SAN VITORES STREETLIGHT AND SIDEWALK SAFETY IMPROVEMENT UPGRADE

Specifications

SPECIFICATIONS
(FP-03)

SECTION 106 ACCEPTANCE OF WORK

106.02 Visual Inspection. Acceptance is based on visual inspection of the work for compliance with the contract and prevailing industry standards.

106.03 Certification. For material manufactured off-site, use a manufacturer with an ISO 9000 certification or an effective testing and inspection system. Require the manufacturer to clearly mark the material or packaging with a unique product identification or specification standard to which it is produced.

Other than references in or to the FAR or Federal Law, when these Standard Specifications reference certifications; certificates; or certified documents, equipment, or individuals, these references are not certifications under Section 4301 of Public Law 104-106, National Defense Authorization Act for Fiscal Year 1996. These references refer to documentation of non-regulatory, peripheral contract requirements that are required to be validated by an individual or organization having unique knowledge or qualifications to perform such validation.

Material accepted by certification may be sampled and tested at any time. If found not in conformance with the contract, the material will be rejected whether in place or not.

One of the following certifications may be required:

(a) Production certification. Material requiring a production certification is identified in the Acceptance Subsection of each Section. Require the manufacturer to furnish a production certification for each shipment of material. Include the following with each production certification:

(1) Date and place of manufacture;

(2) Lot number or other means of cross-referencing to the manufacturer's inspection and testing system; and

(3) Substantiating evidence that the material conforms to the contract quality requirements as required by FAR 46.105(a)(4), including all of the following:

(a) Test results on material from the same lot and documentation of the inspection and testing system;

(b) A statement from the manufacturer that the material complies with all contract requirements; and

(c) Manufacturer's signature or other means of demonstrating accountability for the certification.

(b) Commercial certification. When a certification is required, but not a production certification, furnish one commercial certification for all similar material from the same manufacturer.

A commercial certification is a manufacturer's or Contractor's representation that the material complies with all contract requirements. The representation may be labels, catalog data, stamped specification standards, or supplier's certifications indicating the material is produced to a commercial standard or specification.

106.04 Measured or Tested Conformance. Provide all necessary production and processing of the work and control performance of the work so that all of the work complies with the contract requirements.

Results from inspection or testing shall have values within the specified tolerances or specification limits. When no tolerance values are identified in the contract, the work will be accepted based on customary manufacturing and construction tolerances.

END OF SECTION 106

SECTION 109 MEASUREMENT AND PAYMENT

109.01 Measurement of Work. Take and record measurements and perform calculations to determine pay quantities for invoicing for work performed. Take or convert all measurements of work according to United States customary measure.

Unless otherwise specified, measure when the work is in place, complete, and accepted. Measure the actual work performed, except do not measure work outside the design limits or other adjusted or specified limits (staked limits). Measure structures to the lines shown on the plans or to approved lines adjusted to fit field conditions.

Take measurements as described in Subsection 109.02 unless otherwise modified by the Measurement Subsection of the Section controlling the work being performed.

Remeasure quantities if it has been determined that any portion of the work is acceptable but has not been completed to the lines, grades, and dimensions shown on the plans or established by the CO.

Submit measurement notes to the CO within 24 hours of completing the work. For on-going work, submit measurement notes weekly. When work is not complete, identify the measurement as being an interim measurement. Submit the final measurement when the installation is completed. Measurement notes form the basis of the Government's receiving report (see Subsection 109.08(d)). For lump sum items, submit documentation to support invoiced progress payment on a monthly basis.

Use an acceptable format for measurement records. As a minimum, include the following information in all records of measurement:

(a) Project name and number;

(b) Contract item number;

(c) Date the work was performed;

(d) Location of the work;

(e) Measured quantity;

(f) Calculations made to arrive at the quantity;

(g) Supporting sketch and details as needed to clearly define the work performed and the quantity measured;

(h) Names of persons measuring the work;

(i) Identification as to whether the measurement is interim or final; and

(j) Signed certification statement by the persons taking the measurements, performing the calculations, and submitting them for payment that the measurement and calculations are correct to the best of their knowledge and that the quantity being measured is subject to direct payment for the identified item under the contract.

109.02 Measurement Terms and Definitions. Unless otherwise specified, the following terms are defined as follows:

(a) Acre. 43,560 square feet. Make longitudinal and transverse measurements for area computations horizontally unless specified on the ground surface. Do not make deductions from the area computation for individual fixtures having an area of 500 square feet or less.

(b) Contract quantity. The quantity to be paid is the quantity shown in the bid schedule. The contract quantity will be adjusted for authorized changes that affect the quantity or for errors made in computing this quantity. If there is evidence that a quantity specified as a contract quantity is incorrect, submit calculations, drawings, or other evidence indicating why the quantity is in error and request, in writing, that the quantity be adjusted.

(c) Cubic yard.

(1) Cubic yard in place. Measure solid volumes by a method approved by GVB's Engineer or by the average end area method as follows:

(a) Take cross-sections of the original ground and use with design or staked templates or take other comparable measurements to determine the end areas. Do not measure work outside of the established lines or slopes

(b) If any portion of the work is acceptable but is not completed to the established lines and slopes, retake cross-sections or comparable measurements of that portion of the work. Deduct any quantity outside the designated or staked limits. Use these measurements to calculate new end areas.

(c) Compute the quantity using the average end areas multiplied by the horizontal distance along a centerline or reference line between the end areas. Deduct any quantity outside the designed or staked limits.

(2) Cubic yard in the hauling vehicle. Measure the cubic yard volume in the hauling vehicle using three-dimensional measurements at the point of delivery. Use vehicles bearing a legible identification mark with the body shaped so the actual contents may be readily and accurately determined. Before use, mutually agree in writing on the volume of material to be hauled by each vehicle. Vehicles carrying less than the agreed volume may be rejected or accepted at the reduced volume.

Level selected loads. If leveling reveals the vehicle was hauling less than the approved volume, reduce the quantity of all material received since the last leveled load by the same ratio as the current leveled load volume is to the agreed volume. Payment will not be made for material in excess of the agreed volume.

Material measured in the hauling vehicle may be weighed and converted to cubic yards for payment purposes if the conversion factors are mutually agreed to in writing.

(3) Cubic yard in the structure. Measure according to the lines of the structure as shown on the plans except as altered by GVB's Engineer to fit field conditions. Make no deduction for the volume occupied by reinforcing steel, anchors, weep holes, piling, or pipes less than 8 inches in diameter.

(4) Cubic yard by metering. Use an approved metering system.

(d) Each. One entire unit. The quantity is the actual number of units completed and accepted.

(e) Gallon. The quantity may be measured by any of the following methods:

(1) Measured volume container.
(2) Metered volume. Use an approved metering system.
(3) Commercially-packaged volumes.

When asphalt material is measured by the gallon, measure the volume at 60 ºF or correct the volume to 60 ºF using recognized standard correction factors.

(f) Hour. Measure the actual number of hours ordered by GVB's Engineer and performed by the Contractor.

(g) Linear foot. As applicable, measure the work along its length from end-to-end; parallel to the base or foundation; along the top; along the front face; or along the invert. Do not measure overlaps.

(h) Lump sum. Do not measure directly. The bid amount is complete payment for all work described in the contract and necessary to complete the work for that item. The quantity is designated as "All." Estimated quantities of lump sum work shown in the contract are approximate.

(i) M-gallon. 1,000 gallons. Measure according to (e) above.

(j) Mile. 5,280 linear feet. Measure horizontally along the centerline of each roadway, approach road, or ramp.

(k) Pound. Measure according to Subsection 109.03. If sacked or packaged material is furnished, the net weight as packed by the manufacturer may be used.

(l) Square foot. Measure on a plane parallel to the surface being measured.

(m) Square yard. 9 square feet. Longitudinal and transverse measurements for area computations will be made horizontally. No deductions from the area computation will be made for individual fixtures having area of 9 square feet or less.

(n) Station. 100 linear feet. Measure horizontally along centerline or reference line of each roadway, approach road, or ramp.

(o) Ton. 2,000 pounds avoirdupois. Measure according to Subsection 109.03.

No adjustment in a contract unit price will be made for variations in quantity due to differences in the specific gravity or moisture content.

Use net-certified scale masses, or masses based on certified volumes in the case of rail shipments as a basis of measurement subject to correction when asphalt material is lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt material is shipped by truck or transport, net-certified masses, subject to correction for loss or foaming, may be used for computing quantities.

When emulsified asphalt is converted from volume to mass, use a factor of 240 gallons per ton regardless of temperature.

When asphalt binder for asphalt concrete pavement is stored in tanks devoted exclusively to the project, quantities on invoices. When asphalt binder for asphalt concrete pavement is not stored in tanks devoted exclusively to the project, or when the validity of the quantity requested for payment is in question, base quantities on the asphalt content determined by testing.

109.03 Weighing Procedures and Devices. Not Used.

When material is proportioned or measured and paid for by mass, provide one of the following:

(a) Commercial weighing system. Use permanently-installed and certified commercial scales at batching plant.

(b) Invoices. Not Used.

(c) Project weighing system. Not Used.

109.05 Scope of Payment. Payment for all contract work is provided, either directly or indirectly, under the pay items shown in the bid schedule.

(a) Direct payment. Payment is provided directly under a pay item shown in the bid schedule when one of the following applies:

(1) The work is measured in the Measurement Subsection of the Section ordering the work, and the bid schedule contains a pay item for the work from the Section ordering the work.

(2) The Measurement Subsection, of the Section ordering the work, references another Section for measuring

the work and the bid schedule contains a pay item for the work from the referenced Section.

(b) Indirect payment. Work for which direct payment is not provided is a subsidiary obligation of the Contractor. Payment for such work is indirectly included under other pay items shown in the bid schedule. This includes instances when the Section ordering the work references another Section for performing the work and the work is not referenced in the Measurement Subsection of the Section ordering the work.

Compensation provided by the pay items included in the contract bid schedule is full payment for performing all contract work in a complete and acceptable manner. All risk, loss, damage, or expense arising out of the nature or prosecution of the work is included in the compensation provided by the contract pay items.

Work measured and paid for under one pay item will not be paid for under any other pay item.

The quantities shown in the bid schedule are approximate unless designated as a contract quantity. Limit pay quantities to the quantities staked, ordered, or otherwise authorized before performing the work. Payment will be made for the actual quantities of work performed and accepted or material furnished according to the contract. No payment will be made for work performed in excess of that staked, ordered, or otherwise authorized.

109.08 Progress Payments. Follow the requirements of FAR Clauses 52.232-5 Payments under Fixed-Price Construction Contracts and 52.232-27 — Prompt Payment for Construction Contracts.

(a) General. Only invoice payments will be made under this contract. Invoice payments include progress payments made monthly as work is accomplished and the final payment made upon final acceptance. Only one progress payment will be made each month. No progress payment will be made in a month in which the work accomplished results in a net payment of less than $1,000. Full or partial progress payment will be withheld until a construction schedule or schedule update is submitted to, and accepted by, the CO.

(b) Closing date and invoice submittal date. The closing date for progress payments will be designated by the CO. Include work performed after the closing date in the following month's invoice. Submit invoices to the designated billing office.

(c) Invoice requirements. Submit the invoice to the Government's designated billing office. Include the following items in the invoice:

(1) The information required in FAR Clause 52.232-27(a)(2)(i) through (a)(2)(xi).

(2) A tabulation of total quantities and unit prices of work accomplished or completed on each pay item as of the monthly closing date. Do not include any quantities unless field note documentation for those quantities was submitted by the closing date. Do not include quantities of work involving material for which test reports required under Sections 153 or 154 or certifications required by Subsection 106.03 are, or will be, past due as of the closing date.

(3) The certification required by FAR Clause 52.232-5(c) and, if applicable, the notice required by FAR Clause 52.232-5(d). Provide an original signature on the certification. Facsimiles are not acceptable.

(4) If applicable, a copy of the notices that are required by FAR Clause 52.232-27(e)(5) and (g).

(5) The amount included for work performed by each subcontractor under the contract.

(6) The total amount of each subcontract under the contract.

(7) The amounts previously paid to each subcontractor under the contract.

(8) Adjustments to the proposed total payment that relate to the quantity and quality of individual items of work. Adjustments for the following may be made by the Government after validation of the invoice:

(a) Retent resulting from a failure to maintain acceptable progress;

(b) Retent resulting from violations of the labor provisions;

(c) Retent pending completion of incomplete work, other *"no pay"* work, and verification of final quantities;

(d) Obligations to the Government such as excess testing cost or the cost of corrective work pursuant to

FAR Clause 52.246-12(g); or

(e) Liquidated damages for failure to complete work on time.

(d) Government's receiving report. The Government's receiving report will be developed using the measurement notes received by the CO and determined acceptable. Within 7 days after the closing date, the CO will be available by appointment at the Government's designated billing office to advise the Contractor of quantities and unit prices appearing on the Government's receiving report.

(e) Processing progress payment requests. No payment will be made for work unless field note documentation for the work was provided by the closing date.

(1) Proper invoices. If the invoice meets the requirements of Subsection 109.08(c), and the quantities and unit prices shown on the Contractor's invoice agree with the corresponding quantities and unit prices shown on the Government's receiving report, the invoice will be paid.

(2) Defective invoices. If the invoice does not meet the requirements of Subsection 109.08(c), or if any of the quantities or unit prices shown on the Contractor's invoice exceed the corresponding quantities and unit prices shown on the Government's receiving report, the invoice is defective, and the Contractor will be notified according to FAR Clause 52.232-27(a)(2). Defective invoices will be returned to the Contractor within 7 days after receipt by the Government's designated billing office. Correct and resubmit returned invoices. If the defects are minor, the Contractor may elect, in writing, to accept the quantities and unit prices shown on the Government's receiving report for payment.

(f) Partial payments. Progress payments may include partial payment for material to be incorporated in the work, provided the material meets the requirements of the contract and is delivered on, or in the vicinity of, the project site or stored in acceptable storage places.

Partial payment for material does not constitute acceptance of such material for use in completing items of work. Partial payments will not be made for living or perishable material until incorporated into the project.

Partial payments for material will not exceed the lesser of:

(1) 80 percent of the contract bid price for the item; or

(2) 100 percent of amount supported by copies of invoices submitted.

The quantity paid will not exceed the corresponding quantity estimated in the contract.

109.09 Final Payment. Follow the requirements of FAR Clause 52.232-5 Payment under Fixed-Price Construction Contracts and FAR Clause 52.232-27 Prompt Payment for Construction.

Upon final acceptance and verification of final pay records, the Government will send, by certified mail, a final voucher (SF 1034) and a release of claims document. Execute both the voucher and the release of claims, and return the documents to the Government for payment. The date of approval by the Government of the final voucher for payment constitutes the date of final settlement of the contract.

If unresolved claims exist or claims are proposed, reserve the right to the claims by listing a description of each claim and the amount being claimed on the release of claims document.

Failure to execute and return the voucher and release of claims document within 90 days after receipt shall constitute and be deemed execution of the documents and the release of all claims against the Government arising by virtue of the contract. In this event, the day after 90 days from receipt constitutes the date of final settlement of the contract.

END OF SECTION 109

SECTION 151 MOBILIZATION

151.01 Description. This work consists of moving personnel, equipment, material, and incidentals to the project and performing all work necessary before beginning work at the project site. Mobilization includes the obtaining of permits, insurance, and bonds.

151.02 Measurement. Measure mobilization according to Subsection 109.02.

151.03 Payment. The accepted quantity, measured as provided in Subsection 109.02, will be paid at the contract price per unit of measurement for the Section 151 pay item shown in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for mobilization lump sum will be paid as follows:

(a) Bond premiums will be reimbursed according to FAR Clause 52.232-5 Payments Under Fixed-Price Construction Contracts, after receipt of the evidence of payment.

(b) When 5 percent of the original contract amount is earned from other bid items, 50 percent of the mobilization item, or 5 percent of the original contract amount, whichever is less, will be paid.

(c) When 10 percent of the original contract amount is earned from other bid items, 100 percent of the mobilization item, or 10 percent of the original contract amount, whichever is less, will be paid.

(d) Any portion of the mobilization item in excess of 10 percent of the original contract amount will be paid after final acceptance.

END OF SECTION 151

SECTION 153 CONTRACTOR QUALITY CONTROL

Description

153.01 This work consists of obtaining samples for Contractor quality control testing, performing tests for Contractor quality control, providing inspection, and exercising management control to ensure that work conforms to the contract requirements. See FAR Clause 52.246-12 Inspection of Construction.

Construction Requirements

153.02 Contractor Quality Control Plan. Before the start of the work, submit a written quality control plan for acceptance. With prior approval, submission of a quality control plan for items of work not immediately scheduled to begin may be deferred.

Submit the following with the quality control plan:

(a) Process control testing. List the material to be tested by pay item, tests to be conducted, the location of sampling, and the frequency of testing.

(b) Inspection/control procedures. Address each of the following subjects in each phase of construction:

(1) Preparatory phase.

(a) Review all contract requirements.

(b) Ensure compliance of component material to the contract requirements.

(c) Coordinate all submittals including certifications.

(d) Ensure capability of equipment and personnel to comply with the contract requirements.

(e) Ensure preliminary testing is accomplished.

(f) Coordinate surveying and staking of the work.

(2) Start-up phase.

(a) Review the contract requirements with personnel performing the work.

(b) Inspect start-up of work.

(c) Establish standards of workmanship.

(d) Provide training as necessary.

(e) Establish detailed testing schedule based on the production schedule.

(3) Production phase.

(a) Conduct intermittent or continuous inspection during construction to identify and correct deficiencies.

(b) Inspect completed work before requesting Government inspection acceptance.

(c) Provide feedback and system changes to prevent repeated deficiencies.

(c) Description of records. List the records to be maintained.

(d) Personnel qualifications.

(1) Document the name, authority, relevant experience, and qualifications of person with overall responsibility for the inspection system.

(2) Document the names, authority, and relevant experience of all personnel directly responsible for inspection and testing.

(e) Subcontractors. Include the work of all subcontractors. If a subcontractor is to perform work under this Section, detail how that subcontractor will interface with the Contractor's and other subcontractor's organizations.

Modifications or additions may be required to any part of the plan that is not adequately covered. Acceptance of the quality control plan will be based on the inclusion of the required information. Acceptance does not imply any warranty by the Government that the plan will result in consistent contract compliance. It remains the responsibility of the Contractor to demonstrate such compliance.

Do not begin the work until the quality control plan covering that work is accepted.

Supplement the plan as work progresses and whenever quality control or quality control personnel changes are made.

153.03 Testing. Perform testing according to the accepted quality control plan. Keep laboratory facilities clean and maintain all equipment in proper working condition. Allow unrestricted access for inspection and review of the facility.

153.04 Records. Maintain complete testing and inspection records by pay item number and make them accessible to the CO.

For each day of work, prepare an *"Inspector's Daily Record of Construction Operations"* (Form FHWA 1413) or an approved alternate form. Detail inspection results including deficiencies observed and corrective actions taken. Include the following certification signed by the person with overall responsibility for the inspection system:

"It is hereby certified that the information contained in this record is accurate and that all work documented herein complies with the requirements of the contract. Any exceptions to this certification are documented as a part of this record."

Submit the record and certification within one working day of the work being performed. If the record is incomplete, in error, or otherwise misleading, a copy of the record will be returned with corrections noted. When chronic errors or omissions occur, correct the procedures by which the records are produced.

Maintain linear control charts that identify the project number, pay item number, test number, each test parameter, the upper and lower specification limit applicable to each test parameter, and the test results. Use the control charts as part of the quality control system to document the variability of the process, to identify production and equipment problems, and to identify potential pay factor adjustments.

Post control charts in an accessible location and keep them up-to-date. Cease production and make corrections to the process when problems are evident.

153.05 Acceptance. The Contractor's quality control system will be evaluated under Subsection 106.02 based on the demonstrated ability of the quality control system to result in work meeting the contract requirements.

If the Government's testing and inspection indicate that the Contractor's quality control system is ineffective, make immediate improvements to the system to correct these inadequacies. Furnish notification in writing of improvements and modifications to the system.

Measurement and Payment

153.06 Do not measure Contractor quality control for payment.

END OF SECTION 153

SECTION 154 CONTRACTOR SAMPLING AND TESTING

Description

154.01 This work consists of obtaining samples for testing. When there is a contract pay item for Contractor testing included in the bid schedule, it also consists of testing and reporting required test results. It does not include Contractor quality control testing required under Section 153. However, include the work required under this Section in the Section 153 quality control plan.

Construction Requirements

154.02 Sampling. Sample material to be tested according to the Sampling and Testing Requirements tables included at the end of each section. The sampling schedules and times will be provided by the CO using a random number system. In addition, sample any material that appears defective or inconsistent with similar material being produced unless such material is voluntarily removed and replaced or corrected.

Sample and split samples according to AASHTO or other acceptable procedures. Allow the CO the opportunity to witness all sampling. Immediately perform splits when required. Deliver the Government's portion of the sample or split sample in an acceptable container suitable for shipment. Label all samples with the following information:

(a) Project number;

(b) Source of material;

(c) Pay item number;

(d) Sample number;

(e) Date sampled;

(f) Time sampled;

(g) Location sample taken;

(h) Name of person sampling;

(i) Name of person witnessing sampling; and

(j) Type of test required on sample.

154.03 Testing. When there is a contract pay item for Contractor testing included in the bid schedule, perform all tests required by the Sampling and Testing Requirements tables at the end of each section. Allow the CO the opportunity to witness all testing. Testing of trial samples may be required to demonstrate testing competence.

154.04 Records. Report test results on forms containing all sample information required by Subsection 154.02. Label clearly all interim measurements used to determine the results. Attach work sheets used to determine test values to the test result forms when submitted. When tests are on material being incorporated in the work, report test results within 24 hours except as specified in the Sampling and Testing Requirements tables. Payment for work may be delayed or the work suspended until test results are provided.

154.05 Acceptance. Contractor sampling and testing will be evaluated under Subsections 106.02 and 106.04 based on Government verification testing.

Measurement

154.06 Measure the Section 154 items listed in the bid schedule according to Subsection 109.02.

Payment

154.07 The accepted quantities will be paid at the contract price per unit of measurement for the Section 154 pay item listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for Contractor testing will be paid as follows:

(a) 25 percent of the item amount, not to exceed 0.5 percent of the original contract amount, will be paid after all the testing facilities are in place, qualified sampling and testing personnel are identified, and the work being tested has started.

(b) Payment for the remaining portion of the item amount will be prorated based on the total work completed.

Payment for all or part of this item may be retained if Government verification testing invalidates the Contractor testing.

END OF SECTION 154

SECTION 203 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

203.03 Salvaging Material. Salvage, with reasonable care, all material designated to be salvaged. Salvage in readily transportable sections or pieces. Replace or repair all members, pins, nuts, plates, and related hardware damaged, lost, or destroyed during the salvage operation. Wire all loose parts to adjacent members or pack them in sturdy boxes with the contents clearly marked.

Match mark members of salvaged structures. Furnish one set of drawings identifying the members and their respective match marks.

Stockpile salvaged material at a designated area on the project.

203.05 Disposing of Material. Dispose of debris and unsuitable and excess material as follows:

(a) Remove from project. Recycle or dispose of material legally off the project. Furnish a statement documenting the nature and quantity of material processed or sold for recycling. Otherwise, furnish a signed copy of the disposal agreement before disposal begins.

(b) through (d) NOT USED

203.08 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 203 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

END OF SECTION 203

SECTION 404 MINOR HOT ASPHALT CONCRETE

Description

404.01 This work consists of constructing minor hot asphalt concrete for sidewalks, paved waterways, curbs, and roadways or for repairs required as a result of the work or as otherwise directed by GVB.

Construction Requirements

404.02 Composition of Mix (Job-Mix Formula). Provide a hot asphalt concrete mix composed of crushed stone or gravel and asphalt binder mixed in an approved plant. Use an aggregate gradation and asphalt binder of a quality conforming to those normally used locally by either Federal or State agencies for the type of work being constructed.

Submit the strength, quality, and gradation specifications for the asphalt concrete mix. Include copies of laboratory test reports that demonstrate the properties of the aggregates, asphalt binder, additives, and mix meet Federal or State agency specifications. Also submit the maximum specific gravity (density) of the mix as determined by AASHTO T 209.

404.03 Surface Preparation. Prepare the surface according to section 410.05 as applicable.

404.04 Weather Limitations. Place asphalt concrete on a dry, unfrozen surface when the air temperature in the shade is at least 35 ^{o}F and rising.

404.05 Hauling. NOT USED

404.06 Placing. NOT USED

404.07 Compacting.

(a) Roadway paving. Compact the mix to a minimum of 90 percent of maximum specific gravity (density). Complete compaction before the mix temperature falls below 160 ^{o}F. Determine density by nuclear gauge.

(b) Non-roadway paving. Compact by rolling with a hand-operated roller weighing at least 300 pounds or with a small power roller.

Compact areas that are not accessible to rollers by other approved methods.

404.08 Pavement Smoothness. Use a 10-foot metal straightedge to measure at right angles and parallel to the centerline. Defective areas are surface deviations in excess of 1/4 inch in 10 feet between any two contacts of the straightedge with the surface. Correct defective areas using approved methods.

404.09 Acceptance. See Table 404-1 for sampling and testing requirements.

Minor hot asphalt concrete mixture will be evaluated under Subsections 106.02 and 106.03.

Minor hot asphalt concrete construction work will be evaluated under Subsections 106.02 and 106.04.

Measurement

404.10 Measure the Section 404 items listed in the bid schedule according to Subsection 109.02.

Payment

404.11 The accepted quantities will be paid at the contract price per unit of measurement for the Section 404 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 404-1
Sampling and Testing Requirements

Material or Product	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Asphalt mixture (404.07)	Measured and tested for conformance (106.04)	Compaction (roadway paving)	—	AASHTO T 310	1 per 1200 yd^2	In-place	—	Upon completing tests

END OF SECTION 404

SECTION 410 SLURRY SEAL

Description

410.01 - 410.04 (NOT USED)

410.06 – 410.10 (NOT USED)

410.05 Surface Preparation. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods.

END OF SECTION 410

SECTION 552 STRUCTURAL CONCRETE

552.01 This work consists of furnishing, placing, finishing, and curing concrete in bridges, culverts, and other structures.

Structural concrete class is designated as shown in Table 552-1.

Construction Requirements

552.03 Composition (Concrete Mix Design). Design and produce concrete mixtures that conform to Tables 552-1 and 552-2 for the class of concrete specified. Determine design strength values according to ACI 318. Structural concrete shall also conform to the following ACI specifications.

- ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavy Weight and Mass Concrete;
- ACI 211.2 Standard Practice for Selecting Proportions for Structural Light Weight Concrete; and
- ACI 211.3 Guide for Selecting Proportions of No-Slump Concrete.

Table 552-1
Composition of Concrete

Class of Concrete	Minimum Cement Content (pounds per cubic yard)	Maximum W/C Ratio	Slump[(1)] (inches)	Nominal Maximum Aggregate Size (inches)
A	611	0.49	2 to 4	1½
A(AE)	611	0.44	1 to 4	1½
B	517	0.58	2 to 4	2½
B(AE)	517	0.58	2 to 4	2½
C	658	0.49	2 to 4	3/4
C(AE)	658	0.44	1 to 3	3/4
D(AE)[(2)]	611	0.40	1 to 3	1½
E(AE)[(3)]	611	0.40	4 to 6[(4)]	3/4
P (Prestressed)	658	0.44	0 to 4	1
Seal	658	0.54	4 to 8	1½

(1) Maximum slump is 8 inches if approved mix design includes a high-range water reducer.
(2) Concrete with a water reducing and retarding admixture conforming to AASHTO M 194, type D.
(3) A latex modified concrete with 0.037 gallons of modifier per pound of cement.
(4) Measure the slump 4 to 5 minutes after the concrete is discharged from the mixer.

Table 552-2
Minimum Air Content for Air Entrained Concrete

Nominal Maximum Aggregate Size	As Delivered Minimum Air Content (1) (%)
3 inch	3.0
2½ inch	3.5
2 inch	3.5
1½ inch	4.0
1 inch	4.5
3/4 inch	4.5
1/2 inch	5.5

(1) These air contents apply to the total mix. When testing these concretes, aggregate larger than 1½ inches is removed by handpicking or sieving, and air content is determined on the minus 1½-inch fraction of the mix. Air content of the total mix is computed from the value determined on the minus 1½-inch fraction.

Submit concrete mix designs on FHWA Form 1608.

Verify mixture design with trial mixes prepared according to ACI 318 from proposed source(s) or with previous concrete production data for the mixture design submitted from proposed source(s). Submit written concrete mix designs for approval at least 36 days before production. Each mix design submittal shall include all of the following:

(a) Project identification;

(b) Name and address of Contractor and concrete producer;

(c) Mix design designation;

(d) Class of concrete and intended use;

(e) Material proportions;

(f) Name and location of material sources for aggregate, cement, admixtures, and water; and

(g) Type of cement and type of cement replacement if used. Fly ash, ground iron blast-furnace slag, or silica fume may partially replace cement in any mix as follows:

552.14 Finishing Plastic Concrete. Strike off concrete surfaces that are not placed against forms. Float finish the concrete surface. Remove any laitance or thin grout. Carefully tool all nonchamfered edges with an edger. Leave edges of joint filler exposed.

Protect the surface from rain damage.

Provide at least two work bridges capable of supporting the workers and equipment during placement, curing, and finishing operations without sagging or vibrating. Place the work bridges at a reasonable height above the concrete surface to not impede worker performance and not touch the finished or fresh concrete surface.

(a) THROUGH (b). NOT USED

(c) Texturing. Finish after floating or at a time when finishing operations will not displace aggregate. Produce a skid-resistant surface texture on all driving surfaces by grooving. Use one of the following finishes or a combination thereof for other surfaces as required.

(1) NOT USED

(2) Sidewalk finish. Strike off the surface using a strike board and then float the surface. Use an edging tool on edges and expansion joints. Broom the surface using a broom with stiff bristles, broom perpendicular to the centerline from edge to edge with adjacent strokes slightly overlapped. Produce regular corrugations not over 1/8 inch in depth without tearing the concrete. While the concrete is plastic, correct porous spots, irregularities, depressions, small pockets, and rough spots. Groove contraction joints at the required interval using an approved grooving tool.

(3) NOT USED

(4) Exposed aggregate finish. Strike off the surface using a strike board and then float the surface. Use an edging tool on all transverse and longitudinal joints that are against forms or existing pavement. Do not edge transverse joints in a continuous lane pour or longitudinal joints in a continuous dual lane pour.

As soon as the concrete hardens sufficiently to prevent particles of gravel from being dislodged, broom the surface. Use stiff brushes approved by the CO. Exercise care to prevent marring of the surface and cracking or chipping of slab edges or joints. If approved by the CO, apply a light spray of retardant to the unfinished surface to facilitate this work.

First, broom transversely across the pavement. Pull the loosened semi-stiff mortar entirely off the pavement. Remove the mortar from all adjacent pavements. Then broom parallel to the pavement centerline. Continue this operation until a sufficient amount of coarse aggregate is exposed. Other methods of aggregate exposure, such as using a water spray attachment on a special exposed aggregate broom, will be permitted if satisfactory results are demonstrated.

After curing according to Subsection 552.15(b) or (c), wash the surface with brush and water to remove all laitance and cement from the exposed coarse aggregate.

(d) NOT USED

(e) NOT USED

552.15 – NOT USED

552.16 Finishing Formed Concrete Surfaces. Remove and replace or repair, as approved, all rock pockets or honeycombed concrete. Finish sound, formed concrete surfaces as follows.

(a) Class 1 — Ordinary surface finish. Finish the following surfaces with a class 1, ordinary surface finish:

(1) Under surfaces of slab spans, box girders, filled spandrel arch spans, and the roadway deck slab between superstructure girders;

(2) Inside vertical surface or T-girders of superstructures; and

(3) Surfaces to be buried and culvert surfaces above finished ground that are not visible from the traveled way or a walkway.

Begin finishing as soon as the forms are removed. Remove fins and irregular projections from all surfaces that are exposed or will be waterproofed. Remove bulges and offsets with carborundum stones or discs. Remove localized, poorly-bonded rock pockets or honeycombed concrete, and replace with sound concrete or packed mortar in an approved manner.

Clean and point all form tie cavities, holes, broken corners and edges, and other defects. Saturate the area with water. Finish the area with mortar that is less than 1-hour-old. After the mortar is set, rub it (if required) and continue curing. Match exposed surfaces to surrounding concrete.

Carefully tool and remove free mortar and concrete from construction and expansion joints. Leave joint filler exposed for its full length with clean, true edges.

Rub or grind bearing surfaces on piers and abutments to the specified elevation and slope.

If the final finished surface is not true and uniform, rub it according to (b) below.

(b) THROUGH (g) NOT USED

552.17– 552.21 (NOT USED)

END OF SECTION 552

SECTION 554 REINFORCING STEEL

Description

554.01 This work consists of furnishing and placing reinforcing steel.

Material

554.02 Conform to the following Subsection:

Reinforcing steel	709.01

Construction Requirements

554.08 Placing and Fastening. Support the bars on precast concrete blocks or metal supports according to the CRSI *Manual of Standard Practice.* Attach concrete block supports to the supported bar with wire cast in the center of each block. Use class 1 (plastic protected) or class 2, type B (stainless steel protected) metal supports in contact with exposed concrete surfaces. Use stainless steel conforming to ASTM A 493, type 430.

Coat chairs, tie wires, and other devices used to support, position, or fasten epoxy-coated reinforcement with a dielectric material. Do not use plastic supports.

Space slab bar supports no more than 4 feet apart transversely or longitudinally. Do not use bar supports either directly or indirectly to support runways for concrete buggies or other similar construction loads.

Space parallel bars within 1½ inches of the required location. Do not cumulate spacing variations. The average of any two adjacent spaces shall not exceed the required spacing.

Provide 2 inches clear cover for all reinforcement except as otherwise shown on the plans.

Place reinforcing steel in deck slabs within 1/4 inch of the vertical plan location. Tie bridge deck reinforcing bars together at all intersections except where spacing is less than 12 inches in both directions, in which case alternate intersections may be tied. Check the clear cover over deck reinforcing steel using a template before placing deck concrete. Replace damaged supports.

Tie bundle bars together at intervals not exceeding 6 feet. Do not bundle bars unless the location and splice details are specified.

Do not place concrete in any member until the placement of the reinforcement is approved.

END OF SECTION 554

SECTION 601 MINOR CONCRETE STRUCTURES

601.02 Material. Conform to the following Subsections:

Reinforcing Steel, ties bars, dowel bars, hook bolts, caps	709.01
Water	725.01
Epoxy Resin Adhesives	725.21
Epoxy Grout	725.22 (b)
Non-Shrinking Grout	725.22 (c)

601.03 Concrete Composition. Conform to Table 601-1. Before batching concrete, submit the proposed concrete proportions for approval on Form FHWA 1606 *Minor Concrete Mix Design Trial Batch Summary* or other approved form. As a minimum, submit the following:

(a) Type and source(s) of all material proposed for use.

(b) Material certification for all material proposed for use.

(c) Saturated surface dry mass of the fine and coarse aggregate per cubic yard of concrete.

(d) Gradation of fine and coarse aggregate.

(e) Mass of mixing water per cubic yard of concrete.

(f) Mass of cement per cubic yard of concrete. Fly ash, ground iron blast-furnace slag, or silica fume may be substituted for cement according to Subsection 552.03(g).

(g) Entrained air content of plastic concrete in percent by volume.

(h) Maximum slump of plastic concrete in inches.

(i) When colored concrete is required, submit preliminary samples of the colored concrete. Prepare a 3-foot by 3-foot by 4-inch panel for each acceptable mix that is to be colored. Finish and cure the panels in the same manner as the concrete will be finished and cured on the project.

Table 601-1
Composition of Minor Structure Concrete

Property	Specification
Cement content	611 pounds per cubic yard minimum
Water/cement ratio	0.49 maximum
Slump	5 inches maximum
Air content	4 % minimum
Size of coarse aggregate	AASHTO M 43 with 100% passing the 1½-inch sieve
28-day compressive strength	3,000 pounds per square inch minimum

Construction Requirements

601.04 General. When concrete is cracked, spalling, or scaling, remove concrete to the nearest joint.

Design and construct forms that are free of bulge and warp and allow for removal without injuring the concrete. When concrete contains a retarding admixture, fly ash, or other pozzolan replacement for cement, design the forms for a lateral pressure equal to that exerted by a fluid weighing 150 pounds per cubic foot.

Use wood, metal, or other suitable material for forms. Keep forms clean and coat with a form release agent or form oil before placing concrete.

Place and fasten reinforcing steel according to Subsection 554.08.

601.08 Measurement. Measure the Section 601 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Measure concrete by the cubic yard in the structure.

601.09 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 601 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

The concrete lump sum item will be prorated based on the progress of the work under this Section.

END OF SECTION 601

SECTION 615 SIDEWALKS, DRIVE PADS, AND PAVED MEDIANS

615.01 Description. This work consists of repairing, sidewalks, drive pads, and paved medians upon completion of work related to the repair of streetlight poles

Sidewalks, drive pads, and paved medians are designated as concrete, asphalt, concrete brick, or clay brick.

615.02 Conform to the following Sections and Subsections:

Asphalt mixtures	404
Bed course	704.09
Concrete	601
Masonry and mortar cement	701.02
Sealants, fillers, seals, and sleeves	712.01
Reinforcing steel	709.01

Construction Requirements

615.03 General. Place bed course material in layers not exceeding 4 inches in compacted thickness. Compact each layer with at least three passes of a lightweight mechanical tamper, roller, or vibratory system.

615.04 Concrete Sidewalks, Drive Pads, and Medians. Perform the work according to Section 601. Use forms that extend for the full depth of the concrete.

(a) Joints. Construct joints perpendicular to the outside slab edges and other joints. Match the joints in adjacent curb or pavements. Tool and remove all free mortar and concrete from joints.

(1) Expansion joints. Construct at intervals not exceeding 20 feet. Use 3/4-inch thick preformed expansion joint filler for the full depth of the joints. When joints are to be sealed, use multi-component joint sealant.

(2) Contraction joints. Construct at intervals not exceeding 10 feet. Form the joint with a jointing tool or saw the joints to a depth of 1/4 to 1/3 of the thickness of the concrete and about 1/8 inch wide.

(3) Construction joints. Form construction joints around all appurtenances such as manholes, utility poles, buildings, and bridges. Use 1/2-inch, thick preformed expansion joint filler for the full depth of the joints.

When joints are to be sealed, use multi-component joint sealant.

(b) Finishes. Provide a sidewalk finish unless otherwise required. Edge outside edges of slab and all joints with a 1/4-inch radius edging tool.

(1) Sidewalk finish. See Subsection 552.14(c)(2).

(2) Exposed aggregate finish. See Subsection 552.14(c)(4).

Cure the concrete for at least 72 hours according to Subsection 552.15(b) or (c). Protect the work from pedestrian traffic for 72 hours and from vehicular traffic for 7 days.

615.05 Asphalt Concrete Sidewalks, Drive Pads, and Medians. Perform the work according to Section 404.

615.06 Brick Sidewalks, Drive Pads, and Medians. Lay brick in successive courses on a prepared surface. Lay each course of brick to grade. Relay any course that deviates from a straight line by more than 2 inches in 30 feet.

Sweep and inspect the brick surface before the bed sets. Remove each imperfect brick and replace.

Chock the joints flush with a dry mixture of 4 parts sand and 1 part cement by mass and carefully water the surface to saturate the joint filler.

615.07 Acceptance. See Table 615-1 for sampling and testing requirements.

Clay or shale brick, concrete brick, curing material, joint fillers, and reinforcing steel will be evaluated under Subsections 106.02 and 106.03.

Bed course material will be evaluated under Subsections 106.02 and 106.04.

Construction of sidewalks, drive pads, and medians will be evaluated under Subsections 106.02 and 106.04.

Asphalt mixture will be evaluated under Section 404.

Concrete will be evaluated under Section 601.

615.08 Measurement. Measure the Section 615 items listed in the bid schedule according to Subsection 109.02.

615.09 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 615 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Table 615-1
Sampling and Testing Requirements

Material or Product	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Bed course (704.09)	Measured and tested for conformance (106.04)	Gradation Liquid limit	— —	AASHTO T 27 AASHTO T 89	1 per 600 yd^3 "	Production output "	Yes. when "	— —

END OF SECTION 615

SECTION 618 CONCRETE BARRIERS AND PRECAST GUARDWALLS

Description

618.01 This work consists of constructing and resetting concrete barrier and precast concrete guardwall systems.

Material

618.02 Conform to the following Section and Subsections:

Concrete class A(AE)	552
Precast concrete barrier	725.11(b)
Preformed joint filler	712.01(b)
Reinforcing steel	709.01

Construction Requirements

618.03 General. Excavate and backfill according to Section 209. Construct barriers and guardwalls that meet crash test requirements of NCHRP Report 350, *Recommended Procedures for Safety Performance and Evaluation of the Highway Features.*

618.04 Concrete Barriers. Concrete barriers may be cast-in-place, slip-formed, or precast according to Section 552. Finish the sides and top according to Subsection 552.16(a).

(a) Cast-in-place. Hand form or saw contraction joints 1/4 inch wide and 2 inches deep at 20-foot intervals. Saw as soon as possible after the concrete has set sufficiently to preclude raveling during sawing, but before shrinkage cracking occurs. Decrease the depth of the saw cut at the edge adjacent to the pavement to prevent pavement damage.

Place 3/4-inch preformed joint filler in all construction joints. Cut the joint filler to fit the cross-sectional area at structures and barrier construction joints. Tool construction joint edges. Seal joints according to Subsection 501.11.

(b) Slip-formed. Do not touch the barrier extruded concrete surface as it leaves the slip-form machine except to immediately remove offsets and fins by light troweling.

Make adjustments in the operation to correct any condition causing surface blemishes larger than 1/2 inch. Do not use water on the completed barrier to correct imperfections.

(c) Precast. Precast barriers in section lengths. Prepare the barrier foundation so it does not vary over 1/4 inch when a 10-foot straightedge is laid along the centerline of the barrier. Align the joints and connect adjacent sections.

Use cast-in-place barrier where transitions, split barriers, or gaps shorter than 10 feet require it. At each joint between precast and cast-in-place barrier, provide hardware in the cast-in-place section to tie its end to the abutting precast section.

618.05 Precast Concrete Guardwall.

(a) Fabrication. A full-size sample of the guardwall will be provided at a specified location. Fabricate the guardwall to match the sample's shape, color, and texture. The guardwall shall also conform to the following:

(1) Fabricate in a precast concrete production facility certified by the National Precast Concrete Association and according to the Association's *Manual of Quality Control.*

(2) Formulate the facing mixes, backing mixes, and structural concrete backup to produce concrete mix designs of similar aggregate-cement ratios to minimize differences in shrinkage factors and coefficients of thermal expansion and contraction. Formulate using hydraulic cement, limestone, quartz, mica, and silicious stones in such proportions as to match the sample.

(3) Use epoxy coated reinforcing steel at locations where the reinforcing steel is less than 2 inches from the exposed surface.

(4) Cast the segments straight and true to a line in strong permanent composite molds of steel, plastic resins, concrete, or rubber.

(5) Cast the facing mixes a minimum of 1 inch thick. Ensure a good bond between facing and backup mixes.

(6) Provide 4 lifting inserts in unexposed areas. Provide removable caps for the lifting inserts to allow for future segment replacement.

(b) Test section. Demonstrate the ability to match the sample by fabricating a 10-foot, full-scale guardwall test section and delivering it to the location of the sample for comparison. If the test section is not in reasonably close conformity to the sample, fabricate another test section according to (a) above. Test sections that do not match the sample may not be used in the wall installation.

(c) Installation. After the test section is approved, produce the guardwall sections to match the approved test section. Prevent damage to the segments during fabrication, handling, delivery, and installation. Repair or replace all damaged sections. Prepare the foundation and place the sections. Use backer rods and joint sealant in the section joints to match the false joints.

At 100-foot intervals and at low points in the guardwall, dig outlet ditches and fill them with 6 inches of aggregate conforming to AASHTO M 43, number 57.

618.06 Terminal Sections. Where barrier is being constructed next to roadway lanes open to traffic, connect an approved temporary terminal section to the barrier at the end of each day.

Construct permanent graded berms according to Section 204.

618.07 Resetting Barrier. Reset barrier and terminal sections according to Subsections 618.03 and 618.06. Store barrier sections in an approved location when resetting cannot immediately follow removal.

618.08 Acceptance. Material for concrete barrier and precast guardwall (except concrete and reinforcing steel) will be evaluated under Subsections 106.02 and 106.03.

Construction of concrete barriers and precast concrete guardwalls will be evaluated under Subsections 106.02 and 106.04.

Concrete barrier and precast concrete guardwall appearance will be evaluated under Subsection 106.02.

Precast concrete guardwall test sections will be evaluated under Subsection 106.02.

Concrete will be evaluated under Section 552.

Reinforcing steel will be evaluated under Section 554.

Measurement

618.09 Measure the Section 618 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Measure concrete barrier and precast concrete guardwall excluding terminal sections.

Measure reset barrier in the relocated position including terminal sections.

Measure earth berms under Section 204.

Payment

618.10 No separate payment will be made for this repair or replacement work. It shall be considered incidental. See Subsection 109.05.

END OF SECTION 618

SECTION 625 TURF ESTABLISHMENT

625.01 This work consists of soil preparation, watering, fertilizing, seeding, and mulching.

Seeding and mulching methods are designated as dry or hydraulic.

Material

625.02 Conform to the following Subsections:

Water	725.01

Construction Requirements

625.03 General. Apply turf establishment to finished slopes and ditches within 14 days after completion of construction on a portion of the site. Do not seed during windy weather or when the ground is excessively wet, frozen, snow covered, extremely dry, cloddy, hard pan, or not friable.

625.04 NOT USED

625.05 Watering. Moisten seeding areas before seeding and maintain the moisture until 10 days after germination.

625.06 Fertilizing. Apply fertilizer by the following methods:

(a) Dry method. Incorporate the fertilizer into the upper portion of the seedbed before seeding.

(b) Hydraulic method. Add fertilizer to the slurry and mix before adding seed. Apply the seed and fertilizer in one application.

625.07 Seeding. Apply seed by the following methods:

(a) Dry method. Apply the seed with approved power driven seeders, drills, or other mechanical equipment. Hand-operated seeding methods are satisfactory on areas inaccessible to mechanical equipment. Lightly compact the seedbed within 24 hours after seeding.

(b) Hydraulic method. Use hydraulic-type equipment capable of providing a uniform application using water as the carrying agent. Add a tracer material consisting of either wood or grass cellulose fiber mulch to the water. Apply the tracer material at a rate of 400 pounds per acre to provide visible evidence of uniform application. Add the seed to the water slurry no more than 30 minutes before application. Seed by hand areas inaccessible to seeding equipment.

625.08 NOT USED

625.09 NOT USED

625.10 Acceptance. Seed will be evaluated under Subsections 106.02, 106.03, and 713.04.

Mulch, fertilizer, and other turf establishment material will be evaluated under Subsections 106.02 and 106.03.

Turf establishment work will be evaluated under Subsections 106.02 and 106.04.

Measurement

625.11 Measure the Section 625 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Measure seeding and mulching by the acre on the ground surface or by the slurry unit. A slurry unit consists of approximately 1,000 gallons of water plus the specified turf establishment material. Four slurry units contain the material to cover one acre.

Measure turf establishment and supplemental applications by the acre on the ground surface.

Measure water by the M-gallon in the hauling vehicle or by metering.

Payment

625.12 The accepted quantities will be paid at the contract price per unit of measurement for the Section 625 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

END OF SECTION 625

SECTION 634 PERMANENT PAVEMENT MARKINGS

634.01 Description. This work consists of applying permanent pavement markings and raised pavement markers on the completed pavement.

Pavement markings are designated as follows:

Type A	—	Conventional traffic paint with type 1 glass beads
Type B	—	Waterborne traffic paint with type 1 glass beads
Type C	—	Waterborne traffic paint with type 3 glass beads
Type D	—	Epoxy markings with type 1 glass beads
Type E	—	Epoxy markings with type 1 and type 4 glass beads
Type F	—	Polyester markings with type 1 glass beads
Type G	—	Polyester markings with type 1 and type 4 glass beads
Type H	—	Thermoplastic markings with type 1 glass beads
Type I	—	Thermoplastic markings with type 1 and type 5 glass beads
Type J	—	Preformed plastic markings
Type K	—	Nonreflectorized markings

634.02 Material. Conform to the MUTCD and the following Subsections:

Conventional Traffic Paint	718.13
Epoxy markings	718.15
Epoxy resin adhesives	718.23
Glass beads	718.19
Polyester markings	718.16
Preformed plastic markings	718.18
Raised pavement markers	718.20
Thermoplastic markings	718.17
Waterborne traffic paint	718.14

Construction Requirements

634.03 General. Where existing and final pavement marking locations are identical, stake the limits of all existing pavement markings (no-passing zones, edge stripes, etc.) before any pavement work. Upon completion of the final surface course, establish line limits for the new pavement for approval before marking. Establish markings according to the MUTCD. In curve widening areas, apply the pavement edge markings at the edge of the traveled way and the centerline markings midway between the pavement lines.

Remove loose particles, dirt, tar, grease, and other deleterious material from the surface to be marked. Where markings are placed on rigid pavement less than 1 year old, clean the pavement of all residue and curing compounds. Remove temporary pavement markings the same day permanent pavement markings are applied. Apply markings to a clean, dry surface according to the MUTCD.

At least 7 days before applying pavement markings, furnish a written copy of the marking manufacturer's recommendations for use. A field demonstration may be required to verify the adequacy of recommendations.

Ship marking material in appropriate containers plainly marked with the following information, as appropriate, for the material being furnished:

(a) Manufacturer's name and address;

(b) Name of product;

(c) Lot/batch numbers;

(d) Color;

(e) Net mass and volume of contents;

(f) Date of manufacture;

(g) Date of expiration;

(h) Statement of contents (if mixing of components is required);

(i) Mixing proportions and instructions; and

(j) Safety information.

Apply pavement markings in the direction of traffic according to the manufacturer's recommendations. Apply all markings to provide a clean-cut, uniform, and workmanlike appearance by day and night.

Make lines 4 inches wide. Make broken lines 10 feet long with 30-foot gaps. Make dotted lines 2 feet long with 4-foot gaps. Separate double lines with a 4-inch space.

Protect marked areas from traffic until the markings are dried to no-tracking condition. Remove all tracking marks, spilled marking material, markings in unauthorized areas, and defective markings.

Remove all conflicting pavement markings according to Subsection 635.13.

634.04 Conventional Traffic Paint (Type A). Apply paint when the pavement and air temperatures are above 40 ºF. Spray paint at 15 mil minimum wet film thickness before glass beads or at a rate of 107square feet per gallon. Immediately apply type 1 glass beads on the paint at a minimum rate of 6 pounds per gallon of paint. Conform to AASHTO M 248.

On new asphalt pavements or new asphalt surface treatments, apply two coats. Apply the first coat at 360 square feet per gallon and the second coat at 150 square feet per gallon.

634.05 Waterborne Traffic Paint (Type B and C). Apply paint when the pavement and air temperatures are above 50 ºF. Spray paint at 15 mil minimum wet film thickness before glass beads or at a rate of 107 square feet per gallon.

(a) Type B. Immediately apply type 1 glass beads on the paint at a minimum rate of 6 pounds per gallon of paint.

(b) Type C. Immediately apply type 3 glass beads on the paint at a minimum rate of 12 pounds per gallon of paint.

On new asphalt pavements or new asphalt surface treatments, apply two coats. Apply each coat at 210 square feet per gallon.

634.06 Epoxy Markings (Types D and E). Heat components A and B separately at 110±30 ºF and mix. Discard all material heated over 140 ºF. Apply epoxy when the pavement and air temperatures are above 50 ºF. Apply as a spray at 110±30 ºF (gun tip temperature) at a 15 mil minimum dry film thickness or 107 square feet per gallon.

(a) Type D. Immediately apply type 1 glass beads on the epoxy at a minimum rate of 15 pounds per gallon of epoxy.

(b) Type E. Use two bead dispensers. Immediately apply type 4 glass beads on the epoxy at a minimum rate of 12 pounds per gallon of epoxy immediately followed by an application of type 1 glass beads at a minimum rate of 12 pounds per gallon.

634.07 Polyester Markings (Types F and G). Apply polyester when the pavement and air temperatures are above 50 ºF. Spray at 128±7 ºF (gun tip temperature) at a 15 mil minimum dry film thickness or 107 square feet per gallon. Discard all material heated over 150 ºF. Do not use fast dry polyester markings on asphalt pavements less than 1 year old.

(a) Type F. Immediately apply type 1 glass beads on the polyester at a minimum rate of 15 pounds per gallon of polyester.

(b) Type G. Use two bead dispensers. Immediately apply type 4 glass beads on the polyester at a minimum rate of 12 pounds per gallon of polyester immediately followed by an application of type 1 glass beads at a minimum rate of 12 pounds per gallon.

634.08 Thermoplastic Markings (Type H and I). On areas to be marked on rigid pavements and old asphalt pavements, apply an epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations. Allow the primer/sealer to dry.

Apply thermoplastic when the pavement and air temperatures are above 50 ºF. Spray or extrude the thermoplastic at 430±5 ºF. For centerlines and lane lines, spray or extrude 90 mil minimum dry film thickness or at a rate of 17.8 square feet per gallon. For edge lines, spray or extrude 60 mil minimum dry film thickness or at a rate of 26.7 square feet per gallon.

(a) Type H. Immediately apply type 1 glass beads on the thermoplastic at a minimum rate of 12 pound per 100 square feet.

(b) Type I. Use two bead dispensers. Immediately apply type 5 glass beads on the thermoplastic at a minimum rate of 12 pounds per 100 square feet immediately followed by an application of type 1 glass beads at a minimum rate of 12 pounds per 100 square feet.

The minimum bond strength of the thermoplastic shall be 175 pounds per square inch on rigid pavements.

634.09 Preformed Plastic Markings (Type J). Install to form a durable, weather resistant bond to the pavement. Apply preformed plastic markings according to the manufacturer's recommendation.

Where applied during final compaction of asphalt pavement, apply preformed plastic when the pavement temperature is about 140 ºF. Roll the marking into the surface with a steel wheel roller. The finished pavement marking may extend approximately 10 mil above the final surface.

634.10 Nonreflectorized Markings (Type K). Apply conventional traffic paint, waterborne traffic paint, epoxy markings, polyester markings, or thermoplastic markings as described above, but with no glass beads added.

634.11 Raised Pavement Markers. Install raised pavement markers when the pavement and air temperatures are above 50 ºF. Apply raised pavement markers with epoxy resin or asphalt adhesive.

Heat epoxy components A and B separately with indirect heat, mix, and apply at 70±10 ºF. Discard all material heated over 120 ºF or stiffened by polymerization.

Heat and apply asphalt adhesives at 412±12 ºF. Discard all material heated over 450 ºF.

Space and align the markers to within 1/2 inch of the required location. Do not place raised pavement markers over pavement joints.

The minimum bond strength will be 1.75 pounds per square inch or a total tensile strength of 25 pounds.

634.12 Acceptance. Material for permanent pavement markings will be evaluated under Subsections 106.02 and 106.03.

Placement of permanent pavement marking will be evaluated under Subsections 106.02 and 106.04.

634.13 Measurement. Measure the Section 634 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

When two coats of paint are required, measure each coat.

When pavement markings are measured by the linear foot or station, measure the length of line applied along the centerline of each 4-inch-wide line applied regardless of color. Measure broken or dotted pavement lines from end to end of the line including gaps. Measure solid pavement lines from end to end of each continuous line. For line widths other than 4 inches, the measured length of line is adjusted in the ratio of the required width to 4 inches.

When pavement markings are measured by the square foot, measure the number of square feet of symbol or letter marking based on the marking area shown in the contract or, if not shown, the area of each marking measured in place to the nearest square foot.

634.14 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 634 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

END OF SECTION 634

SECTION 635 TEMPORARY TRAFFIC CONTROL

635.01 Description. This work consists of furnishing, maintaining, relocating, and removing temporary traffic control devices and services as ordered for the control and protection of public traffic through the project.

635.02 Material. Conform to the MUTCD and the following Sections and Subsections:

Retroreflective sheeting	718.01
Temporary concrete barrier	618
Temporary pavement markings	718.21
Temporary traffic control devices	718.22
Traffic markings	634

Construction Requirements

635.03 General. Install and maintain temporary traffic control devices adjacent to and within the project as required by the traffic control plan and the MUTCD. Install and maintain traffic control devices as follows:

(a) Furnish and install traffic control devices before the start of construction operations.

(b) Install only those traffic control devices needed for each stage or phase.

(c) Relocate temporary traffic control devices as necessary.

(d) Remove devices that no longer apply to the existing conditions.

(e) Immediately replace any device that is lost, stolen, destroyed, or inoperative.

(f) Keep temporary traffic control devices clean.

(g) Furnish and maintain traffic control devices that meet the "acceptable" standard described in *Quality Standards for Work Zone Traffic Control Devices* published by ATSSA. Amend the ATSSA standards as follows:

(1) Repair or remove and replace "marginal" devices within 48 hours; and

(2) Repair or remove and replace "unacceptable" devices immediately.

(h) Remove all temporary traffic control devices upon contract completion or when approved.

(i) Furnish temporary traffic control devices that meet the NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, for crashworthiness standards as applicable.

635.04 Advance Warning Arrow Panels. Perform the work described under MUTCD Part 6.

635.05 Barricades. Perform the work described under MUTCD Part 6. Use type III, VII, VIII, or IX retroreflective sheeting.

635.06 Cones and Tubular Markers. Perform the work described under MUTCD Part 6. Use 28-inch cones or tubular markers. Use type III, or VI retroreflective sheeting.

635.07 Construction Signs. Use type III, VII, VIII, or IX retroreflective sheeting. For roll-up signs, use type VI retroreflective sheeting. Remove or completely cover all unnecessary signs with metal, plywood, or other acceptable material.

635.08 Drums. Perform work described in MUTCD Part 6. Use plastic drums that are approximately 36 inches high and a minimum of 18 inches in diameter. Use type III or VI retroreflective sheeting.

635.09 Flaggers. Use flaggers certified by the American Traffic Safety Services Association, the National Safety Council, the International Municipal Signal Association, a state agency, or other acceptable organization. Perform the work described under MUTCD Part 6. Use type III, VII, VIII, or IX retroreflective sheeting on flagger paddles. Do not use flags.

635.10 Pilot Cars. Perform the work described under MUTCD Part 6. Use pilot car operators meeting the minimum qualifications of a flagger according to Subsection 635.09. Mount a rotating amber beacon on the roof of each pilot car. Do not use strobe light beacons.

635.11 Temporary Barriers. Perform the work described under MUTCD Part 6. Use temporary barriers that meet NCHRP Report 350 and are new or used provided they are not badly damaged. Lifting holes no larger than 4 inches or lifting loops are permitted. Individual sections may vary in length.

Mount 3-inch minimum dimension white or yellow retroreflectors, as applicable, to the top or side of the barrier on 25-foot centers. Mount the retroreflectors at a uniform height at least 2 feet above the pavement surface.

635.12 (NOT USED)

Mount 3-inch minimum dimension white or yellow retroreflectors, as applicable, to the top or side of the guardrail on 25-foot centers. Mount the retroreflectors at a uniform height at least 2 feet above the pavement surface.

635.13 Temporary Pavement Markings and Delineation. Before opening a pavement surface to traffic, remove all conflicting pavement markings by sandblasting or other methods that do not damage the surface or texture of the pavement. Make the removal pattern uneven so it does not perpetuate the outline of the removed pavement markings. Lightly coat sandblasted or removal areas on asphalt surfaces with emulsified asphalt.

Place and maintain temporary pavement markings that are neat, crack free, true, straight, and unbroken. For temporary pavement markings, use preformed retroreflective tape, traffic paint, or temporary raised pavement markers as follows:

(a) Preformed retroreflective tape. Apply according to the manufacturer's instructions. Remove all loose temporary preformed retroreflective tape before placing additional pavement layers.

(b) Traffic paint. Do not apply temporary traffic paint to the final surface. Apply traffic paint as the temporary pavement marking if no work will be performed on the project for at least 30 consecutive days. Apply temporary traffic paint at a 15 mil minimum wet film thickness (0.9 gallons per 100 square feet). Immediately apply type 1 glass beads on the paint at a minimum rate of 6 pounds per gallon of paint.

(c) Raised pavement markers. Do not use raised pavement markers during seasonal suspensions. When chip seals, slurry seals, or tack coats are used after marker placement, protect the markers with an approved protective cover, which is removed after the asphalt material is sprayed. Temporary raised pavement markers may be used as temporary pavement markings as follows:

(1) 10-foot broken line. Four pavement markers spaced 3.33 feet apart followed by a 30-foot gap.

(2) 2-foot broken line. Two pavement markers spaced 2 feet apart followed by an 18-foot gap.

(3) Solid line. Pavement markers on 5-foot centers.

Remove all temporary raised pavement markers before placing additional pavement layers.

Remove all temporary pavement markings from the surface course before placing permanent pavement markings.

635.14 Vertical Panels. Perform the work described under MUTCD Part 6. Use type III, VII, VIII, or IX retroreflective sheeting.

635.15 Warning Lights. Perform the work described under MUTCD Part 6. When type C, steady-burn, warning lights are installed on barricades or drums and used in a series for delineation, use type A, flashing, warning lights on the first 2 barricades or drums in the series. Mount batteries for type B warning lights a maximum of 12 inches from ground or roadway surface as measured to top of the battery casing.

635.16 (NOT USED)

635.17 Pavement Patch. Use an asphalt mix according to Section 404 to repair potholes and rough spots in the traveled way before reopening travel lanes to traffic.

635.18 Portable Changeable Message Sign. Conform to the MUTCD Part 6.

635.19 (NOT USED)

635.20 Temporary Signal System. Use a temporary signal system according to Section 636 and MUTCD Parts 4 and 6.

Use signal heads with three lenses, minimum 8 inches diameter, indicating red, yellow, and green phases. Use a signal controller capable of operating in either the solid red, solid green, or a red/yellow/green mode for each signal.

635.21 (NOT USED)

635.22 Portable Rumble Strip. Use a strip 10 feet long, 18 inches wide, and 1¼ inches high to alert drivers of an approaching flagger station or work area.

635.23 Opposing Traffic Lane Divider. Use type III, VII, VIII, or IX retroreflective sheeting.

635.24 Steel Plates. Use 1-inch or thicker steel plates capable of safely carrying traffic. Secure the plates to the pavement to prevent any movement.

635.25 Acceptance. Material (including signs, drums, barricades, cones, tubular markers, crash cushions, concrete barriers, dividers, fence, guardrail, pavement markings, rumble strips, traffic signals, lights, and vertical panels) for temporary traffic control devices will be evaluated under Subsections 106.02 and 106.03. Vehicles for pilot cars and shadow vehicles will be evaluated under Subsection 106.02.

Placement of temporary traffic control devices will be evaluated under Subsections 106.02 and 106.04.

Temporary traffic control services will be evaluated under Subsection 106.02.

635.26 Measurement. Measure the Section 635 items listed in the bid schedule according to Subsection 109.02 and the following as applicable when ordered by the CO and installed.

Measure temporary traffic control items only one time even if relocated or replaced, except for items paid by the hour.

Measure advance warning arrow panels by the hour or by the each. When measurement is by the hour, round portions of an hour up to the half hour.

Measure barricades by the linear foot of width.

Measure construction signs by the square foot of front face sign panel. Do not measure posts and temporary supports.

Measure flaggers, for each hour a person is actually performing the work. Round portions of an hour up to the half hour. Measure time in excess of 40 hours per week at the same rate as the first 40 hours.

Measure pilot cars (including operators) for each hour the car is actually performing the work. Round portions of an hour up to the half hour. Measure time measured in excess of 40 hours per week at the same rate as the first 40 hours.

When there is a pay item for moving temporary barriers, do not measure movement of temporary barriers for work access or the convenience of the Contractor.

Measure temporary guardrail from center-to-center of end posts.

Measure temporary pavement markings for only one application of pavement markings per lift. When temporary pavement markings are measured by the linear foot or mile, measure the number of linear feet or miles of lines applied along the centerline of each 4-inch wide line applied regardless of color. Measure solid lines from end to end of each continuous line. Measure broken lines from end to end including gaps. For line widths greater than 4 inches, adjust the measured length of line in the ratio of the required width to 4 inches. When temporary pavement markings are measured by the square foot, measure the number of square feet of symbols or letter markings based on the marking area shown in the contract or, if not shown, the area of each marking measured in place to the nearest square foot.

Measure temporary raised pavement markers one time for each lift of pavement even if replaced. Measure temporary raised pavement markers used at the option of the Contractor in lieu of temporary pavement markings as equivalent temporary pavement markings and not as temporary raised pavement markers.

Measure pavement marking removal of actual line removed. Do not measure gaps.

Measure temporary crash cushions for each entire crash configuration.

When there is a pay item for moving temporary crash cushion, do not measure movement of temporary crash cushion for work access or the convenience of the Contractor.

Measure replacement barrels or cartridges for crash cushions for the barrels or cartridges damaged by public traffic.

635.27 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 635 pay items in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05.

Progress payments for temporary traffic control devices will be made as follows:

(a) 50 percent of the unit bid price will be paid upon installation.

(b) An additional 25 percent of the unit bid price will be paid following completion of 50 percent of the contract amount.

(c) Payment of the remaining portion of the unit bid price will be paid when the temporary traffic control devices are removed from the project.

Progress payments for items paid for by the hour will be paid at 100 percent of the unit bid price when ordered by the CO and furnished.

END OF SECTION 635

SECTION 636 SIGNAL, LIGHTING, AND ELECTRICAL SYSTEMS

636.01 Description. The project's objective is to restore the streetlighting system to its original operating condition with adequate lighting level and minimum glare both along the roadways and sidewalks. This involves trouble shooting the system including series of tests and ascertain the condition of the light pole assemblies (the bases, the fixtures, electrical components, circuitry, controls, fuses, receptacles, wiring, concrete pole, attachments, arms) and SLPs (panelboards, contactors, wiring, conduits, SS enclosures, photocells, selector switches) including conduit and wiring from SLPs to pole assemblies. Upgrade or replace defective or ineffective light pole assemblies, SLPs and conduit and wiring including but not limited to replacement of some entire pole assemblies in accordance with the findings.

636.02 Material. Conform to the following Subsections:

Backer rod	712.01(g)
Electrical material	721.01
Lighting material	721.02
Precast concrete units	725.11(d)
Sealant	712.01(a)

Construction Requirements

636.03 Regulations and Codes. Furnish material and workmanship conforming to the standards of the National Electrical Code, local safety code, UL, and the National Electrical Manufacturers Association.

Obtain permits, arrange for inspections, and pay all fees necessary to obtain electrical service.

Furnish luminaries with crashworthy supports.

Notify the CO, local traffic enforcement agency, local utility company, 7 days before any operational shutdown to coordinate connections or disconnections to an existing utility or system.

636.04 General. At the preconstruction conference, submit a certified cost breakdown of items involved in the lump sum for use in making progress payments and price adjustments.

Fifteen days before installation, submit a list of proposed equipment and material. Include the manufacturer's name, size, and identification number of each item. Supplement the list with scale drawings, catalog cuts, and wiring diagrams showing locations and details of equipment and wiring.

The CO will establish the exact locations of the systems.

Remove structures and obstructions according to Section 203. Salvage all material acceptable for reuse in the work. Construct concrete according to Section 601.

Where roadways are to remain open to traffic and existing systems will be modified, maintain the existing systems in operation until final connection to the modified circuit to minimize traffic disruptions.

636.05 Conduit. Cut conduit so the ends are smooth. Connect conduit sections with couplings to butt the ends of both conduits squarely against each other inside the couplings. Provide a metal expansion and deflection fitting where conduit crosses a structural expansion joint.

Install conduits continuous between outlets with a minimum of couplings to permit pulling conductors. Terminate conduit with bell fittings or bushings. Furnish pull wires for conduits designated for future cable installation.

Remove and replace crushed, deformed, or damaged conduit. Maintain conduits clean and dry and protect ends of conduit with plugs, caps, or fittings.

Size pull boxes to provide for termination of the conduit and connection of the conductors.

636.06 Installation of Signal and Lighting Systems. Design the control unit to energize the lighting circuit upon failure of any component of its circuit. Furnish a control with an "on" level adjustable between 1 and 5 foot candles. Operate luminaires with circuit distribution system at a potential not exceeding respective rating.

Control lights and luminaires by photocell controls. For current less than or equal to 10 amperes, furnish a photocell switch. For current greater than 10 amperes, furnish a photocell switch operating a magnetic relay for switching the lighting circuit.

636.07 (NOT USED)

636.08 Testing and Demonstration Period. Before energizing any portion of the system, demonstrate that the conductor system is clear and free of all short circuits, open circuits, and unintentional grounds. Repair or replace faulty circuits.

After energizing the system, demonstrate that all electrical components work properly. Repair or replace faulty electrical components.

After completing electrical component tests, conduct a demonstration test for 30 continuous days. Adjust and correct any deficiencies in the system during the 30-day demonstration period. If any part of the system is replaced or repaired, retest that part of the system for an additional 30 days.

636.09 Warranties, Guarantees, and Instruction Sheets. When installations are permanent, deliver manufacturers' warranties, guarantees, instruction sheets, and parts lists at the final inspection.

Upon completion of the work, also submit as-built drawings showing all detail changes from the original plans.

636.10 Relocations. Use material equivalent to existing material, unless present codes require different or improved material. Existing material may be salvaged and reused, provided all material and installation methods used meet the requirements of applicable codes and ordinances.

636.11 Acceptance. Material for signal systems, lighting systems, and electrical systems will be evaluated under Subsections 106.02 and 106.03.

Installation of signal systems, lighting systems, and electrical systems will be evaluated under Subsections 106.02 and 106.04.

Concrete will be evaluated under Section 601.

636.12 Measurement. Measure the Section 636 items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

For relocations, do not measure additional line or connections necessary to place the fixture at the new location.

636.13 Payment. The accepted quantities will be paid at the contract price per unit of measurement for the Section 636 pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this Section. See Subsection 109.05. Payment for lump sum items will be prorated based on the total work completed.

END OF SECTION 636

SECTION 701 CEMENT

701.01 Hydraulic Cement. NOT USED

701.02 Masonry and Mortar Cement.

(a) Masonry Cement. Conform to ASTM C 91, type N, S, or M.

(b) Mortar Cement. Conform to ASTM C 1329, type N, S, or M.

END OF SECTION 701

SECTION 704 SOIL

704.01 – 704.08 (NOT USED)

704.10 – 704-12 (NOT USED)

704.09 Bed Course. Furnish porous, free-draining granular material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:

(a) Gradation, well graded coarse to fine Table 704-3

(b) Liquid limit, AASHTO T 89 30 max.

Table 704-3
Bed Course Gradation

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
1/2 inch	100
No. 200	0 – 10

END OF SECTION 704

SECTION 709 REINFORCING STEEL

709.01 Reinforcing Steel.

(a) General. Furnish the following information with each shipment of steel to the project:

(1) Name and location of the steel rolling mill;

(2) Manufacturing process;

(3) Heat number(s);

(4) Size(s);

(5) Specifications;

(6) Copies of mill test analyses for chemical and physical tests; and

(7) Consignee and destination of shipment.

(b) Reinforcing bars. Furnish deformed, grade 60 bars conforming to AASHTO M 31, M 42, or M 53.

(c) Epoxy-coated reinforcing bars. Furnish bars conforming to Subsection 709.01 (b). Conform to AASHTO M 284.

Inspect the reinforcing bars after the near white blast cleaning. Reject all bars with steel slivers or scabs. Selective sorting and rejection at the fabricator's shop may avoid unnecessary delays and subsequent rejection of bars during the precoating inspection at the coating applicator's shop.

Coat epoxy coated reinforcing steel in a plant certified by CRSI as a fusion bonded epoxy applicator.

(d) Tie bars. Furnish deformed, grade 60 bars conforming to AASHTO M 31 or M 42, except do not use AASHTO M 42 steel for tie bars bent and restraightened during construction.

(e) (NOT USED)

(f) Dowel bars. Conform to AASHTO M 254, type A or B. Use plain round bars, free from burring or other deformation restricting free movement in the concrete. Paint half the length of each dowel bar with one coat of tar paint. When the paint dries and immediately before placing the dowels, lubricate the painted end to prevent concrete from bonding to the painted end.

For expansion joints, furnish a dowel cap that snugly covers 2±1/4 inches of the dowel, has a closed end, and has a suitable stop to hold the closed end 1 inch from the end of the dowel bar.

Lubricants for type B dowels may be rapid-curing cut-back asphalt, medium setting emulsified asphalt, or a flaked graphite and vehicle. Lubricants are not required for type A coated dowel bars.

Furnish dowel assemblies that hold dowel bars within 1/4-inch tolerance vertically and horizontally during concrete placement and permit unrestricted movement of the pavement slab.

Use wire conforming to AASHTO M 32 for dowel assemblies. Coat dowel assemblies with the same material as the dowel bar. Recoat or repair damaged coatings equivalent to the manufacturer's original coating.

(g) THROUGH (i) – NOT USED

END OF SECTION 709

SECTION 712 JOINT MATERIAL

712.01 Sealants, Fillers, Seals, and Sleeves. Conform to the following:

(a) Joint sealants and crack fillers. Furnish a commercial certification identifying the batch and lot number, material, quantity of batch, date and time of manufacture, and the name and address of the manufacturer.

(1) Concrete joint-sealer, hot-poured elastic type — AASHTO M 173

(2) Joint sealants, hot-poured, for rigid and asphalt pavement — ASHTO M 301

(3) Crack filler, hot applied, for asphalt concrete and rigid pavements — ASTM D 5078

(4) For proprietary asphalt-rubber products, furnish the following:

(a) Source and grade of asphalt binder;

(b) Manufacturer's recommended application procedures.

(5) Multi-component joint sealant, conforming to TT-S-00227E, type I, class A or ASTM C 920, type M, grade P, class 25, use T. Provide sealant matching the color of the adjacent sidewalk. Conform to the sealant manufacturer's recommendations for use of primers.

(6) Flexible cellular joint filler — ASTM D 1056, type 2, grade 4 or 5

(b) THROUGH (f) NOT USED

(g) Backer rod. Conform to ASTM D 5249, type 1. Use a compatible sealant as recommended by the rod manufacture. For size of backer rod, conform to Table 712-2.

Table 712-2
Backer Rod Sizes

Joint Width After Preparation	Rod Diameter
5/16 inch	3/8 inch
3/8 inch	1/2 inch
1/2 inch	5/8 inch
5/8 inch	3/4 inch
3/4 inch	1 inch
1 inch	1¼ inch
1¼ inch	1½ inch
1½ inch	2 inch

END OF SECTION 712

SECTION 718 TRAFFIC SIGNING AND MARKING MATERIAL

718.01 Retroreflective Sheeting. Conform to ASTM D 4956.

Conform to ASTM D 4956 Supplemental Requirement S1, Fungus Resistance, if specified. For reboundable retroreflective sheeting, conform to ASTM D 4956 including Supplemental Requirement S2, Reboundable Sheeting Requirements. When an adhesive is used, use ASTM D 4956, backing class 1, 2, or 3.

718.13 Conventional Traffic Paint. Conform to AASHTO M 248.

718.14 Waterborne Traffic Paint. Furnish an acrylic water-based, ready-mixed paint for use on asphalt and rigid pavements conforming to the following:

(a) Composition. Furnish a paint composed of resin solids of 100 percent acrylic polymer with the exact formulation determined by the manufacturer. Conform to the following:

(1) Pigment, % by mass, ASTM D 3723	45% to 55%
(2) Lead, chromium, cadmium, or barium ASTM D 3335 & D3718	0%
(3) Volatile organic compounds, ASTM D 2369	20.0 ounces per gallon max.
(4) Mass of paint, ASTM D 1475	12.0 pounds per gallon min.
(b) Viscosity. ASTM D 562	75-90 Krebs units
(c) Drying time.	
(1) Dry to no pickup, ASTM D 711	10 minutes max.
(2) Drying to no track, 6 pounds per gallon, type 1 waterproofed glass beads, 15±1 mil wet film thickness at 130 ºF	90 seconds max.
(d) Flexibility. ASTM D 522, using the 1/4-inch cylindrical mandrel	No cracking or flaking
(e) Dry opacity. ASTM D 2805, contrast ratio at 319 square feet per gallon spreading rate	0.96 min.
(f) Color.	
(1) White, ASTM D 1729	Match FHWA standard highway white
(2) Yellow, ASTM D 1729	Match FHWA standard highway yellow
(g) Daylight reflectance. (Without glass beads)	
(1) White, FTMS 141 method 6121 ASTM E 1347	84% relative to magnesium oxide standard
(2) Yellow, FTMS 141 method 6121 ASTM E 1347	55% relative to magnesium oxide standard
(h) Bleeding ratio. ASTM 969. Determine reflectance according to ASTM D 1347 immediately after drying. Divide the average of 3 reflectance readings	0.96 min.

of the paint over the bleeding surface by the average of 3 readings over the non-bleeding surface to determine the bleeding ratio.

(i) Scrub resistance. ASTM D 2486	300 cycles min.

(j) Freeze-thaw stability. ASTM D 2243

(1) Change in viscosity	±5 Krebs units max.
(2) Decrease in scrub resistance	-10% max.

(k) Storage stability. During a 12-month storage period, conform to the following:

(1) No excessive setting, caking, or increase in viscosity; and

(2) Readily stirred to a consistency for use in the striping equipment.

718.15 Epoxy Markings. Furnish a 2-component, 100 percent solids type system for hot-spray application conforming to the following:

(a) Pigments. Component A. Percent by mass.

(1) White.

(a) Titanium dioxide (TiO_2), ASTM D 476, type II and type III	18% min.
(b) Epoxy resin	75 to 82%

(2) Yellow:

(a) Chrome yellow ($PbCrO_4$), ASTM D 126, type III.	23% min.
(b) Epoxy resin	70 to 77%

(3) Non-Lead Yellow:

(a) Titanium dioxide ($TiO_{2)}$ ASTM D 476, type II and type III.	14% min.
(b) Organic yellow	7 to 8%
(c) Epoxy resin	75 to 79%

(b) Epoxy content. Component A. Mass per epoxy equivalent, ASTM D 1652	Manufacturer's target value ±50
(c) Amine value. Component B, ASTM D 2074	Manufacturer's target value ±50
(d) Toxicity. Toxic or injurious fumes at application temperature	none

(e) Color. 15 mil film thickness specimen(cured).

(1) White, ASTM D 1729	Match FHWA standard highway white
(2) Yellow, ASTM D 1729	Match FHWA standard highway yellow

(f) Directional reflectance. (Without glass beads)

(1) White, ASTM E 1347	84% relative to magnesium oxide standard

(2) Yellow, ASTM E 1347	55% relative to magnesium oxide standard

(g) Drying time. 15 mil film thickness with beads.

(1) Laboratory at 72 ºF, ASTM D 711	30 minutes maximum to no-pick-up condition
(2) Field at 77 ºF, viewed from 50 feet	10 minutes maximum to no-tracking condition
(h) Abrasion resistance. Wear index with a CS-17 wheel under a 35.3 ounce load for 1000 cycles, ASTM D 4060	82 max.
(i) Hardness. Shore D hardness with 72- to 96-hour cure at 72 ºF, ASTM D 2240	75 to 100

(j) Storage. When stored for up to 12 months, individual epoxy components shall not require mixing before use.

718.16 Polyester Markings. Furnish a 2-component system conforming to the following:

(a) Directional reflectance. (Without glass beads)

(1) White, ASTM E 1347	80% relative to magnesium oxide standard
(2) Yellow, ASTM E 1347	55% relative to magnesium oxide standard

(b) Color.

(1) White, ASTM D 1729	Match FHWA standard highway white
(2) Yellow, ASTM D 1729	Match FHWA standard highway yellow
(c) Viscosity. Uncatalyzed polyester at 25 ºF, ASTM D 562	70 to 90 Krebs units
(d) Bleeding. ASTM D 969	6 minimum
(e) Drying time in field. Viewed from 50 feet	45 minutes maximum to no-tracking condition

718.17 Thermoplastic Markings. Conform to AASHTO M 249.

718.18 Preformed Plastic Markings. Conform to ASTM D 4505, type I, V, VI, or VII, grade A, B, C, D, or E.

718.19 Glass Beads. Conform to AASHTO M 247 for the type specified. Table 1, Gradation of Glass Beads in AASHTO M 247 is supplemented by Table 718-2. Treat glass beads with an adherence coating as recommended by manufacturer.

Table 718-2
Gradation of Glass Beads

Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)		
	Grading Designation		
	Type 3	Type 4	Type 5
No. 8			100
No. 10		100	95 - 100
No. 12	100	95 - 100	80 - 95
No. 14	95 - 100	80 - 95	10 - 40
No. 16	80 - 95	10 - 40	0 - 5
No. 18	10 - 40	0 - 5	0 - 2
No. 20	0 - 5	0 - 2	
No. 25	0 - 2		

For type 3, 4, and 5 glass beads, also conform to the following:

(a) Treat beads with a reactive adherence coating as recommended by the manufacturer.

(b) Roundness, FLH T 520 70% min. per sieve size

(c) Refractive index, AASHTO M 247 1.50 - 1.55

718.20 Raised Pavement Markers.

(a) Non-plowable, extended life, retroreflective, pavement markers. Conform to ASTM D 4280.

(b) Plowable, retroreflective, pavement markers. Conform to ASTM D 4383.

718.21 Temporary Pavement Markings.

(a) Preformed retroreflective tape. Furnish 4-inch wide tape conforming to ASTM D 4592, type I (removable).

(b) Raised pavement markers. Furnish an L-shaped polyurethane marker body with retroreflective tape on both faces of the vertical section, capable of retroreflecting light from opposite directions, and with an adhesive on the base.

Provide a minimum coefficient of retroreflection of 1200 candela per lux per square meter at 0.1-degree observation angle and -4 degrees entrance angle.

Fabricate the marker body from 60-mil minimum thickness polyurethane. Fabricate the vertical leg about 2 inches high by about 4 inches wide. Fabricate the base for the marker body about 1⅛ inches wide.

Factory apply a 125-mil minimum thickness and 750-mil wide pressure sensitive adhesive to the marker base and protect it with release paper.

If approved, variations in design and dimensions will be permitted to meet manufacturer's standards.

718.22 Temporary Traffic Control Devices. Use suitable commercial grade material for the fabrication of the temporary traffic control devices. Construct the devices from material capable of withstanding anticipated weather, traffic conditions, and suitable for the intended use. Do not use units used on other projects without approval.

718.23 Epoxy Resin Adhesives. Epoxy resin adhesives for bonding traffic markers to rigid and asphalt concrete pavements shall conform to AASHTO M 237.

END OF SECTION 718

SECTION 721 ELECTRICAL AND ILLUMINATION MATERIAL

721.01 Electrical Material. Conform to the following:

(a) Conduit. Conform to the following:

(1) Nonmetallic conduit and duct couplings, elbows, bends, and nipples. For above ground and underground use without concrete encasement, furnish rigid PVC, heavy wall conduit conforming to UL 651. For solvent cement to join conduit, conform to ASTM D 2564.

(2) Metallic conduit and duct, couplings, elbows, bends, and nipples. Furnish rigid galvanized steel conduit conforming to UL 6. Uniformly coat the conduit on the outside with an asphalt mastic conforming to AASHTO M 243 or a 20-mil PVC coating. Furnish rigid, full-mass sherardized or galvanized threaded fittings.

(3) Flexible conduit. Furnish a watertight metallic conduit conforming to UL 360, acceptable for equipment grounding. Furnish insulated throat, grounding, malleable iron watertight fittings.

(4) Conduit bodies, boxes, and fittings. Furnish watertight, galvanized steel conforming to UL 514 B.

(b) Pull boxes, frames, and covers. For boxes formed in concrete, fabricate with cast iron or welded sheet steel having a minimum thickness of 0.188 inches. Galvanize, inside and out, according to AASHTO M 232.

(c) Wire and cable. Furnish 600-volt stranded copper conductors, insulation, and jackets. Label and color code the wire and cable to identify its type, size, UL symbol, and manufacturer. Conform to the following:

(1) Rubber-insulated wires and cables	UL 44
(2) Thermoplastic-insulated wires and cables	UL 83
(3) Thermoplastic-insulated underground feeder and branch circuit cables	UL 493
(4) Nonmetallic sheathed cable	UL 719
(5) Service-entrance cables	UL 854
(6) Machine-tool wires and cables	UL 1063
(7) Reference standard for electrical wires, cables, and flexible cords	UL 1581

(d) Circuit breakers and panels. Conform to UL 489 and UL 67. Furnish molded case thermal magnetic trip type breakers. Furnish panel enclosures conforming to NEMA 3R, lockable with padlocks.

(e) Safety disconnect switches. Furnish heavy duty, NEMA 3R, safety disconnect switches conforming to UL 98.

(f) Grounding and bonding equipment. Furnish 5/8-inch diameter, 8-foot long, copper-clad steel ground rods, ground clamps, grounding and bonding bushings, and lock nuts conforming to UL 467.

(g) Contactors and control transformers. Furnish a magnetic, 60-ampere, 2-pole contactor with a 120-volt coil, equipped with control switches for automatic actuation conforming to UL 508. Furnish cadmium-sulfide type photocell controls for 120 or 240-volt operation, as applicable; rated at 1000 watts resistive load or 1800 volt-amperes inductive load; adaptable for pole-top mounting in a plug-in, locking-type receptacle, conforming to UL 773; and with a built-in surge protective device for protection from induced high-voltage and follow-through currents.

Furnish single-phase, 240/480 volt primary, 120/240 volt secondary, dry type, 60 hertz, 1 KVA transformers for indoor or outdoor use, conforming to UL 506.

(h) Secondary lightning arrester. Furnish a secondary lightning arrester rated for a maximum operating voltage of 650 volts RMS with a bracket for mounting on the control cabinet backboard.

(i). (NOT USED)

(j) Meter cabinet. Conform to local power company requirements.

(k) Control cabinet. Furnish a NEMA type IV cabinet, equipped with door clamps on the unhinged sides, solid neoprene gasket, welded seams, continuous hinge with stainless steel pin, stainless steel external hardware, backboard for mounting apparatus, padlock with an outdoor, tumbler-type padlocks keyed the same, supplied with 2 keys for each lock. Furnish a cabinet constructed of one of the following:

(1) Code-gauge stainless steel, ASTM A 167, type 304; or

(2) Code-gauge aluminum sheet with mechanical properties equivalent or exceeding ASTM B 209, alloy 5052-H32.

721.02 Lighting Material. Conform to the following:

(a) Poles. Poles shall be the exact model or approved equivalent of concrete architecturally-themed lightpost assemblies currently along the project length.. The finished pole shall length be 25 feet high from the base of the pole to the top of the pole not including the finial top.

Furnish pole, attachments and fixtures in the lengths as shown in the drawings or exhibits.

Design and furnish poles capable of sustaining the following loadings:

(1) A horizontal load of 500 pounds applied 18 inches from the shaft top, in any direction, without failure of any component part, and a maximum allowable vertical deflection of 7.5 percent of the shaft length.

(2) A horizontal load of 50 pounds applied at the luminaire attachment point and normal to the pole bracket member plane, with a vertical load of 30 pounds on the luminaire supporting arm, and a maximum allowable horizontal deflection of 10 percent of the luminaire supporting arm's horizontal length.

(3) A vertical load of 100 pounds applied at the luminaire attachment point, and a maximum allowable vertical deflection of 5.5 percent of the pole arm's horizontal length.

(4) A vertical load of 250 pounds applied at the luminaire attachment point, and no collapse or rupture of any portion of the structure.

(5) The pole arm and luminaire mass with a maximum allowable deflection from vertical at the top of the pole of 1 percent of the total shaft length.

(6) Pole assemblies and fixtures shall be capable of withstanding forces generated by 175 MPH winds.

The pole exterior shall be factory-finished texture to match existing pole exterior colors and textures.

(b) Pole arms.

(1) Material. Furnish hot-dipped galvanized steel or aluminum. Use the same material, make and model as are on the existing lightpoles. Streetlight arms shall be KA30-5-8 or approved equal. Sidewalk arms shall be KA40-5-4 or approved equal.

(2) Type. Furnish single member arms. Furnish single member arms identical to the existing member arms on the streetlight poles. This applies to both sidewalk and streetlighting fixtures on the existing lighting system poles.

(3) Connection. Furnish a weather resistant connection to the pole and a smooth raceway for wiring. Furnish all fittings for connection to the pole.

(c) Anchor bases. Furnish a one-piece base dimensioned for adequate pole mounting and structural support with holes for anchor bolts and tapped holes for anchor bolt covers. Fabricate anchor bases from material similar to the pole material and conform to the following:

(1) Steel casings	AASHTO M 103, grade 65-35
(2) Steel plate	ASTM A 36
(3) Aluminum castings	ASTM B 26, alloy SG70A-T6 (356-T6)

(d) Bolts, nuts, and washers.

(1) Steel anchor bolts. Conform to ASTM A 36, except as amended by *(a)* or *(b)* below:

(a) (1) Yield strength 55 kips per square inch min.

	(2) Tensile strength	75 to 95 kips per square inch
	(3) Elongation in 8 inches	18% min.
	(4) Elongation in 2 inches	21% min.
	(5) Area reduction	30% min.
(b)	*(1)* Yield strength	105 kips per square inch min.
	(2) Tensile strength	100 to 150 kips per square inch
	(3) Elongation in 2 inches	15% min.
	(4) Area reduction	45% min.

(2) Hex head bolts. Conform to the following:

(a) 55 kips per square inch yield anchor bolts	AASHTO M 164
(b) 105 kips per square inch yield anchor bolts	ASTM A 354, grade BC

(3) Nuts. Conform to AASHTO M 291. Furnish nuts appropriate for the strength of the anchor bolt.

(4) Washers. Furnish flat, circular washers conforming to AASHTO M 293.

Galvanize the top 12 inches of anchor bolts and all associated hardware according to AASHTO M 232.

(e) Anchor bolt covers. Furnish a bolt cover for each anchor bolt and 0.25-inch stainless steel, Phillips-head or hex-head screws to attach the cover to the base or pole.

(f) Fixtures. Operate fixtures on a 120/277 volt series circuit. Furnish the following types of fixtures.

(1) Streetlight Fixtures. Furnish 150-watt, 120/277V Kenclaire K803 Lighting Fixture with LED array including all materials for a complete installation. Furnish heavy wall cast aluminum housings with locking mechanisms, shallow lens, flat array, and taupe finish. Furnish thermal shock-resistant glass prismatic refractors with gaskets and clips. Furnish aluminum spacers with locking latch.

Furnish electronic ballast as recommended by manufacturer. All units shall include surge protection.

(2) Sign lighting luminaires. Not Used.

END OF SECTION 721

SECTION 725 MISCELLANEOUS MATERIAL

725.01 Water. Conform to the following:

(a) Water for mixing or curing cement concrete, mortar, or grout. Conform to AASHTO M 157. Potable water of known quality may be used without testing according to AASHTO T 26. Potable water is safe for human consumption as defined by the public health authority having jurisdiction.

(b) Water for planting or care of vegetation. Furnish water that is free of substances injurious to plant life such as oils, acids, alkalies, or salts.

(c) Water for earthwork, pavement courses, dust control, and incidental construction. Furnish water free of substances detrimental to the work.

725.11 Precast Concrete Units and Accessories.

(a) THROUGH (c) – NOT USED

(d) Underground concrete utility structures. Conform to ASTM C 858.

(e) THROUGH (g) NOT USED .

725.12 TO 725.20 – NOT USED

725.21 Epoxy Resin Adhesives. Conform to AASHTO M 235.

725.22 Grout. Furnish grout mixtures conforming to the following for the type or types specified in the contract.

(a) Expansive hydraulic sanded cement grout. Furnish a mixture of hydraulic cement, fine aggregate, water, expansive admixture, and/or pozzolan, or additional admixtures, conforming to the following:

(1) 7-day compressive strength, AASHTO T 106	600 pounds per square inch min.
(2) Flow (time of efflux), ASTM C 939	16 to 26 seconds

Note: A more fluid mix, having a flow cone time of efflux of 9 to 15 seconds, may be used during the initial injection.

Submit the following with the production certification:

- Current material certifications for the hydraulic cement, fine aggregate, expansive admixture, and other grout additives; and
- Independent laboratory test results for 1-day, 3-day, and 7-day strengths, flow cone times, shrinkage and expansion observed, and time of initial set.

(b) Polymer grout. Furnish a polymer binder and fine aggregate in the proportions recommended by the polymer manufacturer with a minimum compressive strength of 3,500 pounds per square inch in 4 hours.

(c) Nonshrink grout. Conform to ASTM C 1107.

(d) Grout for Post-Tensioned Structures. Conform to the requirements of the *PTI Guide Specification for Grouting of Post-Tensioned Structures.*

(e) Sanded Hydraulic Cement Grout for Miscellaneous Applications. Furnish 1 part hydraulic cement and 3 parts sand. Thoroughly mix with water to produce a thick, creamy consistency.

(f) Neat hydraulic cement grout. Furnish a grout consisting of a mixture of hydraulic cement, water, and admixtures. Do not exceed a water/cement ratio of 0.44. Fly ash, if used, shall not exceed 20% of the cement by weight. Admixtures to reduce water content, improve the flowability, control bleeding, or control shrinkage may be added according to the manufacturer's recommendations. Admixtures shall be free of chlorides, fluorides, sulphites, and nitrates.

725.29 Reinforcing Fibers. Use deformed steel or fibrillated polypropylene fibers conforming to ASTM C 1116.

END OF SECTION 725