SECTION 03100 - CONCRETE FORMWORK

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work included: This section shall apply to all concrete formwork and supporting falsework used for on-site casting of concrete. Form shall be of wood, metal or other materials, as specified or shown on the Drawings or as approved by the **ENGINEER.**

B. Related Work:

1. Section 03200, Concrete Reinforcement.

2. Section 03300, Cast-In-Place Concrete.

1.02 SUBMITTALS

A. Detailed plans for formwork, falsework or centering shall be furnished the **ENGINEER** if requested by him; however, the CONTRACTOR will not be relieved of responsibility for results obtained by the use of these plan s.

B. A sample of the form ties shall be submitted to the **ENGINEER** for approval.

1.03 DESIGN CRITERIA

A. Design of formwork shall include consideration of the following factors:

1. Rate and method of placing concrete.
2. Loads, including live, dead, lateral, and impact.
3. Selection of materials and stresses.
4. Deflection, camber, eccentricity, and uplift.
5. Horizontal and diagonal shore bracing.
6. Shore splices.
7. Cross-grain compression.
8. Vibration of concrete.
9. Loads on ground or on previously placed structure.

B. Falsework:

1. Falsework shall be designed to provide the necessary rigidity and to support the loads without appreciable settlement.

2. A design weight of 150 lbs. Per cubic foot shall be assumed for fresh concrete.

PART 2-PRODUCTS

2.01 MATERIALS

A. Wood Forms:

1. Unexposed Concrete Surfaces: Wood forms for unexposed concrete surfaces shall be No. 2 or better lumber.

2. Exposed Concrete Surfaces: Wood forms for exposed surfaces shall be plywood, or shall be shiplap or tongue and groove boards, of uniform thickness and width not exceeding 6 inches.

3. Smooth Surfaces: Wood forms for smooth concrete surfaces shall be made of plywood or shall have form lining as specified in Part B below.

4. Plywood for forms shall be Commercial Douglas fir, moisture resistant, concrete-form plywood not less than 5-ply and at least 9/16" thick.

B. Form Lining:

1. Plywood: Plywood for form lining shall be Commercial Douglas Fir, concrete-form exterior, 3-ply, not less than ¼" thick.

2. Fiberboard: Fiberboard for form lining shall conform to the requirements of Federal Specification LLL-F-311, Class B, not less than 3/16" thick

3. Absorptive Type Lining: Absorptive type lining shall be a material or combination of materials highly absorptive to water, readily removable from the concrete surface at the end of the curing period. The material shall be easily cut for fitting, free from any element which may discolor the concrete or interfere with the normal chemical reaction of the cement, and shall have an absorptive coefficient to eliminate voids and pitting while producing a dense and uniform concrete surface.

C. Metal Forms:

1. Metal forms shall be of a type approved by the **ENGINEER** that will produce surfaces equal to those specified for wood forms.

2. Holes shall be plugged and uneven surfaces eliminated in a manner approved by the **ENGINEER.**

D. Form Coating:

1. Form coating shall be of a clear amber color and shall form a continuous, tough, hard film highly resistant to alkali and moisture.

2. The film shall not be deposited upon or absorbed with the concrete.

3. The form coating shall be approved by the **ENGINEER** prior to the application.

E. Form Ties:

1. Ties shall be adjustable in length and free of devices which will leave a hole or depression back of the exposed surface of the concrete no larger than a7/8" in diameter.

2. Ties shall be of such make that when forms are removed, no metal shall be within one inch of the finished surface.

3. Wire ties will not be permitted except in unexposed locations where discoloration will not be objectionable.

EXECUTION

PREPARATION

A. Falsework:

1. Falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation.

2. The **CONTRACTOR** may be required to employ screw jacks or hardwood wedges to take up any settlement in the formwork either before or during the placing of concrete.

3. Falsework which cannot be founded on a satisfactory footing shall be supported on piling which shall be spaced, driven and removed in a manner approved by the **ENGINEER.**

4. Falsework shall be so set that after its removal, the finished structure will have the finished grade specified or indicated on the drawings.

5. Arch centering: Provision shall be made by means of suitable wedges, sand boxes or other devices for the gradual lowering of centers and rendering the arch self-supporting. When directed, centering shall be placed upon approved jacks to take up and correct any slight settlement which may occur after the placing of masonry has begun.

B. Form Coating:

1. The original application shall consist of two coatings evenly applied.

2. Subsequent reuses of the forms without recoating shall be permitted at the discretion of the **ENGINEER**, but forms shall not be used more than three times without recoating.

3. After application, any surplus material on the form surface and/or the reinforcing steel shall be removed.

4. Forms for unexposed surfaces may be thoroughly wetted with water in lieu of coating immediately before the placing of concrete.

C. Reuse:

1. The shape, strength, rigidity, water tightness, and surface smoothness of reused forms shall be maintained at all times.

2. Any warped or bulged lumber must be resized before being reused.

END OF SECTION

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 – GENERAL

1.01 DESCRIPTION

This work shall include furnishing and placing all reinforcing steel or wire mesh used in cast-in-place concrete construction except prestressed strands and wires.

A. Related Work:

1. Section 03100, Concrete Formwork.

2. Section 03300, Cast-In-Place Concrete.

1.01 DESCRIPTION

This work shall include furnishing and placing all reinforcing steel or wire mesh used in cast-in-place concrete construction except prestressed strands and wires.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

Reinforcing steel shall be store on platforms, skids or other supports which will keep the steel above ground, well drained and protected from damage.

1.03 SUBMITTALS

A. Shop Drawings: Show sizes and dimensions for fabrication and placing of reinforcing steel
and bar supports. Indicate bar schedules, stirrup spacing and diagrams of bent bars.

B. Certificates: Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcement Bars:

1. Bars shall be deformed and shall conform to ASTM A-615, Grade 60, as specified on the plans.

1. Unless otherwise shown on the drawings, bars less than 3/8" in diameter (No. 3) shall not be used in the work, except for stirrups, ties and distribution steel.

B. Wire mesh shall be furnished in flat sheets and shall conform to ASTM A-185.

C. Wire ties shall be 18 gage black annealed wire, or patented wire ties approved by the **ENGINEER**.

2.02 FABRICATION

A. Bends:

1. Bent bar reinforcement shall be cold bent to the shape shown on the drawings.

2. Unless otherwise specified or shown on the drawings, bends shall be made in accordance with the requirements of ACI 315.

B. Reinforcing details, shown on the drawings, shall govern the furnishing, fabrication and placing of reinforcement, in so far as they apply.

PART 3 – EXECUTION

3.01 PREPARATION

A. Cleaning:

1. Before placing, all reinforcement shall be thoroughly cleaned of rust, mill scale or coatings, including ice, which would reduce or destroy the bond.

2. Reinforcement appreciably reduced in section shall not be used.

3. Following any substantial delay in the work, previously placed reinforcement left for future bonding shall be inspected and cleaned.

B. Reinforcement shall not be cut with a torch or in such a manner as to alter the mechanical properties of the reinforcement material.

C. Bars with kinks or bends not shown on the drawings shall not be placed.

3.02 INSTALLATION

A. Ties and Supports:

1. All steel reinforcement shall be accurately placed in the positions shown on the drawings and firmly held during the placing and setting of concrete.

2. Bars shall be tied at every intersection.

3. Wire tie ends shall point away from the form.

B. Splices:

1. All reinforcement shall be furnished in full lengths as indicated on the drawings.

2. Splicing of bars, except where shown on the drawings, will not be permitted without written approval of the **ENGINEER**.

3. Splices shall be staggered as far as possible.

4. Unless otherwise shown on the drawings, bars shall be lapped sufficiently to secure full bond, but in no case less than 30 bar diameters to make the splice. The bars shall be placed in contact and wired together.

5. Welding of reinforcing steel shall be done only if shown on the drawings or authorized in writing.

6. Sheets of mesh or bar mat reinforcement shall overlap each other sufficiently to maintain a uniform strength, shall be securely fastened at the ends and edges, and shall overlap at least one mesh in width.

7. No splicing of main bars in girders, beams or slabs will be permitted.

C. Anchor Bolts:

1. Where anchor bolts interfere with reinforcing steel, the steel position shall be adjusted to permit the placement of the anchors in their proper locations.

2. The **ENGINEER** shall approve such adjustments prior to placement of concrete.

D. The minimum concrete covering steel reinforcement shall be as follows.

Location	Minimum Cover
Cast against and permanently exposed to earth:	3 in.
Exposed to earth or weather:	
#6 through #18 bars	2 in.
#5 through 5/8 in. wire and smaller	1-1/2 in.
Not exposed to weather or in contact with the ground:	
Slabs, walls, joists:	
#14 and #18 bars	1-1/2 in.
#11 and smaller	¾ in.
Beams, girders, columns, principal reinforcement,	
Ties, stirrups or spirals:	1-1/2 in.
Shells and folded plat members:	
#6 bars and larger	½ in.
#5, 5/8 in. wire and smaller	½ in.

3.03 WELDED WIRE FABRIC

Lay welded fabric continuously, with edges and ends overlapping adjoining sheets a minimum of on full mesh plus 2", tied and placed over all piping and conduit. Lift the fabric by approved methods to the center of slabs during the placing of concrete, or properly support in this position. Where required, construct bulkheads at construction joints and screeds to place the fabric in the proper position.

3.04 CLEANING

Clean reinforcement prior to placing concrete to remove scale, oil, ice or the coatings that will destroy or reduce the bond, including mortar from previous concrete pours.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Furnish and Install:

1. Formed Cast-in-Place Concrete.

2. Concrete Flatwork.

3. Cast-in-Place Concrete for detention outlet structure, or Portland Cement Concrete Paving or other work required by the Specifications or Drawings.

1.02 RELATED WORK

A. Section 03100, Concrete Formwork.

B. Section 03200, Concrete Reinforcement.

1.03 QUALITY ASSURANCE

A. Testing Agency: All testing will be conducted by an approved testing laboratory. See Section 01410.

B. Source Quality Control: The **ENGINEER** shall be offered uninterrupted access to the ready-mix batching plant while the work is in progress.

C. Record of Work: Keep a record listing the time and date of placement of concrete for the structure. Such record shall be kept until the completion of the project and shall be available to the **ENGINEER** for examination at any time.

1.04 REFERENCES

Reference Standards: Except as modified or supplemented in these specifications, structural concrete shall meet the requirements of the latest version of the following standards. Refer to the standards for detailed requirements.

A. ACI 301 – Specifications for Structural Concrete for Buildings (Revised 1981).

B. ACI 304 – Recommended Practice for Measuring, Mixing, Trans-porting and Placing Concrete.

C. ACI 305 – Hot Weather Concreting.

D. ACI 306 – Cold Weather Concreting.

E. ACI 318 – Building Code Requirements for Reinforced Concrete.

1.05 SUBMITTALS:

A. Mix Designs: Prior to placing any concrete, submit concrete mixes for approval in accordance with Section 01300 if requested by **ENGINEER**. Separate mix design shall be submitted for each type of concrete to be used in the project. Submittals shall include all information used in designing the mixes.

B. Test Reports: Reports of control test, special tests and core tests shall be distributed by the testing laboratory in accordance with Section 01410.

C. Submit delivery ticket for each load delivered to site. Include:

1. Mix identification.

2. Time water added.

3. Time unloaded.

4. Amount of initial and supplemental water added.

1.06 DELIVERY, STORAGE AND HANDLING

A. Hauling Time: Discharge concrete transmitted in a truck mixer, agitator or other transportation device within 1-1/2 hours after the mixing water has been added.

B. Extra Water: Deliver concrete to the job in exact quantities required by the design mix. Should extra water be required before depositing the concrete, the **CONTRACTOR'S** superintendent shall have sole authority to authorize the addition of water. Any additional water added to the mix after leaving the batch plant shall be indicated on the truck ticket and signed by the person responsible. Where extra water is added to the concrete it shall be mixed thoroughly for 40 revolutions of the drum of 3-1/2 minutes at mixing speed, whichever is greater. Samples for control tests shall be taken after additional water has been thoroughly mixed into concrete.

C. Store cement in water tight enclosures and protect against dampness, contamination and warehouse set.

D. Stockpile aggregates to prevent excessive segregation or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stockpile.

E. Store admixtures to prevent contamination, evaporation, or damage. Protect liquid admixtures from freezing or harmful temperature ranges.

F. Remove all mud, oil, loose rust or mill scale and other foreign material, from reinforcing steel prior to placing concrete.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Cold Weather Concreting:

a. Refer to ACI 306, "Recommended Practice for Cold Weather Concreting".

b. Temperatures of concrete when placed shall not be less than the following:

Air Temp. °F	Minimum Concrete Temp. °F Sections with Least Dimension Under 12"	12" and Over

30 to 45	60	50
0 to 30	65	55
Below 0	70	60

c. When placed, heated concrete shall not warmer than 80°F.

d. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed, and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35°F.

e. Protect the concrete from freezing during specified curing period.

f. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections. Do not permit heating units to locally heat or dry the concrete. Do not use combustion heaters during the first 24 hours unless the concrete is protected from exposure to exhaust gases which contain carbon dioxide.

2. Hot Weather Concreting:

a. Refer to ACI 305, "Recommended Practice for Hot Weather Concreting".

b. Take precautions when the ambient air temperature is 90°F or above. Temperature of concrete when placed shall not exceed 85°F.

c. Cool forms and reinforcing to a maximum of 90°F by spraying with water prior to placing concrete.

a. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour.

b. Approved set-retarding and water reducing admixtures may be used with **ENGINEER'S** approval when ambient air temperature is 90°F or above to offset the accelerating effects of high temperature.

3. Do not place concrete during rain, sleet or snow unless adequate protection is provided. Do not allow rainwater to increase the mixing water or damage the surface finish.

B. Protection: Protect newly finished slabs from rain damage. Cover walls, glazing and other finish materials with polyethylene or otherwise protect from damage due to placing of slabs or sidewalks.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Concrete Materials:

1. General: Provide ready-mixed concrete conforming with ASTM C94. Onsite mixed concrete will not be allowed.

2. Cement: ASTM C150-Type II for all concrete unless indicated otherwise.

3. Aggregate: Fine aggregate shall be natural sand and coarse aggregate shall be gravel or crushed stone, all conforming to ASTM C33. Maximum coarse

aggregate size shall not be greater than ¾" and shall conform in gradation to the following table:

Percent Passing Seive Sizes	
Sieve Size	Coarse Aggregate
¾"	90-100

4. Air Entraining Agent: ASTM C260.

5. Admixtures: Use only as specified or as approved by **ENGINEER**.

6. Mineral Admixtures: ASTM C618.

7. Water: Use clean, fresh potable supply.

A. Miscellaneous Materials:

1. Curing Compound – Vertical Surfaces: Conform to ASTM C309-81

2. Curing Compound – Horizontal Surfaces: Propulsion - 200

2.02 MIXES

A. Design: Design mixes shall conform to the mix type specified in Section 2.03. Proportion ingredients for mixes in accordance with ACI 301-84, Section 3.9. Obtain this information in accordance with the latest ASTM Specifications. Should a special mix be required due to structural requirements, weather or materials, submit samples of cement and aggregate to be used to approved testing laboratory. The testing laboratory will make and analysis of the materials and design the proper mix to be used.

B. Admixtures:

1. General: No admixtures will be allowed except as specified herein unless authorized by the **ENGINEER**. All requests for approval or substitution must be made by the **CONTRACTOR** and be accompanied by sufficient chemically compatible with cementitious materials and all other admixtures used in the mix. All admixtures shall be chloride free. No calcium chloride shall be added to concrete.

2. Acceptable Manufacturers: Admixtures shall be approved by the **ENGINEER** and supplied by on of the following manufacturers:

a. Protex

b. Master Builders

c. Gifford-Hill

d. Sika

3. Accelerating Admixtures: Conform to ASTM C494 Type C or E. Accelerators shall be chloride free. Dosage shall be per manufacturer's recommendations.

4. Water Reducing and Set Controlling Admixtures: Conform to ASTM C494, Type A or D. Dosage shall be per manufacturer's recommendations.

C. Chloride Ion Content: The maximum water soluble chloride ion concentration in the concrete mix shall not exceed 0.15 % by weight of water.

D. Slump: Design water-cement ratio to provide slumps indicated under mix type at placement. Concrete to be placed by pumping shall have a maximum slump of 6" at the pump.

E. Mixing: Ready-mix concrete shall conform to provision of ASTM C-94.

2.03 CONCRETE MIX TYPES

A. The following concrete mixes will be required:

Mix A – For Sidewalks, Curb and Gutter, Cross-Pans, and Retaining Walls
4000 psi
Type II Cement
¾" Maximum Aggregate Size
6% Plus or Minus 1% Entrained Air
4" Maximum Slump

B. A water reducing agent admixture shall be optional for mixes. See Section 2.02 B.

C. All mix designs shall be identified by the mix identification letter.

2.04 REINFORCING STEEL

A. Bars, refer to ASTM A615, Grade 60 unless specified otherwise.

B. Welded Wire Fabric, refer to ASTM A135 or A497.

C. Fabrication, refer to ACI 315 and 318 unless shown otherwise on drawings.

PART 3 – EXECUTION

3.01 INSPECTION

ENGINEER'S Inspection: Provide ample notice to the **ENGINEER** to allow him to examine forms and reinforcement just before concrete is poured and to observe the placing of concrete. Do not begin placement until inspection of **ENGINEER** is obtained.

3.02 PREPARATION

A. Do not begin concrete work until all operations are complete enough to allow placement to be carried on as a continuous operation for the entire section that is to be placed. Clean all equipment for mixing and transporting the concrete. Forms shall be cleaned of all debris and ice and shall be wetted (except in freezing weather) and coated as specified under Concrete Formwork. If water accumulates in the forms it shall be pumped out before concrete is deposited. Clearly mark finish top surface of vertical members on the form walls.

B. Protection: Cover walls, glazing, and other finish materials with polyethylene or other wise protect from damage due to pouring of slabs or sidewalks.

3.03 FORMING

A. Insure that forms are sufficiently braced to hold position and shape during placing and curing.

B. Leave forms in place until concrete has achieved sufficient strength.

C. Exercise care in removing forms so as not to chip, crack or damage concrete.

3.04 REINFORCEMENT

A. Install reinforcing steel where shown on drawings or specified

B. Support reinforcing steel as required by ACI 315.

3.05 PLACEMENT

A. General: Follow recommendations of ACI 301-84, Chapter 8.

B. Placement: Place concrete in approximately uniform horizontal layers not over 2 feet in height. Piling up of the concrete in the forms or chuting in such a manner to separate the aggregates will not be permitted. Concrete shall not be dropped over 4'-0".

C. Water: Prevent accumulations of water on the surface of the concrete due to water gain, segregation, or other causes, during placement or compacting, as far as possible by adjustments in the mixtures. Make provision for removal of such water as may accumulate so that under no circumstances will no concrete be placed in such accumulation.

D. Compaction: Compact concrete during and immediately after depositing by means of mechanical vibrators. Supplement by hand spading at corners and angles of the forms in other difficult areas. Mechanical vibrator to cycle at 10,000 cycles per minute or more.

E. Finishing: Where tops of poured walls are to form a finished surface, concrete shall be immediately finished in the form by a skilled cement finisher. Walls or surfaces not finished to a level will be ordered removed and replaced.

F. Mechanical vibrators need not be used for thrust restraints.

3.06 JOINTS

A. Contraction joints, minimum depth ¼ thickness of concrete.

1. Hand formed with tool, header board, or trowel pushed into surface to move all aggregate from joint

2. Saw joints as soon as concrete can support equipment without marring, no later than 12 hours after placement. First joints sawed approximately 60'- 0" apart, intermediate joints sawed after initial joints, joints to be straight, true and perpendicular to centerlines.

B. Longitudinal joints in conformance with drawings.

1. Fabricated steel or plastic strip held rigidly in place with adequate pins driven into subgrade.

2. Joints constructed by forms with recess and tie bars.

3. Sawed joints with suitable guidelines to ensure joint is true to line. Saw as soon as possible to prevent erratic or uncontrolled cracking.

C. Construction joints perpendicular to centerline at end of each day's work. Use dowels, bars or load transfer devices in all construction joints in accordance with the drawings.

D. Expansion joints with preformed joint filler in a vertical position, deviating not more the ¼" from a straight line. Install at all existing and proposed structures projecting through, into, or against pavement, in accordance with drawings.

E. Install joint sealant at temperatures above 50°F. in accordance with the manufacturer's recommendations. Clean all dust, debris and water from joint.

3.07 EMBEDMENTS

A. Accurately position and securely fasten all anchor bolts, casting, steel shapes, conduit, sleeves, masonry anchorage, and other materials to be embedded in the concrete.

B. Install conduits between reinforcing steel in walls or slabs with reinforcing in both faces and below reinforcing in slabs with only one layer of reinforcing steel.

C. Embedments shall be clean when installed. Remove concrete spatter from all surfaces not in contact with concrete.

3.08 FINISHING FORMED SURFACES

A. Rough Form Finish:

1. Rough form finish is acceptable for surfaces not exposed to view such as surfaces in contact with earth backfill.

2. Repair and patchy all tie holes and defects with mortar.

3. Remove all fins.

3.09 SLAB FINISHES

A. Broom or belt finish:

1. Use for sidewalks, ramps, curbs, gutters and driveways.

2. After completion of floated finish draw a broom or burlap belt transverse cross the surface.

3.10 TREATMENT OF FORMED SURFACES

A. Form Removal: Finish concrete surfaces covered by formwork immediately after forms have been removed. Do not expose more surface area than can be finished in one working day.

B. Patching: Patch voids, honeycombs or damaged areas in accordance with Chapter 9 of ACI 301. Cut out large defective areas a minimum of 1" deep, and patch as specified. Add white cement to patching grout as required to match color of existing concrete where patches are exposed to view. Patch all tie holes.

C. Laitance: Remove deposits of laitance occurring on the top of the concrete surfaces as soon as the concrete has hardened sufficiently to prevent injury to the concrete. Repair areas where laitance is removed as specified for patching.

D. Unexposed Concrete Surfaces: Treat surface of concrete wall, slabs, beams and columns, which are to be covered by subsequent work, as specified under patching.

E. Unpainted Exposed Concrete Surfaces: Concrete surfaces, both interior and exterior, to remain exposed but unpainted shall be carefully protected for damage. and soiling during the progress of the work. Patch where required as specified under Patching. Upon completion of the work, reclean damaged or soiled surface as required to make clean, smooth and finished in every respect.

3.11 SANITARY SEWER MANHOLES

A. Provide smooth steel trowel finish on inverts.

B. Provide broom finish on benches.

3.12 DEFECTIVE CONCRETE

A. Remove and replace defective concrete as directed by the **ENGINEER**.

B. Repair in accordance with ACI 301, Chapter 9.

3.13 CURING AND PROTECTION

A. Protection: Protect exposed surfaces of concrete from premature drying and frost. Protect freshly placed concrete from rain damage. Protect finished slabs from mortar leakage from pouring of slabs above.

B. Form Removal: Do not remove forms until such time as specified. Remove carefully to not injure the concrete surface. Protect edges and corners to prevent cracking, chipping or other damage and premature drying.

C. Vertical Surfaces: Clean surfaces of loose sand, mortar, debris and grout; spray lightly with water and coat with a clear or translucent curing compound the same working day that the forms are removed.

D. Horizontal Surfaces: As soon as possible after placing concrete, coat exposed horizontal surfaces with curing compound as specified and cover with a white polyethylene sheeting of a minimum of 6 mil nominal thickness. Give special attention to securing adequate curing of slab edges. Provide polyethylene sheeting as wide as practical, edges lapped a minimum of 6", weighted to prevent blowing, and sealed to prevent loss of moisture. Keep sheeting in place a minimum of seven (7) days.

E. Cleaning: Clean off all stains or discoloration's from exterior exposed concrete walls using methods approved by the **ENGINEER**. If diluted acid is used, surfaces shall be thoroughly flushed with water to remove all acid following cleaning. Use only fiber brushes if brushing is required.

F. Protect concrete surfaces from staining, cracking, chipping, and other damage during progress of the work, and leave in good condition upon completion.

G. Keep concrete continuously moist for at lest 7 days after placement by use of wet burlap, wet burlap, wet absorptive mats, waterproof sheets, or membrane curing.

H. Maintain concrete within 50° to 70°F range during curing.

3.14 FIELD QUALITY CONRTOL

A. General: Testing will be conducted by an approved testing laboratory. See Section 01410.

B. Test Priority: Control tests shall be used to determine the concrete quality throughout the project; however, special tests shall have precedence over control tests, and core tests shall have precedence over all previous tests.

C. Tests: Cooperate fully with those making tests. The following test and procedures are subject to change during construction at the discretion of the **ENGINEER**.

1. Test Reports: In accordance with Section 01410.

2. Slump Tests: Provide necessary equipment and make tests in conformity with ASTM C143-78 as frequently as directed by the **ENGINEER**. The tests shall be made by a person thoroughly familiar with the requirements specified. Should the slump exceed the limits stated for Concrete Mix Types in Part 2, the batch shall be rejected. Keep an accurate record of the time, location in the work, and the results of the slum test which shall be available for inspection by the **OWNER** and the **ENGINEER**. When concrete is placed by pumping, slump tests shall be made at the end of the discharge hose. Conduct test for each strength test sample and whenever consistency of concrete appears to vary.

3. Strength Tests: Control tests of concrete work shall be made on every 50 cubic yards or fraction thereof concrete placed including site concrete and, in any case, a minimum of once during each day's pour. Each test sample shall consist of three standard 6" test cylinders cast and cured in accordance with ASTM C31-83 and ASTM C172-82.

4. Air Contact: Conduct test from one of first three batches mixed each day and for each strength test sample.

5. Special Test: Should the CONTRACTOR desire control tests to facilitate the early removal of forms, they shall be made in addition to those specified for control tests

6. Core Tests: If, at any time, the concrete control test specimens show a compressive strength at 28 days of less than that required in the Specifications, or if the concrete has been frozen before it has taken the final set, so severely that, in the opinion of the **ENGINEER**, its strength has been adversely affected, the **CONTRACTOR** shall, at his own expense, have sufficient core tests taken, the number and location to be approved by the **ENGINEER** on such portions of the work as may have been affected to determine the actual conditions of the concrete. The securing, preparing and testing shall be in accordance with ASTM C42-82. Should the tests reveal that the concrete does not meet the requirements of this specification, the **CONTRACTOR** shall, at his own expense,

replace the entire section involved or make corrections deemed necessary by the **ENGINEER**.

END OF SECTION