioflex 600 will require one and one- tenth liters of Thioflex primer.

The sealing compound shall be applied to all the designated joints with the use of Gun Grade all in accordance with the manufacturer's standards conforming to the American Standards Association Specification A0116.1- 1960. Gun Grade pack yields one and a half (1.5) liters of mixed materials.

5. Curing. The curing time of the mixed material will vary with temperature. High temperature and low temperature will correspondingly decrease and increase the curing time. The temperature of the materials to which the Thioflex 600 is applied as well as the ambient air temperature will affect the setting and curing time. Since the mixed materials tend to heat up as it cures, the setting and curing time can also be affected by the volume of materials applied.

Payment for joint sealers shall be incorporated in the unit bid price for concrete where joint sealers are required and as such, shall not be paid as a separate pay item.

13.04 GROUT

Grout shall be composed of Portland cement, sand and water proportioned and mixed as specified in this paragraph.

Grout shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations as shown in the drawings or as specified by the DA.

The proportion of sand to cement measured volume shall be one (1) to two (2). The water cement ratio shall not exceed 0.50. The grout shall be mixed until smooth and free of lumps, but in no case less than three minutes. Grout is not placed within 45 minutes after mixing shall be wasted.

Concrete areas to be in contact with grout shall be cleaned of all loose or foreign materials that would in any way prevent bond between the grout and the concrete surfaces and shall be kept thoroughly softened with water for a period of not less than 24 hours immediately prior to placing of the grout. After placing, all surfaces of grout shall be cured.

Payment of work for Grouting, unless otherwise specified, shall be considered included in the various in the Bill of Quantities where it is required.

13.05 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

All concrete construction joint materials and joint sealers shall not be measured separately for payment purposes. The costs of these materials are to be included in the cost per cubic meter of concrete structures to be constructed.

PVC or rubber waterstops shall be measured in lineal meters each type of materials installed and accepted by the Project Engineer. Payment shall be made based on the unit bid price per linear meter of waterstop installed.

SECTION 13
ITEM 404
REINFORCING STEEL BARS

14.01 SCOPE

All reinforcing steel bars required for the works as detailed in the Construction Drawings or as directed by the Project Engineer shall be furnished by the DA Western Visayas unless otherwise specified in the Bill of Quantities.

The Length of each size of reinforcing steel bars to be furnished is computed by taking the theoretical length of steel bars shown in the Drawings multiplied by 1.07 to get the actual length required for the work.

All reinforcing steel bars will be furnished in commercial standard lengths and the Contractor shall cut and bend reinforcing steel bars to the details and dimensions shown on the Drawings.

14.02 MATERIALS

All reinforcing steel bars shall be Grade 40 or PS 275, deformed type and conforming to the requirements of ASTM Designation A-615 or its latest revision. The nominal dimensions and unit weights of bar designation shall be in accordance with the following table:

| Bar Designation Number | Unit Wt. (kg/m) | Diameter (mm) | Nominal Dimensions Cross- Section Area (mm ²) | Perimeter (mm) |
|---------------------------|--------------------|------------------|--|-------------------|
| 10 mm | 0.616 | 10 | 78.54 | 31.42 |
| 12 mm | 0.888 | 12 | 113.1 | 37.7 |
| 16 mm | 1.579 | 16 | 201.1 | 50.27 |

Bar number are based on the number of weights of an inch included in the nominal diameter of bars. The nominal diameter of a deformed bar is equivalent to the diameter of a plain bar having the same weight per foot of the deformed bar.

14.03 CONSTRUCTION REQUIREMENT

Workmanship shall be at the highest grade and quality, and shall be in accordance with the latest standard practice of the industry. Workmanship shall conform to the following conditions:

a. Cutting and Bending

Cutting and bending of reinforcing bars may be done in shop or at the jobsite. All bending works shall be in accordance with the latest standard practice and be approved machine methods. Radii for bends and hooks will be specified on the approved detailed reinforcement Drawings in accordance with sound design procedures.

b. Placing

Reinforcement shall be laid, anchored and embedded in the concrete as shown on the Drawings or as directed by the Project Engineer. Unless otherwise directed, the spacing of reinforcement bars shall be measured along the center line of the bars. Reinforcement shall be inspected for compliance with requirements as to size, length, splicing, position and number after placement based on the approved reinforcement Drawings has been done.

Before reinforcement are placed, the surfaces of the bars and the surfaces of any metal bar support shall be cleaned of heavy flaky rust, loose scales, dirt, grease or other foreign substance which in the opinion of the Project Engineer are objectionable. After being placed, the reinforcing bars shall be maintained in a clean condition until completely embedded in concrete.

Reinforcing bars shall be accurately placed and secured in position so as to avoid displacement during pouring of concrete. Special care shall be exerted to prevent any disturbance of the embedded reinforcement during the setting of the concrete. Metal chairs, hangers, spacers or other approved support may be used by the Contractor for supporting reinforcing bars. Metal supports shall be galvanized when they are to be exposed to view on completed concrete surfaces or where its use will contribute in any way to the discoloration or deterioration of the concrete.

c. Relation of Bars to Concrete Surfaces

The minimum cover for all reinforcements shall conform to the dimensions shown on the detailed reinforcement Drawings.

d. Splicing

All splices in reinforcement shall be as shown on the Drawings or as directed by the Project Engineer. The lapped ends to bars shall be either supported sufficiently to permit the embedment of the entire surface of each bar in concrete or shall be securely wired.

e. Welding

Welding of bars shall be performed only where shown on the Drawings or as authorized in writing by the Project Engineer and shall conform to the requirements of AWS: D12.1, latest revision. All welders employed shall show proof of their welding qualifications to the Project Engineer. All welding shall be done using metal arc welding, pressure gas welding, submerged arc welding or thermit welding.

Coverings of low hydrogen electrodes must be thoroughly dry when used. The surfaces to be welded shall be clean and shall be free from rust and dirt. All welds shall develop the full strength of the bar on the smaller bar when two different sizes are welded. Test will be required of not more than five per cent (5%) of the welds. Approved resting equipment for testing welds shall be furnished by Contactor.

f. Protection

Reinforcement to remain exposed and intended for future concrete embedment shall be protected from corrosion or other damages in an approved manner where directed. The reinforcement protection shall be of such nature that it can be thoroughly cleaned without difficulty prior to encasement in concrete.

14.04 PREPARATION OF REINFORCEMENT DRAWINGS

Contractor shall submit for the approval of DA Western Visayas detailed reinforcement drawings in accordance with Article SC-8. These drawings will include bar-placing drawings, bar bending drawings, bar list, and any other reinforcement drawings, as may be required to facilitate placement and checking of reinforcing bars. No work shall be done by Contractor until such approval has been given.

The reinforcement Drawings submitted shall show the name of the structure location by stationing where the reinforcement drawings is intended and all the necessary information required by DA Western Visayas. It shall likewise bear the stamp or seal of Contractor as evidenced that the Drawings have been checked by Contractor.

Contractor shall be held responsible for any delay in the progress of the work occasioned by his failure to observe the requirements and the time for the completion of the contract will not be extended on account of his failure to promptly submit said drawings in strict adherence herewith.

14.05 SAMPLING FOR TESTING AND ACCEPTANCE OF MATERIALS

Sampling for testing and acceptance of all reinforcement steel bars furnished shall be the responsibility of DA Western Visayas being the supplier of the materials. Thus, the Contractor shall not undertake sampling for tests except upon instruction by DA Western Visayas.

14.06 METHOD OF MEASUREMENT

Measurement for payment for reinforcing steel bars will be made on the weight of reinforcing steel bars actually placed with the concrete structure in accordance with the Drawings and Bar Schedule approved by DA Western Visayas or as directed by the Project Engineer and weights will be computed based on the published manufacturer's weights or in the absence thereof, on the weights specified in the table presented in paragraph 13.02.

Steel bars in laps or splices indicated in the approved reinforcement Drawings as required by DA Western Visayas will be measured for payment. Additional steel bars in laps which are authorized for the convenience of the Contractor and such items as wires, clips, chairs, or other devices for securing the steel bars in place will not be measured for the payment. Where weld splices are specified on the Drawings, weld splices will not be measured for payment but the weight for its equivalent lap splices will be measured for payment instead.

Where Contractor chooses to weld reinforcement bars for his convenience and welding is not specified, no separate payment will not be made for such welds, but instead the weight for the lapped splices shown on the Drawings will be measured for payment.

14.07 BASIS OF PAYMENT

Payment for installation of reinforcing steel bars measured as provided above, will be paid for at the contract unit price per kilogram of material installed which price and payment shall constitute full compensation for furnishing all materials, labor, tools, equipment and all incidentals and subsidiary works necessary for the successful handling and placing the materials.

SECTION 14
ITEM SPL7, AND 713
TRASH RACK AND WOOD WORKS

15.01 SCOPE

The work under this Section shall include installation and testing of the following:

- a. Trashracks
- b. Flashboards

15.02 CONTRACTOR'S DRAWINGS AND OTHER DATA

Contractor shall submit to Da Western Visayas Project Engineer for approval all necessary fabrication and installation Drawings.

Installation procedures shall be submitted in English.

15.03 MATERIALS

All materials shall be new, free from defects and shall be the best available for the purpose for which they are intended, considering strength, ductility, suitability for the intended service and best engineering practice. All steel or cast iron materials needed for the works shall be furnished complete by the Contractor. All other materials covered by this Section shall be furnished by the Contractor.

Cast iron steel pipes shall conform to the provisions of the latest edition of International Organization for Standardization-ISO R13 Recommendation-"CI Pipes, Special Castings and CI Parts For Pressure Main Lines" or its equivalent. Steel pipe to be used shall be of continuous seamless pipe construction and shall conform to API Standard 5LXm x 42 grade or ASTM A53-62T, latest edition. Other materials which will be furnished shall conform to the following:

- A. Steel Trashracks. The trashrack shall be made of standard structural steel which conforms with ASTM A- 6 specifications and shall be of type FY- 36. All steel plates, bars and angle members to be used shall be free of injuries and shall be of the dimensions as shown on the Drawings. Welding materials including equipment, electrodes, wires and fluxes to be used in the fabrication of the trashracks shall conform to AWS A-5-69 or A-5, 5-64.
- B. Stoplogs/ Flashboards. All wood materials to be used for the vertical stoplogs of the intake structure shall be made of well-seasoned Yakal. Before installation, the stoplogs shall be pressure-treated with anti-termite asphalt-based compound. Before fabrication, the Contractor shall see to it that Yakal to be used shall be of the approved quality, free from large, loose and/or unsound knots, sap shakes or other imperfections which can impair the strength and durability of the stoplogs.

15.04 METHOD OF CONSTRUCTION

a. General. Workmanship shall be of the highest quality and in accordance with the best shop practice of the industry. All work shall be in accordance with practices and with approved machine methods. Like parts shall be interchangeable whenever possible. Machining of fits on renewable parts shall be accurate to specified dimensions so that replacement parts made in conformity with the Drawings may be installed.

b. Welding

- 1. Preparation for Welding. Members to be joined by welding shall be cut accurately to size and where required, shall be rolled or pressed to the proper curvature. The edges of the members shall be sheared, flame cut and machined to suit the required type of welding and to allow thorough penetration. The cut surfaces shall expose sound metal free from laminations, surface defects caused by shearing and flame-cutting operations and other injurious defects. The surfaces of the members to be welded shall be free from grease, rust and other foreign matter.
- 2. Welding Procedure. Unless otherwise authorized, all welding shall be fusion welding by the electric arc welding processes, using a method which excludes the atmosphere from the molten metals. Welding shall conform to the provisions of the ASME Boiler and Pressure Vessel Code, Section VIII, "Rules for Construction of Unfired Pressured Vessels", latest edition applicable to the work, except that thermal stress relief, stamping with the code symbol and reports will not be required.

The Contractor shall submit drawings of such attachments showing all details including welding, for approval before fabrication. All such temporary attachments shall be removed after installation and welds shall be ground flush.

During assembly and welding, adjoining sections shall be held rigidly by temporary fastenings and bracings in such a manner which maintains correct end spacings for full weld penetration. Dimensions and tolerances will be checked by the DA Western Visayas Project Engineer prior to final welding of sections and joints. Cutting of plates or sections to obtain the necessary clearance between sections shall be done at the expense of the Contract.

c. Trashrack

Trashrack shall be fabricated in the shop and transported to the project site when needed for installation. All welded connections shall be 6-mm. continuous fillet welds done in accordance with AWS shielded arc welding. Anchor bolts in concrete shall be embedded to the depth and in shapes as shown on the Drawings. Nuts and washers shall be secured in place and nuts shall be tightened as specified by the Project Engineer.

All metalworks except cast-iron unless otherwise specified, shall be primed with red lead-oxide anti-rust paint before a final coat of coal tar epoxy paint is applied. Metal members to be immersed in water or metal members or parts have started to rust before paint is applied, such areas shall be thoroughly cleaned with steel brush or sand-blasting before the primer is applied.

d. Stoplogs

Vertical stoplogs of kiln-dried yakal or equivalent shall be constructed and installed to conform with the shape and dimension shown on the Drawings. The Contractor shall ensure that the stoplogs shall fit the concrete guides with the maximum tolerances as shown on the Drawings. Stoplogs panels shall be fabricated to conform closely with the dimensions and sizes shown on the Drawings.

15.05 TESTING AND INSPECTION

Standard for acceptance of welded joints and the procedure for radiographic examination shall be that of the ASME Code for Unfired Pressure Vessels unless otherwise specified the Project Engineer. The Project Engineer will select the location at which circumferential welds shall be inspected and tested. All radiographs of welds shall become the property of DA Western Visayas. Instead of radiography, the Contractor may substitute ultrasonic inspections only upon prior approval by the Project Engineer. In cases where both test are done by the Contractor, radiographic evaluation shall prevail over ultrasonic evaluation. Before conducting actual ultrasonic test of welded connections, the test equipment shall be calibrated and approved by the Project Engineer. Cost of testing shall be borne by the Contractor who will have on its staff a qualified well inspector trained in operating test equipment.

All circumferential field welds shall be spot radiographed. Three spots per circumferential field joints shall be examined with each spot to at least 20 centimeters in length. Should any of the spots radiographed along the same joints. Should any of the second set of spots still prove defective, then the entire circumferential joint shall be radiographed. Defects in weld disclosed by the test shall be repaired in accordance with the standards and radiographed again by and at the Contractor's expense until such welds are found satisfactory.

15.06 TEST PROCEDURES, TEST RUNS AND ADJUSTMENTS

Cast-iron pipe, steel-ypipe, wye-branch, reducers, and gate valve shall meet the following requirements:

- a. Pressure Head. The system shall be able to operate at a full hydrostatic pressure of 125 psi.
- b. Hydrostatic Test Pressure. The system must be able to withstand a test pressure equivalent to 1.5 times operating pressure.

After complete installation and adjustment is done for operation, the Contractor shall conduct test runs for the pipes and valves. The cost of performing the test shall be considered included in the contract unit price for furnishing and/or installing these items.

All tests shall be performed in the presence of an authorized representative of the DA Western Visayas. All data shall be certified correct and be submitted to the DA Western Visayas. All defects found during the test as the result of the installation work shall be corrected accordingly to the satisfaction of the DA Western Visayas.

15.07 PROTECTIVE COATING

- a. Immersed Steel. Except where otherwise specified, all steel surfaces and all parts of the structures that have surfaces which are normally immersed in water, shall be painted with two coats of coal tar epoxy paint in accordance with SSPC No. 11.01 Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint System.
- b. Embedded Steel Work. Where not otherwise specified, all steel surfaces which will be embedded or against which concrete shall be placed, shall be cleaned in accordance with SSPC-SP 93 then painted with one coat of cement latex cement consisting of 10 parts of Portland cement (by weight), five parts of water and one part of modified latex emulsion.

15.08 METHOD OF MEASUREMENT

The quantity of steel pipe installed shall be measured by lineal meters of pipe actually installed. Steel gate, trashrack, stoplog, gate valve and dresser coupling shall be measured by the number of set acceptably installed. Wye-branch flanges and reducers shall be measured by weight in kilograms of material acceptably placed.

15.09 BASIS OF PAYMENT

Payment of works under this Section shall be based upon unit price per linear meter, per kg, per unit, per set of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

SECTION 15
PAINTING METAL WORKS

16.01 GENERAL

Contractor shall clean all surfaces of metalworks and apply paint and protective coatings as hereinafter provided and shall furnish all the required materials. Surfaces not required to be painted and coated, but which are adjacent to the surfaces to be cleaned and painted, shall be protected against contamination and damage during the cleaning and painting operations. Before proceeding with cleaning or painting operations, Contractor shall clean and repair all shop applied paint which is defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition. Temporary or permanent welding will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coating which could be damaged thereby are accessible for repairing and inspection. Except where specified, Contractor will not be required to disassemble any machinery, equipment or other metal work for the purpose of painting the interiors. Tinting where required for color contrast, shall be done by using not more than three (3) ounces of tinting color per U.S. gallon of paint.

Items being delivered shop-coated with priming paint or standard shop coat will have coatings compatible with the types of paint indicated in the following schedule. Certain items will be furnished with a gasoline-soluble rust-preventive compound.

Contractor shall take care to procure the painting materials according to a schedule which will insure that paint will not be stored longer than the limits recommended by the manufactures.

16.02 CLEANING AND PAINTING SCHEDULE

| No. | Item | Method of Surface Preparation * | Paint or Coating Material | No. |
|-----|---|--|--|-----|
| 6 | Machined surfaces, steel cables and finished surfaces which will be in rolling or sliding contact and which are not required to be painted or lubricated | A | One heavy coat of gasoline soluble rust preventive compound | 1 |
| 7 | Surfaces of metalwork which will be inaccessible after installation or assembly | B or C As specified for the metalwork if furnished unpainted or | Priming paint specified for other surfaces of the same metalwork | 3 |
| | | A If furnished painted | None | |
| 8 | Stainless steel; nonferrous metalwork, galvanized metalwork which will be exposed outdoors; and surfaces of cast-iron which are to be buried or continuously subjected to moisture and not exposed to public view | Painting is not required unless otherwise tabulated | None | |
| 9 | Interior surfaces of cast-iron pipe, valves, fittings | Painting is not required unless specifically listed elsewhere in this tabulation | None | |
| 10 | Metal surfaces to be encased in concrete and which concrete is to be placed | Painting is not required | None | |
| 6 | Machined surfaces, steel cables and finished surfaces which will be in rolling or sliding contact and which are not required to be painted or lubricated | A | One heavy coat of gasoline soluble rust preventive compound | 1 |
| 7 | Surfaces of metalwork | B or C | Priming paint | 3 |

| | which will be inaccessible after installation or assembly | As specified for the metalwork if furnished unpainted or | specified for other surfaces of the same metalwork |
|----|---|--|--|
| | | A | |
| | | If furnished painted | None |
| 8 | Stainless steel; nonferrous metalwork, galvanized metalwork which will be exposed outdoors; and surfaces of cast-iron which are to be buried or continuously subjected to moisture and not exposed to public view | Painting is not required unless otherwise tabulated | None |
| 9 | Interior surfaces of cast-iron pipe, valves, fittings | Painting is not required unless specifically listed elsewhere in this tabulation | None |
| 10 | Metal surfaces to be encased in concrete and which concrete is to be placed | Painting is not required | None |

16.03 PREPARATION OF SURFACES

Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any dirt or dust remaining from the cleaning operation shall be removed before the surfaces are painted. Cleaning solvent shall be mineral spirits or xylol except the xylol shall be used for surfaces which require coaltar coatings. In the event that rust forms or the surface becomes otherwise contaminated in the interval between cleaning and painting, or between coats of paints, recleaning will be required.

Method A. All oil, grease and dirt shall be removed by the use of clean solvent and clean wiping materials.

Method B. All oil, grease and dirt shall be removed by the use of clean solvent and clean wiping materials. Following the solvent cleaning, the surfaces to be painted shall be cleaned of all defective or damage areas of existing paint, and of all loose rust, loose mil scale, and other foreign substances by scraping, chipping, blasting, power wire brushing or other effective means.

Method C. All oil, grease and dirt shall be removed by the use of clean solvent and clean wiping materials. Following the solvent cleaning, the surfaces to be painted shall be blast cleaned to base metal, using dry, hard, sharp sand or still grit, to produce a gray-etched surface. The blasting material shall pass a No. 16 U. S. standard screen and at least 85 percent shall be retained on a No. 50 U. S. standard screen.

16.04 APPLICATION

Materials shall be thoroughly mixed and surfaces shall be clean and free from moisture at the time of application. Effective means shall be provided for removing all spraying equipment. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting. Each coat shall be free from runs, pinholes and sags. Each coat shall be allowed to dry or to harden before succeeding coating is applied. Thicknesses specified in millimeters shall be measured by an approved dry-film thickness gage. Red-lead priming paint, regular or phenolicresin aluminium paint and machinery paint may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum and in no event shall it exceed 15 percent of the paint. Thinning of other materials will be permitted only if approved by the Project Engineer. If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water to temperature not exceeding 38 °C.

Application of specific materials shall be as follows:

- a. Red-lead priming paint shall be applied at a maximum coverage of 12.5 square meters per liter per coat for Type II and a maximum coverage of between 11 and 12.5 square meters per liter coat for Type IV. The first coat shall be applied by either brush or spray. Following the first coat, an additional tinted brush coat shall be applied over all rivets, welds, bolts, seams, sharp corners and edges before subsequent painting. Alternate coats shall be tinted for color contrast using IB black. If necessary, each additional pass shall be by strokes of right angles to the previous pass.

Specific color matches will not be required except that all paint used for the last coat shall be uniform in color.

- b. Cold-applied coal-tar paint, CA-59, shall be applied at a coverage of approximately 3 square meters per liter per coat. It shall be applied by brushing. Thinning will not be permitted.
- c. Coal-tar epoxy coating shall be applied at a maximum coverage of 2.7 square meters per liter per coat. Alternate coat shall be of different colors and the final coat shall be a color other than black, the color being subject to approval by the Project Engineer. Surface preparation, coating preparation, application and thinning shall be done in accordance with the manufacturer's instructions.

16.05 MATERIALS

All pigmented paints and primers shall be purchased in sealed containers packaged by the manufacturer and shall be delivered with the seals unbroken. Colors of finish paints shall match color samples, furnished by the DA Western Visayas unless color requirements are specifically stated otherwise. Materials shall be in accordance with the following specifications:

- a. U. S. Federal Specifications:
 - 1) Red-lead priming paint, TT-P-8c, Type II and Type IV.
 - 2) Zinc-dust zinc oxide primer, TT-P-641b, Type II.
 - 3) Mixing varnish for regular aluminium paint, TT-V-81b, Type II, class B.
 - 4) Mixing varnish for phenolic-resin aluminium paint, TT-V-119.
 - 5) Aluminum paste, TT-A320a, Type II, Class B
 - 6) Machinery enamel, TT-E-489b, Class A.
 - 7) Pigment-in-oil (tinting colors) TT-P-381b.
 - 8) Mineral spirits, TT-T-291a, Grade I.

- b. U. S. Bureau of Reclamation Specification:

- 1) Cold-applied, coal tar paint CA-50.
- 2) Vinyl-resin paint, VR-6, aluminium paste and thinner.

- c. United States Maritime Administration Specification:

Rust preventive compound, 52 MA-602a, Type B, medium except that equally effective inhibitors, in suitable quantities, may be used in lieu of the specified percentage of chromates.

- d. U. S. Military Specifications:

Coal tar epoxy, MCL-P23236, Type I, and II, Class A.

- e. Certification, Sampling and Testing of Materials:

Contractor shall furnish manufacturer's certificates in compliance with specifications for all paint materials being furnished.

Contractor shall conduct film thickness measurements and electrical inspection of the coated surfaces and shall record and repair defective work as necessary for compliance with the specifications. All test equipment shall be furnished by the Contractor.

Contractor shall provide magnetic type dry film thickness gage for measuring paint thickness and a high voltage type detector for electrical inspection of coal tar epoxy resin coatings. All coats to be done shall be under the direction of DA Western Visayas and testing equipment to be used shall be subjected to approval by the DA Western Visayas.

16.06 BASIS OF PAYMENT

No separate measurement and payment will be made for the above painting requirements and the cost for the painting test shall be included in the metalworks in the Bill of Quantities for which painting is required.

SECTION 16 CHANNEL EXCAVATION

17.01 SCOPE

The work under this Section shall consist of excavating and removal of all classes of materials in the approach channels for the spillway and diversion intake, main canal and the wasteway channel including disposal of unsuitable or surplus materials to designated waste disposal areas, stockpiling of excavated materials suitable for embankment and backfilling, and trimming of side slopes inside the channel prism and channel beds except for portion where concrete lining is required all in accordance with the Drawings and these Specifications and as directed by the DA Western Visayas Project Engineer.

All channel/canal excavations shall be true to lines, grades, slopes and profile shown on the Drawings or as required by the Project Engineer.

17.02 CLASSIFICATION

All excavated materials under this Section will be classified as follows:

- a. Indurated Materials- A massive formation of inorganic materials not falling under the classification of “ Rock “ such as Adobe, Hardpan and the like, shall be classified as “ Indurated Materials “.
- b. Common- All other materials not falling under the above classifications will be classified as “ Common Materials”.

17.03 CONSTRUCTION REQUIREMENTS

17.03.1 Sections and Slopes

Excavation sections, profiles and slopes shall be cut true and straight in conformity with the lines and grades shown on the Drawings within the following tolerances, measured normal to the excavated surfaces:

| Item | Tolerances |
|--|------------|
| 1. Side slopes above minimum elevation of operating roads | + 30 cms |
| 2. Profile of operating roads, access roads and protection dikes | + 9 cms |
| 3. Profile of invert channels | + 3 cms |
| 4. Side slopes inside channel prism | + 15 cms |

The extreme of the above tolerances shall not be continuous over a distance of 40 meters measured at any place, in any direction, parallel to the excavated surface.

17.03.2 Excavation Beyond Established Lines

Precautions shall be taken to preserve, in an undisturbed condition, materials beyond the designated limits of excavations as shown on the Drawings except unsuitable materials ordered removed by the Project Engineer. Materials loosened beyond the excavation limits as a result of excavation operations shall be considered defective work and shall be compacted or removed and replaced with compacted embankment at the Contractor’s expense, as directed by the DA Western Visayas Project Engineer

17.04 METHOD OF CONSTRUCTION

Channel/canal excavation shall include all excavation works in the channel/canal prism whether common, indurated or rock materials, except additional excavations at structure sites which is specified to be done and measured for payment under Section 4.

The Contractor shall also excavate after the area of operation is acceptably cleared and grubbed in accordance with Section 3, Clearing and Grubbing. Excavation shall be in accordance with the cross-section, lines and grades shown on the Drawings. On portion where concrete lining is required, excavation shall not extend beyond the neat lines of the underside face of lining as shown on the Drawings. Excavation operations shall be such that all materials suitable for embankment or backfilling and filling shall be separated for objectionable materials which are to be wasted. All surfaces from the excavation shall be trimmed to the required slopes and grades within the specified tolerances.

The method of construction or excavation shall be at the option of the Contractor whether by the use of manual labor or by the use of equipment. For cut above 1.00 meter but less than 1.50 meters, if there is sufficient manual labor such that the timetable for completion of the project will not be adversely affected, and the work can be done with manual labor at a price not exceeding the price for mechanized work, excavation shall be done by manual labor. These limits refer only to workable soil. If the soil is wet and sticky, the above limits may be reduced. If the soil is hard as to require picks for loosening, thereby impairing the efficiency of manual labor considerably, the cut section shall be plowed mechanically with the use of disc plows towed by TD-9 tractor until the soft layer is reached.

In case no manual labor is available to meet project deadline, the Contractor shall be required to secure a certification from the Mayor of the locality concerned to support his request for exemption. On the other hand, if the availability of manual labor is more than enough to meet project deadline the Contractor may be required to undertake manual excavation more than what can be mechanically done.

In the absence of manual labor, the channels, canal should preferably excavated with the use bulldozers (D7 or D8) and motorized scrapers, excavating in excessive layers of about 30 centimeters followed subsequently by trimming of the side lopes using a Grader or a

Backhoe. Should the Contractor proposes o do excavation works by some other means, prior approval of the Project Engineer must be secured.

If slides occur on excavated slopes or if run-off flows deposit additional materials in excavations before the acceptance of the works, the removal of the said slopes and /or deposit shall be at the expense of the Contractor.

17.05 FINISHING CHANNELS/CANALS

Upon completion of all construction operations, the slopes of all canal/channel sections shall be finished as specified and shown in the Drawings. Channel beds, embankment and side slopes shall be trimmed and shape to the finished cross-sections to produce smooth surfaces and slopes, and uniform cross-sections, as shown on the Drawings.

Stockpiling of materials on finished sections, roadways and embankments shall not be permitted. All finished works and surfaces shall be cleaned of dirt and foreign materials.

The Contractor should also be required to clear all right-of-way for all excess or objectionable materials, if all excess or objectionable materials are the result of the Contractor's operation as determined by the DA Western Visayas Project Engineer.

All weeds and other objectionable growth, roots, excess earth, debris, loosened rock larger than 7.5 centimeters shall be removed and disposed off in approved sites outside the right-of-way as specified or directed by the Project Engineer.

Entire channel section, side slope and structure approaches shall be left in neat and presentable conditions.

17.06 METHOD OF MEASUREMENT

Channel excavation will be measured for every cubic meter of material excavated from the channel prism. Measurement shall be made in its original position after undertaking clearing and grubbing including stripping operations and computed by the Average-End-Area Method for every 20- meter section of finished channel within the pay lines or neat lines shown on the Drawings, acceptably excavated and formed into embankments of used for structure backfill, or wasted as directed.

Hauling of excavated materials within the free haul distance either for embankment or disposal to waste areas and trimming of side slopes in channel prism and beds except for portion where concrete lining is required, are considered subsidiary works and thus, shall be paid under this Section and the cost thereof shall be considered included in the contract unit price for channel excavation. Hauling or overhauling for disposal of excavated materials into embankments is a subsidiary work for impervious fill core trench backfill, coffer dam of dam embankment or structure backfill as the case maybe. Thus, it will not be measured for payment and the cost thereof is included in the contract unit price for impervious fill, core trench backfill, and coffer dam for dam embankment or structure backfill as the case maybe.

17.07 BASIS OF PAYMENT

The volume measured as provided above shall be paid at the contract unit price per cubic meter for the different classes of Channel/Canal excavation, which price and payment shall constitute full compensation for furnishing all materials, supplies, labor, equipment, tolls and all incidentals necessary for the successful completion of the work described under this Section.