SECTION 35 31 19

CONCRETE SLOPE PAVEMENT

APPROVAL STATUS						
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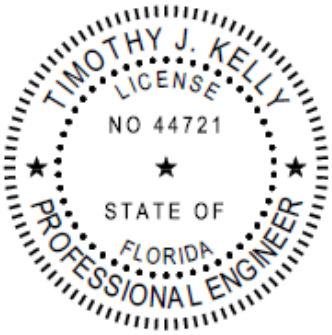
Engineer's Seal



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SECTION 35 31 19

CONCRETE SLOPE PAVEMENT

PART 1 - GENERAL

1.01 SCOPE

A. Supplying labor, equipment and materials and utilize appropriate means and methods for the installation of turbidity controls, surface preparation and excavation of key trenches necessary and sufficient to meet all requirements specified herein, comply with the requirements in any applicable permits and any other requirements to satisfy the authorities having jurisdiction.

1.02 APPLICABLE PUBLICATIONS

A. The environmental protection rules and standards in the applicable sections of the Florida Administrative Code (F.A.C.) incorporated herein by reference are:

1. http://www.dep.state.fl.us/legal/Rules/rulelistnum.htm
2. Design and Performance Standards - 62-25.025 F.A.C.
3. Quality Assurance - 62-160 F.A.C.
4. Surface Waters of the State - 62-301 F.A.C.
5. Surface Water Quality Standards - 62-302 F.A.C.
6. Generic Permits - 62-621.300(2) & (4) F.A.C.

B. American Society of Testing Materials, (ASTM – latest edition):

1. ASTM A1064:

   Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed.

   ASTM A276:

   Standard Specification for Stainless Steel Bars & Shapes.

2. ASTM C33:

   Standard Specification for Concrete Aggregates.

3. ASTM C39:

   Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C94:

   Standard Specification for Ready-Mixed Concrete.

5. ASTM C105:

   Standard Specification for Portland Cement.

6. ASTM C143:

   Standard Testing Method for Slump of Portland Cement Concrete.

7. ASTM C231:

   Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

8. ASTM C260:

   Standard Specification for Air-Entraining Admixtures for Concrete.

9. ASTM C494:

   Standard Specification for Chemical Admixtures for Concrete.

10. ASTM C1017:

    Standard Specification for Chemical Admixtures for Use-In Producing Flowing Concrete.

11. ASTM C309:

    Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

12. ASTM C171:

    Standard Specification for Sheet Materials for Curing Concrete.

C. American National Standards Institute/American Welding Society, (ANSI/AWS):

1. ANSI/AWS D 1-4:

   Structural Welding Code – Reinforcing Steel.

D. American Concrete Institute, (ACI):

1. ACI 301:

   Specification for Structural Concrete.

2. ACI 304.6R-00:

   Guide for Measuring, Mixing, Transporting, and Placing Concrete.

3. ACI 305R-10:

   Specification for Hot Weather Concreting.

4. ACI 306R-10:

   Specification for Cold Weather Concreting.

5. ACI 318:

   Building Code Requirements for Structural Concrete.

6. ACI 347:

   Guide to Formwork for Concrete.

7. ACISP 04:

   Formwork for Concrete.

8. ACISP 66:

   ACI Detailing Manual.

E. Florida Department of Transportation

1. Standard Specifications for Road and Bridge Construction, latest edition

1.03 DEFINITIONS (NOT USED)

1.04 SUBMITTALS

A. All proposals and submissions by the Supplier and all responses by the Owner's Representative shall be in writing. Acceptance of the Supplier's proposals and submissions by the Owner's Representative shall not relieve the Supplier of his responsibility for the work as defined by the Contract.

B. The Supplier shall submit a detailed Turbidity Control and Monitoring Plan for review and approval to the Owner's Representative prior to beginning work. Supplier submissions shall include qualifying documentation for all materials and products including.

1. Detailed information on the turbidity barriers and proposed layout.
2. Detailed information and calibration data on the turbidity monitoring equipment, proposed monitoring locations and frequency.
3. Periodical Turbidity monitoring reports.

C. The Supplier shall submit a detailed Surface Preparation Plan for review and approval to the Owner's Representative prior to beginning work. The plan shall include detailed information of the equipment to be used, surface preparation procedures, and disposal of the debris and sediments.

D. The Supplier shall submit a detailed excavation plan for review and approval to the Owner's Representative prior to beginning work. The plan shall include detailed information on the equipment to be used, excavation methods, and means/methods for the disposal of the excavated materials based on the type of excavation as well as the disposal location.

E. Supplier submissions to the Purchaser Representative shall include qualifying documentation for all materials and products including.

1. Proposed concrete mix design(s) that meet the minimum performance criteria for the various types of concretes as shown on the Drawings and specified in Section 2.02 of this Specification. The mix design shall detail proportions including supporting trial mix results and certification that the mix proportions will produce concrete of the specified quality and yield; anticipated slumps for each proposed mix before and after addition of superplasticizer.
2. Documentation that the plant, equipment, and all materials to be used in the concrete comply with the requirements of ACI 301.
3. Mill certificates for wire reinforcing.
4. Wire reinforcing detail lists and placing drawings shall be submitted to the Purchaser Representative for his records.
5. Mill certificates for cement and supplemental cementing materials.
6. Description of the proposed concrete batching plant and conveying systems, including capacity, admixture provision batching system, cold weather capabilities, hot weather capabilities, quality control procedures.

7. The Supplier shall submit the name and qualifications of the proposed Ready Mix Concrete Supplier (Concrete Supplier) at least 21 days prior to placing concrete. The Purchaser Representative will verify acceptability of the Concrete Supplier. Acceptance of the Concrete Supplier and the concrete mix design(s) by the Purchaser does not relieve or reduce the responsibility of the Supplier or Concrete Supplier from the requirements of this Specification.

8. Supplier shall submit to the Purchaser Representative qualifying documentation for Water-Reducing Admixture; Water-Reducing High Range Admixture (Superplasticizer); and Accelerating Admixtures including: Manufacturer, Proposed dosage, and timing of addition for each class of concrete, as applicable, and Type of admixture (retarding, accelerating, normal set).

9. Note that submissions to the Purchaser Representative and reviews of submissions by the Purchaser shall be completed prior to placing any concrete or doing any concrete work. The Supplier shall schedule the submissions to allow for at least two weeks for review by the Purchaser.

F.

1.05 QUALIFICATIONS (NOT USED)

1.06 RESPONSIBILITIES

A. The Supplier shall provide on onsite representative certified by the Florida Department of Environmental Protection as a Stormwater Erosion and Sedimentation Control inspector.

B. The Supplier is responsible for implementing a Turbidity Control and Monitoring Plan in compliance with the requirements in these specifications and any applicable permits, and any additional requirements to satisfy the authorities having jurisdiction.

C. The Supplier is responsible for providing, installing, and maintaining turbidity barriers during the excavation of any trenches and disposal of the soils/sediments.

D. The Supplier shall provide a full time coordinator who shall be present at all times during the performance of the work and who shall be experienced in the procedures involved in this task.

E. The Supplier is responsible for performing the work described herein in accordance with all applicable regulations, adhering to the diving safety procedures, and monitoring plan.

F. The Supplier is responsible for obtaining any necessary environmental permits and conducting any necessary compliance monitoring.

G. The Supplier is responsible for disposal of the soils/sediments excavated from the trench at a location approved by the Purchaser.

H. The Purchaser Representative will identify soil/sediment acceptable disposal areas within the project site.

I. The Supplier is responsible for disposal of the soils/sediments excavated from the trench at a location approved by the Purchaser.

J. The Purchaser Representative will identify soil/sediment acceptable disposal areas within and outside the Lake.

K. The Supplier is responsible for taking all necessary precautions to minimize undermining of the soil-cement revetment or damage to the steepened upper slope, toe of the embankment and during the excavation of the toe trench, side key trench and construction of the concrete key.

L. The Supplier is responsible for the supply, storage, and handling of all materials set forth in this Specification. Materials are to be obtained from the same source of supply or Manufacturer for the duration of the contract.

M. The evaluation of concrete quality shall be the responsibility of the Supplier and shall be carried out as outlined in Drawing Plan.

N. The Supplier shall provide a full time coordinator who shall be present at all times during concrete work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all the work performed under this specification. The coordinator shall have the authority to request that mixing trucks return to the batch plant if delivery times are exceeded or to interrupt work if any other quality issues are not being met.

O. The Supplier shall, at the start and during the course of Work where appropriate, meet with the Purchaser Representative for the review of the following:

1. Proposed equipment and methods for storing constitutive components, mixing, and conveying concrete. The Supplier shall provide documentation that the concrete supplier meets industry certification.

2. Supplier's Quality Control Program. The concrete supplier shall implement a Quality Control Plan to ensure that the Owner and Supplier's performance requirements will be met.

3. Inspection and testing of cement, aggregate, water, admixtures, reinforcement, and storage of these materials.

4. Proposed form material, form ties, and form release materials. The Supplier shall provide calculations for all concrete formwork and shoring, sealed by a Professional Engineer.

5. Concrete mix designs with regard to strength, performance, shrinkage, porosity, durability, and suitability for Project requirements. The concrete supplier shall submit documentation to the satisfaction of the Owner demonstrating that the proposed mix design(s) will achieve the required strength, durability, and performance requirements.

6. Proposed methods of placing concrete.

7. Proposed methods and materials for supporting and securing reinforcement items to be cast-in and formwork including details of the reinforcement chairs and spacers.

8. Proposed details and positions of construction and crack control joints.

9. The inspection by the Purchaser of formwork, reinforcement, cast-in items, and preparation of existing concrete. Inspection by the Purchaser of formwork shall be for conformance with the project documents, but not for structural strength and stability, which is the sole responsibility of the Supplier.

10. Sampling and testing of concrete and inspection of concrete placement procedures.

11. Preparation of existing soil-cement for bonding to new concrete.

12. Proposed curing methods, stripping times and hot and cold weather protection and concreting procedures.

P. The Supplier shall submit test results to the Purchaser Representative for review within 5 working days of the tested concrete placement.

Q. The Supplier shall keep all records of the following:

1. Temperature, slump, and air content of the plastic concrete and strength tests.

2. A certificate of accuracy of the scales at the batch plant.

3. Temperature at the time of concrete placement.

4. Delivery tickets: The Supplier shall ensure that the records indicate where the delivered concrete was used so that remedial action can be taken if it is subsequently determined that the concrete is unsuitable for use.

R. Placing concrete in hot weather shall be in accordance with recommended practice for hot weather concreting (ACI-305). Concrete with a placement temperature that will cause loss of slump, flash set or cold joints shall not be used.

S. Placing concrete in cold weather shall be in accordance with recommended practice for cold weather concrete placement (ACI-306). Concrete shall be placed with the mix temperature between 50°F and 90°F. When the mean daily outdoor temperature is at or below 40°F, the concrete shall be maintained between 50°F and 70°F for the required curing period. Concrete will not be placed against or on frozen material.

1.07 CERTIFICATIONS AND TESTING

A. The compressive strength tests shall conform to ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens".

B. A set of four standard cylinders shall be molded and tested from the first placement of 50 cubic yards, or any fraction thereof, placed each day. Additional sets shall be molded and tested for each additional 50 cubic yards, or fraction thereof, placed in the same day.

C. Unconfined compressive strength tests shall be performed on one of the cylinders at 7 days and two of the cylinders at 28 days, holding the fourth cylinder in reserve to verify the test results or test at a greater age if necessary. The acceptance of the test results shall be based on the average of the two specimens tested at 28 days as per ACI 318. Evaluation and acceptance of the concrete shall be per ACI 318, Chapter 5.

D. The slump test shall conform to ASTM C143, "Standard Testing Method for Slump of Portland Cement Concrete". Tests shall be performed on the first two trucks delivering concrete for any placement, when molding test cylinders, and as specified by the Purchaser Representative.

E. The air content shall be determined by testing in accordance with ASTM C231 or C173. Tests shall be performed on the first two trucks delivering concrete for any placement, when molding test cylinders, and as specified by the Purchaser Representative.

1.08 INSPECTION COORDINATION

A. The Supplier shall provide access to the Work for the Owner's Representative on a continual basis as required for inspection and testing.

1.09 WARRANTY (NOT USED)

PART 2 - PRODUCTS

2.01 TURBIDITY BARRIERS

A. The Supplier shall provide full depth turbidity barriers that are flexible and impermeable.

B. The Supplier shall provide floats for barriers of sufficient buoyancy to prevent the top of the barrier from submerging under any water and wind conditions. If the top of the barrier becomes submerged for any reason, the Supplier shall suspend construction operations until the condition is corrected.

C. The Supplier shall provide and maintain an anchoring system to secure the barriers in position. Attach weights to the barrier as necessary to keep the fabric at an angle to the vertical of 30 degrees or less.

2.02 GEOTEXTILE CONTAINERS (GEOTUBES)

A. If the excavation procedures involve the use of suction dredging with containment of the solids from the dredge slurry using geo-tubes, the Supplier is responsible for the adequacy of the geo-tubes.

B. Geo-tubes should be designed such that they have adequate permeability to accommodate the slurry flow while containing the dredged solids, and sufficient strength to withstand the pressures during filling and the anticipated stresses from handling once filled.

2.03 FORMWORK

A. The Supplier is responsible for the adequacy of all formwork and falsework, and for satisfying all codes and regulations governing formwork and falsework.

B. All form lumber in contact with exposed concrete shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, or other acceptable material capable of producing the desired finish.

C. Form ties shall be a type which does not leave an open hole through the concrete and which permits neat and solid patching at every hole. Wire ties and wood spreaders shall not be used. When forms are removed, all metal shall be not less than two inches from the surface. Alternative forming systems may be used subject to advance approval by the Purchaser Representative.

D. All other materials not specifically described but required for proper completion of concrete formwork, shall be as selected by the Supplier subject to advance approval by the Purchaser Representative.

E. Design and construction of all required forms shall be sufficiently tight to prevent leakage of mortar, and shall be able to prevent excessive deflection when filled with wet concrete. Design loads and pressures shall conform to those stipulated in "Guide to Formwork for Concrete Recommended Practice for Concrete Formwork", American Concrete Institute Publication ACI 347.

F. All required cast-in-place concrete shall be formed to the shapes, sizes, lines, and dimensions indicated on the Drawings. Reinforcement and other such items required to be anchored in the concrete, shall be set before the concrete is placed.

G. The forms shall be braced and/or anchored to maintain position and shape and to ensure safety to personnel. Bracing and supporting members of ample size and strength shall be constructed to safely carry, without excessive deflection, all dead, and live loads to which they may be subjected. The Supplier shall provide metal spreader ties that give positive tying and accurate spreading. Forms shall be constructed straight, true, plumb, and square.

2.04 CONCRETE MIX

A. Portland cement shall be ASTM C150 Type I/II with minimum requirements as shown in Tables 1 and 2 unless otherwise shown on the Drawings.

Table 1
Minimum Requirement for Concrete Mix – Curb

Max. Size Aggregate (in.)	Total Entraining Air ±1%	Minimum 28-Day Compressive Strength (psi)	Max. Water Cement	Min-Max Slump (in.)
3/4	5	2,500	0.40	4-6

Table 2
Minimum Requirement for Concrete Mix – Underwater Placement *

Max. Size Aggregate (in.)	Total Entraining Air ±1%	Minimum 28-Day Compressive Strength (psi)	Max. Water Cement	Min-Max Slump (in.)
7/16	5	3,000	0.40	6-8

* Special Requirements - Shall include an anti-washout admixture conforming to ASTM C494, Type S for concrete approved by Purchaser

Table 3
Minimum Requirement for Concrete Mix – Above Water Placement

Max. Size Aggregate (in.)	Total Entraining Air ±1%	Minimum 28-Day Compressive Strength (psi)	Max. Water Cement	Min-Max Slump (in.)
7/16	5	3,000	0.40	4-6

B. All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles.

C. The maximum nominal size of coarse aggregate shall be 7/16-inch. Coarse aggregate shall be uniformly graded and shall consist of rounded crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances.

D. Fine aggregate shall be graded uniformly and between 10 to 25% shall pass a No. 50 sieve and a maximum of 4% shall pass a No. 200 sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics, or a combination thereof.

E. All concrete, unless otherwise specifically permitted by the Purchaser, shall be ready-mixed in accordance with ASTM C 94.

2.05 WIRE REINFORCEMENT

A. All concrete reinforcement shall be new, free from rust, and comply with ASTM A82 and ASTM A185.

B. Concrete reinforcement shall be provided in accordance with the requirements of ACI 318.

C. Concrete reinforcement shall be fabricated in strict accordance with the approved shop drawings.

D. Before the start of concrete placement, all concrete reinforcement shall be accurately placed, secured, and supported with chairs, spacers, or metal hangers. The Supplier shall provide a minimum 2.5 inches of concrete covering for all reinforcement as shown on the drawings.

E. The Supplier shall place wire reinforcement with minimum overlaps of 8”.

PART 3 - EXECUTION

3.01 TURBIDITY CONTROL

A. The Supplier shall install and maintain turbidity barriers as necessary to maintain turbidity outside of the work area below permit compliance levels. Barriers shall be installed prior to the commencement of any work on the upstream embankment slope and maintained in place until construction is complete, and turbidity from construction has dissipated and turbidity levels return to background levels based on monitoring results.

B. Any rips or tears that occur in the turbidity barrier material during use shall be repaired or replaced immediately by the Supplier at its expense. Rips or tears that occur in the turbidity barrier material in use that are not repaired or replaced immediately by the Supplier will result in a suspension of construction operations, and shall require repairs and replacements as a prerequisite to the resumption of work.

C. The Supplier shall conduct its operations at all times in a manner that minimizes turbidity. The Supplier is required to conform to the requirements herein and to meet the special requirements of any environmental permits that may be necessary.

D. Turbidity controls shall be inspected by the Supplier every workday, after every rainfall event of 0.5 inches or greater in a 24-hour period, and after every extreme weather event that could dislodge or damage the turbidity controls, to assure that the turbidity controls remain properly installed, undamaged, and fully functional at all times.

3.02 TURBIDITY MONITORING

A. The Supplier shall conduct and record the results of turbidity monitoring appropriate to the conditions and at the locations, times, and frequencies specified below.

B. Background Monitoring Location: At least 1,000 feet (or as specified in the applicable environmental permit) upstream of the construction activities, at least 50 feet away from the water's edge, at mid-depth in the water column, and outside of any visible turbidity plume.

C. Compliance Monitoring Location: At a point no greater than 50 feet (or as specified in the applicable environmental permit) waterward of the construction activities, at least 50 feet away from the water's edge, at mid-depth in the water column, in the densest portion of any visible plume.

D. Sampling Time:

1. During Activities or Environmental Conditions that Can Generate Construction-Related Turbidity: Water samples for turbidity measurement shall be collected beginning no sooner than one hour after and no later than two hours after construction activity commences (or as specified in the applicable environmental permit) and every four hours thereafter until the work day ends. Water samples shall be collected at the same time(s) every workday according to this schedule. Any substantial deviation from this schedule must be approved by the Owner's Representative, unless otherwise

compelled by force majeure, in which case, an explanation must be provided verbally as soon as possible and in writing within 48 hours of the deviation.

2. During Activities and Conditions That Cannot Generate Construction-Related Turbidity: Once daily mid-morning (or as specified in the applicable environmental permit). Water samples shall be collected at the same time every workday.

E. Equipment: The turbidity monitoring equipment shall meet the specifications and be calibrated, maintained, repaired, and replaced according to the methods, procedures, and frequencies set forth in Chapter 62-160, F.A.C.

F. Records Management: The individual conducting the turbidity monitoring shall transcribe the readings to the approved Turbidity Log Form and sign and date the form at the close of each monitoring day. The notebook containing the signed and dated daily turbidity log forms shall be accessible at the construction site during the workday.

The Supplier shall submit monitoring data (Turbidity Log Forms) bi-weekly. Documents submitted shall contain the following information: Dates of sampling and analysis, a statement describing the methods used in collection, handling, storage, and analysis of the samples, a map indicating the sampling locations, a statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, and limits of detection and accuracy of the data. The monitoring reports that also include the following information for each sample that is taken: Time of day samples taken, overall depth of water, depth of sample, and weather conditions prior to sampling.

3.03 EXCEEDANCES OF WATER QUALITY STANDARDS

A. If at any time, monitoring reveals the turbidity levels, at the compliance sampling station are greater than 29 NTUs above the corresponding background sample, construction activities shall cease immediately and not resume until corrective measures have been taken and turbidity has returned to acceptable levels. Turbidity violations and corrective measures shall be documented in the monitoring reports.

B. The Supplier must notify the Owner's Representative immediately of any exceedances of the water quality standards. The Supplier must also follow applicable notification procedures required by any environmental permits.

3.04 SURFACE PREPARATION

A. INITIAL CLEANING

1. The above-water portion of the soil-cement to be rehabilitated shall be cleaned to remove any sediment, vegetation, and loose debris using hand tools or low-pressure washing. If low-pressure washing is used, sufficient time should be allowed for the sediments washed onto the pond water settle before proceeding with the underwater cleaning.

2. The underwater portion of the soil-cement to be rehabilitated shall be cleaned using suction dredging methods. The dredge slurry should be pumped into a designated settling area identified by the Purchaser. The settling area should be enclosed by full depth turbidity curtains. Alternatively, geotextile containers (geotubes) can be used to separate soils/sediments from the dredge slurry. The solids collected in the geotubes can be disposed outside the Lake at a suitable area identified by the Purchaser. The soils shall then be spread within the area enclosed by turbidity

barriers in a manner that will minimize the suspension of fines and the development of turbidity.

B. PRESSURE WASHING

1. The entire surface of the soil-cement revetment to receive the concrete overlay shall be pressure washed with a stream of water under a pressure of 1,000 to 2,000 psi to remove any loose/deteriorated soil-cement, cement-based patches, and/or any deleterious deposits adhered to the soil-cement surface. Care should be exercised to prevent erosion of the sound soil-cement mass.
2. Additional cleaning immediately preceding concrete placement will be required if sediments greater than 1/8 of an inch are observed to cover the soil cement.

3.05 BOTTOM AND SIDE KEY TRENCH EXCAVATION

A. The trench shall be sized as needed to allow the construction of a concrete key with the minimum dimensions shown in the Drawings. The minimum three-foot depth shall be measured from the lowest point of the bottom of the existing soil cement; the minimum two-foot width shall be measured from the point of the existing soil cement that extends the furthest into the reservoir. Alternate designs using sloped sides may be proposed as long as the result includes a minimum two-foot width at the bottom and a three-foot total effective depth.

B. If the trench is excavated using mechanical methods, the excavated soils can be disposed at the bottom of the cooling pond, in close proximity to the excavation. The soils shall be spread within the area enclosed by the turbidity barriers in a manner that will minimize the suspension of fines and the development of turbidity.

C. If the trench is excavated using suction dredging methods, the dredge slurry should be pumped into a designated settling area identified by the Purchaser. The settling area should be enclosed by full depth turbidity curtains. Alternatively, geotextile containers (geo-tubes) can be used to separate soils/sediments from the dredge slurry. The solids collected in the geo-tubes can be disposed outside the Lake at a suitable area identified by the Purchaser or deposited at the bottom of the Lake after it is stabilized. If the sediments are deposited at the bottom of the Lake, the Supplier shall remove the geo-tube fabric in its entirety and dispose of it offsite. The soils shall then be spread within the area enclosed by the turbidity barriers in a manner that will minimize the suspension of fines and the development of turbidity.

D. The trench must be founded in well-consolidated sands. Before placement of reinforcement and concrete, the trench shall be cleaned of debris and fine materials that would be subject to settlement.

3.06 MID KEY TRENCH EXCAVATION

A. The trench shall be sized as needed to allow the construction of a concrete key with the minimum dimensions shown in the Drawings.

B. The trench must be founded in well-consolidated sands. Before placement of reinforcement and concrete, the trench shall be cleaned of debris and fine materials that would be subject to settlement.

3.07 CONCRETE DELIVERY

A. The Supplier's on-site construction superintendent and the concrete supplier shall attend a pre-placement meeting with the Purchaser Representative at least two weeks prior to the first scheduled placements. The concrete placement plan may be revised at the request of the Supplier or Purchaser Representative based on the meeting. Concrete placement shall not proceed until the revised placement plan has been submitted and approved by the Purchaser.

B. The maximum time allowed for all types of concrete to be delivered to the site of the Work, including the time required to discharge, shall not exceed 90 minutes from the time concrete was mixed, if centrally mixed, or from the time the original water was added, if transit-mixed, or before the drum has been revolved [300] revolutions, whichever is first.

C. Under no circumstances shall the Supplier add retarders to the concrete mix without first obtaining the written approval of the Purchaser.

3.08 CONCRETE PLACEMENT

A. The Supplier shall give the Purchaser Representative a minimum of two days advance notice of a concrete placement date.

B. Concrete placement shall not be started until the Purchaser has inspected and approved all forms, reinforcement, and methods of mixing, conveying, spreading, consolidating, finishing, curing, and protection of the concrete.

C. The concrete shall be deposited in a manner meeting with the approval of the Purchaser, and the concrete placing shall not begin until the Purchaser's approval has been obtained. The Purchaser may stop the Supplier from placing concrete in the event of adverse or even threatening adverse weather conditions when, in the Purchaser's opinion, these weather conditions may adversely influence the proper placing of the concrete.

D. All equipment proposed for use in mixing, conveying, placing and compacting concrete shall be approved by the Purchaser prior to its use. All the necessary equipment for any particular placement shall be on site and proven to be in working condition before the placement commences, with backup equipment on site as determined by the Purchaser. The equipment shall be well maintained, suitable in kind, and adequate in capacity for the work.

E. In preparation for the concrete placement, all soils/sediments, loose soil-cement, debris and other deleterious matter shall be removed from the interior of forms.

F. The forms (except in freezing weather) shall be thoroughly wet or oiled. All transporting and handling equipment shall be thoroughly cleaned.

G. Concrete shall be placed in conformance with ACI 304. Concrete shall be conveyed from the mixer to the place of final deposit by a method that will prevent separation and loss of materials. Only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials shall be used. Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to re-handling and flowing. Concrete shall be placed as dry as possible consistent with good workmanship, never exceeding the maximum specified slump. Concrete shall be placed in a manner that will avoid splashing forms or wire reinforcing and shall not be dropped freely more than four feet. When placing operations would involve free drop of concrete by more than four feet, it shall be deposited through metal or other pipes as approved by the Purchaser.

H. Concrete shall be placed at such a rate that it is at all times plastic and flows readily between bare reinforcement. Once concrete placement is started, it shall be a continuous operation until placement of the panel or section is complete.

I. Concrete batches delivered to the job site shall be kept as uniform as possible in consistency and strength. The following shall be considered a basis for the rejection of the concrete delivered to the site:

1. Concrete that has been contaminated with foreign material;
2. Slump exceeding maximum specified;
3. Percent of entrained air outside specified limits; and
4. The maximum time allowed for discharge has been exceeded.

J. When concrete is to be placed by pump, properties shall be measured at discharge from the hose.

K. All concrete shall be cured regardless of temperature, weather, or season, to protect it from premature drying, excessively hot or cold temperatures, and mechanical damage. Immediately upon removing formwork from vertical surfaces, water-curing procedures shall be initiated. Curing shall be continued for at least seven days.

L. Alternative curing methods shall not be permitted.

M. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal, the concrete shall be water cured until the end of the time prescribed.

3.09 CONSOLIDATION OF CONCRETE

A. Concrete shall be compacted thoroughly and uniformly to obtain a dense, homogeneous structure, free of cold joints, fill planes, voids and honeycombing. Formed surfaces shall be smooth and free from large air and water pockets. The concrete shall be well bonded to all reinforcement, hardware anchors, water stops and other embedded parts.

3.010 JOINTS

A. Contraction joints shall be 3/16” deep and spaced on 10’ intervals.

B. Saw-cut construction joints shall be constructed within 8 hours of placement or before shrinkage cracks develop.

C. Expansion joints shall be ½” thick and placed on 20’ intervals. Preformed joint filler shall meet requirements of AASHTO M153 or AASHTO M213. The joint sealer shall be of a type intended for asphaltic concrete and portland cement concrete pavement.

3.011 REMOVAL OF FORMS

A. Forms may be removed, with Purchaser’s approval, 24 hours after placement of concrete, but the time may be extended if deemed necessary. Nails, tie wires and form ties shall be cut off flush, and all surfaces shall be left smooth and clean.

B. Immediately after forms have been removed, the Supplier shall inspect all concrete surfaces and patch all placement joints, voids, rock pockets, form tie holes, and other imperfections before the concrete is thoroughly dry. No patching of defective areas shall commence until the concrete has been inspected by the Purchaser.

3.012 SURFACE FINISH

A. All exposed concrete surfaces shall receive an ordinary surface finish, unless otherwise indicated on the Drawings. Ordinary surface finish shall be defined as smooth, even concrete surfaces, free of all honeycomb, objectionable fins, projections, offsets, streaks or other surface imperfections. No remedial measures will be required for satisfactory ordinary surface finish beyond the filling of the holes or cavities caused by the removal of the snap ties and tie rods.

B. Immediately after the removal of the forms, all defects in the concrete surfaces shall be brought to the attention of the Purchaser Representative, and such defects shall be repaired as herein specified or as the Purchaser may approve.

3.013 PATCHING

A. Minor Areas:

1. The Supplier shall chip away defective areas to a depth of about one inch, leaving edges perpendicular to the surface. The area to be patched and a margin area extending at least six inches beyond shall be thoroughly wet to prevent water being absorbed out of the mortar.

2. Bonding agent approved by Purchaser shall be applied on the area to be patched. The patching mortar shall be applied after the bond becomes tacky.

3. Patching mortar shall consist of one part cement to two and one-half parts (1:2 1/2) sand. With bonding agent added, the mortar shall be wetted to a

consistency as dry as possible within the requirements of handling and placing. The mortar shall be thoroughly compacted by ramming it into place

4. The patch shall be screeded off so as to leave the patch slightly higher than surrounding surfaces. It shall be left undisturbed for a period of one to two hours to permit initial shrinkage, before performing final finishing.

5. The patch shall be finished to match adjacent surfaces and kept wet for at least seven days. The Supplier shall provide and install all required protective covering.

B. Major Defective Areas: If the defects are serious or if patching does not satisfactorily restore the quality and appearance of the surface, the Purchaser may require the concrete be completely removed and replaced in accordance with the provisions of this section, all at no additional cost to the Purchaser.

END OF SECTION