

- A. Where obstructions make it difficult to drive certain piles at the locations shown and to the required depth, the CONTRACTOR shall resort to all usual methods to install piles as required. If, in the judgement of the OWNER, the CONTRACTOR is unable to complete the proper driving of any pile, the OWNER may order an additional pile or piles driven for which the CONTRACTOR will be paid in accordance with the Unit Prices established in this contract.
- B. Piles abandoned because of obstructions encountered, shall be cut off or pulled out at the discretion of the OWNER. The CONTRACTOR will be paid on the basis of the pile length driven if the pile is pulled out.

PART 4 DYNAMIC TESTING

4.01 Summary of Work

- A. Dynamic testing involves attaching at least two strain transducers and two accelerometers to the pile near the pile head during initial driving. A cable connects the gages near the pile head with the Pile Driving Analyzer located a safe distance from the pile, but not more than 330 ft (100 m) from the pile.
- B. Dynamic pile testing shall also be performed on 2 production piles as chosen by the Owners On-Site Representative. The production pile testing shall be performed during initial driving to monitor hammer and drive system performance (additional tests required following any hammer or driving system modifications or if another hammer is to be used on the site), assess pile installation stresses and integrity, as well as to evaluate pile capacity

4.02 Equipment and Personnel

- A. The dynamic monitoring shall be performed using a Pile Driving Analyzer Model PAK or PAL. All equipment necessary for the dynamic monitoring such as gages, cables, etc., shall be furnished by the Dynamic Testing Consultant. The equipment shall conform to the requirements of ASTM D-4945-00, Standard Test Method for High Strain Dynamic Testing of Piles.
- B. An engineer with a minimum of 10 years of experience and who has achieved Advanced Level or better on the Foundation QA Examination for Providers of PDA Testing Services shall be in charge of Pile Driving Analyzer (PDA) operation and of result interpretation, either on site or by remote connection (PAL-R).
- C. To prepare the pile for transducer attachment, either a generator or a DC drill of sufficient power shall be available.

4.03 Construction Access

- A. Prior to lifting the pile to be dynamically tested, the Contractor shall provide a minimum of 3 ft (1 m) of clear access to 180 degree opposite faces of the pile for pile preparation. The Dynamic Testing Consultant or the Contractor's personnel shall then drill and prepare holes for gage attachment.
- B. The Contractor's personnel shall attach the gages to the pile after the pile has been driven to the penetration depths requested by the Dynamic Testing Consultant. Driving shall then continue using routine pile installation procedures. When the level of the gages is within 1 ft (0.3 m) of any obstruction endangering the survival of sensors or cables, driving shall be halted to remove the gages from the pile. If additional driving is required, the obstruction shall be removed or the pile shall be spliced and the gages shall be reattached to the head of the next pile segment prior to the resumption of driving.

4.04 Testing Procedures

- A. Preconstruction Wave Equation Analyses
 1. Ten days prior to driving the indicator piles, the Contractor shall submit the pile and complete driving equipment data form to the Owners On-Site Representative. The Dynamic Testing Consultant shall use the submitted information to perform wave equation analyses and shall prepare a summary report of the wave equation results. The wave equation analyses shall be used to assess the ability of the proposed driving system to install the pile to the required capacity and desired penetration depth within the allowable driving stresses.
 2. Approval of the proposed driving system by the Owners On-Site Representative shall be based upon the wave equation analyses indicating that the proposed driving system can develop a pile capacity of 180 kips (pile design load times 2.5) at a driving resistance not greater than 15 blows per inch within allowable driving stress limits. The hammer should also be sized such that the penetration per blow at the required ultimate capacity does not exceed 0.5 inches (12 mm).
 3. A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the pile installation stresses predicted by wave equation analysis or calculated by the Pile Driving Analyzer measurements exceed the following maximum values:

Compression Stresses - 45ksi
Tension Stresses - 45ksi

B. Production Pile Testing

1. Dynamic pile testing shall be performed on 2 piles during initial driving over the duration of the production pile installation. The frequency and purposes of the dynamic testing shall be as defined in 4.01 B.
2. The Owners On-Site Representative may request additional piles to be dynamically tested if the hammer and/or driving system is replaced or modified, the pile type or installation procedures are modified, the pile capacity requirements are changed, unusual blow counts or penetrations are observed on any other piling behavior differ from normal installation.

4.05 Dynamic Testing Reports

- A. Within one day of production pile testing, the Dynamic Testing Consultant shall prepare a hand written daily field report summarizing the dynamic testing results. As a minimum, the daily reports shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Non-uniform piles require a CAPWAP analyses for capacity determination. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be submitted to the Owners On-Site Representative.
- B. CAPWAP analyses shall be performed on all of the production piles dynamically tested. CAPWAP analyses shall be performed by an engineer who has achieved Advanced Level or better on the Foundation QA Examination for Providers of PDA Testing Services.
- C. Once per month, or upon completion of various project or testing phases, the Dynamic Testing Consultant shall prepare a formal report summarizing the dynamic testing results. This report shall be submitted no later than ten working days after the completion of the reported part of the testing.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 02483

LANDSCAPE DEVELOPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions (if any) and Division-1 Specification Sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of landscape development work is shown on Drawings.
- B. In addition to general requirements applicable to landscape work, this Section includes requirements for the following:
 - 1. Preparation of planting soil.
 - 2. Provide new topsoil.
 - 3. Provide soil amendments.
 - 4. Provide fertilizers.
 - 5. Provide ditch and slope stabilization fabric.
 - 6. Provide miscellaneous landscape materials.
 - 7. Provide trees, types and sizes as indicated on the drawings.

- C. Refer to earthwork sections for requirements of general excavation, filling, and grading in areas to receive landscape work.

- D. Topsoil for landscape work is available at site. Furnish additional topsoil as required as specified under "Materials".

1.03 QUALITY ASSURANCE

- A. General: Comply with applicable federal, state, county, and local regulations governing landscape materials and work.

B. Employ only experienced personnel familiar with required work.

1.04 SUBMITTALS

A. Product Certification: Submit certificates of inspection as may be required by governing authorities to accompany shipments. For standard products, submit manufacturer's certified analysis. For other materials, submit analysis by a recognized laboratory made in accordance with methods established by Association of Official Agricultural Chemists, wherever applicable.

B. Planting Schedule: Submit proposed planting schedule indicating anticipated dates and locations for each type of planting.

1.05 PRODUCT HANDLING

A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.06 JOB CONDITIONS

A. Planting Time: Planting for seed specified in Part 2 shall be completed between 4/15 and 9/15. For areas that cannot be completed within this time frame, provisions as outlined in Section 3.02 for fall and winter protection shall be implemented.

B. Utilities: Determine location of underground utilities and perform work in a manner, which will avoid damage. Hand excavate, as required.

1.07 SUBSTITUTIONS

A. Do not make substitutions of planting materials. If required landscape material is not obtainable, submit proof of non-availability to Owner, together with proposal for use of equivalent material. When authorized, adjustment of contract amount (if any) will be made by change order.

1.08 SPECIAL PROJECT WARRANTY

A. Warranty lawns through specified maintenance period, and until final acceptance.

B. Warranty trees for a one-year warranty period from final Project acceptance.

PART 2 PRODUCTS

2.01 SEEDS

- A. Provide seed with not less than 90% germination for each variety, 85% purity, and not more than 1% weed content. Seed mixture shall be proportioned by weight as follows:

Creeping Red Fescue	1.4 lbs/1000 sq. ft.
Kentucky Bluegrass	1.4 lbs/1000 sq. ft.
Perennial Ryegrass	0.3 lbs/1000 sq. ft.

2.02 NEW TOPSOIL

- A. Provide topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.
- B. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at site of work. Obtain topsoil from naturally well drained sites where topsoil occurs in depth of not less than 4"; do not obtain from bogs or marshes.

2.03 SOIL AMENDMENTS

- A. Lime: Natural limestone containing equivalent to 50% calcium plus magnesium.

2.04 FERTILIZER

- A. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources, containing following percentages of available plant nutrients:
 - 1. Provide fertilizer. A granular commercial grade fertilizer containing 10-20-20 (N-P205-K20).

2.05 MULCH

- A. Provide hay or straw mulch.

2.06 MULCH ANCHORING

- A. Mulch shall be anchored to all seeded surfaces.

- B. Provide biodegradable mulch netting or other Owner approved anchoring system.
- C. Mulch shall be anchored per manufacturer's recommendations.

2.07 EROSION CONTROL BLANKETS

- A. Provide erosion control blankets in all drainage swales and on all side slopes as noted on the Drawings or as specified below:
 1. Drainage Swales: Provide XCEL Regular R1 erosion control blankets or Owner approved alternate.
 2. Side Slopes: 2 Horizontal to 1 Vertical: Provide XCEL Superior S2 erosion control blankets or approved alternate.

2.08 PREPARATION OF PLANTING SOIL

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Mix soil amendments and fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

PART 3 EXECUTION

3.01 INSPECTION

- A. Landscape Installer must examine subgrade upon which work is to be performed, verify subgrade elevations, observe conditions under which work is to be performed, and notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. General:

1. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. Mulching or seeding and mulching shall be completed within 14 days of soil exposure.
2. Cooperate with other subcontractors and trades working in and adjacent to landscape work areas. Examine drawings, which show

development of entire site and become familiar with scope of other work required.

3. For fall and winter protection (9/15-4/15) provide temporary anchored mulch with dormant seed.

3.03 SCHEDULE OF APPLICATION

- A. Topsoil - Provide loam to a minimum depth of 4 inches in all areas shown or disturbed by Contractor.
- B. Limestone - Apply at the rate of 140 lbs. per 1,000 sq. ft.
- C. Fertilizer - Apply at the rate of 30 lbs. per 1,000 sq. ft.
- D. Seed - Apply at the rate of 3 lbs. per 1,000 sq. ft.
- E. Mulch - Apply at the rate of 100 lbs. per 1,000 sq. ft. for hay or straw. All mulch shall be anchored. On critical areas such as side slopes, basin embankment and channel bases, biodegradable mulch shall be utilized unless indicated otherwise on the drawings. Anchoring shall be per manufacturer's recommendations.

3.04 LANDSCAPE MAINTENANCE

- A. Begin maintenance period immediately after planting of landscape materials.
- B. Maintain lawns for periods required to establish an acceptable lawn, but not less than following period:
 1. Seeded lawns, not less than 60 days, after date of substantial completion.
 2. If seeded in fall and not given full 60 days of maintenance, or if not considered acceptable at that time, continue maintenance during following spring until acceptable lawn is established.

3.05 INSPECTION AND ACCEPTANCE

- A. When landscape work is substantially completed, including maintenance, Owner will, upon request, make an inspection to determine acceptability.
 1. Landscape work may be inspected for acceptance in parts agreeable to Owner, provided work offered for inspection is complete, including maintenance.

B. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Owner and found to be acceptable.

3.06 CLEAN-UP, PROTECTION, AND REPAIRS:

A. During landscape work, store materials, and equipment where directed. Keep pavements clean and work area in an orderly condition.

B. Protect landscape work from loss, damage, and deterioration during storage, installation, and maintenance periods.

END OF SECTION

TECHNICAL SPECIFICATIONS

SECTION 02741

HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving overlay.
4. Asphalt surface treatments.

- B. Related Sections include the following:

1. Section 02200 "Earthwork" for aggregate subbase and base courses.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
 1. Standard Specification: Division 400- Maine Department of Transportation (MDOT)
 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Qualification Data: For manufacturer
- E. Material Test Reports: For each paving material.
- F. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with Division 400 of MDOT for asphalt paving work.
- D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 50 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 50 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 50 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 5821, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: Shall conform to the requirements of AASHTO M 320.
- B. Prime Coat: AASHTO M 320, medium-curing cutback asphalt.
- C. Prime Coat: Asphalt emulsion prime complying with Maine DOT requirements.
- D. Tack Coat: AASHTO M 140, emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: AASHTO M 29, Grade Nos. 2 or 3.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: Hot Bituminous Pavement Grading "B".
 - 3. Surface Course: Hot Bituminous Pavement Grading "C".
- B. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: 2 inch.
 - b. Surface Course: 1 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at minimum temperature of 250 deg F.
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. Base Course: 1/4 inch.
 2. Surface Course: 1/8 inch.
 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.7 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With a fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to [ASTM D 979] [or] [AASHTO T 168].

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
- 3.9 DISPOSAL
- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 02741

V.

TECHNICAL SPECIFICATIONS

SECTION 02830

CHAIN LINK FENCING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Chain link fences and gates as indicated on drawings.
- B. Install Owner-furnished gate thresholds. Precast concrete gate thresholds will be off-loaded at site by supplier.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions (if any) and Division 1 Specification sections apply to the work of this Section.

1.03 QUALITY ASSURANCE

- A. Provide chain link fences and gates as complete units produced by a single source including necessary erection accessories, fittings, and fastenings.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for metal fencing fabric, gates, and accessories.

1.05 MEASUREMENT & PAYMENT

- A. Work for this section will be paid for on a lump sum basis under the appropriate Division 2 bid item on the Proposal Form.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Dimensions shown for pipe, roll-formed, and H-Sections are outside dimensions, exclusive of coatings.

- B. Posts, Top Rail, Braces and Trusses: Schedule 40, A36 steel hot dip galvanized with a zinc coating of not less than 2.0 ounces per square foot of uncoated surface and must conform to the latest applicable ASTM standard specifications. **SS40 STEEL POST WILL NOT BE ACCEPTED AS A SUBSTITUTION.**

<u>USE</u>	<u>NOMINAL DIAMETER</u>	<u>LENGTH</u>
Top Rail	1 1/4"	-----
Braces and Trusses	1 1/4"	-----
End & Corner Posts	2 1/2"	12'-6"
Line Posts	2"	12'-6"
Gate Posts	3 1/2"	13'-6"

- C. Extension Arms: Aluminum alloy #6063-T6 of such design to provide a weather cap when seated on top of the posts. The base of the arm shall have an opening to pass the top rail through. The arm shall extend at 45° with 3 evenly spaced slots to attach barbed wire strands with the top most slot 12" above and 12" outside the top rail.
- D. Barbed Wire: Three (3) strands of 0.11" diameter twisted line wires with 0.08" diameter, 4 point barbs spaced approximately 4" apart of aluminum alloy #6061-T94 in accordance with ASTM Spec. B211 and alloy designation GS11-A heat-treated.
- E. Fence Fabric: 2" Diamond mesh chain link woven from #9 gauge (0.148") aluminized steel.
- F. Misc. Components: Aluminum tubing shall be schedule 40 aluminum alloy #6063-T6, ASTM B241.
- G. Tension Wire: #6 gauge aluminized steel tension wire.
- H. Bolts, clips, fasteners, and miscellaneous hardware shall be aluminum alloy or galvanized steel.

2.02 GATES

- A. Fabricate swing fence gate perimeter frames of 2" aluminum tubing. Metal and finish to match framework. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space so that frame members are not more than 9' apart.
- B. Fabricate pipe gate frame of Schedule 40 steel of sufficient diameter for gate strength. Hot dip galvanize after fabrication.
- C. Assemble gate frames by welding for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at

vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15" o.c. Attach hardware to provide security against removal or breakage. Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gate to ensure frame rigidity without sag or twist.

1. Where barbed wire is indicated above gates, extended end members of gate frames 1'-0" above top member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.

D. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180° gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
 2. Latch: Forked type to permit operation from either side of gate, with padlock eye as integral part of latch.
 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
 4. Double Gates: Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
 5. Concrete Thresholds: Owner will supply and Contractor shall install concrete threshold as shown per CMP Substation Standard I-C-4; contractor shall provide Styrofoam insulation and prepare site accordingly to accept thresholds.
- E. Concrete: Provide concrete as specified in Division 3.
- F. Thresholds: Precast concrete provided by Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

Do not begin installation and erection before final grading is completed, unless otherwise permitted.

- A. Excavation: Drill holes for posts to diameters and spacing indicated in firm, undisturbed or compacted soil.

- B. Posts shall be installed at a depth of 4'-6" and evenly spaced at an average of 8' and no farther than 9' on corners; see Standards Sheet I-C-1, Sheets 1 and 2 for footing details.
- C. All end and corner posts shall be braced to the first adjacent line post midway between the top rail and ground. A 3/8" truss rod shall be trussed from the line post brace point to the base of the end or corner post.
- D. Each post shall be equipped with an extension arm securely riveted or bolted to the post cap.
- E. Gate posts shall have a dome-shaped weather cap.
- F. A top rail, passing through the base of each extension arm, shall be installed from end to end of each straight-line section of fence. All rail couplings shall be outside sleeve type.
- G. Fabric shall be securely fastened to the outside of all line posts and top rail with aluminum alloy wire clips, spaced not in excess of 24", and adequately tightened to provide a smooth and uniform appearance. The fabric shall be secured to all terminal posts using 1/4" by 3/4" tension bars with 5 heavy gauge post bands spaced 14" apart. The bottom of the fabric shall be held to 2" maximum from finish grade.
- H. Tension wire shall be attached to the bottom of the fence at 24" intervals and secured at all end and gate posts with brace bands.
- I. Three strands of barbed wire shall be tightly stretched and well secured in the slots of the extension arm and firmly anchored to the end posts.
- J. Gates shall be built with sufficient braces and trusses to prevent sagging of the gate. Fabric to match the main fence shall be installed in the gate frame by means of tension bars and other suitable connectors. The gate is to be equipped with a positive type latching device with provisions for padlocking. Gate hinges shall be adjustable and arranged for the gate to swing out.
- K. If ledge should be found when digging postholes less than 2' below finish grade, it should be drilled a depth of 2' and the post grouted in.
- L. If ledge is found deeper than 2', it should be drilled to a depth of 4' below finish grade. The post shall be grouted in and the standard concrete footing poured up to 2' below grade.
- M. Concrete for fence post shall be placed in the presence of the Owner.
- N. Provide rigid insulation and prepared gravel bed for gate thresholds. Install in accordance with CMP Substation Standard Sheet I-C-4.
- O. Fence grounding shall be done by the Owner or others. Owner will supply grounding materials.
END OF SECTION

V.

TECHNICAL SPECIFICATIONS

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Structure foundations.
- B. Control house foundation.
- C. Equipment foundations.
- D. Fence footings.

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 3. ACI 311 "Recommended Practice for Concrete Inspection".
 - 4. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 5. ACI 347 "Recommended Practice for Concrete Formwork".
 - 6. Concrete Reinforcing Steel Institute "Manual of Standard Practice".
 - 7. Concrete Reinforcing Steel Institute "Placing Reinforcing Bars."
 - 8. BOCA – Building Officials and Code Administrators International – 1999.
- B. Workmanship: The Contractor is responsible for correction of concrete work, which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as directed by the Owner.

- C. Concrete Testing Service: The Contractor shall employ an independent testing laboratory acceptable to Owner to perform material evaluation tests and to design concrete mixes.
1. Materials and installed work may require testing and retesting, as directed by the Owner, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times. The retesting of rejected materials and installed work, shall be done at the Contractor's expense.
- D. Quality Control Testing During Construction: Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:
1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 3. Air Content: ASTM C 231, pressure method; one for each set of compressive strength test specimens.
 4. Compression Test Specimens: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
 5. Concrete Temperature: Test hourly when air temperature is 49 degrees F and below, and when 80 degrees F and above; each time a set of compression test specimens are made.
 6. Compressive Strength Tests: ASTM C 39; one set for each 100 cu yds or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq ft of surface area placed.
 - a. When the frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - b. When the total quantity of a given class of concrete is less than 50 cu yds, the strength tests may be waived by the Owner if, in his judgment, adequate evidence of satisfactory strength is provided.

C. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

7. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Owner. The testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
8. Report test results in writing to the Owner on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

1.03 MEASUREMENT & PAYMENT

- A. Work for this Section including excavation and backfilling of foundations will be paid for on a lump sum basis under the appropriate Division 3 bid item on the Proposal Form.
- B. Concrete in place for fence posts will be paid for on a lump sum basis under Division 2.2-Chain Link Fence on the Proposal Form.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Whenever possible, patented forms shall be used. All round piers shall be formed with fibre forms such as Sonotube, Economold, or approved equal. Fibre forms shall be spirally constructed of laminated plies of fibre to diameters and lengths indicated on the plans. If other than patented forms are used, they shall be constructed of plywood nailed to 2" x 4" frames with double 2" x 4" wales, and designed to withstand pressure of newly placed concrete without bow or deflection.
- B. All forms shall have patented form ties with spacer devices and no wire ties will be permitted. All forms shall have waling pieces and shall be securely

braced in such a manner as to prevent deflection. All forms shall be true to line and grade and shall be thoroughly checked and cleaned before concrete is placed.

- C. No splicing of fibre forms will be allowed above the finish yard grade.
- D. Layout of structures is critical. Contractor shall double check the layout of all structures and anchor bolts before notifying Owner that forms are ready for inspection.
- E. All form work, reinforcing, anchor bolts, etc. shall be inspected and approved by the Owner prior to making any concrete placement.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60
- B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars. Use wire bar type supports unless otherwise specified. Wood, brick and other devices will not be acceptable.
- C. No welding of reinforcement bars shall be allowed.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Owner. Use only one brand of cement throughout the project, unless otherwise acceptable to Owner.
- B. Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for all exposed concrete.
 - 1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - a. Dune sand, bank-run sand and manufactured sand are not acceptable.
 - 2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Use of pit or bankrun gravel is not permitted.

- 3. Maximum Aggregate Size: Not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.
- C. Water: Clean, fresh, free from oil, acid, organic matter or other deleterious substances when used.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Water-Reducing Admixture: ASTM C 494, Type A, containing no set-accelerating or set-retarding compounds, chlorides, fluorides or nitrates.
- F. Calcium Chloride: Calcium chloride shall not be used as an admixture to concrete.

2.04 RELATED MATERIALS

- A. Preformed Expansion Joint Fillers: Bituminous fiber type, ASTM D1751.
- B. Joint Sealant Compound: Polysulfide based 1-part elastomeric sealant.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. complying with AASHTO M 182, Class 3, or cotton mats complying with ASTM C 440.
- D. Moisture-Retaining Cover: One of the following at Contractor's option:
 - 1. Waterproof Paper: ASTM C 171, Type 1 or Type 2.
 - 2. Polyethylene Sheeting: AASHTO M 171.
 - 3. Polyethylene-coated burlap.
- E. Membrane-Forming Curing Compound: Resin Type, complying with Fed. Spec. TT-C-00800, Type I, containing a fugitive dye not subject to reactivation by solvents. Dye shall be readily distinguishable upon the concrete surface for at least 4 hours after application. Color shall be inconspicuous within 7 days. Submit test reports from an independent testing agency, subject to approval by the Owner, indicating compliance with TT-C-00800.
- F. Concrete Waterproofing: Consolideck Salt Guard, manufactured by Prosoco, Inc. (telephone 913-281-1700). Apply in accordance with manufacturer's instructions.
- G. Waterstop: Leakmaster gunnable expanding waterstop as manufactured by Greenstreak, Inc. (tel. 1-800-325-9504).

H. Concrete Patching Mortar: Sika Top 122 for concrete patching and repair of areas not exposed to view. Submit for approval the material to be used for patching and repair of concrete that is exposed to view. A test patch/repair is to be done to see if the color of the cured material matches the color of the concrete.

I. Grout for anchoring reinforcing into ledge (Rock): Super Por-Rok, manufactured by the Construction Products Division of Minwax Corporation.

2.05 PROPORTIONING AND DESIGN OF MIXES

A. General:

1. All concrete shall be of such a mix as to produce a 4,000 psi concrete at 28 days.
2. Prepare design mixes for each type of concrete. Use an independent testing facility acceptable to the Owner for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
3. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 318.
4. Submit written reports to the Owner of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by the Owner.
5. Trial mixes shall be based on the use of all admixtures proposed for use in the concrete.

B. Laboratory Trial Batches: When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C 192 and conduct strength tests in accordance with ASTM C 39, specified in ACI 301.

1. Establish a curve showing relationship between water-cement ratio (or cement content) and compressive strength, with at least 3 points representing batches which produce strengths above and below that required. Use not less than 3 specimens tested at 28-days, or an earlier age when acceptable to the Owner, to establish each point on the curve.

C. Field Experience Method: When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.

1. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.
 - a. Standard Deviation: If standard deviation exceeds 600 PSI or if no suitable records are available, select proportions to produce an average strength of at least 1200 PSI greater than the required compressive strength of concrete.
 - b. After sufficient experience and test data become available from the job, using ACI 214 methods of evaluation, the standard deviation may be reduced when the probable frequency of an average of 3 consecutive tests below required compressive strength will not exceed 1 in 100.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Owner. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Owner before using in the work.
- E. Admixtures: Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control.
 1. Air-Entraining Admixtures: Use air-entraining admixture in all concrete exposed to the weather, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete, at the point of placement, having air content within the following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or subject to hydraulic pressure:
 $6\% \pm 1$ for 3/4".
 $5\% \pm 1$ for 1 1/2".
 - b. The concrete mix design shall be adjusted by the addition of cement content, reduction of water content, or both, as required to offset the weakening action of air-entraining admixtures.
- F. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement of not less than 2" and not more than 4".

2.06 CONCRETE MIXING

- A. Job-Site Mixing: Will not be permitted.
- B. Ready-Mix Concrete: Comply with the requirements of ASTM C 94, and as herein specified.
 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required by the Owner.
 2. When the air temperature is between 85 degrees F and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F, reduce the mixing and delivery time to 60 minutes.

2.07 ANCHOR BOLTS

- A. All anchor bolts shall be provided by the Owner for installation by the Contractor.

PART 3 EXECUTION

3.01 FORMS

- A. General:
 1. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
 2. All form material used in areas that will be exposed to view shall be free of raised grain, torn surfaces, worn edges, patches, and other defects, which would impair the appearance of the concrete surface.
 3. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
 4. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain

required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

5. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
 6. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
 7. Chamfer exposed corners and edges as shown, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- B. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- C. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.02 PLACING REINFORCEMENT

- A. Comply with the specified codes and standards for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
- D. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold

reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- E. Do not place reinforcing bars more than 2 in. beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- F. Grout reinforcing rods into ledge. Owner direction is required to provide anchored pier foundations if ledge is encountered.

3.03 JOINTS

- A. Construction Joints: Locate and install construction joints, which are not shown on the Drawings, so as not to impair the strength and appearance of the structure, as acceptable to the Owner.

3.04 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto. The Owner shall furnish all anchor bolts for electrical equipment foundations. Anchor bolts shall be supported at the top and bottom to prevent skewing or movement during concrete placement operations. Tolerance for anchor bolts is $\pm 1/16$ inch.
- B. After concrete placement chase all anchor bolt threads to insure free movement of nuts.

3.05 PREPARATION OF FORM SURFACES

- A. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating material to accumulate in the forms or to come in contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative form of oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

A. General:

1. Comply with ACI 304, and as herein specified.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

B. **Pre-Placement Preparation:** Before placing concrete, complete the formwork installation, reinforcing steel, and items to be embedded or cast-in and inspect the same to assure compliance with Contract requirements. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used. Be sure that all debris and other foreign matter are removed from forms.

C. **Placing Concrete in Forms:** Deposit concrete in forms in horizontal layers not deeper than 18 in. and in a manner to avoid inclined construction joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete, maintaining a speed of not less than 6000 impulses per minute.
2. Do not use vibrators to transport concrete inside the forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

D. **Placing Concrete Slabs:** Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Maintain reinforcing in the proper position during concrete placement operations by proper use of chairs or other devices.

2. Apply steel trowel finish to monolithic slab surfaces.
3. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge placed on surface at not less than 2 different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to uniform, smooth, granular texture.
4. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface.
5. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge.

E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to, or is expected to fall, below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in writing by the Owner.
4. All temporary heat, form insulation, insulated blankets, coverings, salt hay, or other equipment and materials necessary to protect the concrete work from physical damage caused by frost, freezing action, or low temperature shall be supplied under this Section when required.

F. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
2. Wet forms thoroughly before placing concrete.
3. Do not use retarding admixtures without the written acceptance of the Owner.

3.07 FINISH ON FORMED SURFACES

- A. Standard Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction. Concrete surface shall have the texture imparted by the form facing material used, with defective areas repaired and patched as specified, and fins and other projections exceeding 1/4 in. in height rubbed down with wood block.
- B. Standard Smooth Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to the concrete or a covering material bonded to the concrete, such as waterproofing, dampproofing, painting or other similar system. Concrete surface shall have the texture imparted by the form facing material, with defective areas repaired and patched as specified, and fins and other projections on the surface completely removed and smoothed.
- C. Related Unformed Surfaces: At top of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise shown.
- D. At tops of piers apply steel trowelled finish. Tops of piers shall be finished to elevations as indicated on the Drawings with a tolerance of $\pm 1/8$ inch.

3.08 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.
2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 168 cumulative hours (not necessarily consecutive) during which concrete has been exposed to air temperatures above 50 degrees F. Avoid rapid drying at the end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-in. lap over adjacent absorptive covers.
2. Provide moisture-cover curing as follows:
 - a. Apply moisture-retaining cover to damp concrete, placed in widest practicable width with sides and ends lapped at least 3 in. and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide membrane forming curing as follows:
 - a. Apply membrane-forming curing compound to damp concrete surfaces as soon as water film has disappeared. Apply uniformly in 2-coat continuous operation by power-spray equipment in accordance with manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Do not use membrane-forming curing compounds on surfaces which are to be covered with a coating material applied directly to

concrete or with a covering material bonded to concrete, such as other concrete, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, without first having obtained from the membrane curing compound manufacturer a guarantee in writing that the curing compound will not adversely affect the bond of the proposed finishing materials. Any corrective action needed to provide proper bond for finishing materials shall be performed at no additional cost to the Owner.

- c. Do not apply membrane-forming curing compound to any surfaces that are to receive other concrete or Portland cement based finishes, such as setting beds for tile.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.09 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed 48 hours after placing concrete. Concrete shall be sufficiently hard to not be damaged by form removal operations. Curing and protection operations shall be maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, girders, slabs, and other structural elements, may not be removed in less than 14 days. Supports may be removed in less time if the Contractor can demonstrate that the concrete has reached at least 60 percent of the design compressive strength for 28 days, but in no event less than 7 days.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.
- D. The Contractor shall be solely responsible for ascertaining that concrete has reached sufficient strength to safely allow the removal of forms and supports, notwithstanding any minimum waiting periods specified herein. In the event of extended cold spells or other conditions that would delay the curing of concrete, the waiting periods shall be increased as required.

3.10 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact form surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Owner.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill in holes and openings left in concrete structures for passage of work by other trades, after work of other trades is in place. Mix, place, and cure concrete to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment.

3.12 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with Sikatop 122 immediately after removal of forms, but only when acceptable to Owner.
 - 1. Cut out honeycomb, rock pockets, voids over 1/2 in. diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Repair with Sikatop 122.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets and holes left by tie rods and bolts; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.
 - 1. Repair concealed formed surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.
- C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to tolerances specified for

each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

1. Repair finished unformed surfaces that contain defects, which adversely affect durability of concrete. Surface defects including crazing, cracks in excess of 0.01 in. wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Owner.
4. Repair defective areas, except random cracks and single holes not exceeding 1-in. diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 in. clearance all around. Dampen concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
5. Repair isolated random cracks and single holes not over 1 in. in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout coating. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
6. Repair methods not specified above may be used, subject to acceptance of Owner.

3.13 CONCRETE WATERPROOFING

1. Apply concrete waterproofing to tops of all concrete piers, cable trench covers, foundations, and control house entrance slab. Waterproofing shall be applied to the top of piers and foundations down to an elevation 6 inches below finish grade.

END OF SECTION

V.

TECHNICAL SPECIFICATIONS

SECTION 03370

GROUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions (if any) and Division-1 Specification Sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. The Contractor shall provide all non-pressure grout as shown on the Contract Drawings and as may be required to successfully complete the Contract.
- B. Grouting of dowels set in drill holes into existing concrete shall be done using non-metallic, non-shrink grout or proprietary epoxy or polyester resin grouts.

1.03 SUBMITTALS

- A. The Contractor shall submit product information for all proprietary products proposed for use.

1.04 MEASUREMENT & PAYMENT

- A. Work for this Section will be paid for on a lump sum basis under the appropriate Division 3 item on the Proposal Form.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Non-metallic Non-shrink Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C588, Type A.

- 1. Products offered by manufacturers to comply with requirements for non-metallic, non-shrink grout include the following: