

Work Technical Specification

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Section 01

1.1 Civil & Structure Work

1.1.1 General Requirements

Do not begin demolition or deconstruction until authorization is received from the NRC Representative. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials; do not allow accumulations inside work areas or on job site pavements. The work includes demolition, of identified items and materials, and removal of resulting rubbish and debris. Store materials that cannot be removed daily in areas specified by the NRC Representative

1.1.2 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dirt, and debris from work areas daily.

1.1.3 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.1.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations.

1.1.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the NRC Representative. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.1.6 Burning

The use of burning at the project site for the disposal of refuse and debris may be permitted with permission from the base commander.

1.1.7 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building on job site pavements and avoid the creation of a nuisance or hazard] in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.2 Protection

1.2.1 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.2.2 Existing Condition

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the NRC Representative showing the condition of structures and other facilities adjacent to areas of alteration or removal.

2 Concrete Reinforcing

2.1 Reinforcing Steel

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 996/A 996M, grades and sizes as indicated. If Grade 60 bars are unavailable the Contractor may substitute Grade 40 or Grade 50 bars of the same size and spacing as indicated for Grade 60 bars when authorized.

2.2 Reinforcement Steel Tests

Mechanical testing of steel shall be in accordance with ASTM A 370 except as otherwise specified or required by the material specifications. Tension tests shall be performed on full cross-section specimens using a gage length that spans the extremities of specimens with welds included. Chemical analyses of steel heats shall show the percentages present in the steel.

2.3 Reinforcement

Reinforcement steel and accessories shall be fabricated and placed as specified and shown and approved shop drawings. Fabrication and placement details of steel and accessories not specified or shown shall be in accordance with ACI SP-66 and ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill.[Zinc-Coated and epoxy-coated bars shall be mill-bent prior to coating. All steel shall be bent cold unless authorized.] Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms. Submit detail drawings showing

reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

2.4 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

2.5 Splicing

Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches.

2.6 Placing Tolerances

2.6.1 Spacing

The spacing between adjacent bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than 1 inch.

2.6.2 Concrete Cover

The minimum concrete cover of main reinforcement steel bars shall be as shown. The allowable variation for minimum cover shall be as follows:

MINIMUM COVER (mm/inch)	VARIATION (mm/inch)
150/6	plus 131/2
100/4	plus 103/8
75/3	plus 103/8
50/2	plus 61/4
38/1-1/2	plus 61/4
25/1	plus 31/8
193/4	plus 31/8

2.6.3 Splicing

Splices in steel bars shall be made only as required. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval.

2.6.4 Lap Splices

Lap splices shall be used only for bars smaller than 28 mm. Lapped bars may be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than 1/5 the required length of lap or 6 inches (150 mm).

2.7 Identification of Splices

Establish and maintain an approved method of identification of all field butt-splices which will indicate the splicer and the number assigned each splice made by the splicer.

3 Concrete Material

3.1 Mix Design

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 7 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial or approved on-site testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

3.2 Strength Requirements and w/c Ratio

3.2.1 Strength Requirements

Specified compressive strength (f'_c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
Non- air entraining	
21 MPa - 3000 psi (cylinder) at 28 days	Foundation, Columns, slabs
17 MPa – 2500 psi (cylinder) at 28 days	Fence post, Manholes, Septic Tank

Concrete slabs on-grade shall have a 28-day compressive strength of 21 MPa (3000 psi).

Concrete of Roof slabs shall have a 28-day compressive strength of 21 MPa (3000 psi).

Concrete mix for Roof slabs and slab on grades shall have types of plasticizers as per mix design, especially for designs requiring high slump concrete.

21 MPa - 3000 psi (cylinder) at 28 days

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens 150 cm x 300 mm cylinders. 150x150x150 cubes may be substituted, however correction factors must be applied to cube to convert into cylinder strength. Cylinders shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c and no individual test result falls below the specified strength f'_c by more than 3.5 MPa (500 psi). A "test" is defined as the average of two companion cylinders or cubes, or if only one is tested, the results of the single test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cubes falls below the specified strength requirement by more than 3.5 MPa(500 psi) or if tests of field-cured cubes indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42/C 42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the NRC Representative to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cubes or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the NRC Representative in accordance with the requirements of ACI 318M(ACI 318). Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the NRC Representative.

3.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT STRUCTURE OR PORTION OF STRUCTURE

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

<u>WATER-CEMENT RATIO, BY WEIGHT</u> <u>STRUCTURE</u>	<u>STRUCTURE OR PORTION OF</u> <u>STRUCTURE</u>
--	--

0.45

All Structures

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

3.3 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143/C 143M.

<u>Structural Element</u>	<u>Minimum</u>	<u>Maximum</u>
Walls, columns and beams	50 mm (2 in.)	125 mm
Foundation walls, substructure		
walls, footings, slabs	50 mm (2 in.)	125 mm
Any structural concrete approved		
for placement by pumping:		
At pump	50 mm 2 in.	150 mm
At discharge of line	50 mm 2 in.	125 mm

When use of a plasticizing admixture conforming to ASTM C 1017/C 1017M or

when a Type F or G high range water reducing admixture conforming to ASTM C 494/C 494M is permitted to increase the slump of concrete, concrete With admixture shall have a maximum slump of 200 mm 8 inches at the point of delivery after the admixture is added.

3.4 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 33 degrees C (90 degrees F). When the ambient temperature during placing is 5 degrees C (40 degrees F) or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 33 degrees C.

3.5 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

3.6 Special Properties and Products

Concrete may contain admixtures such as air entraining agents, water reducers, super-plasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

3.7 Mixture Proportions

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement. Laboratory trial mixtures shall be designed for maximum permitted slump. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these

specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. For each water-cement ratio, at least three test cubes for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 28 days in accordance with ASTM C 39/C 39M. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

3.8 Storage of Materials

Cement and other cementitious materials shall be stored in weather tight buildings, lay-down pallets, bins, or silos which will exclude contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

3.9 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

3.9.1 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

3.9.2 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

3.9.3 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

3.10 Cementitious Materials

Cementitious Materials shall be Portland cement, and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

3.10.1 Portland Cement

ASTM C 150, Type I low alkali, or Type II low alkali including false set requirements or Type V. White Portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing.

3.10.2 Aggregates

Fine and coarse aggregates shall be tested and evaluated for alkali-aggregate reactivity in accordance with ASTM C 1260 upon government request. The fine and coarse aggregates shall be evaluated separately and in combination, which matches the Contractor's proposed mix design proportioning.

3.10.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and graduation requirements of ASTM C 33.

3.10.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation.

3.10.2.3 Chemical Admixtures

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed.

3.11 Curing Materials

Are subject to the approval of the Government.

3.11.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

3.11.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be

used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Non pigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

3.11.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

3.12 Water

Water for mixing and curing shall be clean, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400 or ASTM C 1602 / C 1602 M.

3.13 Non Shrink Grout

Non shrink grout shall be used under base plates of steel columns. 5000 PSI bagged mixed per manufacture instructions.

3.13 Embedded Items

Embedded items shall be of the size and type indicated or as needed for the application. Hangers for suspended ceilings shall be as specified in Section 09 51 00 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

3.14 Vapor Barrier

Vapor barrier shall be polyethylene sheeting with a thickness of 0.15 mm(6 mils) or other equivalent material.

4 Concrete Execution

4.1 Preparation for placing

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, and adequately supported. Reinforcing steel shall be in place, clean, tied, and adequately supported. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site

to provide shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

4.1.1 Foundations

4.1.1.1 Concrete on Earth Foundations

Earth surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

4.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

4.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the NRC Representative. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface shall be washed completely clean as the last operation prior to placing the next lift. For heavy duty floors and two-course floors a thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the topping placing. The grout shall be a 1:1 mixture of Portland cement and sand. The topping concrete shall be deposited before the grout coat has had time to stiffen.

4.2.1 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area.

4.2.2 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

4.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm (12 inches). Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 300 mm (12 inches). Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, a thin layer of approximately 13 mm (1/2 inch) of fine graded material should be rolled or compacted over the fill before installation of the vapor barrier to reduce the possibility of puncture. Concrete placement shall be controlled so as to prevent damage to the vapor barrier.

4.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids.

5 Concrete Production

5.1 General Requirements

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in at job site. Site-mixed concrete shall be accepted for structures in case required in the project according to approved Mix design under supervision of NRC Representative.

5.1.1 Batching Plant

The batching plant shall have the ability for and certified equipment to produce the concrete as per the Mix Design proportions; however, rating plates attached to batch plant equipment are not required.

5.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and

type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

5.1.3 Scales

The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

5.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

PERCENT OF REQUIRED	
MATERIAL	WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2

Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

PERCENT OF REQUIRED	
MATERIAL	MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

5.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the

Materials being batched.

5.2 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired?

5.3 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94/C 94M applicable to central-mixed concrete.

5.4 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94/C 94M. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Water can be added at the placing site at the presence of Government representative; and in no case shall it exceed the specified w/c and the required slump.

5.5 Conveying Concrete on Site

5.5.1 Buckets

5.5.2 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94/C 94M. Non agitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of non-agitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

5.5.3 Chutes

Concrete may be conveyed by displacement chutes for the footings and other ground element.

5.5.4 Placing Concrete

Mixed concrete shall be discharged within 90 minutes after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 33 degrees C, the time shall be reduced to 45 minutes. Concrete shall be placed within 30 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

5.5.5 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 1.5 meters(5 feet) except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 300 mm (12 inches) thick, except that all slabs shall be placed in a single lift. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic.

Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

5.5.6 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm (4 inches) thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm (6 inches) into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm (4 inches) and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented.

5.5.7 Cold Weather Requirements

Special design mix for cold weather application should be provided and strictly followed. Special protection measures, approved by the NRC Representative, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C nor more than 33 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494/C 494M, Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used.

5.5.8 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 40 degrees C, the concrete shall be placed and finished with procedures previously submitted and as specified

herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	36 C
40-60	33 C
Less than 40	30 C

6.1 Joints

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 50 mm(2 inches) clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1.5 kg per square meter(30 pound) asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints.

6.1.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 6.00 meters. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the NRC Representative. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

6.1.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 3 and 5 mm(1/8 and 3/16 inch) wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

6.1.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of JOINT SEALANTS defined in Arc specification.

6.2 Water stops

Install water stops in conformance with the locations and details shown on the drawings using materials and procedures specified requirements of JOINT SEALANTS defined in Arc specification.

7. Earth Work

7.1.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP. Satisfactory materials for grading comprise of stones less than 200 mm (8 inches) for soils below 1(one) meter below finished grade. Material from finished grade to minus (1) one meter shall not contain stones larger than 75 mm (3 inches).

7.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; cobbles; boulders; rock; lenses or pockets of gypsum; gypsiferous soils; expansive soils; and material classified as satisfactory which contains root and other organic matter or frozen material. SC and GC are unsatisfactory when more than 25 percent of the material passes the 0.075 mm sieve. The NRC Representative shall be notified of any contaminated materials. Unsatisfactory materials also include those materials listed in paragraph.

7.1.3 Cohesion less and Cohesive Materials

Cohesion less materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesion less only when the fines are neoplastic. Perform testing, required for classifying materials, in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

7.1.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180.

7.1.5 Topsoil

Material suitable for topsoil obtained from [offsite areas] [excavations] [areas indicated on the drawings] is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

7.1.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 1 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

7.1.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding .375 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.7.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.7.9 Select Granular Material

1.7.9.1 General Requirements

Select granular material consists of materials classified as GW, GP, SW, or SP by ASTM D 2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index must not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight may be finer than 75 micrometers sieve when tested in accordance with ASTM D 1140.

1.7.1.2 California Bearing Ratio Values

Select granular material consists of materials classified as GW, GP, SW, or SP by ASTM D 2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index must not be greater than 12 percent when tested in

Accordance with ASTM D 4318, and not more than 25 percent by weight may be finer than 75 micrometers sieve when tested in accordance with ASTM D 1140.

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
63 mm	100
4.75 mm	40 - 85
2.00 mm	20 - 80
425 micrometers	10 - 60
75 micrometers	5 - 25

8. Stripping and Topsoil

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones

larger than 2 inches (50 mm) in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and grading.

8.1 General Requirement

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

8.2 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on Drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 1 meter from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

8.3 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the NRC Representative prior to concrete placement. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D 698 maximum density.

8.4 Selection of Borrow Material

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas selected by the Contractor. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

9 Embankment

9.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 20 cm in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise brake up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesion less materials.

-- End of Section 01 --

Section 02

Architecture Work

1 Doors and Windows

1.1 General Requirement

All exterior and interior Door or Windows shall conform to AAMA 101 or ASTM D 4099 and to requirements specified herein. Provide door and windows of materials, types, grades, performance classes, combinations and sizes indicated or specified. Each window shall be a unit consisting of [sub frame,] frame, sash, glass, hardware, fins, and weather-stripping, anchors and accessories complete. Design doors and windows to accommodate glass, hardware, [weather-stripping,] and accessories to be furnished. Glass shall be factory or field installed.

Glass 4mm thick with Insect Screening ASTM D 3656, Class 2, 18 by 14 mesh, color [as approved].

1.2 Accessories

As standard with the manufacturer and as specified herein.

1.2.1 Construction

Ventilators shall have one or more stabilizing arms attached to the frame when ventilator is opened from top. When ventilator is in the tilt-open position, stabilizing arms shall provide positive positioning of the ventilator.

1.2.2 Hardware

Equip each ventilator with one handle to provide both tilt and swing operation. The tilt or swing operation shall be individually selected and rendered operable starting only from the closed sash position. Provide a secondary locking device for each ventilator to prevent accidental swing operation.

1.3 Frames

1.3.1 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, provide continuous drips across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

1.3.2 Hardware

The item, type, and functional characteristics shall be the manufacturer's standard for the particular door or window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip operating ventilators with a lock or latching device which can be secured from the inside.

1.3.3 Weather-Stripping

Provide for ventilating sections of windows to ensure a watertight seal meeting the infiltration requirements. Provide easily replaceable factory-applied weather-stripping.

1.3.4 Screen for Window

Provide one insect screen for each the windows as requested by the project requirement. Design screens to be rewritable, easily removable from outside the building, and to permit easy access to operating hardware.

1.3.5 Color

Door or Window (PVC) color shall be [white]or [as approved]. Color shall be integral or coextruded to the PVC to prevent heat build-up.

1.3.6 Fasteners

Provide fastener types as standard with the window manufacturer for door and windows, trim, and accessories.

1.3.7 Accessories

Provide door complete with clips, fins, anchors, and other appurtenances necessary for complete installation and proper operation.

1.3.8 Anchors

Provide concealed anchors of the type recommended by the door and window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. For each jamb 900 mm or longer, provide a minimum of three anchors located approximately 150 mm from each end and at midpoint. For jambs less than 900mm long, provide two anchors.

1.3.9 Door and Window – Cleaner Anchored

Provide double head anchors for windows [indicated]. Anchors shall be steel of size and design. Provide two anchors for each single window. Fasten anchors as per manufacturer installation guideline. Reinforce frames to receive anchors. Provide wall anchors on backs of frames at points where anchors are located.

1.4 Installation

Install in accordance with the door and window manufacturer's printed instructions and details. Build in doors and windows as work progresses or install without forcing into prepared door and window openings. Set door and windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, and contacts of windows with sills, built-in fins, and sub frames in mastic sealant of a type recommended by the manufacturer.

1.4.1 Anchors and Fastenings

Secure units to each other, to masonry, and to other adjoining construction with clips, fins, screws, or other devices recommended by the manufacturer.

1.4.2 Adjusting

After installation of door or windows and completion of glazing and field painting, adjust ventilators and hardware to operate smoothly and to provide watertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Verify products are properly installed, connected, and adjusted.

1.4.3 Cleaning

Clean interior and exterior surfaces of door and window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with operation of hardware. Replace stained, discolored, or abraded doors that cannot be restored to their original condition with new door or windows.

1.4.4 Protection

Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame.

Tile Working

1.5 Ceramic Tile

Conform to ANSI A137.1 for standard grade tile. Provide grade sealed containers. Provide an impact resistant tile with a minimum floor breaking strength for wall tile of 41 kg and for floor tile of 113 kg in accordance with ASTM C 648.

1.5.2 Ceramic Tile for floor

Provide ceramic tile 400x200mm for Wall smooth and square at edges with good quality of resistance against goods impacts.

1.5.3 Ceramic Tile Grout

Provide a 21 MPa concrete fill mix to dry as consistency as practicable. Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable. Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material

1.5.4 Cleaning and protecting

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved

method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

1.6 Acoustical PVC Ceiling system

Provide mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. Coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor is responsible for all associated labor and materials and for the final assembly and performance of the specified work and products if I-P products are used. The location and extent of acoustical treatment must be as shown on the approved detail drawings. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.6.1 Units for PVC Ceiling

Nominal size: 400 by 2000 mm.

Edge detail: Square.

Finish: Factory-applied standard finish.

Color: White or light gray

1.7 Toilet Accessories

Accessory items shall conform to the requirements specified below.

1.7.1 Mirror, Glass

Framed mirror dimensions shall be as shown on the drawings. Backing sheet shall be secured to the frame with concealed screws. Concealed galvanized-steel wall hanger of the size required for the mirror size shall be provided. Mirror shall be hung and locked in place with not less than two screws per mirror.

1.7.2 Paper Towel Dispenser

Surface-mounted dispensers shall be sized to dispense not less than paper towels. Front of the cabinet shall be hinged at the bottom with a continuous corrosion-resistant steel piano hinge or two corrosion-resistant steel pin hinges. Dispenser shall be fabricated with tight seams and joints with exposed edges rolled. Exposed surfaces shall be smooth and without blemishes.

1.7.3 Toilet Tissue Dispenser

Toilet tissue holder shall surface mounted or recess mounted horizontally unless specified otherwise.

1.8 Plaster work**Materials****1.8.1 Portland Cement**

Portland cement shall be grey Portland cement

1.8.2 Aggregates

The unit weight of aggregates shall be determined in relatively dry, constant mass condition. Portland cement based plaster aggregates shall be natural or manufactured sand for Portland-cement plaster shall be as follows:

Sand, Percentage by Weight Retained on Each Sieve			
(mm)	Sieve Size	Maximum	Minimum
4.75	0	--	
2.36	8	2	
1.18	38	22	
0.60	78	52	
0.30	97	65	
0.15	100	97	

1.8.3 Water

Water shall be clean, fresh and free from injurious amounts of oils, acids, alkalis and organic matter injurious to the plaster and to any metal in the system.

1.8.4 Lime

Lime shall be composed primarily of calcium and magnesium oxides and suitable for use in scratch brown and finish coats of Portland-cement plaster, and shall be used at the option of the contractor where necessary.

1.8.5 Proportions and Mixing

1.8.5.1 Portland Cement Plaster Base Coat

The approved mix design shall be followed at the site. Base coat shall be proportioned and mixed by volume, 1 part Portland cement, 0 to $\frac{3}{4}$ part lime and aggregate, 1st coat: 2-1/2 to 4 parts. 2nd coat: 3 to 5 parts, but not less than used the first coat,

1.8.5.2 Portland Cement-Plaster Finish

The approved mix design shall be followed at the site. The finish coat shall be proportioned and mixed by volume 1 part Portland cement, $\frac{3}{4}$ to 1-1/2 parts lime and 1.1/2 to 3 parts aggregate, unless specified otherwise.

1.8.6 Quality Control

Fluidity or stiffness of plaster shall be tested with a standard 50 x 100 x 150 mm plaster slump testing cone or by a 100 x 200 x 300 mm concrete slump testing cone. Method of making slump test shall be as follows:

- a. Place cone on center of dry base plate located on a level, firm surface. Hold cone tightly against plate.
- b. Fill the cone with plaster obtained from the hose or nozzle, without air on the nozzle, puddling with tamping rod during the operation to eliminate air bubbles or voids.
- c. Screed plaster level with top of cone.
- d. Lift cone straight up from base plate in a slow and uniform motion, and place it on the base plate next to plaster sample.

- e. Lay a straightedge across top of cone, being careful not to disturb or jostle the plate, and measure the slump in mm from the bottom of the straightedge to the top of the plaster sample.

1.9 Painting Work

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.9.1 Environmental Conditions

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 5 degrees C or over 45 degrees C, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.9.2 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.9.2.1 Exterior Painting

Includes new surfaces of the building[s] and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

Exterior painting shall be one coat of primer and two coats of Acrylic Emulsion Paint as approved color and quality to rendered external surfaces of plaster and concrete.

1.9.2.2 Interior Painting

Includes new surfaces of the building[s] and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

All interior painting shall be one coat of primer and two coats of Plastic Emulsion Paint as approved color and quality to rendered internal surfaces of plaster and concrete.

1.10 Thermal Insulation

1.10.1 Roof Insulation

All exterior wall shall be insulated by Polystyrene Foam of Class D-20 with 5cm thick according to ASTM C578.

Size: 195x95cm

Density: 7.5Kg/m³

Color: White

1.10.2 Exterior Wall insulation

Roof of the Transit Center shall be insulated by Polystyrene Foam of Class D-20 with 10cm thick according to ASTM C578

Size: 195x95cm

Density: 7.5kg/m³

Color: White

-- End of Section 02 --

Section 03

Plumbing and Mechanical Work

1.1 Material

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products for at least 2 years. Unit shall be factory assembled, weatherproof packaged unit. The ACs must be standard and guaranteed. Contractor must install them correctly according to the client instruction. The units must have approved by the client.

1.1.1 Pipe

All sewer line shall be PCV pipe Schedule 40 according to ASTM D1785 and ASTM F441 and water supply shall be aquatherm green pipe for direct contact with food and potable water and is an ideal distribution main system used in hospitals, schools, hotels, residence and many other projects.

1.1.2 Water Heater

Water heater should have 50 gallon capacity of Medial Brand 220v with thermal gauge.

1.1.3 Valves

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80mm and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable standard.

1.1.4 Wall Faucet

Wall faucets shall have 20 mm male inlet threads, hexagon shoulder, and 20 mm hose connection. Faucet handle shall be securely attached to stem.

1.1.5 Lavatories

Vitreous china lavatories shall be nonabsorbent, hard-burned, and vitrified throughout the body. Lavatories shall be provided with p-traps.

1.1.6 Flush Tank Water Closets

White vitreous china, siphon jet, round bowl, pressure assisted, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 356 to 381 mm, except 432 to 483 mm for wheelchair water closets. Gravity tank type water closets are not permitted. Water flushing volume of the water closet shall not exceed 8 liters per flush. Provide white solid plastic round closed-front seat with cover. Closets shall be elongated bowl type.

1.1.7 Hose bib

Provide hose bib with flexible pipe inside the toilets have the 1.5bar pressure gauge.

1.1.8 Shower and Shower Rod

In the bathrooms provide bronze shower and shower rod with all related fixture and fittings.

1.1.9 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, and perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and collar. Toilet room floor drains are similar.

1.1.10 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where supply drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

1.1.11 Pipe Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations.

Joints for threaded pipes shall be made with an approved Teflon tape or graphite compound applied to the male threads only. Flanged joints shall be installed for all valve connections. Flanged joints shall be truly parallel to each other so that bolts are used only to tighten joints, rather than to correct alignment. Flanges shall be chosen to suit the maximum working pressure of the pipe system. All PVC pipe joints shall be installed in accordance with the pipe manufacturer's instructions.

1.1.12 Flexible Connection

Flexible connections at inlets and outlets shall be of neoprene rubber impregnated fabric reinforcement, bellow shape with flanged ends. The flexible connectors shall be designed for excellent vibration and noise protection. Isolated tension members shall be provided to prevent excessive elongation.

Connections of pipes with joints, elbows, or tee shall have thread or pipe solution to prevent water intake.

1.1.12 Vents and Drains

Manually operated air vents shall be furnished as required for purging air or other gases from the water circuits during filling-up. Outlets shall be piped to the nearest drain.

1.1.13 Fixture

Fixtures shall be water conservation type. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white,

acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, and drain fittings.

Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Internal parts of fixtures may contain ABS or other plastic material, if the material has provided satisfactory service for not less than 2 years.

1.2 Plumbing work

The plumbing system shall be installed complete with necessary fixtures, fittings, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A gate valve full port ball valve or ball valve and drain shall be installed on the water service line inside the building approximately 150 mm above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

1.2.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with IPC except that the drainage and vent system final test shall include the smoke test.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests static Head test
- c. Water Supply Systems Tests pressure test

Mechanical Work

1.1 Material

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products for at least 2 years. Unit shall be factory assembled, weatherproof packaged unit. The ACs must be standard and guaranteed. Contractor must install them correctly according to the client instruction. The units must have approved by the client

1.1.1 Water Cooler

Brand Name: Mashhad Davam,

Model Name: MD-800

Capacity: 6150 m²/hr, 220V

Water cooler feed from domestic water system.

1.1.2 Air Conditioning

Brand Name: Chigo

Model Name: R410a

Capacity: Heating and cooling 9000 Btu/h, 220V

Water cooler feed from domestic water system.

1.1.3 Ceiling Fan

Brand Name: Deluxe Model GFC,

Air Delivery: 250m³/min

Sweep Size: 1400 mm

Speed: 330 RPM

1.1.4 Exhaust Fan

Brand Name: Center fusion Damendah ,

Model Name: BEB-40/14Z4S

Capacity: 3000-4500 m³/hr

Motor revolution: 900 – 1400 RPH

1.1.5 Fire Extinguisher

Type: Portable Dry Powder Fire Extinguisher

Agent: Dry Powder

Capacity: 6 kg

Effective Rang: 5m

-- End of Section 03 --

Section 04

Electrical Work

1.1 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.1 Material and Equipment

All materials and equipment shall be new with no defects that are supplied and installed. All materials and equipment shall be noted on the Contractor's Submittal register. Equipment and material submittals shall contain all essential manufacturer's literature, specifications, reports, samples, tests, and or certifications as necessary to verify that the material and/or equipment meets specification requirements.

1.1.1 Material Guarantee All materials and equipment furnished shall be guaranteed against defective materials and workmanship for a period agreed with the contractor.

1.1.2 CODES, RULES, PERMITS AND FEES

The contractor shall issue all necessary notices, obtain all permits and pay all government taxes, fees, and costs, including utility connections or extensions for all work associated with this specification section. The contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of all necessary jurisdictional government departments.

1.2 Grounding

1.2.1 Grounding electrode system shall be accomplished to obtain the low resistance allowable for the system.

1.2.2 Grounding electrodes shall be placed not less than 60 cm. away from exterior surfaces and foundations. Wherever possible, they shall not be placed under concrete slabs.

1.2.3 Grounding electrodes shall be driven to a depth, not less than 60 cm below the original ground surface.

1.2.4 All non-current carrying metal parts of the electrical system shall be grounded.

1.2.5 The grounding conductors shall be copper.

11.1.5 ACCEPTANCE TESTING

11.1.5.1 All acceptance testing and testing procedures shall be incorporated in the contractors Quality Control Plan.

11.1.5.2 Acceptance testing shall, as a minimum, include testing for overall resistance of grounding electrode systems and the electrical continuity of all conductors and earth resistance.

1.3 Conduit and conduit wiring system

1.3.1 Description

This specification Section describes general requirements associated with the supply, manufacture and installation of electrical wiring and cable conduit and conduit system. Other provisions of the specifications pertaining to electrical requirements and equipment shall be applicable as appropriate.

1.3.1.1 Conduit for different systems shall be kept separate and individual. Conduit provided for systems having different voltages shall be installed separately and individually, with the exception of the control circuits, of 220 VAC rated operating voltage, and low voltage power circuit which shall be permitted to occupy the same conduit system.

1.3.1.2 Conduit systems for different panel-boards, distribution boards, motor control centers and terminal cabinets shall be separate and individual.

1.3.1.3 Conduits smaller than 12mm electrical trade size shall not be used.

1.3.1.4 The number of branch circuits contained in a single conduit shall be no more than three.

1.3.2 Polyvinyl Chloride Conduit

1.3.2.1 Shall be of UPVC type according to DIN requirements.

1.3.2.2 Shall be permitted for use with under plaster, underground grounding conductors, and lighting system grounding conductors.

1.3.2.3 Shall be permitted to serve as the ducting of duct banks.

Pull boxes for UPVC conduits shall be UPVC type as per applicable Din requirements.

Junction boxes for UPVC conduits shall be Adaptable UPVC square boxes as per applicable DIN requirements. Outlet boxes for UPVC conduits shall be UPVC gage boxes recessed in the wall.

1.4.1 Cable and wire

1.4.1.1 Conductor

a) Shall be solid annealed copper conductor.

b) Conductors with cross-sectional areas of 6sq.mm or more shall be Stranded conductors.

1.4.1.2 Insulation

- a) Polyvinyl chloride
- b) Maximum Conductor Temperature
- c) Not be less than 70 degree C.
- d) Rated Voltage
- e) Not be less than 750 VAC

1.4.1.3 Insulation

- a) Polyvinyl chloride
 - b) Sheath and Under Sheath
 - c) Polyvinyl chloride.
- #### 1.4.1.4 Maximum Conductor Temperature

- a) Not be less than 70 degree C
- b) Rated Voltage
- c) Not be less than 750 VAC

1.4.2 Phase ID and color coding

Phase – A : yellow

Phase – B : Red

Phase – C : Blue

Phase – N : White

Ground : yellow and Green

1.4.3 Grounding Systems

All non-Current carrying metal parts of equipment and materials of the electrical system and related systems shall be grounded.

The grounding conductors and grounded conductors shall be copper.

1.4.3.1 Grounding Electrodes Systems

Grounding electrodes shall be the solid copper rods having a diameter of not less than ½ inch and a length of not less than 10 feet.

1.4.4 Acceptance Testing

- I. All acceptances testing and testing procedures shall be incorporated in the Contractors Constriction Quality Control plan.
- II. All testing reports shall be submitted to the Engineer in accordance with consented procedures and requirements of the plan.
- III. Acceptance testing shall, as a minimum, shall include insulation resistance tests performed using a voltage of 500 V, prior to connecting low voltage cables of feeder and branch circuits to equipment.

1.4.5 Work Testing

1.4.5.1 the electrical installation shall be fully tested and inspected to assure that all equipment, devices and wiring has been properly installed, that all components meet specified requirements and all components operate as intended.

1.4.5.2 The conduit system shall be fully tested and inspected to assure that its components have been properly installed and meet specified requirements.

1.4.5.3 Special attention shall be given to ensure requirements are adhered to with respect to weatherproof enclosures, sealed location and sealed pouring.

1.4.5.4 Conduit drains, supports, fitting covers and other components shall be checked and verified.

1.4.5.5 Insulation resistance tests shall be performed using a 5000-volt DC meager on a 400-volt system.

1.4.5.6 Insulation resistance shall not be less than on mega-ohm per 1,000-volt rating.

1.4.6 Panel Boards

Material and equipment shall be standard products of a manufacturer regularly engaged in their manufacture and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. All materials shall conform to the requirements of these specifications.

Materials shall be of high quality, free from defects and imperfections, of recent manufacture, and of the classification and grades designed.

1.4.6.1 Nameplates

Nameplates shall be made of laminated sheet plastic or of anodized aluminum to provide white letters on a black background, the nameplates shall be fastened to the panels in proper positions.

1.4.6.2 Products

All bolts, studs, machine screws, nuts, and tapped holes shall be in accordance with ASME B1.1 or equivalent DIN, I.E.C., BS, or EN standards. The sizes and threes of all conduit and fittings, tubing and fittings, and connecting equipment shall be in accordance with ASME B1.20.1 or equivalent DIN, I.E.C., BS, or EN standards.

1.4.6.3 Circuit Breakers

Molded case circuit breakers shall conform to the applicable requirements of NEMA AB 1, UL 489, or DIN, IEC 60898-1 or BS EN 60947-2, standards. The circuit breakers shall be manually operated, shall be quick-make, quick-break, common trip type, and shall be of automatic-trip type unless otherwise specified or indicated on the drawings. All poles of each breaker shall be operated simultaneously by means of a common handle. The operating handles shall clearly indicate whether the breakers are in "On," "Off," or "Tripped" position and shall have provisions for padlocking in the "Off" position. Personnel safety line terminal shields shall be provided for each breaker. The circuit breakers shall be products of only one manufacturer, and shall be interchangeable when of the same frame size. Except as otherwise noted, the

circuit breakers, of frame sizes and the trip unit ratings as shown on the drawings, shall be provided with combination thermal and instantaneous magnetic trip units. Nonadjustable instantaneous magnetic trip units shall be set at approximately 10 times the continuous current ratings of the circuit breakers.

1.4.6.4 Panel boards

- Panel boards shall consist of assemblies of molded-case circuit breakers with buses and terminal lugs for the control and protection of branch circuits to motors, heating devices and other equipment operating at 380 volts ac or less. Panel boards shall be designed for installation in surface-mounted or flush –mounted cabinets accessible from the front only, as shown on the drawings.
- Enclosures shall meet the requirements of UL 50, IEC 60529. All cabinets shall be fabricated from sheet steel. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication.
- All panel boards shall be of the dead-front type with buses and circuit breakers mounted on a plate or base for installation as a unit in a cabinet. All bus bar shall be of copper. Copper bars and shapes for bus bar conductors shall conform to the applicable requirements of ASTM B 187. The size of buse and the details of panel board construction shall meet or exceed the requirements of NEMA PB 1, or BSEN 609472.
- Each branch circuit and the main bus bar where so specified or shown on the drawings, shall be equipped with molded-case circuit breakers having over current trip ratings as shown on the drawings. The circuit breakers shall be of a type designed for bolted connection to busses in a panel board assembly.
- Provide starter as specified for stand-alone full voltage no reversing starter, and provide with non fse disconnect switch mounted in common enclosure. Providing operating handle for disconnect mechanism with indication of control switch position, with enclosure door either opened or closed.
- Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than on coat of corrosion resisting paint in accordance with the manufacturer’s standard practice.
- Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semi glass finish. Equipment located indoors shall be light gray, and equipment located outdoors shall be light grey or dark gray, or according to international building code requirements and ASTM standards.

1.5 Interior Electrical Work

1.5.1 Grounding conductors: A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panel boards, the equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When switches or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

1.5.2 Wiring Methods

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of rigid plastic conduit, flexible conduit, or intermediate metal conduit. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

1.5.3 Cable Systems:

Cable systems shall be installed where indicated. Cables shall be installed concealed behind ceiling or wall finish where practicable. Cables shall be threaded through holes bored on the approximate centerline. Sleeves shall be provided through bond beams of masonry-block walls for threading cables through hollow spaces. Exposed nonmetallic-sheathed cables less than 1.2 meters above floors shall be protected from mechanical injury by installation in conduit or tubing.

1.5.4 Cable Splicing:

Splicing shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

1.5.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made, where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

1.5.5 Receptacles

1.5.5.1 Single and Duplex, 15 or 20-ampere, 220 volt: Single and duplex receptacles shall be rated 20 amperes, 220 volts, two-pole, three-wire, grounding type with polarized parallel slots...

1.5.5.2 Water proof Applications: Waterproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeling to identify the allowable use.

1.5.5.3 Special-Purpose or Heavy-Duty Receptacles: Special-Purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose, contact surfaces may be either round or rectangle.

1.5.6 Wall Switches

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type of the solder less pressure type having suitable conductor-released arrangement.

1.5.7 Underground Services

Unless otherwise indicated, interior conduit systems shall be stubbed out 1.5 m beyond the building wall and 600 mm below finished grade, for interface with the exterior service lateral conduits and exterior communications conduits.

1.5.8 Lighting Fixtures

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

1.5.8.1 Lamps: lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the government if more than 15% of their rated life has been used.

1.5.8.2 Lighting Fixture: suspended fixtures shall be provided with swivel hangers or hand-strights so that they hang plumb. Pendants, rods, or chains 1.2 meters or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Maximum distance between suspension points shall be 3.1 meters.

1.5.8.3 Emergency light Sets: Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

-- End of Section 04 --