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PREPARED BY: Frances Thomas
Andy Harper
Ray Haverty
Trey Tillander, P.E.



SPECIFICATIONS PACKAGE
FINANCIAL PROJECT ID(S). 422823-1-52-01
FEDERAL FUNDS
DISTRICT THREE
GADSDEN COUNTY

The 2013 Edition of the Florida Department of Transportation Standard Specifications is revised as follows:

I hereby certify that this specifications package has been properly prepared by me, or under my responsible charge, in accordance with procedures adopted by the Florida Department of Transportation.

The official record of this package is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.

Engineer of Record: Virgil Y. Tillander III, P.E.
Date: February 15, 2013
Fla. License No.: 123123
Firm Name: Florida Department of Transportation
Firm Address: 605 Suwannee Street
City, State, Zipcode: Tallahassee, FL 32399
Certificate of Authorization: N/A
Page(s): 1 - 164

Certification of
Authorization required
unless firm is a
government entity.

SPECIAL PROVISIONS	4
PROPOSAL REQUIREMENTS AND CONDITIONS - EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF WORK.....	5
SCOPE OF WORK – INTENT OF CONTRACT.....	5
SCOPE OF THE WORK.....	6
UNFORESEEABLE WORK.....	6
CONTROL OF MATERIALS – SOURCE OF SUPPLY - STEEL.....	6
REQUIREMENTS FOR FEDERAL JOBS – COMPLIANCE WITH FHWA 1273.....	7
PERMITS PROCURED BY THE DEPARTMENT.....	8
DISCHARGE TO OR WORK OR STRUCTURES IN NAVIGABLE WATERS OF THE U.S., WATERS OF THE U.S. AND WATERS OF THE STATE.....	8
UTILITY SCHEDULES.....	9
LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC - WAGE RATES FOR FEDERAL-AID PROJECTS.....	9
LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC – DISADVANTAGED BUSINESS ENTERPRISE PROGRAM.....	10
LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC – E- VERIFY.....	12
LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC – SCRUTINIZED COMPANIES.....	13
PROSECUTION AND PROGRESS - SUBMISSION OF WORKING SCHEDULE.....	13
PROSECUTION OF WORK – REGIONAL DISPUTES REVIEW BOARD.....	17
PROSECUTION OF WORK – STATEWIDE DISPUTES REVIEW BOARD.....	21
PROSECUTION AND PROGRESS – COORDINATION WITH RESEARCH PERSONNEL.....	24
COMPUTATION OF CONTRACT TIME.....	24
DAMAGE RECOVERY.....	25
PORTLAND CEMENT CONCRETE.....	25
CONCRETE STRUCTURES.....	28
PRECAST PRESTRESSED CONCRETE CONSTRUCTION.....	31
STRUCTURES FOUNDATIONS.....	34
ADMIXTURES FOR CONCRETE.....	35
NON-SHRINK GROUT.....	38
DEVELOPMENTAL SPECIFICATIONS.....	41
PRECAST CONCRETE ELEMENTS FOR BRIDGE CONSTRUCTION.....	42
SUPPLEMENTAL SPECIFICATIONS.....	54
005 CONTROL OF THE WORK.....	55
102 MAINTENANCE OF TRAFFIC.....	74
346 PORTLAND CEMENT CONCRETE.....	90
347 PORTLAND CEMENT CONCRETE – CLASS NS.....	111
400 CONCRETE STRUCTURES.....	114

425	INLETS, MANHOLES, AND JUNCTION BOXES.....	152
APPENDICES.....		156
	TECHNICAL SPECIAL PROVISIONS.....	157
	OSTERBERG LOAD CELL TEST.....	158
THIS COMPLETES THIS SPECIFICATIONS PACKAGE		164

SPECIAL PROVISIONS

PROPOSAL REQUIREMENTS AND CONDITIONS - EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF WORK.

(REV 12-12-12) (FA 7-26-12) (1-13)

ARTICLE 2-4 (Page 12) is deleted and the following substituted:

2-4 Examination of Contract Documents and Site of Work.

Examine the Contract Documents and the site of the proposed work carefully before submitting a proposal for the work contemplated. Investigate the conditions to be encountered, as to the character, quality, and quantities of work to be performed and materials to be furnished and as to the requirements of all Contract Documents.

Direct all questions to the Department by posting them to the Department's website at the following URL address:

<https://www3.dot.state.fl.us/BidQuestionsAndAnswers/Proposal.aspx/SearchProposal> .

Questions posted to this site before 5:00 P.M. (EST) on the seventh calendar day prior to the bid opening, or tenth calendar day prior to the December bid opening, will be responded to by the Department. For questions posted after these times, an answer cannot be assured. For all questions posted before the deadline, the Department will provide and post responses at the same website before 8:00 A.M. (EST) on the second calendar day prior to bid opening. Take responsibility to review and be familiar with all questions and responses posted to this website and to make any necessary adjustments in the proposal accordingly. If the Department's web site cannot be accessed, contact Hal Gore at (850) 330-1250.

When, in the sole judgment of the Department, responses to questions require plans revisions, specifications revisions and/or addenda, the Contracts Office will issue them as necessary.

The Department does not guarantee the details pertaining to borings, as shown on the plans, to be more than a general indication of the materials likely to be found adjacent to holes bored at the site of the work, approximately at the locations indicated. The Contractor shall examine boring data, where available, and make his own interpretation of the subsoil investigations and other preliminary data, and shall base his bid on his own opinion of the conditions likely to be encountered.

The bidder's submission of a proposal is prima facie evidence that the bidder has made an examination as described in this Article.

SCOPE OF WORK – INTENT OF CONTRACT.

(REV 8-19-09) (FA 8-24-09) (1-13)

ARTICLE 4-1 (Page 19) is expanded by the following:

The Improvements under this Contract consist of the construction of four new bridges and approaches on State Road 10 (US 90) to replace the two existing bridges over Little River and the existing three barrel bridge culverts at Hurricane Creek in Gadsden County. This contract

also includes drainage improvements, guardrail, signing and pavement markings, and, at the eastern end of the project, friction course milling and resurfacing and shoulder pavement.

The summary of pay items for this project is listed in the Plans.

SCOPE OF THE WORK.

(REV 8-1-12)

SUBARTICLE 4-3.9.1 (Page 26) is expanded by the following.

(5) Cost Savings Initiative Proposals or Contractor Redesigns modifying the precast components of this project to cast-in-place components will not be allowed. Cost Savings Initiative Proposals or Contractor Redesigns eliminating either the prestressed or non-prestressed deck panels will not be allowed.

UNFORESEEABLE WORK.

(REV 9-28-98) (1-13)

ARTICLE 4-4 (Page 29) is deleted and the following substituted:

4-4 Unforeseeable Work.

When the Department requires work that is not covered by a price in the Contract and such work does not constitute a “Significant Change” as defined in 4-3.1, and the Department finds that such work is essential to the satisfactory completion of the Contract within its intended scope, the Department will make an adjustment to the Contract. Such adjustment will be made by Work Order when the Contract Documents provide for Contingency Work. When the Contract Documents do not provide for Contingency Work or the available funds for Contingency Work are insufficient, such adjustment will be made by Supplemental Agreement. The cost of Unforeseeable Work will be a negotiated amount or, in lieu of negotiations or other agreement, an amount based on material invoices, equipment costs, labor payrolls, and markups provided in 4-3.2.

Contingency Work, as used in this Article, is defined as possible additional work required to satisfactorily complete the Contract within its intended scope.

CONTROL OF MATERIALS – SOURCE OF SUPPLY - STEEL.

(REV 10-19-12) (1-13)

SUBARTICLE 6-5.2 (Page 54) is deleted and the following substituted:

6-5.2 Source of Supply-Steel: Use steel and iron produced in the United States, in accordance with the Buy America provisions of 23 CFR 635.410, as amended. Ensure that all manufacturing processes for this material occur in the United States. As used in this

specification, a manufacturing process is any process that modifies the chemical content, physical shape or size, or final finish of a product, beginning with the initial melding and mixing and continuing through the bending and coating stages. A manufactured steel or iron product is complete only when all grinding, drilling, welding, finishing and coating have been completed. If a domestic product is taken outside the United States for any process, it becomes foreign source material. When using steel and iron as a component of any manufactured product incorporated into the project (e.g., concrete pipe, prestressed beams, corrugated steel pipe, etc.), these same provisions apply, except that the manufacturer may use minimal quantities of foreign steel and iron when the cost of such foreign materials does not exceed 0.1% of the total Contract amount or \$2,500, whichever is greater. These requirements are applicable to all steel and iron materials incorporated into the finished work, but are not applicable to steel and iron items that the Contractor uses but does not incorporate into the finished work. Provide a certification from the producer of steel or iron, or any product containing steel or iron as a component, stating that all steel or iron furnished or incorporated into the furnished product was manufactured in the United States in accordance with the requirements of this specification and the Buy America provisions of 23 CFR 635.410, as amended. Such certification shall also include (1) a statement that the product was produced entirely within the United States, or (2) a statement that the product was produced within the United States except for minimal quantities of foreign steel and iron valued at \$ (actual value). Furnish each such certification to the Engineer prior to incorporating the material into the project. Prior to the use of foreign steel on a project, furnish invoices to document the cost of such material, and obtain the Engineer's written approval prior to incorporating the material into the project.

**REQUIREMENTS FOR FEDERAL JOBS – COMPLIANCE WITH FHWA 1273.
(REV 7-16-12) (FA 8-2-12) (1-13)**

SUBARTICLE 7-1.1 (Pages 55 - 56) is expanded by the following:

The FHWA-1273 Electronic version, dated May 1, 2012 is posted on the Department's website at the following URL address <http://www.dot.state.fl.us/specificationsoffice/Implemented/URLinSpecs/Files/FHWA1273.pdf> . Take responsibility to obtain this information and comply with all requirements posted on this website up through five calendar days before the opening of bids.

Comply with the provisions contained in FHWA-1273.

In addition to the requirements of Section IV, No. 3(a), include gender and race in the weekly annotated payroll records.

If the Department's website cannot be accessed, contact the Department's Specifications Office Web Coordinator at (850) 414-4101.

PERMITS PROCURED BY THE DEPARTMENT.

(REV 8-7-01) (FA 4-14-05) (1-13)

SUBARTICLE 7-2.1 (Pages 59 - 60) is expanded by the following:

All Permits procured by the Department are posted on the Department's website at the following URL address: <ftp.dot.state.fl.us/permitsandorutilityworkschedules/> . Take responsibility to obtain this information and comply with all requirements posted on this website up through five calendar days before the opening of bids.

Comply with the provisions contained in these permits.

If the Department's web site cannot be accessed, contact the Department's Specifications Office Web Coordinator at (850) 414-4101.

DISCHARGE TO OR WORK OR STRUCTURES IN NAVIGABLE WATERS OF THE U.S., WATERS OF THE U.S. AND WATERS OF THE STATE.

(REV 7-16-09) (FA 7-30-09) (1-13)

SUBARTICLE 7-2.2 (Page 60) is expanded by the following:

The "State of Florida Department of Environmental Protection (DEP) Generic Permit for Stormwater Discharge from Large and Small Construction Activities" applies to this Contract. Obtain a copy of the permit through the Department's website and comply with the requirements of the permit. The URL for obtaining a copy of the permit is www.dot.state.fl.us/specificationsoffice/Implemented/URLinSpecs/Files/DEPPermit.pdf .

In accordance with the requirements of the DEP generic permit, accept responsibility for the following:

(a) Preparation, execution and submission of DEP Generic Permit Notice of Intent (NOI) and payment of associated fee(s)

(b) Preparation and submission of Erosion Control Plan as outlined in Section 104

(c) Any Contractor initiated SWPPP modifications

(d) Performing inspections using a qualified inspector

(e) Completion of SWPPP construction inspection reports

(f) Executing associated certification forms provided by the Engineer

(g) Preparation, execution and submission of Notice of Termination

(NOT) of the DEP Generic Permit coverage.

Use the SWPPP Construction Inspection Form provided by the Engineer to report all inspection findings and to document all corrective actions taken as a result of the inspection. Sign each inspection report and submit it weekly to the Engineer.

UTILITY SCHEDULES.

(REV 8-27-01) (FA 4-14-05) (1-13)

SUBARTICLE 7-11.6.3 (Page 67) is expanded by the following:

The utility work which will be accomplished concurrently with the highway construction Contract will involve facilities owned by other agencies. Utility Schedules (Utility Relocation and/or Work Schedules) for these agencies are posted on the Department's website at the following URL address: <ftp://ftp.dot.state.fl.us/permitsandorutilityworkschedules/>. Take responsibility to obtain this information and comply with all requirements posted on this website up through five calendar days before the opening of bids.

Where utility work must be coordinated with highway construction operations, the portion of the anticipated utility work period covering such concurrent work may or may not begin on the day highway construction commences and may or may not be consecutive days.

The anticipated scheduling of new work, adjustments and/or relocation work is included on the Utility Schedules.

More precise scheduling to accomplish utility work in the most expeditious manner that is feasible will be established at the preconstruction conference as provided in 8-3.5.

The Utility Schedules shall be used in conjunction with the utility sheets included in the roadway plans.

If the Department's website cannot be accessed, contact the Department's Specifications office Web Coordinator at (850) 414-4101.

LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC - WAGE RATES FOR FEDERAL-AID PROJECTS.

(REV 12-21-09) (FA 12-28-09) (1-13)

ARTICLE 7-16 (Page 69) is expanded by the following:

For this Contract, payment of predetermined minimum wages applies.

The U.S. Department of Labor (USDOL) Wage Rates applicable to this Contract are listed in Wage Rate Decision Number(s) **FL214**, as modified up through ten days prior to the opening of bids.

Obtain the applicable General Decision(s) (Wage Tables) through the Department's Office of Construction website and ensure that employees receive the minimum compensation applicable. Review the General Decisions for all classifications necessary to complete the project. Request additional classifications through the Engineer's office when needed.

For guidance on the requirements for the payment of wages and benefits and the submittal of certified payrolls, and for general guidance and examples of multiple wage rates when assigned to a Contract, refer to the Department's Office of Construction website. Questions regarding wage rates and the applicability of wage tables should be submitted in accordance with 2-4.

Contact the Department's Wage Rate Coordinator at (850) 414-4492 if the Department's website cannot be accessed or there are questions.

**LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC –
DISADVANTAGED BUSINESS ENTERPRISE PROGRAM.**

(REV 10-23-12)(1-13)

ARTICLES 7-24 (Pages 71 - 73) is deleted and the following substituted.

7-24 Disadvantaged Business Enterprise Program.

7-24.1 Disadvantaged Business Enterprise Affirmative Action Plan: Prior to award of the Contract, have an approved Disadvantaged Business Enterprise (DBE) Affirmative Action Program Plan filed with the Equal Opportunity Office. Update and resubmit the plan every three years. No Contract will be awarded until the Department approves the Plan. The DBE Affirmative Action Program Plan is incorporated into and made a part of the Contract.

7-24.2 Required Contract and Subcontract DBE Assurance Language: In accordance with 49 CFR 26.13 (b), the Contract FDOT signs with the Contractor (and each subcontract the prime contractor signs with a subcontractor) must include the following assurance: “The Contractor, sub-recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted Contracts. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the recipient deems appropriate.”

7-24.3 Plan Requirements: Include the following in the DBE Affirmative Action Program Plan:

(a) A policy statement, signed by an authorized representative (president, chief executive officer, or chairman of the contractor), expressing a commitment to use DBEs in all aspects of contracting to the maximum extent feasible, outlining the various levels of responsibility, and stating the objectives of the program. Circulate the policy statement throughout the Contractor’s organization.

(b) The designation of a Liaison Officer within the Contractor’s organization, as well as support staff, necessary and proper to administer the program, and a description of the authority, responsibility, and duties of the Liaison Officer and support staff. The Liaison Officer and staff are responsible for developing, managing, and implementing the program on a day-to-day basis for carrying out technical assistance activities for DBEs and for disseminating information on available business opportunities so that DBEs are provided an equitable opportunity to participate in Contracts let by the Department.

(c) Utilization of techniques to facilitate DBE participation in contracting activities which include, but are not limited to:

1. Soliciting price quotations and arranging a time for the review of plans, quantities, specifications, and delivery schedules, and for the preparation and presentation of quotations.

2. Providing assistance to DBEs in overcoming barriers such as the inability to obtain bonding, financing, or technical assistance.

3. Carrying out information and communication programs or workshops on contracting procedures and specific contracting opportunities in a timely manner, with such programs being bilingual where appropriate.

4. Encouraging eligible DBEs to apply for certification with the Department.

5. Contacting Minority Contractor Associations and city and county agencies with programs for disadvantaged individuals for assistance in recruiting and encouraging eligible DBE contractors to apply for certification with the Department.

7-24.4 DBE Records and Reports: Submit the following through the Equal Opportunity Compliance System:

1. Anticipated DBE Participation Statement - within 3 business days after the Pre-Construction Conference.

2. Report monthly, through the Equal Opportunity Compliance System on the Department's Website, actual payments (including retainage) made to DBEs for work performed with their own workforce and equipment in the area in which they are certified. Report payments made to all DBE and Minority Business Enterprise (MBE) subcontractors and DBE and MBE construction material and major suppliers.

The Equal Opportunity Office will provide instructions on accessing this system. Develop a record keeping system to monitor DBE affirmative action efforts which include the following:

- (a) the procedures adopted to comply with these Specifications;
 - (b) the number of subordinated Contracts on Department projects awarded to DBEs;
 - (c) the dollar value of the Contracts awarded to DBEs;
 - (d) the percentage of the dollar value of all subordinated Contracts awarded to DBEs as a percentage of the total Contract amount;
 - (e) a description of the general categories of Contracts awarded to DBEs;
- and
- (f) the specific efforts employed to identify and award Contracts to DBEs.

Upon request, provide the records to the Department for review.

Maintain all such records for a period of five years following acceptance of final payment and have them available for inspection by the Department and the Federal Highway Administration.

7-24.5 Counting DBE Participation and Commercially Useful Functions:

49 CFR Part 26.55 specifies when DBE credit shall be awarded for work performed by a DBE. DBE credit can only be awarded for work actually performed by DBEs themselves for the types of work for which they are certified. On the Anticipated DBE Participation Statement only include the dollars that a DBE is expected to earn for work they perform with their own workforce and equipment. Submit a revised Anticipated DBE Participation Statement to reflect changes to the initial Anticipated DBE Participation Statement within 14 business days from the date of the change.

When a DBE participates in a contract, the value of the work is determined in accordance with 49 CFR Part 26.55, for example:

(a) The Department will count only the value of the work performed by the DBE toward DBE goals. The entire amount of the contract that is performed by the DBE's own forces (including the cost of supplies, equipment and materials obtained by the DBE for the contract work) will be counted as DBE credit.

(b) The Department will count the entire amount of fees or commissions charged by the DBE firm for providing a bona fide service, such as professional, technical, consultant, or managerial services or for providing bonds or insurance specifically required for

the performance of a Department-assisted contract, toward DBE goals, provided that the Department determines the fees to be reasonable and not excessive as compared with fees customarily followed for similar services.

(c) When the DBE subcontracts part of the work of its contract to another firm, the Department will count the value of the subcontracted work only if the DBE's subcontractor is itself a DBE. Work that a DBE subcontracts to a non-DBE firm does not count toward DBE goals.

(d) When a DBE performs as a participant in a joint venture, the Department will count the portion of the dollar value of the contract equal to the distinct, clearly defined portion of the work the DBE performs with its own forces toward DBE goals.

(e) The Contractors shall ensure that only expenditures to DBEs that perform a commercially useful function in the work of a contract may be counted toward the voluntary DBE goal.

(f) A DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself.

(g) To determine whether a DBE is performing a commercially useful function, the Department will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and other relevant factors.

(h) A DBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation.

(i) If a DBE does not perform or exercise responsibility for at least 30% of the total cost of its contract with its own workforce, or if the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, the DBE has not performed a commercially useful function.

7-24.6 Prompt Payments: Meet the requirements of 9-5 for payments to all DBE subcontractors.

LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC – E-VERIFY. (REV 6-13-11) (FA 6-16-11) (1-13)

SECTION 7 (Pages 55 – 78) is expanded by the following new Article:

7-28 E-Verify.

The Contractor shall utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of all new employees hired by the Contractor during the term of the Contract and shall expressly require any subcontractors performing work or providing services pursuant to the Contract to likewise utilize the U.S. Department of Homeland

Security's E-Verify system to verify the employment eligibility of all new employees hired by the subcontractor during the Contract term.

**LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC –
SCRUTINIZED COMPANIES.**

(REV 6-17-11) (1-13)

SECTION 7 (Pages 55 – 78) is expanded by the following new Article:

7-29 Scrutinized Companies.

For Contracts \$1,000,000 and greater, if the Department determines the Contractor submitted a false certification under Section 287.135(5) of the Florida Statutes, or if the Contractor has been placed on the Scrutinized Companies with Activities in the Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, the Department shall either terminate the Contract after it has given the Contractor notice and an opportunity to demonstrate the Department's determination of false certification was in error pursuant to Section 287.135(5)(a) of the Florida Statutes, or maintain the Contract if the conditions of Section 287.135(4) of the Florida Statutes are met.

PROSECUTION AND PROGRESS - SUBMISSION OF WORKING SCHEDULE.

(REV 1-11-11) (FA 5-12-11) (1-13)

SUBARTICLE 8-3.2 (Page 80) is deleted and the following substituted:

8-3.2 General: For this Contract submit the following schedules and reports.

8-3.2.1 Contract Schedule: Submit to the Engineer for acceptance a Critical Path Method (CPM) Contract Schedule for the project within 30 calendar days after execution of the Contract or at the preconstruction conference, whichever is earlier.

The Contract Schedule shall include detailed schedule diagrams and schedule data as described below for the entire Contract Period. The Contract Schedule shall be consistent with the Contract Maintenance of Traffic plan, showing activities for each discrete Contract activity to be accomplished within each Maintenance of Traffic phase. Include activities for deliverables and reviews in the schedule. Sufficient liaison shall be conducted and information provided to indicate coordination with utility owners having facilities within the project limits. The schedule must reflect the utility adjustment schedules included in the Contract Documents, unless changed by mutual agreement of the utility company, the Contractor and the Department.

Failure to include any element of work or any activity relating to utility work will not relieve the Contractor from completing all work within the Contract Time at no additional time or cost to the Department, notwithstanding the acceptance of the schedule by the Department.

Submit monthly updates of the Contract Schedule reflecting progress through the monthly estimate cut-off date within 7 calendar days after the monthly estimate cut-off date.

The Engineer will withhold monthly payments due for failure of the Contractor to submit an acceptable schedule or monthly updates within the time frame described herein.

8-3.2.2 Schedule Submissions: Develop the schedule in Precedence Diagram Method (PDM) format. All schedule submittals, shall have a copy of the schedule files on a Windows compatible CD or DVD attached. The files shall be in a Primavera format. Make sure to use "Back up" menu selection and ensure that the option "Remove access list during backup" is checked.

Each schedule submission and monthly update shall include a minimum of 4 items:

1) a Critical Path Method (CPM) Network Diagram in time-scale logic diagram, by week starting on Monday, grouped (banded) by phase and location and sorted by early start days. Prominently identify the critical path activities, defined as the longest continuous path of work activities. Submit the Network Diagram, printed in color on D size, 22 inches by 34 inches or E size, 34 inches by 44 inches paper. The network diagram shall contain, as a minimum, the following information for each schedule activity: identification, activity description, total duration, remaining duration, early start date, late finish date, and total float.

2) a report with the following schedule activity information for each construction activity: identification, description, original duration, remaining duration, early start, early finish, total float, percent complete, and budgeted cost. The bar chart diagram shall not be included in this report. It will be submitted on 8.5 inches by 11 inches paper.

3) a schedule narrative report describing current project schedule status and identifying potential delays. This report will include a description of the progress made since the previous schedule submission and objectives for the upcoming 30 calendar days. It will be submitted on 8.5 inches by 11 inches paper. This report shall at a minimum include the following information:

a) This report shall indicate if the project is on schedule, ahead of schedule or behind schedule. If the project is ahead of schedule or behind schedule, the report shall include the specific number of calendar days. If the project is behind schedule, the report shall include a detailed recovery plan that will put the project back on schedule or include a properly supported request for Time Extension.

b) The report will describe the current critical path of the project and indicate if this has changed in the last 30 calendar days. Discuss current successes or problems that have affected either the critical path's length or have caused a shift in the critical path within the last 30 calendar days. Identify specific activities, progress, or events that may reasonably be anticipated to impact the critical path within the next 30 calendar days, either to affect its length or to shift it to an alternate path.

c) List all schedule logic or duration changes that have been made to the schedule since the previous submission. For each change, describe the basis for the change and specifically identify the affected activities by identification number.

d) Identify any and all activities, either in progress or scheduled to occur within the following 30 days that require Department participation, review, approval, etc.

4) a copy of the schedule files on a Windows compatible CD or DVD in Primavera format.

The Engineer will have 30 days to accept the Contract Schedule or to schedule a meeting, if needed, within that time, with the Contractor to resolve any problems that prevent acceptance of the schedule. Attend the meeting scheduled by the Engineer, and submit a corrected schedule to the Engineer within seven days after the meeting. The process will be continued until a Contract Schedule is accepted by the Engineer.

8-3.2.3 Schedule Content: All schedule submissions shall comply with the following content guidelines as appropriate to the specific submission:

Outline Schedule Diagrams and Data shall show the sequence, order, and interdependence of major construction milestones and activities. Include ordering and procurement of major materials and equipment, long-lead time items, and key milestones identified by the Contract. Identify planned work schedule(s) and include all non-workdays. Provide a description of each major construction activity or key milestone.

Detailed Schedule Diagrams shall include activity number, description, early dates, float, and all relationships (i.e. logic ties), resources and costs. Show the sequence, order, and interdependence of activities in which the work is to be accomplished. Include allowance for Department oversight, acceptance and return of submittals, samples and shop drawings where Department acceptance is specifically required (in accordance with 5-1.4.6 of the standard specifications). In addition to construction activities, detailed network activities shall include the submittals, procurement, and Department or Utility activities impacting progress:

a. Submittal activities shall include oversight and acceptance of submittals. If the Department's action on any submittal is "Not Accepted" or "Revise and Resubmit", a new series of submittal preparation activities shall be inserted into the schedule. Predecessor for the new submittal preparation activity will be the original acceptance activity and the successor of the new acceptance activity will be the fabrication/delivery activity for the equipment or material.

b. Procurement activities shall include all materials and equipment, receipt of materials with estimated procurement costs of major items for which payment of stockpiled materials will be requested in advance of installation, fabrication of special material and equipment, and their installation and testing.

c. Show activities of the Department or Utilities that affect progress and contract-required dates for completion of all or parts of the work.

Detailed Schedule Data: shall conform to the following:

a. All activities shall be assigned to a specific calendar within the software. Specific calendars will be defined within the software to include planned work days. These calendars will include both Contractor and Contract defined holidays and suspension days as non-workdays.

b. Each schedule activity shall be cost loaded. Activity cost loading shall be consistent with the bid breakdown. The sum total of the activity cost loading shall be equal to the current contract value, and should not include bid items.

c. At a minimum, each schedule activity shall contain codes by:

1. Responsibility: including, but not be limited to, Department, Utility, Contractor/Subcontractor, Supplier/Vendor, Consultant, etc.

2. Phasing: identify the appropriate Maintenance of Traffic phase or subphase.

d. Key milestones as identified by contract. At a minimum, the start and finish of each Maintenance of Traffic phase or subphase shall be represented by a milestone activity.

e. All non-procurement activities must be less than or equal to 20 workdays unless approved by the Engineer to be greater by the Engineer.

f. Detailed description of each activity. In each activity, give quantity and unit of measure so that the amount of work the activity involves is clearly communicated.

g. Only two open-ended activities (the first and the last) are allowed.

h. Constraints shall only be used for "Project Start," and "Project Completion." Constraints cannot override logic. The use of any other imposed constraints is not allowed without specific approval by the Engineer. Any other desired constraints must be submitted to the Engineer with the rationale for the use of each desired additional constraint. If allowed by the Engineer, the rationale should be recorded in the activity's log field. Mandatory constraints (start and finish) violate network logic and shall not be used.

i. Out of sequence progress, if applicable, shall be handled through Retained Logic. Use of the Progress Override option is not appropriate for this project and will not be allowed.

j. Progress shall be calculated based on percent complete.

k. All changes to activities shall be recorded with a note in the activity log field. The log shall include, as a minimum, the date and reason for the change, as well as reference to a document wherein the Engineer acknowledges and accepts the change.

l. The use of resource leveling, either manual or automatic, is prohibited.

8-3.2.4 Weekly Meetings: Attend weekly meetings scheduled by the Engineer to discuss Contract progress, near term scheduled activities, including utility relocations, problems and their proposed solutions. Submit a Two-Week "Look Ahead" Planning Schedule at each weekly meeting, showing the items of work planned for the next two weeks. Develop the schedule in Bar Chart format, identifying current and planned activities and related Contract Schedule work activities, including subcontractor work. Designate all activities that are controlling work items as determined by the currently accepted Contract Schedule. A report shall be submitted at each weekly meeting identifying schedule activity progress including actual start or finish dates achieved for any activities.

8-3.2.5 Float: Is also known as slack time or slide time; it is defined as the amount of time the finish of an activity can be delayed. Two kinds of float are possible: Total float is how much an activity can be delayed without affecting the finish date of the project or an intermediate deadline (constraint); it is the difference between the late finish date and the early finish date. Free float is how much an activity can be delayed without affecting its earliest successor.

Float is not for the exclusive use or benefit of either the Department or the Contractor.

Use of float suppression techniques, such as preferential sequencing (arranging critical path through activities more susceptible to Department caused delay), special lead/lag logic restraints, zero total or free float constraints, extended activity times, or imposing constraint dates other than as required by the contract, shall be cause for rejection of the project schedule or its updates. The use of Resource Leveling (or similar software features) used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is expressly prohibited.

Negative float shall not be a basis for requesting time extensions. Any extension of time shall be addressed in accordance with 8-3.2.6 Time Extensions. Scheduled completion date(s) that extend beyond the contract completion date (evidenced by negative float) may be used in computations for assessment of payment withholdings. The use of this computation is not to be construed as a means of acceleration.

8-3.2.6 Time Extensions: The Contractor is responsible for submitting a request for Contract Time extension in accordance with 8-7.3.2 of the standard specifications. An extension of time for performance shall be considered only to the extent that a delay to an activity or activities exceeds the total float along the project critical paths within the current approved schedule.

As a minimum, time extension requests shall contain:

- a. A descriptive summary of the changes
- b. An analysis of project impact
- c. A fragnet that shows the impacted activities before the change
- d. A fragnet that shows the impacted activities after the change

Time extensions shall not be considered for proposals that do not include full documentation for the schedule change. Once a change has been approved by the Engineer, the specific activities and the overall schedule must be updated.

8-3.2.7 Performance of Work: By submitting a schedule the Contractor is making a positive assertion that the project will be constructed in the order indicated on the schedule. Prosecute the work in accordance with the latest accepted Working Schedule. Any costs associated with meeting milestones and completing the project within the authorized Contract Time will be borne solely by the Contractor.

8-3.2.8 As-Built Schedule: As a condition for Final Acceptance of the project, submittal of an as-built schedule which describes the actual order and start and stop times for all activities by the Contractor is required.

PROSECUTION OF WORK – REGIONAL DISPUTES REVIEW BOARD. (REV 1-4-11) (FA 1-21-11) (1-13)

ARTICLE 8-3 (Pages 80 - 81) is expanded by the following new Subarticle:

8-3.7 Disputes Review Board: For this Contract, a Disputes Review Board will be available to assist in the resolution of disputes and claims arising out of the work on the Contract.

8-3.7.1 Purpose: The Board will provide special expertise to assist in and facilitate the timely and equitable resolution of disputes and claims between the Department and the Contractor in an effort to avoid construction delay and future claims.

It is not intended that the Department or the Contractor default on their normal responsibility to cooperatively and fairly settle their differences by indiscriminately assigning them to the Board. It is intended that the Board encourage the Department and Contractor to resolve potential disputes or claims without resorting to this alternative resolution procedure.

The Board will be used when normal Department-Contractor dispute or claim resolution is unsuccessful. Either the Department or the Contractor may refer a dispute or claim to the Board. Referral to the Board should be initiated as soon as it appears that the normal dispute resolution effort is not succeeding. Referral to the Board is accomplished by providing a position paper outlining the nature and scope of the dispute or claim and describing the basis for entitlement to the dispute or claim. Only disputes or claims that have been duly preserved under the terms of the Contract as determined by the Board will be eligible to be heard by the Board. Requests for equitable adjustment must be certified as required by 4-3.2. Claims that are referred to the Board must be in compliance with 5-12. It is a condition of this Contract that the parties shall use the Dispute Review Board. The completed DRB hearing of any unresolved disputes or claims is a condition precedent to the Department or the Contractor having the right to initiate arbitration, other alternative resolution procedures, or to file a lawsuit, as provided by law on such unresolved disputes or claims.

The recommendations of the Board will not be binding on either the Department or the Contractor.

The Board will fairly and impartially and without regard to how or by whom they may have been appointed, consider disputes or claims referred to it and will provide written recommendations to the Department and Contractor to assist in the resolution of these disputes or claims.

8-3.7.2 Continuance of Work: During the course of the Disputes Review Board process, the Contractor will continue with the work as directed by the Engineer in a diligent manner and without delay or otherwise conform to the Engineer's decision or order, and will be governed by all applicable provisions of the Contract. Throughout any protested work, the Contractor will keep complete records of extra costs and time incurred. The Contractor will permit the Engineer and Board access to these and any other records needed for evaluating the disputes or claims.

8-3.7.3 Membership: The Disputes Review Board will consist of members pre-selected by the Engineer and the President of the Florida Transportation Builders' Association (FTBA), and posted on the Department's Website.

If during the life of the contract, a Board member has a discussion regarding employment or entered into any agreement for employment after completion of the contract with the Department, the Contractor or any subcontractor or supplier on the project, he/she shall immediately disclose this to the Contractor and the Department and shall be disqualified from serving on the Board.

Once established, the Board will remain active and in full force and effect. If, after the Department has made final acceptance of the project, there are unresolved disputes and claims remaining, the Disputes Review Board shall remain active and in full force and effect until the project is otherwise administratively closed by the Department following final payment so that the Board may continue in operation until all unresolved disputes and claims are resolved.

8-3.7.4 Procedure and Schedules for Disputes Resolution: Disputes and claims will be considered as quickly as possible, taking into consideration the particular circumstances

and the time required to prepare detailed documentation. Steps may be omitted as agreed by the Department and the Contractor and the time periods stated below may be shortened in order to hasten resolution.

a. If the Contractor objects to any decision, action or order of the Engineer, the Contractor may file a written protest with the Engineer, stating clearly and in detail the basis for the objection, within 15 days after the event.

b. The Engineer will consider the written protest and make his decision on the basis of the pertinent contract provisions, together with the facts and circumstances involved in the dispute or claim. The Engineer's decision will be furnished in writing to the Contractor within 15 days after receipt of the Contractor's written protest.

c. This decision will be final and conclusive on the subject, unless a written appeal to the Engineer is filed by the Contractor within 15 days of receiving the decision. Should the Contractor preserve its protest of the Engineer's decision, the matter can be referred to the Board by either the Department or the Contractor.

d. Upon receipt by the Board of a written duly preserved protest of a dispute or claim, either from the Department or the Contractor, it will first be decided when to conduct the hearing.

e. Either party furnishing any written evidence or documentation to the Board will furnish copies of such information to the other party a minimum of 15 days prior to the date the Board sets to convene the hearing for the dispute or claim. If the Board requests any additional documentation or evidence prior to, during, or after the hearing, the Department and/or Contractor will provide the requested information to the Board and to the other party.

f. The Contractor and the Department will each be afforded an opportunity to be heard by the Board and to offer evidence. Neither the Department nor the Contractor may present information at the hearing that was not previously distributed to both the Board and the other party.

g. The Board's recommendations for resolution of the dispute or claim will be given in writing to both the Department and the Contractor, within 15 days of completion of the hearings. In cases of extreme complexity, both parties may agree to allow additional time for the Board to formulate its recommendations. The Board will focus its attention in the written report to matters of entitlement and allow the parties to determine the monetary damages. If both parties request, and sufficient documentation is available, the Board may make a recommendation of monetary damages.

h. Within 15 days of receiving the Board's recommendations, both the Department and the Contractor will respond to the other and to the Board in writing, signifying either acceptance or rejection of the Board's recommendations. The failure of either party to respond within the 15 day period will be deemed an acceptance of the Board's recommendations by that party. If the Department and the Contractor are able to resolve the dispute or claim with or without the aid of the Board's recommendations, the Department will promptly process any required Contract changes.

i. Should the dispute or claim remain unresolved, either party may seek reconsideration of the decision by the Board only when there is new evidence to present. No provisions in this Specification will abrogate the Contractor's responsibility for preserving the request for equitable adjustment in accordance with 4-3.2 or the Contractor's responsibility for preserving a claim filed in accordance with 5-12.

Although both the Department and the Contractor should place great weight on the Board's recommendation, it is not binding. If the Board's recommendations do not resolve the dispute or claim, all records and written recommendations of the Board will be admissible as evidence in any subsequent dispute resolution procedures.

8-3.7.5 Contractor Responsibility: The Contractor shall furnish to each Board member a set of all pertinent documents which are or may become necessary for the Board, except documents furnished by Department, to perform their function. Pertinent documents are any drawings or sketches, calculations, procedures, schedules, estimates, or other documents which are used in the performance of the work or in justifying or substantiating the Contractor's position. A copy of such pertinent documents must also be furnished to the Department.

Except for its participation in the Board's activities as provided in the construction Contract and in this Agreement, the Contractor will not solicit advice or consultation from the Board or any of its members on matters dealing in any way with the project, the conduct of the work or resolution of problems.

8-3.7.6 Department Responsibilities: Except for its participation in the Board's activities as provided in the construction Contract and in this Agreement, the Department will not solicit advice or consultation from the Board or any of its members on matters dealing in any way with the project, the conduct of the work or resolution of problems.

The Department shall furnish the following services and items:

a. **Contract Related Documents:** The Department shall furnish each Board member a copy of all Contract Documents, supplemental agreements, written instructions issued by the Department to the Contractor, or other documents pertinent to the performance of the Contract and necessary for the Board to perform their function. A copy of such pertinent documents must also be furnished to the Contractor.

b. **Coordination and Services:** The Department, in cooperation with the Contractor, will coordinate the operations of the Board. The Department, through the Project Engineer, will arrange or provide conference facilities at or near the Contract site and provide secretarial and copying services.

8-3.7.7 Limitation for Referral of Disputes or Claims to the Board: Any disputes or claims that were not resolved prior to Final Acceptance of the project pursuant to 5-11 must be referred to the Board within 90 calendar days after Final Acceptance for projects with an original Contract amount of \$3,000,000 or less, and within 180 calendar days after Final Acceptance on projects with an original Contract amount greater than \$3,000,000. Only duly preserved disputes or claims will be eligible to be heard by the Board. Failure to submit all disputes or claims to the Board within aforementioned timeframe after Final Acceptance constitutes an irrevocable waiver of the Contractor's dispute or claim.

8-3.7.8 Basis of Payment: A per hearing cost of \$8,000 has been established by the Department for providing compensation for all members of the Dispute Review Board for participation in an actual hearing. The Board chairman will receive \$3,000 for participation in the hearing while the remaining two members will receive \$2,500 each. The Department and the Contractor will equally provide compensation to the Board for participation in an actual hearing. The Department will compensate the Contractor \$4,000 as its contribution to the hearing cost. Such payment will be full and complete compensation to the Board members for all expenses related to the hearing. This includes travel, accommodations, meals, pre- and post-hearing work, review of position papers and any rebuttals, conducting the hearing, drafting and issuance of recommendations, readdressing any requests for clarification. It is not intended for hearings to

last longer than a single day, however, in some cases they may. Any additional time and/or compensation for a hearing would only be allowed upon prior written approval of the Department and the Contractor. If an additional day(s) is granted for the hearing, it will be at \$3,300 per day, payment of which is equally split between the Department and the Contractor. Payment shall be made by issuing a work order against contingency funds set aside for this Contract.

The Department will prepare and mail minutes and progress reports, will provide administrative services, such as conference facilities and secretarial services, and will bear the cost of these services. If the Board desires special services, such as legal consultation, accounting, data research, and the like, both parties must agree, and the costs will be shared by them as mutually agreed.

**PROSECUTION OF WORK – STATEWIDE DISPUTES REVIEW BOARD.
(REV 1-4-11) (FA 1-21-11) (1-13)**

ARTICLE 8-3 (Pages 80 - 81) is expanded by the following new Subarticle:

8-3.8 Statewide Disputes Review Board: For this Contract, a Statewide Disputes Review Board will be available to assist in the resolution of disputes and claims arising out of the administration and enforcement of a specification when such specification specifically refers disputes to this Board.

8-3.8.1 Purpose: The Board will provide special expertise to assist in and facilitate the timely and equitable resolution of the disputes and claims between the Contractor and the Department.

It is not intended that the Department or the Contractor default on their normal responsibility to cooperatively and fairly settle their differences by indiscriminately assigning them to the Board. It is intended that the Board encourage the Department and Contractor to resolve potential disputes or claims without resorting to this alternative resolution procedure.

The Board will be used when normal Department-Contractor dispute or claim resolution is unsuccessful. Either the Department or the Contractor may refer a dispute or claim to the Board. Referral to the Board should be initiated as soon as it appears that the normal dispute resolution effort is not succeeding. Referral to the Board is accomplished by providing a position paper outlining the nature and scope of the dispute or claim and describing the basis for entitlement to the dispute or claim. Only disputes or claims that have been duly preserved under the terms of the Contract as determined by the Board will be eligible to be heard by the Board. Requests for equitable adjustment must be certified as required by 4-3.2. Claims that are referred to the Board must be in compliance with 5-12. It is a condition of this Contract that the parties shall use the Statewide Disputes Review Board.

The recommendations of the Board will be binding on both the Department and the Contractor.

The Board will fairly and impartially and without regard to how or by whom they may have been appointed, consider disputes or claims referred to it and will provide written recommendations to the Department and Contractor to assist in the resolution of these disputes or claims.

8-3.8.2 Membership: The Statewide Disputes Review Board will consist of members pre-selected by the Engineer and the President of the Florida Transportation Builders' Association (FTBA), and posted on the Department's Website.

Members on the Board will be pre-qualified as experts of the type of work being referred to this Board.

If during the life of the contract, a Board member has a discussion regarding employment or entered into any agreement for employment after completion of the contract with the Department, the Contractor or any subcontractor or supplier on the project, he/she shall immediately disclose this to the Contractor and the Department and shall be disqualified from serving on the Board.

After the Department has made final acceptance of the project, if disputes arise, the Statewide Disputes Review Board shall be activated to hear and rule on the disputed issue.

8-3.8.3 Procedure and Schedules for Disputes Resolution: Disputes or claims will be considered as quickly as possible, taking into consideration the particular circumstances and the time required to prepare detailed documentation. Steps may be omitted as agreed by the Department and the Contractor and the time periods stated below may be shortened in order to hasten resolution.

a. If the Contractor objects to any decision, action or order of the Engineer resulting from the Engineer's evaluation of the guaranteed product or performance period, the Contractor may file a written protest with the Engineer, stating clearly and in detail the basis for the objection, within 15 days after the event.

b. The Engineer will consider the written protest and make his decision on the basis of the pertinent contract provisions, together with the facts and circumstances involved in the dispute. The Engineer's decision will be furnished in writing to the Contractor within 15 days after receipt of the Contractor's written protest.

c. The Engineer's decision will be final and conclusive on the subject, unless the Contractor files a written appeal to the Engineer within 15 days of receiving the decision. Upon the Engineer's receipt of the Contractor's written appeal containing specific protest of all or part of the Engineer's decision, either the Department or the Contractor can refer the matter to the Board.

d. Upon receipt by the Board of a written duly preserved protest of a dispute or claim, either from the Department or the Contractor, it will first be decided when to conduct the hearing.

e. Either party furnishing any written evidence or documentation to the Board will furnish copies of such information to the other party a minimum of 15 days prior to the date the Board sets to convene the hearing for the dispute or claim. If the Board requests any additional documentation or evidence prior to, during, or after the hearing, the Department and/or Contractor will provide the requested information to the Board and to the other party.

f. The Contractor and the Department will each be afforded an opportunity to be heard by the Board and to offer evidence. Neither the Department nor the Contractor may present information at the hearing that was not previously distributed to both the Board and the other party.

g. The Board's recommendations for resolution of the dispute or claim will be given in writing to both the Department and the Contractor, within 15 days of completion of the hearings. The Board will focus its attention in the written report to matters of

responsibility for repairs of guaranteed work or performance period as provided for by the Contract Documents.

8-3.8.4 Contractor Responsibility: The Contractor shall furnish to each Board member a set of all pertinent documents that are or may become necessary for the Board, except documents furnished by Department, to perform their function. Pertinent documents are any drawings or sketches, calculations, procedures, schedules, estimates, or other documents which are used in the performance of the work or in justifying or substantiating the Contractor's position. A copy of such pertinent documents must also be furnished to the Department.

Except for its participation in the Board's activities as provided in the construction Contract and in this Agreement, the Contractor will not solicit advice or consultation from the Board or any of its members on matters dealing in any way with the project, the conduct of the work or resolution of problems.

8-3.8.5 Department Responsibilities: Except for its participation in the Board's activities as provided in the construction Contract and in this Agreement, the Department will not solicit advice or consultation from the Board or any of its members on matters dealing in any way with the project, the conduct of the work or resolution of problems.

The Department shall furnish the following services and items:

a. **Contract Related Documents:** The Department shall furnish each Board member a copy of all Contract Documents, supplemental agreements, written instructions issued by the Department to the Contractor, or other documents pertinent to the performance of the Contract and necessary for the Board to perform their function. A copy of such pertinent documents must also be furnished to the Contractor.

b. **Coordination and Services:** The Department, in cooperation with the Contractor, will coordinate the operations of the Board. The Department, through the Project Engineer, will arrange or provide conference facilities at or near the Contract site and provide secretarial and copying services.

8-3.8.6 Basis of Payment: A per hearing cost of \$8,000 has been established by the Department for providing compensation for all members of the Dispute Review Board for participation in an actual hearing. The Board chairman will receive \$3,000 for participation in the hearing while the remaining two members will receive \$2,500 each. The Department and the Contractor will equally provide compensation to the Board for participation in an actual hearing. The Department will compensate the Contractor \$4,000 as its contribution to the hearing cost. Such payment will be full and complete compensation to the Board members for all expenses related to the hearing. This includes travel, accommodations, meals, pre- and post- hearing work, review of position papers and any rebuttals, conducting the hearing, drafting and issuance of recommendations, readdressing any requests for clarification. It is not intended for hearings to last longer than a single day, however, in some cases they may. Any additional time and/or compensation for a hearing would only be allowed upon prior written approval of the Department and the Contractor. If an additional day(s) is granted for the hearing, it will be at \$3,300 per day, payment of which is equally split between the Department and the Contractor. Payment shall be made by issuing a work order against contingency funds set aside for this Contract.

The Department will prepare and mail minutes and progress reports, will provide administrative services, such as conference facilities and secretarial services, and will bear the cost of these services. If the Board desires special services, such as legal consultation,

accounting, data research, and the like, both parties must agree, and the costs will be shared by them as mutually agreed.

PROSECUTION AND PROGRESS – COORDINATION WITH RESEARCH PERSONNEL.

(REV 12-19-12)

ARTICLE 8-4 (Pages 81 - 83) is expanded by the following new Subarticle:

8-4.10 Coordination with Research Personnel: Researchers authorized by the Department will be conducting observations, measurements and testing on precast concrete elements for bridge construction during the construction process.

Provide safe access for the research personnel both at the precast plant and on the project for observation of construction including video recording and the documentation of all bridge construction phases. The Engineer will coordinate with the Contractor for arranging access to the project and precast plant sites for research personnel at least 24 hours in advance of their arrival.

In addition, notify the Engineer at least 30 days prior to the completion of each bridge. Research personnel will perform instrumentation and testing for seven consecutive calendar days (“Testing Period”) upon completion of each bridge but prior to opening the bridge to traffic. Restrict access to the bridge during the Testing Period to allow only research personnel and equipment (i.e. no construction personnel, equipment, materials and activities permitted) unless the Engineer approves otherwise. Attend pre-test and post-test meetings as needed to open and close the Testing Period. All work and costs for this effort will be included in the Maintenance of Traffic pay item and no separate payment will be made.

COMPUTATION OF CONTRACT TIME.

(REV 12-22-98) (FA 1-19-99) (1-13)

SUBARTICLE 8-7.1 (Page 85) is expanded by the following:

Contract Time for this project includes 4 calendar days for periods of reduced productivity by the Contractor’s forces due to utility adjustment/relocation. These days of reduced productivity shall be reflected in the Contractor’s work progress schedule.

No additional compensation will be made to the Contractor for periods of reduced productivity as defined above.

DAMAGE RECOVERY.
(REV 2-4-04) (1-13)

SECTION 8 (Pages 79 - 91) is expanded by the following:

A damage recovery/user cost will be assessed against the Contractor if all lanes are not open to traffic during the times as shown in the Traffic Control Plans. Costs will be assessed beginning at the appropriate time as shown in the Traffic Control Plans and continue until all lanes are open as recorded by the Engineer. This assessment will be in the following amounts:

First 30 minutes and under: \$5,200.00

Each additional 30 minute period or portion thereof: \$2,600.00

Such costs will not exceed \$25,000.00 over a 24 hour period.

At the discretion of the Engineer, damage recovery/user cost will not be assessed for failure to open traffic lanes if such cause is beyond the control of the Contractor, i.e., catastrophic events, accidents not related or caused by the Contractor's operations.

The Department will have the right to apply as payment on such damages any money which is due to the Contractor by the Department.

PORTLAND CEMENT CONCRETE.
(REV 8-1-12)

SUBARTICLE 346-2.1 (of the Supplemental Specifications) is deleted and the following substituted:

346-2.1 General: Meet the following requirements:

Coarse Aggregate.....	Section 901
Fine Aggregate*	Section 902
Portland Cement.....	Section 921
Water.....	Section 923
Admixtures.....	Section 924
Pozzolans and Slag	Section 929

*Use only silica sand except as provided in 902-5.2.3.

Do not use materials containing hard lumps, crusts or frozen matter, or that is contaminated with dissimilar material in excess of that specified in the above listed Sections.

SUBARTICLE 346-2.5 (of the Supplemental Specifications) is expanded by the following new Subarticle:

346-2.5.6 Shrinkage Reducing Admixture (SRA): Use SRA in accordance with Section 924.

SUBARTICLE 346-3.1 (of the Supplemental Specifications) is deleted and the following substituted:

346-3.1 General: The separate classifications of concrete covered by this Section are designated as Class I, Class II, Class III, Class IV, Class V and Class VI. Strength and slump are specified in Table 2. The air content range for all classes of concrete is 1.0 to 6.0%, except for Class IV (Drilled Shaft) which is 0.0 to 6.0%.

Substitution of a higher class concrete in lieu of a lower class concrete may be allowed when the substituted concrete mixes are included as part of the Contractor's Quality Control Plan, or for precast concrete, the Precast Concrete Producer's Quality Control Plan. The substituted higher class concrete must meet or exceed the requirements of the lower class concrete and both classes must contain the same types of mix ingredients. When the compressive strength acceptance data is less than the minimum compressive strength of the higher design mix, notify the Engineer. Acceptance is based on the requirements in Table 2 for the lower class concrete.

Class of Concrete	Specified Minimum Strength (28 day) (psi)	Target Slump Value (inches) (c)
I (a)	3,000	3 (b)
I (Pavement)	3,000	2
II (a)	3,400	3 (b)
II (Bridge Deck)	4,500	3 (b)
II (Bridge Deck) with SRA	4500	3 (b)
III (e)	5,000	3 (b)
III (Seal)	3,000	8
IV	5,500	3 (b) (d)
IV (Drilled Shaft)	4,000	8.5
V (Special)	6,000	3 (b) (d)
V	6,500	3 (b) (d)
VI	8,500	3 (b) (d)

(a) For precast three-sided culverts, box culverts, endwalls, inlets, manholes and junction boxes, the target slump value and air content will not apply. The maximum allowable slump is 6 inches, except as noted in (b). The Contractor is permitted to use

concrete meeting the requirements of ASTM C 478 4,000 psi in lieu of Class I or Class II concrete for precast endwalls, inlets, manholes and junction boxes.

(b) The Engineer may allow a higher target slump when a Type F, G, I or II admixture is used, except when flowing concrete is used. The maximum target slump shall be 7 inches.

(c) For a reduction in the target slump for slip-form operations, submit a revision to the mix design to the Engineer.

(d) When the use of silica fume, ultrafine fly ash, or metakaolin is required as a pozzolan in Class IV, Class V, Class V (Special) or Class VI concrete, ensure that the concrete exceeds a resistivity of 29 KOhm-cm at 28 days, when tested in accordance with FM 5-578. Submit three 4 x 8 inch cylindrical test specimens to the Engineer for resistivity testing before mix design approval. Take the resistivity test specimens from the concrete of the laboratory trial batch or from the field trial batch of at least 3 cubic yards. Verify the mix proportioning of the design mix and take representative samples of trial batch concrete for the required plastic and hardened property tests. Cure the field trial batch specimens similar to the standard laboratory curing methods. Submit the resistivity test specimens at least 7 calendar days prior to the scheduled 28 day test. The average resistivity of the three cylinders, eight readings per cylinder, is an indicator of the permeability of the concrete mix.

(e) When precast three-sided culverts, box culverts, endwalls, inlets, manholes or junction boxes require a Class III concrete, the minimum cementitious materials is 470 pounds per cubic yard. Do not apply the air content range and the maximum target slump shall be 6 inches, except as allowed in (b).

SUBARTICLE 346-4.1 (of the Supplemental Specifications) is deleted and the following substituted:

346-4.1 Master Proportion Table: Proportion the materials used to produce the various classes of concrete in accordance with Table 3:

Class of Concrete	Minimum Total Cementitious Materials Content pounds per cubic yard	Maximum Water to Cementitious Materials Ratio pounds per pounds *
I	470	0.53
I (Pavement)	470	0.50
II	470	0.53
II (Bridge Deck)	611	0.44
II (Bridge Deck) with SRA	611	0.44***
III	611	0.44
III (Seal)	611	0.53
IV	658	0.41**
IV (Drilled Shaft)	658	0.41

TABLE 3		
Class of Concrete	Minimum Total Cementitious Materials Content pounds per cubic yard	Maximum Water to Cementitious Materials Ratio pounds per pounds *
V (Special)	752	0.37**
V	752	0.37**
VI	752	0.37**

*The calculation of the water to cementitious materials ratio (w/cm) is based on the total cementitious material including cement and any supplemental cementitious materials that are used in the mix.
**When the use of silica fume or metakaolin is required, the maximum water to cementitious material ratio will be 0.35. When the use of ultrafine fly ash is required, the maximum water to cementitious material ratio will be 0.30.
*** When using SRA, modify the Water content per Manufacturer's recommendations.

CONCRETE STRUCTURES.
(REV 8-1-12)

ARTICLE 400-1 (of the Supplemental Specifications) is deleted and the following substituted:

400-1 Description.

Construct concrete structures and other concrete members, with the exception of pavement and incidental concrete construction (which are specified in other Sections).

Refer to Section 404 for precast concrete elements for bridge construction requirements additional to the requirements of this Section.

Refer to Section 450 for precast prestressed concrete construction requirements additional to the requirements of this Section.

Except for precast concrete elements for bridge construction, for precast concrete structures meet the requirements of Section 450 for inserts and lifting devices, handling, storage, shipping, and erection.

Obtain incidental precast products from a plant that is currently on the list of Producers with Accepted Quality Control Programs. Producers seeking inclusion on the list shall meet the requirements of 105-3.

ARTICLE 400-2 (of the Supplemental Specifications) is deleted and the following substituted:

400-2 Materials.

Meet the following requirements:

Concrete	Sections 346 and 347
Penetrant Sealer	Section 413
High Molecular Weight Methacrylate (HMWM)	Section 413
Reinforcing Steel	Section 415
Water.....	Section 923
Curing Materials*	Section 925
Epoxy Bonding Compounds	Sections 926 and 937
Joint Materials.....	Section 932
Bearing Pads	Section 932
Non-Shrink Grout	Section 934
Class 5 Applied Finish Coatings.....	Section 975
Galvanizing Compound	Section 562
Dowel Bar Assembly	Section 931
Filter Fabric.....	Section 985

*The Engineer will allow clean sand and sawdust for certain curing, when and as specified.

ARTICLE 400-12 (of the Supplemental Specifications) is deleted and the following substituted:

400-12 Anchor Rods and Dowels.

Set anchor rods and dowels as specified in Section 460.

Galvanize all anchor rods as specified in Section 962.

When using the percent of required strength, cast test cylinders for each mix for compressive strength determination or develop a curing concrete strength versus time curve (S/T Curve) which can be used in lieu of multiple test cylinders to determine when percent of required strength has been met.

Prior to curve use; obtain the Engineer’s approval of the S/T Curve and its supporting data. An approved testing laboratory may be used to provide this information with approval of the Engineer. Plot S/T Curves using at least three different elapsed times that begin once test cylinders are cast; however, one of the elapsed times must be prior to the Contractor’s intended form removal. Each elapsed time plotted must have a corresponding compressive strength computed by averaging the compressive strength of two test cylinders.

Cure such test cylinders as nearly as practical in the same manner as the concrete in the corresponding structural component, and test them in accordance with ASTM C 39 and ASTM C 31. Perform cylinder casting, curing, and testing at no expense to the Department and under the observation of the Engineer. When the S/T Curve indicates a compressive strength equal to or greater than the percentage of specified strength shown in the table above for form removal, the Contractor may remove the forms. When the ambient air temperature falls 15°F or

more below the ambient air temperature that existed during development of a S/T Curve, use a S/T Curve that corresponds to the lower temperature and that is developed in accordance with this section.

Do not remove forms at any time without the consent of the Engineer. Even when the Engineer provides consent to remove the forms, the Contractor is responsible for the work.

SUBARTICLE 400-16.4 (of the Supplemental Specifications) is deleted and the following substituted:

400-16.4 Cast-in-place Bridge Decks: Cure cast-in-place bridge decks for a duration of seven days. Apply a membrane curing compound to the deck top surface in accordance with 400-16.2 using a compressor driven sprayer. In general, apply curing compound to a concrete deck when the surface is damp and after all pooled water has evaporated. For Short bridges, begin applying curing compound immediately after the initially placed concrete has been floated, straightedged, textured and a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. For Long bridges, begin applying curing compound to the initially placed concrete as soon as a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. However, for both Short and Long bridges, the elapsed time between the initial placement of deck concrete and the completed application of curing compound must not exceed 120 minutes. The 120 minute limit may be extended by the Engineer if project specific factors (cool temperatures, high humidity, retarding admixtures, etc.) are prolonging wet surface conditions.

Prior to the first deck placement, submit to the Engineer the method that will be used to periodically measure the rate of application of curing compound in, gallons/sq ft as the deck placement progresses. Prior to the placement of each deck, submit to the Engineer the anticipated quantity of curing compound in gallons along with the corresponding square feet of deck to be covered to meet the coverage rate in 400-16.2. Compute the actual quantity of curing compound applied at the conclusion of each deck placement and submit the quantity to the Engineer. Apply the curing compound from a work platform.

Place curing blankets on all exposed surfaces which are not formed as soon as possible with minimal effect on the surface texture. Place the curing blankets with sufficient overlapping seams to form an effective moisture seal. Before using curing blankets, mend tears, splits, or other damage that would make them unsuitable. Discard curing blankets that are not repairable. Wet all curing blankets immediately after satisfactorily placing them and maintain them in a saturated condition throughout the seven day curing period. Supply sufficient quantity of potable water at the job site for wetting the blankets.

Where a bridge deck slab is to be subjected to walking, wheeling or other approved construction traffic within the seven day curing period, protect the curing blankets and the slab surface from damage by placing wooden sheeting, plywood or other approved protective material in the travel areas.

When the ends of the curing blankets are rolled back to permit screeding of adjacent bridge deck slabs, keep the exposed surfaces wet throughout the period of exposure.

Removal of bottom and side forms after 72 hours is acceptable upon compliance with 400-14. Apply membrane curing compound to all surfaces stripped of forms within one hour of loosening. Apply curing compound according to 400-16.2.

ARTICLE 400-18 (of the Supplemental Specifications) is deleted and the following substituted:

400-18 Precast Elements.

400-18.1 General: Where shown in the plans, construct precast concrete elements for bridge construction as specified in Section 404.

SUBARTICLE 400-21.1 (of the Supplemental Specifications) is deleted and the following substituted:

400-21.1 General: The disposition of cracked concrete is described in this Article and applies to all cast-in-place concrete members, and once installed, to the precast and prestressed concrete members that are produced in accordance with 404, 410, 450, 521, 534, 548 and 641.

**PRECAST PRESTRESSED CONCRETE CONSTRUCTION.
(REV 8-1-12)**

ARTICLE 450-5 (Page 464) is deleted and the following substituted:

450-5 Shop Drawings.

For precast prestressed deck panels, refer to Section 404. Otherwise, submit shop drawings when the Contract Documents do not contain all the detailed information necessary to fabricate and erect the pretensioned prestressed concrete product. Ensure the submitted shop drawings meet the requirements of 5-1 and any additional Contract Document requirements.

Shop drawings are not required to depict supplemental reinforcing steel used to facilitate fabrication of products.

In lieu of shop drawings, furnish one copy of the following to the Engineer:

1. A copy of the Framing Plan with product designations for all superstructure components.
2. Strand detensioning schedule.
3. Tensioning and elongation calculations.
4. Details of supplemental steel that remains as part of the finished product.
5. When proposing to use materials and/or methods that differ from the requirements of the Contract Documents, submit full plan details and Specifications for the alternate materials and methods. Ensure the alternate materials and methods meet the following requirements:

- a. The provisions of the Contract Documents.
- b. The AASHTO LRFD Bridge Design Specifications, edition with interims as referenced in plans.

- c. The recommendations of the material manufacturer.
- d. Any materials change proposed by the Contractor and approved by the Engineer.
- e. Net compressive stress in the concrete due to prestressing acting alone, after all losses, is not less than that provided by the stranding shown in the plans.
- f. Ultimate strength of the structure with the proposed changes is not less than the ultimate strength of the original design.
- g. The provisions of the Departments Structures Design Guidelines.

SUBARTICLE 450-6.1 (Pages 464 - 465) is deleted and the following substituted:

450-6.1 General: Use metal side and bottom forms, unless otherwise specified in the Contract Documents. For members with special shapes such as corner sheet piles, wood forms are permitted. Sheet piles may be cast on concrete surfaces meeting the profile dimensional tolerances of 450-6.3. Apply release agents in accordance with the manufacturer's recommendations. Liquid membrane curing compounds may be used to prevent bonding of sheet piles to the existing concrete surface, when applied in two or more coating. Ensure the last application of liquid membrane is applied immediately before placement of the sheet pile.

For all beam members, use side forms designed to be removed without damaging the top flange of the beam. Remove the forms horizontally away from the beam by a method that prevents any contact of the form with the top flange after release of the form. Do not subject the top flange to any vertical force at any time. Include the form details and method of removal in the QC Plan.

For all Florida-I Beams, use forms that do not have more than two horizontal joints.

Use void forms of a type for which service adequacy has been demonstrated, having sufficient strength to provide stability during handling and placing and to withstand hydrostatic pressures and other forces imposed upon them during concrete placement. Use form material that is neutral with respect to the generation of products harmful to the physical and structural properties of the concrete. Ensure that the presence of the form materials does not cause any detrimental effect to the concrete or other materials within the member. Positively vent all voids to the outside of the member. For end headers and inside forms, other materials capable of resisting the pressure from concrete are permitted.

Use end headers so designed that they can be placed and maintained in correct position between the side forms. Hold the headers in place with devices capable of being removed or loosened after the concrete has attained its initial set allowing free form expansion during curing methods that involve heat. Use end headers with openings conforming to the prestressing steel pattern to permit passage of the prestressing steel. Locate the openings accurately within 1/8 inch of planned location of prestressing steel elements.

Construct circular openings for strands a maximum of 1/4 inch larger than the nominal strand diameter. Construct square or rectangular openings a maximum of 1/4 inch larger, horizontally and vertically, than the nominal strand diameter. Ensure that all headers are mortar tight.

SUBARTICLE 450-10.3.2.1 (Page 472) is deleted and the following substituted:

450-10.3.2.1 AASHTO Type II, Florida-I Beam 36 and Double-T Beams, Piling, Precast Slab Units (Except Voided Piling and Slabs) and Full Depth Prestressed Precast Deck Panels: Place concrete in one or more layers or lifts. If more than one layer is used for Double-T Beams, end the first layer such that the top of the concrete is slightly below the bottom of the flange.

SUBARTICLE 450-10.5.2 (Page 473) is deleted and the following substituted:

450-10.5.2 Beams: Rough float the top surface of the beam and then scrub it transversely with a coarse brush or metal tine to produce a roughened surface for bonding. For beams on bridges with full-depth prestressed precast deck panels, refer to the plans for top surface finishing requirements. Unless otherwise specified, apply a Class 3 surface finish to the external surfaces of prestressed beams in accordance with Section 400. Remove mortar leakage and stains to produce beams with a uniform appearance.

SUBARTICLE 450-10.5.4 (Page 473) is deleted and the following substituted:

450-10.5.4 Slabs and Double-T Beams: When the plans show the top surface of prestress slab, full depth prestressed precast deck panels, or Double-T Beams units to be the riding surface, apply a Class 4 floor finish in accordance with Section 400. When the plans show the surface to be overlaid with asphalt or concrete, rough float the top surface and then scrub it transversely with a coarse brush to remove all laitance and to produce a roughened surface for bonding. Unless otherwise specified, apply a Class 3 surface finish to other exposed surfaces in accordance with Section 400.

SUBARTICLE 450-11.5 (Page 477) is deleted and the following substituted:

450-11.5 Trimming Strands and Bars: Upon completion of the detensioning operation, cut the exposed strands to required length, using an oxygen flame or mechanical cutting device. On piles and other products requiring flush cutting of strands and bars, use only mechanical cutting, unless specifications require strand to be burned or ground below the pile surface. Do not use electric arc welders. Unless otherwise specified, allow all strands to protrude 2.5 inches plus or minus 0.5 inch beyond the end of the product, except cut strands for piling back to be flush with or below the concrete surface. For beams with ends not to be encased in permanent concrete diaphragms and for full depth prestressed precast deck panels, cut strands a minimum of 1/8 inch below the concrete surface.

SUBARTICLE 450-11.6 (Page 477 - 478) is deleted and the following substituted:

450-11.6 Protecting Ends of Strands: For beams with ends not to be encased in permanent concrete diaphragms and for full depth prestressed precast deck panels, epoxy coat

the exposed beam ends, including clipped and chamfered surfaces with two layers of Type F-1 epoxy compound within seven calendar days of detensioning and prior to development of any corrosion at the ends of strands. Prepare the concrete surface and apply epoxy in accordance with the manufacturer's recommendations. The finish thickness of the epoxy coating must be a minimum of 1/16 inch, forming a vertical flat plane at the end of the beam without deviations for localized depressions resulting from recessing of the strands or other defects.

SUBARTICLE 450-17 (Pages 487 - 488) is expanded by the following new subarticle:

450-17.5 Full Depth Prestressed Precast Deck Panels: Payment will be made under Section 404, Precast Deck Panel (Prestressed).

STRUCTURES FOUNDATIONS.

(REV12-14-12)

ARTICLE 455-20 (Pages 578 - 579) is deleted and the following substituted.

455-20 Construction Tolerances.

Meet the following construction tolerances for drilled shafts:

- (a) Ensure that the top of the drilled shaft is no more than 3 inches laterally in the X or Y coordinate from the position indicated in the plans.
- (b) Ensure that the vertical alignment of the shaft excavation does not vary from the alignment shown in the plans by more than 1/4 in/ft of depth.
- (c) After placing all the concrete, ensure that the top of the reinforcing steel cage is no more than 6 inches above and no more than 3 inches below plan position. When connecting to precast bent caps, cut any exposed reinforcing cage level with the top of the drilled shaft.
- (d) Ensure that the reinforcing cage is concentric with the shaft within a tolerance of 1-1/2 inches. Ensure that concrete cover is a minimum of 4-1/2 inches unless shown otherwise in the Plans.
- (e) All casing diameters shown in the Plans refer to I.D. (inside diameter) dimensions. However, the Contractor may use casing with an outside diameter equal to the specified shaft diameter if the extra length described in 455-15.7 is provided. In this case, ensure that the I.D. of the casing is not less than the specified shaft diameter less 1 inch. When approved, the Contractor may elect to provide a casing larger in diameter than shown in the Plans to facilitate meeting this requirement. When casing is not used, ensure that the minimum diameter of the drilled shaft is 1 inch less than the specified shaft diameter. When conditions are such that a series of telescoping casings are used, provide the casing sized to maintain the minimum shaft diameters listed above.
- (f) Ensure that the top elevation of the drilled shaft concrete has a tolerance of plus 1 inch and minus 3 inches from the top of shaft elevation shown in the Plans. When connecting to precast bent caps, finish the top of the drilled shaft within plus or minus 1 inch of the elevation shown in the plans.
- (g) The dimensions of casings are subject to American Petroleum Institute tolerances applicable to regular steel pipe.

(h) Use excavation equipment and methods designed so that the completed shaft excavation will have a flat bottom. Ensure that the cutting edges of excavation equipment are normal to the vertical axis of the equipment within a tolerance of plus or minus 3/8 inches per foot of diameter.

ADMIXTURES FOR CONCRETE.

(REV 8-1-12)

SECTION 924 (Pages 1004 - 1006) is deleted and the following substituted:

SECTION 924 ADMIXTURES FOR CONCRETE

924-1 General.

This Section covers materials for use as admixtures for concrete. The use of admixtures is restricted to those admixtures as may be allowed or required elsewhere in the specifications for specific concrete applications. Except for Shrinkage Reducing Admixtures (SRA), admixtures shall comply with applicable AASHTO and ASTM specifications as modified in 924-2.3 through 924-2.7. Except for SRA, admixtures that have been previously qualified for Department use are listed on the Qualified Products List.

924-2 Acceptance of Admixtures other than Shrinkage Reducing.

924-2.1 Qualified Products List (QPL): The Department maintains a list of qualified admixtures for air-entraining, water-reducing (Type A), accelerating (Type C), water-reducing and retarding (Type D), water-reducer and accelerating (Type E), high range water reducing (Type F) and high range water-reducing and retarding (Type G), high range water-reducing (Type I - Plasticizing and Type II - Plasticizing and retarding) in producing flowing concrete, and corrosion inhibitor, which have been determined as meeting requirements for use on Department projects. Admixtures included on this list, will be permitted without further testing.

The inclusion of any specific product on the QPL, as specified in 6-1, indicates that the product has been given contingent approval, as evidenced by previous tests and apparent effectiveness under field conditions.

Except as specified in Sections 346 and 347, no further testing will be required for any product on the QPL unless there is indication in actual field use of inadequate or unreliable results.

924-2.2 Certification: Manufacturers of admixtures shall provide certified test results from an independent laboratory inspected by the Cement and Concrete Reference Laboratory (CCRL) on a regular basis for applicable tests, with all deficiencies corrected for QPL approval and upon request of the Engineer.

924-2.3 For Air-Entraining: Air-entraining admixtures shall meet the requirements of AASHTO M-154, except for the flexural strengths, relative durability factor, and length change requirements are waived.

924-2.4 For Type A (Water-Reducing) and Type D (Water-Reducing and Retarding): Water-reducing and water-reducing and retarding admixtures shall meet the requirements of AASHTO M-194 for Type A and D, respectively, except for the compressive

strength at six months and one year, flexural strengths, and relative durability factor requirements are waived.

924-2.5 For Type C (Accelerating) and Type E (Water Reducing and Accelerating): Accelerating and water reducing and accelerating admixtures shall meet the requirements of AASHTO M 194 for Type C and Type E, respectively, except for the compressive strength at six months and one year, flexural strengths and relative durability factor requirements are waived.

924-2.6 For High Range Water-Reducing: High range water reducing admixtures shall meet the requirements of the applicable AASHTO or ASTM specifications as modified in 924-2.6.1 and 924-2.6.2.

924-2.6.1 For Type F or Type G: High range water reducing (Type F) and high range water reducing and retarding (Type G), shall meet the requirements of AASHTO M-194, except for the compressive strengths, at one year, and relative durability factor requirements are waived.

924-2.6.2 For Type I and Type II: High range water reducing (Type I) and high range water reducing and retarding (Type II), for use in producing flowing concrete shall meet the requirements of ASTM C-1017, except for the compressive strength, at one year, and relative durability factor requirements are waived.

924-2.7 For Corrosion Inhibitors: Corrosion inhibitors shall meet the requirements of ASTM G-109 and all requirements in this Section.

Calcium nitrite is a chemically reactive admixture used in concrete to inhibit the corrosion of embedded reinforcing steel and other metallic components. The calcium nitrite supplier shall furnish the Engineer with test certificates from an independent laboratory indicating compliance with this Specification. The test certificate shall include corrosion inhibiting properties per ASTM G-109 and results of physical tests included in this section. Calcium nitrite shall be supplied by the same manufacturing source throughout the project. If a single primary source of calcium nitrite cannot be maintained throughout the project, new test certificates shall be submitted. The Engineer will determine specification compliance of a new supplier's product, and evaluate the effectiveness of the new calcium nitrite product before approving the source.

The active ingredient shall be calcium nitrite $\text{Ca}(\text{NO}_2)_2$.

The calcium nitrite shall be furnished in solution containing not less than 29% calcium nitrite solids. The concentration of the calcium nitrite solution shall be verified by spectrophotometric analysis or other comparable methods. The nitrite concentration shall be measured in accordance with Standard Methods for the Examination of Water and Waste Water, 18th Edition.

A volume of one gallon of calcium nitrite solution shall weigh within the range of 10.40 to 11.92 lb.

The calcium nitrite solution shall be added to the concrete mixture at a rate of 4.50 to 4.60 gal/yd³ of concrete.

The addition of calcium nitrite to the concrete mix shall not adversely affect the properties of fresh and hardened concrete.

Calcium Nitrite concrete shall meet the following physical requirements when mixed and tested in accordance with AASHTO M-194:

Water Content, % of control	95 to 100
Time of setting, allowable deviation from control, h:min:	

Initial: at least not more than	1:00 earlier nor 1:30 later
Final: at least not more than	1:00 earlier nor 1:30 later
Compressive Strength, min. % of control:	shall be 100 for all ages
Flexural strength, min, % of control:	shall be 100 for all ages
Length change, max Shrinkage (alternative Requirements): % of control	135
Increase over control	0.010
Relative durability factor, min	80

The following table lists the corrosion inhibiting test result limits for calcium nitrite concrete tested in accordance with ASTM G-109:

Maximum Allowable Test Results of Calcium Nitrite Concrete	
Measured average macrocell current any time during the test	10 μ A
Average macrocell current at test completion	2 μ A
Average visible corrosion measured as percent corroded area of control	85%

924-3 Performance Test on Air-Entraining Admixtures, for Effect on Strength of Concrete.

924-3.1 Conditions under which Test is Required: For any air-entraining admixture selected for use, the Engineer may call for a performance test (either prior to or at any time during construction) for determining its effect on the strength of the concrete. In general, this check-test will be required only when there is indication that such admixture is giving erratic results or is unduly reducing the strength of the concrete. Test in accordance with 924-3.2 and 924-3.3.

924-3.2 Permissible Reduction in Strength of the Concrete: For concrete composed of the same cement and aggregates (and in the same proportions) to be used in the work, and containing the admixture under test, in an amount sufficient to produce between 3 and 5% entrained air in the plastic concrete, the compressive strength at seven days shall be at least 90% of the strength of the same concrete without the admixture.

924-3.3 Method of Test for Strength Reduction: Calculate the percentage reduction in strength from the average strength of at least three standard 6 inch by 12 inch cylinders of each class of concrete. Make and cure specimens in the laboratory in accordance with ASTM C-192, and test in accordance with ASTM C-39. Determine the percentage of entrained air in accordance with ASTM C-173 or ASTM C-231.

924-4 Shrinkage Reducing Admixtures (SRA).

924-4.1 Acceptance: Provide to the Engineer for approval, certification from the manufacturer showing the SRA meets the performance requirements of this Section.

924-4.2 Handling: Ensure SRA does not come in contact with any other admixture before or during the batching process prior to mixing, even if diluted in water.

924-4.3 Performance Requirements: Provide a liquid SRA which reduces drying shrinkage a minimum of 80% during the first 28 days and 50% thereafter. Ensure SRA is free of chlorides and does not initiate or contribute to corrosion of steel reinforcement.

Ensure the SRA is compatible with batch sequencing and other admixtures contained within the mix design.

Properly adjust the proportions of any air-entraining admixtures and water in accordance with the SRA manufacturer's recommendations.

Use dosage rate of SRA as recommended by the manufacturer to optimize the effect of the SRA.

At seven days, the compressive strength of concrete mixture containing SRA and adjustments to other admixtures and water shall be at least 90% of the seven day strength of the same concrete without the SRA and adjustments to other admixtures and water.

924-4.4 Performance Testing: Test concrete containing SRA in accordance with ASTM C157 before use and as conditions and materials change in order to optimize dosage rates and batch sequence to assure concrete performance.

The Engineer may call for a performance test (either prior to or at any time during construction) for determining the effect of the SRA on the performance of the concrete. In general, this check-test will be required only when there is indication that such admixture is giving erratic results or is unduly reducing the strength of the concrete. Test in accordance with Section 346.

924-5 Retesting.

The approved admixtures are required to be tested for their uniformity and equivalence whenever there is an indication of erratic results. Perform the tests in accordance with the following procedure. Check the admixture for comparison between infrared spectrophotometry, pH value, specific gravity, and solids content. Any marked variation from the original curve, pH value, specific gravity, or solids content will be considered sufficient evidence that the chemistry of the original material has been changed and, therefore, the use of this material will be rejected and the material will be removed from the QPL.

NON-SHRINK GROUT.

(REV 12-14-12)

ARTICLE 934-2 (Page 1041) is expanded by the following new Subarticle:

934-2.1 Precision Grout: Provide precision grout mixed to a Fluid Consistency in accordance with the manufacturers recommendations.

ARTICLE 934-3 (Page 1041) the first sentence is changed to the following:

934-3 Sampling and Testing Methods.

Except for Precision Grout, perform concrete sampling and testing in accordance with the following methods:

Making and Curing Concrete Test Specimens
in the LaboratoryASTM C192

Time of Setting Concrete Mixtures by
Penetration ResistanceASTM C403

Determining Low-Levels of Chloride in Concrete and
Raw Materials FM 5-516

Compressive Strength of Hydraulic Cement
MortarsASTM C109

Flow of Grout for Preplaced Aggregate Concrete
(Flow Cone Method).....ASTM C939

Measuring Changes in Height of Cylindrical Specimens from
Hydraulic Cement Grout.....ASTM C1090

Expansion and Bleeding of Freshly Mixed Grout for Preplaced
Aggregate Concrete in the Laboratory.....ASTM C940

ARTICLE 934-4 (Page 1041) is expanded by the following new Subarticle:

934-4.1 Precision Grout: Meet the requirements of ASTM C1107 and the following additional performance requirements:

Testing Method	Property	Test Value
ASTM C109 or ASTM C942	Compressive Strength 3 Days	4,000 psi minimum
	Compressive Strength 28 Days	6,750 psi minimum
ASTM C496	Splitting Tensile Strength 28 Days	650 psi minimum
ASTM C191	Time of set, initial	4 hours minimum
	Time of set, final	8 hours maximum
FM 5-516	Chloride Content	0.40lb/yd ³ maximum
ASTM C1090	Volume Change at 1, 3, 14 Days	< Height Change at 28 Days
ASTM C940	Bleeding, Final	0.0% at 3 Hours
ASTM C939	Efflux Time	20 – 30 seconds
ASTM C666	Freeze Thaw	300 cycles, RDF 90%
ASTM C531	Coefficient of Thermal Expansion	3.0 – 10.0 x 10 ⁻⁶ psi

ARTICLE 934-5 (Page 1042) is expanded by the following new Subarticle:

934-5.1 Product Acceptance on the Project for Precision Grout: Furnish to the Engineer, certified test results from an independent lab showing the grout meets the requirements of this Section.

DEVELOPMENTAL SPECIFICATIONS

PRECAST CONCRETE ELEMENTS FOR BRIDGE CONSTRUCTION.
(REV 12-17-12)

PAGE 395. The following new Section is added after Section 400.

SECTION DEV404
PRECAST CONCRETE ELEMENTS FOR BRIDGE CONSTRUCTION

404-1 Description.

Fabricate, store, ship and erect precast concrete bent caps and deck panels (hereafter referred to as precast elements). Erect precast elements on prepared supports, to the established lines and grades, joining them with cast-in-place closure joints, overlays, grouted connections or keyways in accordance with the design, dimensions and details shown on the plans and in accordance with this Section.

Fabricate precast elements in a precast plant, forming and curing in accordance with this Section and Section 400. Handle, store, ship, erect and complete construction of precast elements in accordance with this Section.

Fabricate prestressed precast deck panels in accordance with Section 450. Handle, store, ship, erect and complete construction of prestressed precast deck panels as precast deck panels in accordance with this Section while maintaining handling requirements as specified in Section 450. Meet fabrication tolerances and surface finishes for prestressed precast deck panels in accordance with this Section.

Obtain precast elements from a plant that is currently on the list of Incidental Precast Producers with Accepted Quality Control Plans. If the plant's Quality Control Program is suspended, accept responsibility of either obtaining precast elements from a plant with an accepted Quality Control Plan, or await re-approval of the plant's Quality Control Plan. The Engineer will not allow changes in Contract Time or completion dates as a result of the plant's Quality Control Plan suspension. Accept responsibility for all delay costs or other costs associated with the plant's Quality Control Plan suspension.

404-2 Materials.

Meet the following requirements:

Concrete	Section 346
Reinforcing Steel	Section 931
Epoxy Compounds.....	Section 926
Water.....	Section 923
Non-Shrink Grout (Precision Grout)	Section 934

404-3 General.

404-3.1 Contractor Submittals: Submit the Precast Placement Plan and shop drawings in accordance with Section 5 and as required herein. Do not set precast elements until the Engineer has approved all required submittals and the Grouting Trial Batch has been successfully completed. No deviation from the approved materials and/or details will be permitted unless details are submitted by the Contractor and approved by the Engineer in advance of use.

404-3.1.1 Shop Drawings: Submit detailed shop drawings to the Engineer for approval.

Clearly detail all reinforcement including supplemental steel that remains in place as part of the finished product.

Clearly detail the size and type of any ducts or other types of grout or block out forms for all precast element connections. Show duct supports, tremie tubes, air vents, and drains, including size, type, and locations.

Clearly show precast element erection marks indicating its location and orientation. Use these same designations and locations in the Precast Placement Plan.

404-3.1.2 Precast Placement Plan: Precast Placement Plan must completely describe the proposed construction sequence and show enough detail to enable construction of all precast elements.

Include, at a minimum, the following items:

1. Show erection marks on each precast element as designated in the approved shop drawings. Place erection marks on ends of precast elements as to ensure proper orientation and fit-up during erection.

2. Step-by-step description of the precast element placement and proposed method to place grout and/or form any bedding layer, vent tube material size and locations, and ensure grout is properly consolidated in the connection.

3. A table showing elevations and geometry to be used in positioning any bedding layer collar or precast element.

4. Method and description of the hardware used to hold the precast elements in position prior to connection grouting. Hardware must consist of any required bracing, friction collars, leveling bolts and/or plastic shims. The hardware submittal must consist of product information, material descriptions, and drawings for bracing, friction collars, leveling bolts and/or shim placement.

5. Manufacturer's product information for at least two candidate grouts, including a description of the performance characteristics as specified in Section 934, mixing requirements, working time, curing requirements, and other information related to grouting of precast connections.

6. Details of any Grouting Demonstration Test as required in the plans.

7. Hardware and equipment associated with grouting connections.

8. A mitigation plan to repair any voids observed within any bedding layer, coordinated and approved by the Engineer.

9. Weather protection system coordinated with and approved by the Engineer.

404-3.2 Tolerances: Fabricate, construct and inspect the product for conformance with the product dimension tolerances shown in the plans. Apply the tolerances with respect to the theoretical positions and dimensions shown in the plans.

Ensure the tolerance on all miscellaneous shaping including, but not limited to, chamfers, miters, bevels, keys, tapers, radii, holes, inserts, and block outs is within plus or minus 1/8 inch of the control dimension of the shape.

The tolerances represent the total allowable tolerance that will be accepted in the finished product. Do not apply tolerances shown for the overall dimensions of an element to violate the tolerances shown for positions of reinforcing and prestressing steel. Apply the

tolerances during and after the fabrication of precast element. Do not reduce the concrete cover for reinforcing steel or any other metallic objects specified in the plans more than 1/4 inch. Do not reduce the concrete cover for reinforcing steel or any other metallic objects when the cover specified in the plans is minimum cover.

404-3.2.1 Reinforcing Steel: Fabricate and place reinforcing steel in accordance with the plans or as superseded by the approved shop drawings. Meet the requirements of 415-5.9.2 for the maximum variation in the position of steel in the precast bent caps. Meet the requirements of 415-5.10.2 for the maximum variation in the position of steel in the precast deck panels.

404-3.3 Forms:

404-3.3.1 General: Use metal side and bottom forms for all side and bottom surfaces which remain exposed after construction is completed unless otherwise specified in the plans.

404-3.3.2 Supports: Use forms of sufficient thickness, with adequate external bracing and stiffeners, which are anchored to withstand the forces due to placement and vibration of concrete. Support bottom forms on concrete pallets with metal stiffeners, wales or shims. Do not use timber elements between the bottom metal form and concrete pallets.

404-3.3.3 Alignment: Provide and maintain during their use, forms having the shapes and dimensions for the element being produced. Plumb, align, and secure forms for each element in position before each reuse.

404-3.3.4 Surface Conditions: Use clean, rust free form surfaces against which concrete is to be cast. Inspect forms and recondition them as necessary.

404-3.3.5 Form Ties: Ensure that no form wires or metal pieces are left within 2 inches of the surface of the finished concrete.

404-3.3.6 Corners, Angles and Joints: Ensure corners and angles are chamfered, mitered, or rounded with a radius of 3/4 inch, unless otherwise specified or shown on the plans. Provide smooth mortar tight joints between panel forms within the alignment tolerances.

404-3.3.7 Form Release Agent: Before placing concrete, treat the facing of all forms with a form release agent in accordance with the manufacturer's requirements. Ensure the application of form release agents does not contaminate reinforcing steel.

404-3.4 Void and Block-out Forming: Secure void and block-out forming material to maintain position during concrete placement without rigidly connecting to exterior formwork of precast element to allow free movement between surfaces of the precast element and its exterior formwork. Use expanded polystyrene forming material meeting the requirements of this section.

404-3.4.1 Expanded Polystyrene Forming Material: Use polystyrene foam comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation.

Extrude or form the polystyrene foam and hot-wire cut to match the geometry of the void shown in the plans within a tolerance of plus 0 inch and minus 1/2 inch.

Use polystyrene foam meeting the requirements of ASTM C578 (Type II) or ASTM D6817 (Type EPS22), and a water absorption of less than 3.0% when tested in accordance with ASTM C272.

For product acceptance upon delivery to the project site, provide a written certification from the manufacturer stating that the product meets the requirements of this section.

404-3.5 Casting: Ensure that all materials, details, and procedures are as specified herein, as noted on the plans, or as amended on approved shop drawings.

Cast precast elements on unyielding beds or pallets. Check bearing surfaces on casting beds with a level and a straightedge prior to the casting. Give each element an erection mark when designated in the plans or approved shop drawings.

404-3.6 Concrete Curing: Cure precast elements in accordance with Section 400.

Alternate curing methods and details proposed by the fabricator must be included in the Quality Control Plan or otherwise approved by the QC Manager. Base alternate curing methods upon a demonstrated ability to retain surface moisture of the concrete and to control curing temperatures within acceptable limits. Discontinue use of any alternate curing method upon any indication of noncompliance with Section 400.

404-3.7 Moving, Placing, and Opening to Traffic: Unless otherwise shown, precast members may be moved from casting beds, stored, shipped, erected, and loaded at the minimum age or percentage of 28-day compressive strength, whichever occurs first, as specified in the following table:

Element	Activity	Minimum Age	Minimum % of 28-day Compressive Strength
Precast Cap	Move from casting bed to storage	7 days	75
	Ship and/or Erect	14 days	85
	Grouting Operation	14 days	85
	Set beams on cap	28 days	100
Grout for Precast Cap	Remove temporary bracing	1 day	40
	Set beams on cap	3 days	60
Precast Deck Panel (non-prestressed)	Move from casting bed to storage	9 days	80
	Ship and/or Erect	28 days	100
	Grouting Operation	28 days	100
Precast Deck Panel (pretensioned)	Move from casting bed to storage	9 days	80
	Ship and/or Erect	28 days	100
	Grouting Operation	60 days	100
Grout for Precast Deck Panel	Remove temporary connections	1 day	40
	Remove leveling bolts	3 days	60
Transverse Closure Joints	Place traffic railing	3 days	60
	Open to traffic	28 days	100

When using the time period criterion, include in the time period all days except days in which the temperature falls below 40°F at any time.

When using the percent of required strength, cast test cylinders for each mix for compressive strength determination or develop a curing concrete strength versus time curve (S/T Curve) which can be used in lieu of multiple test cylinders to determine when percent of required strength has been met.

Prior to curve use, obtain the QC Manager's approval of the S/T Curve and its supporting data. An approved testing laboratory may be used to provide this information with approval of the QC Manager. Plot S/T Curves using at least three different elapsed times that begin once test cylinders are cast; however, one of the elapsed times must be prior to the fabricator's intended form removal. Each elapsed time plotted must have a corresponding compressive strength computed by averaging the compressive strength of two test cylinders.

Cure such test cylinders as nearly as practical in the same manner as the concrete in the corresponding structural component, and test them in accordance with ASTM C 39 and ASTM C 31. Perform cylinder casting, curing, and testing at no expense to the Department and under the observation of the QC Manager. When the S/T Curve indicates a compressive strength equal to or greater than the percentage of specified strength shown in the table above for form removal, the fabricator may remove the forms. When the ambient air temperature falls 15°F or more below the ambient air temperature that existed during development of a S/T Curve, use a S/T Curve that corresponds to the lower temperature and that is developed in accordance with this section.

Do not remove forms at any time without the consent of the QC Manager.

404-3.8 Handling, Storage, Shipping and Erection:

404-3.8.1 Handling: Exercise care in handling to prevent damage to precast elements. Lift and move precast elements so as to minimize stresses due to sudden changes in momentum. Pick up precast elements using embedded lifting devices located only at points designated as pickup points on the plans or approved shop drawings. Maintain all precast elements in an upright position at all times.

Evaluate the temporary stresses and stability of precast elements during their handling. The temporary stresses induced into the precast elements during handling must be within the acceptable limits for crack control.

Verify lifting devices for capacity in lifting and handling products, taking into account various positions during handling. Keep multiple component lifting devices matched to avoid non-compatible use. When an element has multiple lifting devices, use lifting equipment capable of distributing the load to each embedded lifting device uniformly to maintain the stability of the element and prevent overload of any embedded lifting device. When the lifting devices are grouped in multiples at one location, align them for equal lifting.

Take appropriate steps to prevent the occurrence of cracking. When cracking occurs during handling and transportation, revise handling and transporting equipment and procedures as necessary to prevent cracking for subsequent precast elements.

404-3.8.2 Storage: Support precast elements on an adequate number of supports so as to keep stresses in the precast elements within the acceptable limits for crack control. Locate multiple supports (more than two) within 1/2 inch of a horizontal plane through the top surface of the supports. Adequately brace precast elements as necessary to maintain stability.

All supports must be level and on adequate foundation material that will prevent shifting or differential settlement which may cause twisting or rotation of precast elements. Immediately pick up precast elements in storage that have rotated or twisted and adjust the supports to provide level and uniform support for the element.

Support precast elements that are stacked by dunnage placed across the full width of each bearing point and aligned vertically over lower supports. Do not use stored precast elements as a storage area for either shorter or longer precast elements or heavy equipment.

Continuous application of water during the initial curing period may be interrupted for a maximum of one hour to allow relocation of precast elements within the plant. Keep the moist burlap in place during relocation of the element.

404-3.8.3 Shipping: Do not ship precast elements to the project site prior to the completion of the 72 hour curing period and attainment of the required shipping strength. Do not ship precast elements until accepted and stamped by the QC Manager or the inspectors under the direct observation of the QC Manager. At the beginning of each project, provide a notarized statement to the Engineer from a responsible company representative certifying that the plant will manufacture the precast elements in accordance with the requirements set forth in the Contract Documents and plant's QC Plan. The QC Manager's stamp on each element indicates certification that the element was fabricated in conformance with the Contractor's QC Plan, the Contract, and this Section. Ensure that each shipment of precast elements to the project site is accompanied with a signed or stamped delivery ticket providing the description and the list of the precast elements.

Evaluate the temporary stresses and stability of all elements during shipping and locate supports in such a manner as to maintain stresses within acceptable limits for crack control. Include impact loadings in the evaluation.

404-3.8.4 Erection: Erect precast elements without damage. Meet the handling and storage requirements of this Section for field operations. Immediately prior to placing precast elements on their final supports, remove all loose material, dirt and foreign matter from the tops of the supports and any protruding reinforcing bars before setting the precast elements. Completely remove all form release agents and curing membranes from areas of the precast element that will be in contact with any bearing seat or connection grout.

404-3.9 Corrosion Protection of Inserts and Lifting Devices: Unless otherwise specified in the plans, provide corrosion protection for embedded metal inserts or lifting devices that would remain exposed after construction as follows:

404-3.9.1 Precast Bent Caps: After lifting operations using recessed metal lifting devices are complete, backfill block-outs with a Type F epoxy compound meeting the requirements of Section 926 for a minimum distance of 2 inches beyond the perimeter of the metal device as measured parallel to the exposed concrete surface. If the block-out extends less than 2 inches beyond the perimeter of the metal device, extend the epoxy compound beyond the block-out along the concrete surface. If Type 304 or 316 stainless steel lifting devices are used, non-shrink or precision grout meeting the requirements of Section 934 may be used to backfill the block-out within its limits.

After lifting operations using flush or protruding metal lifting devices are complete, cut the lifting devices back to a minimum depth of 1 inch below the concrete surface and patch with a Type F epoxy compound meeting the requirements of Section 926.

404-3.9.2 Precast Deck Panels: After lifting operations are complete, ensure metal lifting device is recessed a minimum of 2-1/2 inch below the deck surface prior to planing and grooving operations. Prior to planing and grooving of the deck, backfill block-outs with Precision Grout. If the metal lifting device is recessed less than 2-1/2 inch below the concrete surface, use Type 304 or 316 stainless steel lifting devices and fill block-outs with Precision Grout.

404-3.10 Wind Velocity Restriction: Do not erect precast components, place grout for haunch, or place concrete for transverse closure joints if the forecast of the average wind velocity at any time during the planned hours of erection exceeds 15 mph. Obtain weather forecasts from the National Weather Service "Hourly Weather Graph" for the city closest to the project site.

404-3.11 Weather Protection: Provide an approved means of protecting unhardened grout or concrete from rain. Position the protection system to shield the grout or concrete from rain and running water. Provide a shield impervious to water over the protected area of sufficient size to protect all areas of grout and concrete subject to water damage, and include a means of intercepting and diverting water away from freshly placed grout or concrete. Arrange the equipment so that the weather protection system can be erected over unhardened grout or concrete. When there is a possibility of rain during grout or concrete placement operations, place the weather protection system in stand-by readiness, capable of being deployed in a timely manner. Use the weather protection immediately when rain begins so that damage will not occur. Do not place grout or concrete during rain. Assume responsibility for damage to the grout connection or transverse closure joint in the case of failure of the weather protection system. Describe the weather protection materials and methods in the Contractor's quality control plan or Precast Placement Plan.

404-3.12 Construction Joints: Provide construction joints only at locations shown in the plans unless otherwise approved in writing by the Engineer.

404-3.13 Grout: Provide prepackaged, cementitious, Precision Grout in accordance with Section 934 for precast cap bedding layers, precast cap grouted duct connections, beam haunches and precast deck panel shear pockets.

No additives or admixtures, including retarders, will be added to prepackaged grout. It is permitted to adjust the temperature of mixing water or substitute ice for water to extend the working time and pot life. Addition of water to previously mixed grout or remixing of grout is not permitted. Do not exceed the manufacturer's recommendations for addition of water to increase flowability.

Extension of grout with fine aggregate will only be permitted when recommended by the manufacturer and approved by the Engineer.

At a minimum, establish grout compressive strength and flowability with trial batches during the Grouting Demonstration Test as shown in the plans. Laboratory testing will be permitted to establish other properties listed in Section 934.

404-3.13.1 Grout Trial Batch: At least two weeks prior to grouting of connections, prepare a trial batch of grout to demonstrate grout properties per Section 934, adequacy of equipment, and to familiarize job site personnel with grouting procedures.

Establish grout flowability by measuring efflux (flow) time of the grout with a standard flow cone according to ASTM C 939. Determine the flow time twice: immediately after mixing, then at the expected working time corresponding to the pot life of the grout. The ambient temperature and mixing water temperature at the time of trial batch mixing must be within plus or minus 5 deg F of that expected at the time of grout placement. Ensure the grout flow time satisfies the limits prescribed in Section 934.

Observed segregation, clumps of grout, or other anomalies in the final trial batch will be cause for rejection of the proposed brand of grout. Take samples for compressive strength testing from the middle of the batch.

Prepare one set of six grout cubes and test to verify the compressive strengths meet Section 934.

Validate the proposed grout placement technique by using the trial batch grout and grout equipment in a sample grouting operation similar to proposed connection grouting. Establish adequacy of the mixer, pump, tremie tubes, vent tubes, and other grouting equipment. Demonstrate that the equipment is adequate for mixing the grout and grouting the connection

within the pot life of the batch and does not introduce air into the grout or connection. Use a wire mesh to filter out potential clumps when transferring grout between the mixer and containers.

404-3.13.2 Grout Placement: All equipment necessary to properly perform grouting operations must be present before grouting operations begin. Perform all grouting operations in the presence of the Engineer in accordance with the Contractor's approved Precast Placement Plan. Perform grouting operations under the weather limitations and protection requirements of this Section and as required by the grout manufacturer. Grout pumping will be required for connections that cannot be completed by other methods within the pot life established for the grout during the trial batch.

Place all additional materials required to ensure proper connection according to the plans and approved shop drawings.

Prior to placement of grouting forms, clean all surfaces to be in contact with the grout, removing all loose or foreign material that would, in any way, prevent proper bonding.

Draw forms tight against the existing concrete to avoid leakage or offsets at the joints. Vent tubes must have a minimum 1/2 inch inner diameter and be flush with the top of the upper surface of any bedding layer. Vents must not be plugged until a steady stream of grout flows out.

Perform one standard flow cone test per batch of grout in accordance with ASTM C 939.

Deposit grout with a continuous flow having a consistent shear rate until the entire volume contained within the formed boundaries are filled and free of voids. Consolidate grout at intervals during placement operations as needed. Grout all connections in a manner that deposits the grout from the bottom of connection upward. When pumping is used, place grout through ports located at the bottom of the connection. Prevent introducing air into the system, when continuous flow grouting is not possible with shutoff valves.

Wet cure all exposed grout surfaces using continuous moisture for a curing period of seven days. Place curing blankets and form an effective moisture seal on all exposed surfaces as soon as possible with minimal effect on the surface texture. Before using curing blankets, mend tears, splits, or other damage that would make them unsuitable. Discard curing blankets that are not repairable. Wet all curing blankets immediately after satisfactorily placing them and maintain them in a saturated condition throughout the curing period. Supply sufficient quantity of potable water at the job site for wetting the blankets.

All grout surfaces will be inspected post-grouting in coordination with the Engineer. Repair any voids as specified in the approved mitigation plan. Completely remove all grout leakage.

Final acceptance of the connection will be after the grout has reached the 28-day compressive strength in accordance with Section 934 or as approved by the Engineer.

404-3.13.3 Grout Testing: Determine the 3-day and 28-day compressive strength of the grout using grout cubes prepared and tested in accordance with ASTM C109 or ASTM C942. Prepare a minimum of six cubes per batch. A Commercial Testing Laboratory approved by the Engineer must test the specimens. Grout failing to meet the minimum required compressive strengths in accordance with Section 934 may be cause for rejection of the connection, grout removal, and re-grouting of the connection by means approved by the Engineer.

404-3.14 Cast-in-Place Keys: Where precast elements are to be joined with cast-in-place keys, carefully align the elements prior to casting the keys in accordance with the details and tolerances shown in the plans.

404-3.15 Disposition of Defective or Damaged Members: Evaluate cracks, spalls and other deficiencies in accordance with 450-12 and 450-14. After members are installed, repair cracks in accordance with 400-21, and all other deficiencies in accordance with 450-13 or the plant's approved repair methods that are included as part of the Quality Control Plan. Ensure that the original performance and durability of the repaired members are maintained.

Use materials for concrete repair that will meet or exceed the strength requirement of the class of concrete used. Materials meeting the requirements of Section 930 may be substituted for non-shrink grout when required by 450-13. Members are subject to rejection if they fail to conform to any of the Specification requirements after repair or when damaged surfaces would prevent making a satisfactory connection or joint.

404-4 Precast Bent Caps.

404-4.1 Materials:

404-4.1.1 Concrete: Use the Class of concrete shown in the plans.

404-4.1.2 Steel Ducts: Provide 4 inch diameter galvanized ferrous metal per ASTM A653, fabricated with either welded or interlocked seams. Ducts must be corrugated with a minimum wall thickness of 26 gage. Rib height of the corrugation must be at least 0.12 inch.

404-4.1.3 Shims: Provide high density plastic polymer shims with a minimum compressive strength of 6,000 psi and a modulus of elasticity not greater than 2,000,000 psi per ASTM D695.

404-4.2 Fabrication:

404-4.2.1 General: Chamfer all exterior bent cap corners 1-1/2 inch, except chamfer pedestals and keeper blocks 3/4 inch.

Install steel ducts within 1/4 inch of the plan position at all locations.

After installation in the forms, ensure that the ends of any steel ducts are plugged at all times to prevent entry of debris and fine material.

404-4.2.2 Surface Finish: For surfaces under bridge bearings, provide a finish in accordance with Section 400-11. For all other surfaces, provide a general surface finish in accordance with Section 400-15.

404-4.3 Construction:

404-4.3.1 Bent Cap Installation: Install precast bent caps to the elevations shown in the plans. Support precast bent caps with either plastic shims, leveling bolts or friction collars. Remove any leveling bolts after grout has reached its minimum 3-day compressive strength.

Maintain stability of the bent cap prior to and during grouting.

Determine and verify all stations, offsets, grades, dimensions and elevations before the precast bent cap is placed. Verify proper alignment between the drilled shafts or piles, including drilled shaft column dowel bars, corrugated metal ducts, and other connection hardware cast into the bent cap.

After the precast bent cap has been horizontally and vertically aligned and prior to grouting, verify that the vertical embedment of the drilled shaft reinforcing bars or piles into the precast bent cap meets the minimum embedment shown in the plans.

Immediately prior to grouting of the ducts, again demonstrate to the satisfaction of the Engineer that each duct is unobstructed and free of debris.

404-4.3.2 Beam Placement: Prior to placement of beams, finish the top surface of any grouted duct connection openings flush with the surrounding surface of the cap or pedestal.

404-4.3.3 Contact and Bearing Surfaces: Meet the requirements of Section 400-11.

404-5 Precast Deck Panel.

404-5.1 Materials:

404-5.1.1 Concrete: Use the Class of concrete shown in the plans.

404-5.1.2 Leveling Device: Leveling device includes a leveling bolt, pipe sleeve, nut and washer with dimensions and grades as shown in the plans. Reuse of leveling bolts is at the discretion of the Engineer. Do not reuse leveling bolts unless the contractor satisfactorily demonstrates their fitness for reuse to the Engineer's satisfaction and obtains the Engineer's approval.

404-5.1.3 Haunch Forming Material: Use polyethylene foam meeting the requirements of ASTM D5249 in the form of a sheet or backer rod. For product acceptance upon delivery, provide a written certification from the manufacturer stating that the element meets the requirements of this Section.

404-5.1.3.1 Polyethylene Foam Sheet: Cut to a height 25% to 35% larger than the haunch height and a width equal to or greater than the maximum of half the haunch height or 2 inch. If installed prior to setting precast deck panel, gluing of foam to the beam is only permitted at intermittent locations along the length of the beams top flange using a manufacturer approved adhesive prior to placing the precast deck panel. Do not glue or fasten haunch forming material immediately adjacent and parallel to the cast-in-place transverse closure joints for the deck panels.

404-5.1.3.2 Polyethylene Foam Backer Rod: Use backer rod having a diameter or 25% to 35% larger than the haunch height. Install in accordance with manufacturer instructions.

404-5.2 Fabrication: Ensure proper alignment of side forms and their associated offset protruding reinforcing bars per the plans. Chamfer all exposed corners 3/4 inch. Precast deck panel ends adjacent to closure joints are not considered exposed corners.

404-5.2.1 Surface Finish: Finish side surfaces of shear pockets and bottom surface of precast deck panels that will be in contact with the beam haunch with a textured surface having a minimum amplitude of 1/8 inch.

Finish the top surface of the precast deck panels with a Medium Broom Finish.

404-5.3 Installation: At the construction site and prior to setting precast deck panels, survey top of beam elevations at each transverse closure joint. For elevations at this stage, consider only the dead load of beams. Submit information to the Engineer for review.

Preset leveling bolts to anticipated height. The preset height should consider final grade elevation, erected beam's camber just prior to precast deck panel placement, anticipated beam deflection due to dead load of precast deck panel, dead load of haunch grout, transverse joint concrete and traffic railing. Creep deflection shall be included if the beam is less than 120 days old.

When installing leveling bolts, add lubricant as necessary to achieve free turning of bolt by hand.

Form haunches between the top flange of the beam and the bottom of the precast deck panel. Form each end of the precast deck panels at the transverse joint to keep haunch grout out of transverse closure joint.

Erect all precast deck panels within a span. After the precast deck panels have been placed on the beams, secure the precast deck panels with temporary connection devices to eliminate sliding longitudinally and transversely.

Adjust leveling devices on precast deck panels to bring them to grade. Torque all leveling bolts to approximately the same value (within 20%) to ensure theoretical precast deck panel dead load distribution to the beams.

Survey top of beam elevations at each transverse closure joint after all precast deck panels have been placed and leveled within a span. For elevations at this stage, consider only the dead load of beams and precast deck panels placed. Submit information to the Engineer for review. If the survey data indicates the precast deck panel leveling operation does not produce the required dead load distribution, reset all panels within the span then resurvey and resubmit information to the Engineer for review.

Water spray concrete surfaces of shear pockets, bottom of precast deck panels and top flange of beams immediately prior to grouting. Do not allow water to pond at any location along the top flange of beams. Provide clean, saturated surface-dry conditions on vertical surface of shear pockets.

Grout all haunches and shear pockets of each precast deck panel separately. Do not cast transverse closure joints for any precast deck panels at this time. Remove leveling bolts after the haunch grout has reached the minimum 3-day compressive strength, then grout leveling bolt block outs using precision grout.

After grout reaches the 3-day strength, remove haunch forming material immediately adjacent and parallel to the transverse closure pour. Remove haunch forming material in at least two panels per span and as directed by the Engineer to allow for inspection of grouted haunch.

404-5.4 Transverse Closure Joint: Coat surfaces of precast deck panels to be in contact with closure joint concrete with a sprayed Type A epoxy. Provide surface preparation, application, and curing of epoxy bonding compound in strict accordance with the manufacturer's recommendations. Use an epoxy bonding compound listed on the Department's Qualified Products List. Overspray of the epoxy onto the reinforcement is permissible and does not require removal.

Install transverse closure joint reinforcement, place scuppers, form and cast closure joint prior to the hardening of the previously applied Type A epoxy.

Place concrete under the same weather limitations as cast-in-place concrete in Section 400 and as required by the shrinkage reducing admixture (SRA) manufacturer. Cure closure joint concrete in accordance with Section 400-16.4 and the SRA manufacturer's recommendations.

404-5.5 Finishing Deck Surface: Profilograph and plane the deck and approach slabs in accordance with Section 400-15.2.5.5.

404-5.6 Expansion Joints: After meeting the smoothness criteria in 400-15, construct expansion joints to permit absolute freedom of movement. Carefully remove all loose or thin shells of concrete likely to cause a spall with movement at a joint from all expansion joints as soon as possible. Construct the joint in accordance with approved manufacturer's recommendations.

404-6 Method of Measurement.

404-6.1 General: The work specified in this Section will be measured and paid for as shown below for the particular item involved. Precast concrete members are acceptable to the Department for full payment when all requirements of the Contract Documents have been met. No partial payments will be made for precast concrete members until the 28-day strength requirement, along with other applicable specification requirements, have been met.

404-6.2 Precast Bent Caps: Payment will be made at the Contract unit price per cubic yard of concrete for each of the various elements shown in the plans.

404-6.3 Precast Deck Panel: Payment will be made at the Contract unit price per square yard of each of the various elements shown in the plans without discounting voids.

404-6.4 Grout for Precast Deck Panel: Payment will be made at the Contract unit price per cubic yard of precision grout required as shown in the plans.

404-6.5 Closure Joint for Precast Deck Panel: Payment will be made at the Contract unit price per linear foot of closure joints as shown in the plans.

404-7 Basis of Payment.

404-7.1 Precast Bent Caps: Payment includes the cost of all materials incorporated into the precast cap including reinforcing, grout, installation and all other incidental items necessary to complete the installation.

404-7.2 Precast Deck Panel: Payment includes the cost of all materials incorporated into the precast deck panel, leveling bolts, delivery to the bridge site, placing and leveling procedure as described in this Section including all forming material for subsequent grouting.

404-7.3 Grout for Precast Deck Panel: Payment includes all grouting operations as described in this Section for beam haunches, shear pockets, leveling bolt block outs and lifting device block outs.

404-7.4 Closure Joint for Precast Deck Panel: Payment includes materials and placement of epoxy, reinforcing bars, concrete and scuppers.

404-7.5 Payment Items:

Payment will be made under:

Item No. 404-1	Precast Bent Caps – per cubic yard.
Item No. 404-5	Precast Deck Panel – per square yard.
Item No. 404-6	Grout for Precast Deck Panel – per cubic yard.
Item No. 404-7	Closure Joint for Precast Deck Panel – per linear foot.

SUPPLEMENTAL SPECIFICATIONS

005 CONTROL OF THE WORK.
(REV 12-16-11) (FA 1-10-12) (1-13)

Section 5 (Pages 31 - 50) is deleted and the following substituted:

SECTION 5
CONTROL OF THE WORK

5-1 Plans and Working Drawings.

5-1.1 Contract Documents: The Contractor may purchase copies of the Standard Specifications and Design Standards from the Department or access them from the Department's website. Have available on the worksite, at all times, one copy of the Contract Documents.

5-1.2 Department's Plans: Plans consist of general drawings showing such details as are necessary to give a comprehensive idea of the construction contemplated. In general, roadway plans will show alignment, profile grades, typical cross-sections and general cross-sections. In general, structure plans will show in detail all dimensions of the work contemplated. When the structure plans do not show the dimensions in detail, they will show general features and such details as are necessary to give a comprehensive idea of the structure.

Grades shown are finished grades, and B.M. Datum is North American Vertical Datum 1988 (NAVD-1988) National Geodetic Vertical Datum of 1929 (NGVD-1929) or other datum as noted in the plans.

5-1.3 Alterations in Plans: The Department will issue, in writing, all authorized alterations affecting the requirements and information given on the approved plans.

5-1.4 Shop Drawings:

5-1.4.1. Definitions:

(a) Shop Drawings: All working, shop and erection drawings, associated trade literature, calculations, schedules, manuals and similar documents submitted by the Contractor to define some portion of the project work. The type of work includes both permanent and temporary works as appropriate to the project.

(b) Permanent Works: All the permanent structures and parts thereof required of the completed Contract.

(c) Temporary Works: Any temporary construction work necessary for the construction of the permanent works. This includes but is not limited to bracing, falsework, formwork, scaffolding, shoring, temporary earthworks, sheeting, cofferdams, and special erection equipment.

(d) Construction Affecting Public Safety: Construction that may jeopardize public safety such as structures spanning functioning vehicular roadways, pedestrian walkways, railroads, navigation channels of navigable waterways and walls or other structure foundations located in embankments immediately adjacent to functioning roadways. It does not apply to those areas of the site under the Contractor's control and outside the limits of normal public access.

(e) Major and Unusual Structures: Bridges of complex geometry and/or complex design. Generally, this includes the following types of structures:

1. Bridges with an individual span longer than 300 feet.
2. Structurally continuous superstructures with spans over 150 feet.

3. Steel box and plate girder bridges.
4. Steel truss bridges.
5. Concrete segmental and longitudinally post-tensioned continuous girder bridges.
6. Cable stayed or suspension bridges.
7. Arch bridges.
8. Tunnels.
9. Movable bridges (specifically electrical and mechanical components).

10. Rehabilitation, widening, or lengthening of any of the above.

(f) Special Erection Equipment includes launching gantries, beam and winch equipment, form travelers, stability towers, strong-backs, erection trusses, launching noses or similar items made purposely for construction of the structure. It does not apply to commonly available proprietary construction equipment such as cranes.

(g) Falsework includes any temporary construction work used to support the permanent structure until it becomes self-supporting. Falsework includes steel or timber beams, girders, columns, piles and foundations, and any proprietary equipment including modular shoring frames, post shores, and adjustable horizontal shoring.

(h) Formwork includes any structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Formwork comprises common materials such as wood or metal sheets, battens, soldiers and walers, ties, proprietary forming systems such as stay-in-place metal forms, and proprietary supporting bolts, hangers and brackets. Formwork may be either permanent formwork requiring a shop drawing submittal such as stay-in-place metal or concrete forms, or may be temporary formwork which requires certification by the Specialty Engineer for Construction Affecting Public Safety and for Major and Unusual Structures.

(i) Scaffolding is an elevated work platform used to support workmen, materials and equipment, but not intended to support the structure.

(j) Shoring is a component of falsework such as horizontal, vertical or inclined support members. In this Section, this term is interchangeable with falsework.

(k) Bracing is a temporary structural member(s) placed between beams, girders, piles columns, etc. to provide stability during construction activities.

(l) Contractor Originated Designs: Items which the Contract Documents require the Contractor to design, detail and incorporate into the permanent works.

5-1.4.2 Work Items Requiring Shop Drawings: In general, the Department requires shop drawings for items of work not fully detailed in the plans which require additional drawings and coordination prior to constructing the item, including but not limited to:

(a) Bridge components not fully detailed in the plans, i.e. segments, steel girder details, post-tensioning details, handrails, etc.

(b) Retaining Wall Systems

(c) Precast Box Culverts

(d) Non-standard lighting, signalization and signing structures and components

(e) Building structures

(f) Drainage structures, attenuators, and other nonstructural items

(g) Design and structural details furnished by the Contractor in compliance with the Contract

(h) Temporary Works affecting public safety

Additional clarification for certain types of bridge structures is provided in 5-1.4.7. Other provisions of the Contract Documents may waive the requirement for submittals for certain items; i.e., items constructed from standard drawings or those complying with alternate details for prestressed members under Section 450. Review the Contract Documents to determine the submittals required.

5-1.4.3 Schedule of Submittals: Prepare and submit a schedule of submittals that identifies the work for which shop drawings apply. For each planned submittal, define the type, and approximate number of drawings or other documents that are included and the planned submittal date, considering the processing requirements herein. Submit the schedule of submittals to the Department's Shop Drawing Review Office and the Engineer of Record within 60 days of the start of the Contract, and prior to the submission of any shop drawings.

Coordinate subsequent submittals with construction schedules to allow sufficient time for review, approval, and re-submittal as necessary.

5-1.4.4 Style, Numbering, and Material of Submittals:

5-1.4.4.1 Drawings: Furnish two clearly legible photographic or xerographic copies of all shop drawings that are necessary to complete the structure in compliance with the design shown on the plans. Prepare all shop drawings using the same units of measure as those used in the Department's plans. Use sheets no larger than 11 by 17 inches. Consecutively number each sheet in the submittal series, and indicate the total number in the series (i.e., 1 of 12, 2 of 12, . . . , 12 of 12). Include on each sheet the following items as a minimum requirement: the complete Financial Project Identification Number, Bridge Number(s), drawing title and number, a title block showing the names of the fabricator or producer and the Contractor for which the work is being done, the initials of the person(s) responsible for the drawing, the date on which the drawing was prepared, the location of the item(s) within the project, the Contractor's approval stamp with date and initials, and, when applicable, the documents shall be signed and sealed by the Specialty Engineer or Contractor's Engineer of Record, as appropriate. A re-submittal will be requested when any of the required information is not included.

5-1.4.4.2 Other Documents: Provide four sets of original documents or clearly legible photographic or xerographic copies of documents other than drawings, such as trade literature, catalogue information, calculations, and manuals. Provide sheets no larger than 11 by 17 inches. Clearly label and number each sheet in the submittal to indicate the total number of sheets in the series (i.e., 1 of 12, 2 of 12, . . . , 12 of 12). Provide an additional three sets of documentation for items involved with precast prestressed components. Provide an additional two sets of documentation for items involving structural steel components.

Prepare all documents using the same units of measure as those used in the Department's plans. Bind and submit all documents with a Table of Contents cover sheet. List on the cover sheet the total number of pages and appendices, and include the complete Financial Project Identification Number, a title referencing the submittal item(s), the name of the firm and person(s) responsible for the preparation of the document, the Contractor's approval stamp with date and initials, and, when applicable, the documents shall be signed and sealed by the Specialty Engineer or Contractor's Engineer of Record, as appropriate.

Submit appropriately prepared and checked calculations and manuals that clearly outline the design criteria. Include on the internal sheets the complete Financial Project Identification Number and the initials of the person(s) responsible for preparing and checking the document.

Clearly label trade literature and catalogue information on the front cover with the title, Financial Project Identification Number, date and name of the firm and person(s) responsible for that document.

5-1.4.5 Submittal Paths and Copies:

5-1.4.5.1 General: Shop drawings are not required for prequalified items. For non-prequalified items, determine the submittal path to be followed based upon the identity of the Engineer of Record as shown adjacent to the title block on the structural plan sheets, and on the key sheets of roadway plans, signing, and pavement marking plans, and/or lighting plans. At the preconstruction conference, the Department will notify the Contractor of any changes in the submittal path and whether the Department's or the Consultant's red-ink review stamp will signify an officially reviewed shop drawing.

(a) When the Florida Department of Transportation is the Engineer of Record, submit shop drawings to the appropriate Department Shop Drawing Review Office with a copy of the letter of transmittal sent to the Resident Engineer. For work requiring other information (e.g., catalog data, procedure manuals, fabrication/welding procedures, and maintenance and operating procedures), submit the required number of copies to the appropriate Department Shop Drawing Review Office. If not shown on the plans, the Department will furnish the mailing address of the appropriate Department Shop Drawing Review Office. Provide copies of material certifications and material tests to the Resident Engineer.

(b) When the Engineer of Record is a consultant hired by the Department, submit shop drawings to the consultant with a copy of the letter of transmittal sent to the Resident Engineer and, when requested, to the appropriate Department Shop Drawing Review Office. For work requiring other documentation (e.g., catalog data, procedure manuals, fabrication/welding procedures, and maintenance and operating manuals), submit the required number of copies with the prints. If not shown on the plans, the Department will furnish the mailing address of the Consulting Engineer of Record. Provide copies of material certifications and material tests to the Resident Engineer.

5-1.4.5.2 Building Structures: Submit working, shop and erection drawings, and all correspondence related to building structures, such as Rest Area Pavilions, Office Buildings, and Maintenance Warehouses, to the Architect of Record for review and approval. Send a copy of the transmittal to the Resident Engineer.

5-1.4.5.3 Contractor-Originated Design: Submit shop drawings and applicable calculations to the Engineer of Record for review. Ensure that each sheet of the shop drawings and the cover sheet of the calculations are signed and sealed by the Specialty Engineer or the Contractor's Engineer of Record. Transmit the submittal and copies of the transmittal letters in accordance with the requirements of 5-1.4.5.1 through 5-1.4.5.3, as appropriate.

5-1.4.5.4 Temporary Works: For Construction Affecting Public Safety, submit to the Engineer of Record shop drawings and the applicable calculations for the design of special erection equipment, bracing, falsework, scaffolding, etc. Ensure that each sheet of the shop drawings and the cover sheet of the applicable calculations is signed and sealed by the Specialty Engineer. Transmit the submittal and copies of the transmittal letters in accordance with the requirements of 5-1.4.5.1 through 5-1.4.5.3, as appropriate.

5-1.4.5.5 Falsework Founded on Shallow Foundations: When vertical displacement limits are provided in the Plans for falsework founded on shallow foundations such as spread footings and mats, submit to the Engineer of Record shop drawings and applicable calculations of the falsework system including subsurface conditions and settlement estimates. Ensure that each sheet of the shop drawings and the cover sheet of the applicable calculations is signed and sealed by the Specialty Engineer. Transmit the submittal and copies of the transmitted letters in accordance with the requirements of 5-1.4.5.1 through 5-1.4.5.3, as appropriate.

5-1.4.5.6 Formwork and Scaffolding: The Contractor is solely responsible for the safe installation and use of all formwork and scaffolding. The Department does not require any formwork or scaffolding submittals unless such work would be classified as Construction Affecting Public Safety.

5-1.4.5.7 Beam and Girder Temporary Bracing: The Contractor is solely responsible for ensuring stability of beams and girders during all handling, storage, shipping and erection. Adequately brace beams and girders to resist wind, weight of forms and other temporary loads, especially those eccentric to the vertical axis of the products, considering actual beam geometry and support conditions during all stages of erection and deck construction. At a minimum, provide temporary bracing at each end of each beam or girder. Develop the required bracing designs in accordance with the AASHTO LRFD Bridge Design Specifications (LRFD) using wind loads specified in the Structures Design Guidelines (SDG). For information not included in the SDG or LRFD, refer to the AASHTO Guide Design Specifications for Bridge Temporary Works and Construction Handbook for Bridge Temporary Works.

For Construction Affecting Public Safety, when temporary bracing requirements are shown in the plans, submit plans and calculations signed and sealed by a Specialty Engineer for the design of temporary bracing members and connections based on the forces shown in the plans. In addition, submit a written certification that construction loads do not exceed the assumed loads shown in the plans.

For Construction Affecting Public Safety, when temporary bracing requirements are not shown in the plans or an alternate temporary bracing system is proposed, submit plans and calculations signed and sealed by a Specialty Engineer including the stability analysis and design of temporary bracing members and connections.

5-1.4.5.8 Erection Plan: Submit, for the Engineer's review, an Erection Plan that meets the specific requirements of Sections 450, 452 and 460 and this section. Refer to Index 600 for construction activities not permitted over traffic.

5-1.4.5.9 Other Miscellaneous Design and Structural Details
Furnished by the Contractor in Compliance with the Contract: Submit to the Engineer of Record shop drawings and the applicable calculations. Ensure that each sheet of the shop drawings and the cover sheet of the applicable calculations is signed and sealed by the Specialty Engineer. Transmit the submittal and copies of the transmittal letters in accordance with the requirements of 5-1.4.5.1 through 5-1.4.5.3, as appropriate.

5-1.4.6 Processing of Shop Drawings:

5-1.4.6.1 Contractor Responsibility for Accuracy and Coordination of Shop Drawings: Coordinate, schedule, and control all submittals, with a regard for the required priority, including those of the various subcontractors, suppliers, and engineers, to provide for an orderly and balanced distribution of the work.

Coordinate, review, date, stamp, approve and sign all shop drawings prepared by the Contractor or agents (subcontractor, fabricator, supplier, etc.) prior to

submitting them to the Engineer of Record for review. Submittal of the drawings confirms verification of the work requirements, units of measurement, field measurements, construction criteria, sequence of assembly and erection, access and clearances, catalog numbers, and other similar data. Indicate on each series of drawings the specification section and page or drawing number of the Contract plans to which the submission applies. Indicate on the shop drawings all deviations from the Contract drawings and itemize all deviations in the letter of transmittal. Likewise, whenever a submittal does not deviate from the Contract plans, clearly state so in the transmittal letter.

Schedule the submission of shop drawings to allow for a 45 day review period. The review period commences upon the Engineer of Record's receipt of the valid submittal or valid re-submittal and terminates upon the transmittal of the submittal back to the Contractor. A valid submittal includes all the minimum requirements outlined in 5-1.4.4.

Submit shop drawings to facilitate expeditious review. The Contractor is discouraged from transmitting voluminous submittals of shop drawings at one time. For submittals transmitted in this manner, allow for the additional review time that may result.

Only shop drawings distributed with the "red ink" stamps are valid and all work that the Contractor performs in advance of approval will be at the Contractor's risk.

5-1.4.6.2 Scope of Review by Engineer: The Engineer of Record's review of the shop drawings is for conformity to the requirements of the Contract Documents and to the intent of the design. The Engineer of Record's review of shop drawings which include means, methods, techniques, sequences, and construction procedures are limited to the effects on the permanent works. The Engineer of Record's review of submittals which include means, methods, techniques, sequences, and construction procedures does not include an in-depth check for the ability to perform the work in a safe or efficient manner. Review by the Engineer of Record does not relieve the Contractor of responsibility for dimensional accuracy to ensure field fit and for conformity of the various components and details.

5-1.4.6.3 Special Review by Engineer of Shop Drawings for Construction Affecting Public Safety: For Construction Affecting Public Safety, the Engineer of Record, or other Engineer as the Department appoints for this purpose, will make an independent review of all relevant shop drawings and similar documents. Do not proceed with construction of the permanent works until receiving the Engineer of Record's approval. The review of these shop drawings is for overall structural adequacy of the item to support the imposed loads and does not include a check for economy, efficiency or ease of construction.

5-1.4.7 Other Requirements for Shop Drawings for Bridges:

5-1.4.7.1 Shop Drawings for Structural Steel and Miscellaneous Metals: Furnish shop drawings for structural steel and miscellaneous metals. Shop drawings shall consist of working, shop, and erection drawings, welding procedures, and other working plans, showing details, dimensions, sizes of material, and other information necessary for the complete fabrication and erection of the metal work.

5-1.4.7.2 Shop Drawings for Concrete Structures: Furnish shop drawings for concrete components that are not cast-in-place and are not otherwise exempted from submittal requirements. Also, furnish shop drawings for all details that are required for the effective prosecution of the concrete work and are not included in the Contract Documents such as: special erection equipment, masonry layout diagrams, and diagrams for bending reinforcing steel, in addition to any details required for concrete components for the permanent work.

5-1.4.7.3 Shop Drawings for Major and Unusual Structures:

In addition to any other requirements, within 60 days from the Notice to Proceed, submit information to the Engineer outlining the integration of the Major and Unusual Structure into the overall approach to the project. Where applicable to the project, include, but do not limit this information to:

(1) The overall construction program for the duration of the Contract. Clearly show the Milestone dates. (For example, the need to open a structure by a certain time for traffic operations.)

(2) The overall construction sequence. The order in which individual structures are to be built, the sequence in which individual spans of girders or cantilevers are erected, and the sequence in which spans are to be made continuous.

(3) The general location of any physical obstacles to construction that might impose restraints or otherwise affect the construction, and an outline of how to deal with such obstacles while building the structure(s). (For example, obstacles might include road, rail and waterway clearances, temporary diversions, transmission lines, utilities, property, and the Contractor's own temporary works, such as haul roads, cofferdams, plant clearances and the like.)

(4) The approximate location of any special lifting equipment in relation to the structure, including clearances required for the operation of the equipment. (For example, crane positions, operating radii and the like.)

(5) The approximate location of any temporary falsework, and the conceptual outline of any special erection equipment. Provide the precise locations and details of attachments, fixing devices, loads, etc. in later detailed submittals.

(6) An outline of the handling, transportation, and storage of fabricated components, such as girders or concrete segments. Provide the precise details in later detailed submittals.

(7) Any other information pertinent to the proposed scheme or intended approach.

Clearly and concisely present the above information on as few drawings as possible in order to provide an overall, integrated summary of the intended approach to the project. The Department will use these drawings for information, review planning, and to assess the Contractor's approach in relation to the intent of the original design. The delivery to and receipt by the Engineer does not constitute any Department acceptance or approval of the proposals shown thereon. Include the details of such proposals on subsequent detailed shop drawing submittals. Submit timely revisions and re-submittals for all variations from these overall scheme proposals.

5-1.4.8 Modifications for Construction: Where the Engineer allows the Contractor to make modifications to the permanent works for the purposes of expediting the Contractor's chosen construction methods, the Contractor shall submit proposals to the Engineer of Record for review and approval prior to modifying the works. Submit proposals for minor modifications under the shop drawing process. Indicate on all drawings the deviations from the Contract Documents and itemize all deviations in the letter of transmittal. The Department will require additional submittals and/or submittal under a Cost Savings Initiative Proposal for major modifications.

Minor modifications are those items that, in the opinion of the Engineer, do not significantly affect the quantity of measured work, or the integrity or maintainability of

the structure or its components. (For example, adjusting concrete dimensions, substituting steel plate sizes, changing reinforcing bar size and spacing, etc., all within the acceptable limits of the design.)

Major modifications are any modifications that, in the opinion of the Engineer, significantly affect the quantity of measured work, or the integrity or maintainability of the structure or its' components. (For example, substituting alternative beam sizes and spacings, changing material strength or type, and the like.). Provide signed and sealed revised sheets to the Engineer for any such revisions to the Contract plans prior to submitting shop drawings.

The Engineer's decision on the delineation between a minor and a major modification and the disposition of a proposal is final.

5-1.4.9 Cost of Shop Drawings: Include the cost of furnishing shop and working drawings in the Contract prices for the work requiring the shop and working drawings. The Department will not pay the Contractor additional compensation for such drawings.

5-1.5 Certifications:

5-1.5.1 Special Erection Equipment: Prior to its use, ensure that the Specialty Engineer personally inspects the special erection equipment and certifies to the Engineer in writing that the equipment has been fabricated in accordance with the submitted drawings and calculations. In addition, after assembly, ensure that the Specialty Engineer observes the equipment in use and certifies to the Engineer in writing that it is being used as intended and in accordance with the submitted drawings and calculations. In each case, ensure that the Specialty Engineer also signs and seals the letter of certification.

5-1.5.2 Falsework and Shoring Requiring Shop Drawings: After its erection or installation but prior to the application of any superimposed load, ensure that the Specialty Engineer personally inspects the falsework and certifies to the Engineer in writing that the falsework has been constructed in accordance with the materials and details shown on the submitted drawings and calculations. Ensure that the Specialty Engineer also signs and seals the letter of certification.

5-1.5.3 Temporary Formwork: For Construction Affecting Public Safety and for Major and Unusual Structures, prior to the placement of any concrete, ensure that the Specialty Engineer inspects the formwork and certifies to the Engineer in writing that the formwork has been constructed to safely withstand the superimposed loads to which it will be subjected. Ensure that the Specialty Engineer signs and seals the letter of certification.

5-1.5.4 Erection: For Construction Affecting Public Safety, submit an erection plan signed and sealed by the Specialty Engineer to the Engineer at least four weeks prior to erection commencing. Include, as part of this submittal, signed and sealed calculations and details for any falsework, bracing or other connections supporting the structural elements shown in the erection plan.

At least two weeks prior to beginning erection, conduct a Pre-erection meeting to review details of the plan with the Specialty Engineer that signed and sealed the plan, any Specialty Engineers that may inspect the work and the Engineer.

After erection of the elements, but prior to opening of the facility below the structure, ensure that a Specialty Engineer that is qualified to inspect temporary works has personally inspected the erected members and certified to the Engineer that the structure has been erected in accordance with the signed and sealed erection plan.

Perform daily inspections of the erected structural systems. For structures

without temporary supports but with temporary girder bracing systems, perform inspections until all the diaphragms and cross frames are in place. For structures with temporary supports, perform inspections until the temporary supports are no longer needed as indicated in the erection plans. Provide written documentation of the inspections to the Engineer within 24 hours of the inspection.

5-1.6 Corrections for Construction Errors: For work that the Contractor constructs incorrectly or does not meet the requirements of the Contract Documents, the Contractor has the prerogative to submit an acceptance proposal to the Engineer for review and disposition. The acceptance proposal shall describe the error or defect and either describe remedial action for its correction or propose a method for its acceptance. In either case, the acceptance proposal shall address structural integrity, aesthetics, maintainability, and the effect on Contract Time. The Department will judge any such proposal for its effect on these criteria and also for its effect on Contract Administration.

When the Engineer judges that a proposal infringes on the structural integrity or maintainability of the structure, the Contractor's Engineer of Record will perform a technical assessment and submit it to the Engineer for approval. Do not take any corrective action without the Engineer's approval.

Carry out all approved corrective construction measures at no expense to the Department.

Notwithstanding any disposition of the compensation aspects of the defective work, the Engineer's decision on the technical merits of a proposal is final.

5-2 Coordination of Contract Documents.

These Specifications, the Plans, Special Provisions, and all supplementary documents are integral parts of the Contract; a requirement occurring in one is as binding as though occurring in all. All parts of the Contract are complementary and describe and provide for a complete work. In addition to the work and materials specified in the Specifications as being included in any specific pay item, include in such pay items additional, incidental work, not specifically mentioned, when so shown in the plans, or if indicated, or obvious and apparent, as being necessary for the proper completion of the work under such pay item and not stipulated as being covered under other pay items.

In cases of discrepancy, the governing order of the documents is as follows:

1. Special Provisions.
 2. Technical Special Provisions.
 3. Plans.
 4. Design Standards.
 5. Developmental Specifications.
 6. Supplemental Specifications.
 7. Standard Specifications.
- Computed dimensions govern over scaled dimensions.

5-3 Conformity of Work with Contract Documents.

Perform all work and furnish all materials in reasonably close conformity with the lines, grades, cross-sections, dimensions, and material requirements, including tolerances, as specified in the Contract Documents.

In the event that the Engineer finds that the Contractor has used material or produced a finished product that is not in reasonably close conformity with the Contract Documents, but that

the Contractor has produced reasonably acceptable work, the Engineer will determine if the Department will accept the work in place. In this event, the Engineer will document the basis of acceptance by Contract modification, which provides for an appropriate reduction in the Contract price for such work or materials included in the accepted work as deemed necessary to conform to the determination based on engineering judgment.

In the event that the Engineer finds that the Contractor has used material or produced a finished product that is not in reasonably close conformity with the Contract Documents, and that the Contractor has produced an inferior or unsatisfactory product, the Contractor shall remove and replace or otherwise correct the work or materials at no expense to the Department.

For base and surface courses, the Department will allow the finished grade to vary as much as 0.1 foot from the grade shown in the plans, provided that the Contractor's work meets all templates and straightedge requirements and contains suitable transitions.

5-4 Errors or Omissions in Contract Documents.

Do not take advantage of any apparent error or omission discovered in the Contract Documents, but immediately notify the Engineer of such discovery. The Engineer will then make such corrections and interpretations as necessary to reflect the actual spirit and intent of the Contract Documents.

5-5 Authority of the Engineer.

Perform all work to the satisfaction of the Engineer.

The Director, Office of Construction will decide all questions, difficulties, and disputes, of whatever nature, that may arise relative to the interpretation of the plans, construction, prosecution, and fulfillment of the Contract, and as to the character, quality, amount, and value of any work done, and materials furnished, under or by reason of the Contract.

5-6 Authority and Duties of Engineer's Assistants.

The Director, Office of Construction may appoint such assistants and representatives as he desires. These assistants and representatives are authorized to inspect all work done and all materials furnished. Such inspection may extend to all or any part of the work and to the manufacture, preparation, or fabrication of the materials to be used. Such assistants and representatives are not authorized to revoke, alter, or waive any requirement of these Specifications. Rather, they are authorized to call to the attention of the Contractor any failure of the work or materials to meet the Contract Documents, and have the authority to reject materials or suspend the work until any questions at issue can be referred to and decided by the Engineer. The Engineer will immediately notify the Contractor in writing of any such suspension of the work, stating in detail the reasons for the suspension. The presence of the inspector or other assistant in no way lessens the responsibility of the Contractor.

5-7 Engineering and Layout.

5-7.1 Control Points Furnished by the Department: The Engineer will provide centerline control points (Begin Project, End Project, PIs, PTs, etc.) and bench marks at appropriate intervals along the line of the project to facilitate the proper layout of the work. Normally, the Engineer will furnish only one bench mark for water crossings. Preserve all reference points and bench marks that the Department furnishes.

As an exception to the above, for projects where the plans do not show a centerline or other survey control line for construction of the work (e.g., resurfacing, safety

modifications, etc.) the Engineer will provide only points marking the beginning and ending of the project, and all exceptions.

5-7.2 Furnishing of Stake Materials: Furnish all stakes, templates, and other materials necessary for establishing and maintaining the lines and grades necessary for control and construction of the work.

5-7.3 Layout of Work: Utilizing the control points furnished by the Department in accordance with 5-7.1, establish all horizontal and vertical controls necessary to construct the work in conformity to the Contract Documents. Perform all calculations required, and set all stakes needed such as grade stakes, offset stakes, reference point stakes, slope stakes, and other reference marks or points necessary to provide lines and grades for construction of all roadway, bridge, and miscellaneous items.

When performing utility construction as part of the project, establish all horizontal and vertical controls necessary to carry out such work.

5-7.4 Specific Staking Requirements: When performing new base construction as part of the project, set stakes to establish lines and grades for subgrade, base, curb, and related items at intervals along the line of the work no greater than 50 feet on tangents and 25 feet on curves. Set grade stakes at locations that the Engineer directs to facilitate checking of subgrade, base, and pavement elevations in crossovers, intersections, and irregular shaped areas.

For bridge construction stakes and other control, set references at sufficiently frequent intervals to ensure construction of all components of a structure in accordance with the lines and grades shown in the plans.

For projects where the plans do not show a centerline or other survey control line for construction of the work (resurfacing, safety modifications, etc.), provide only such stakes as necessary for horizontal and vertical control of work items.

For resurfacing and resurfacing-widening type projects, establish horizontal controls adequate to ensure that the asphalt mix added matches with the existing pavement. In tangent sections, set horizontal control points at 100 foot intervals by an instrument survey. In curve sections, set horizontal control points at 25 foot intervals by locating and referencing the centerline of the existing pavement.

Establish by an instrument survey, and mark on the surface of the finished pavement at 25 foot intervals, the points necessary for striping of the finished roadway. As an exception, for resurfacing and resurfacing/widening projects, establish these points in the same manner as used for horizontal control of paving operations. Mark the pavement with white paint. If performing striping, the Engineer may approve an alternate method for layout of striping provided that the Contractor achieves an alignment equal to or better than the alignment that would be achieved using an instrument survey.

For projects that include temporary or permanent striping of "no passing zones", provide the location and length of these zones as shown in the plans, except projects where the vertical or horizontal alignment is new or altered from preconstruction alignment. For projects that consist of new or altered vertical or horizontal alignment, the Department will provide the location and length of the "no passing zones" during construction. For these projects, notify the Engineer not less than 21 calendar days prior to beginning striping.

For all projects, set a station identification stake at each right-of-way line at 100 foot intervals and at all locations where a change in right-of-way width occurs. Mark each of these stakes with painted numerals, of a size readable from the roadway, corresponding to the project station at which it is located. As an exception to the above, for projects where plans do

not show right-of-way lines, set station identification stakes at locations and intervals appropriate to the type of work being done. For resurfacing and resurfacing/widening projects, set station identification stakes at 200 foot intervals.

5-7.5 Personnel, Equipment, and Record Requirements: Employ only competent personnel and use only suitable equipment in performing layout work. Do not engage the services of any person or persons in the employ of the Department for performance of layout work.

Keep adequate field notes and records while performing as layout work. Make these field notes and records available for the Engineer's review as the work progresses, and furnish copies to the Engineer at the time of completion of the project. The Engineer's inspection, checking, or acceptance of the Contractor's field notes or layout work does not relieve the Contractor of his responsibility to achieve the lines, grades, and dimensions shown in the Contract Documents.

Prior to final acceptance of the project, mark, in a permanent manner on the surface of the completed work, all horizontal control points originally furnished by the Department.

5-7.6 Payment: Include the cost of performing layout work as described above in the Contract unit prices for the various items of work that require layout.

5-8 Contractor's Supervision.

5-8.1 Prosecution of Work: Give the work the constant attention necessary to ensure the scheduled progress, and cooperate fully with the Engineer and with other contractors at work in the vicinity.

5-8.2 Contractor's Superintendent: Maintain a competent superintendent at the site at all times while work is in progress to act as the Contractor's agent. Provide a superintendent who is a competent superintendent capable of properly interpreting the Contract Documents and is thoroughly experienced in the type of work being performed. Provide a superintendent with the full authority to receive instructions from the Engineer and to execute the orders or directions of the Engineer, including promptly supplying any materials, tools, equipment, labor, and incidentals that may be required. Furnish such superintendence regardless of the amount of work sublet.

Provide a superintendent who speaks and understands English, and maintain at least one other responsible person who speaks and understands English, on the project during all working hours.

5-8.3 Supervision for Emergencies: Provide a responsible person, who speaks and understands English, and who is available at or reasonably near the worksite on a 24 hour basis, seven days a week. Designate this person as the point of contact for emergencies and in cases that require immediate action to maintain traffic or to resolve any other problem that might arise. Submit, by certified mail, the phone numbers and names of personnel designated to be contacted in cases of emergencies, along with a description of the project location, to the Florida Highway Patrol and all other local law enforcement agencies.

5-9 General Inspection Requirements.

5-9.1 Cooperation by Contractor: Do not perform work or furnish materials without obtaining inspection by the Engineer or his representative. Furnish the Engineer with every reasonable facility for ascertaining whether the work performed and materials used are in accordance with the requirements and intent of the Contract Documents. If the Engineer so

requests at any time before final acceptance of the work, remove or uncover such portions of the finished work as directed. After examination, restore the uncovered portions of the work to the standard required by the Contract Documents. If the Engineer determines that the work so exposed or examined is unacceptable, perform the uncovering or removal, and the replacing of the covering or making good of the parts removed, at no expense to the Department. However, if the Engineer determines that the work thus exposed or examined is acceptable, the Department will pay for the uncovering or removing, and the replacing of the covering or making good of the parts removed in accordance with Section 4-4.

5-9.2 Failure of Engineer to Reject Work During Construction: If, during or prior to construction operations, the Engineer fails to reject defective work or materials, whether from lack of discovery of such defect or for any other reason, such initial failure to reject in no way prevents the later rejection when such defect is discovered, or obligates the Department to final acceptance. The Department is not responsible for losses suffered due to any necessary removals or repairs of such defects.

5-9.3 Failure to Remove and Renew Defective Materials and Work: If the Contractor fails or refuses to remove and renew any defective materials used or work performed, or to make any necessary repairs in an acceptable manner and in accordance with the requirements of the Contract within the time indicated in writing, the Engineer has the authority to repair, remove, or renew the unacceptable or defective materials or work as necessary, all at the Contractor's expense. The Department will obtain payment for any expense it incurs in making these repairs, removals, or renewals, that the Contractor fails or refuses to make, by deducting such expenses from any moneys due or which may become due the Contractor, or by charging such amounts against the Contract bond.

5-9.4 Inspection by Federal Government: When the United States Government pays a portion of the cost of construction, its representatives may inspect the construction work as they deem necessary. However, such inspection will in no way make the Federal Government a party to the Contract.

5-10 Final Inspection.

5-10.1 Maintenance until Acceptance: Maintain all Work until the Engineer has given final acceptance in accordance with 5-11.

5-10.2 Inspection for Acceptance: Upon notification that all Contract Work, or all Contract Work on the portion of the Contract scheduled for acceptance, has been completed, the Engineer will make an inspection for acceptance. The inspection will be made within seven days of the notification. If the Engineer finds that all work has been satisfactorily completed, the Department will consider such inspection as the final inspection. If any or all of the Work is found to be unsatisfactory, the Engineer will detail the remedial work required to achieve acceptance. Immediately perform such remedial work. Subsequent inspections will be made on the remedial work until the Engineer accepts all Work.

Upon satisfactory completion of the Work, the Department will provide written notice of acceptance, either partial or final, to the Contractor.

Until final acceptance in accordance with 5-11, replace or repair any damage to the accepted Work. Payment of such work will be as provided in 7-14.

5-10.3 Partial Acceptance: At the Engineer's sole discretion, the Engineer may accept any portion of the Work under the provisions of 5-10.2.

5-10.4 Conditional Acceptance: The Engineer will not make, or consider requests for conditional acceptance of a project.

5-11 Final Acceptance.

When, upon completion of the final construction inspection of the entire project, the Engineer determines that the Contractor has satisfactorily completed the work, the Engineer will give the Contractor written notice of final acceptance.

5-12 Claims by Contractor.

5-12.1 General: When the Contractor deems that extra compensation or a time extension is due beyond that agreed to by the Engineer, whether due to delay, additional work, altered work, differing site conditions, breach of Contract, or for any other cause, the Contractor shall follow the procedures set forth herein for preservation, presentation and resolution of the claim.

Submission of timely notice of intent to file a claim, preliminary time extension request, time extension request, and the certified written claim, together with full and complete claim documentation, are each a condition precedent to the Contractor bringing any circuit court, arbitration, or other formal claims resolution proceeding against the Department for the items and for the sums or time set forth in the Contractor's certified written claim. The failure to provide such notice of intent, preliminary time extension request, time extension request, certified written claim and full and complete claim documentation within the time required shall constitute a full, complete, absolute and irrevocable waiver by the Contractor of any right to additional compensation or a time extension for such claim.

5-12.2 Notice of Claim:

5-12.2.1 Claims For Extra Work: Where the Contractor deems that additional compensation or a time extension is due for work or materials not expressly provided for in the Contract or which is by written directive expressly ordered by the Engineer pursuant to 4-3, the Contractor shall notify the Engineer in writing of the intention to make a claim for additional compensation before beginning the work on which the claim is based, and if seeking a time extension, the Contractor shall also submit a preliminary request for time extension pursuant to 8-7.3.2 within ten calendar days after commencement of a delay and a request for Contract Time extension pursuant to 8-7.3.2 within thirty calendar days after the elimination of the delay. If such notification is not given and the Engineer is not afforded the opportunity for keeping strict account of actual labor, material, equipment, and time, the Contractor waives the claim for additional compensation or a time extension. Such notice by the Contractor, and the fact that the Engineer has kept account of the labor, materials and equipment, and time, shall not in any way be construed as establishing the validity of the claim or method for computing any compensation or time extension for such claim. On projects with an original Contract amount of \$3,000,000 or less within 90 calendar days after final acceptance of the project in accordance with 5-11, and on projects with an original Contract amount greater than \$3,000,000 within 180 calendar days after final acceptance of the project in accordance with 5-11, the Contractor shall submit full and complete claim documentation as described in 5-12.3 and duly certified pursuant to 5-12.9. However, for any claim or part of a claim that pertains solely to final estimate quantities disputes the Contractor shall submit full and complete claim documentation as described in 5-12.3 and duly certified pursuant to 5-12.9, as to such final estimate claim dispute issues, within 90 or 180 calendar days, respectively, of the Contractor's receipt of the Department's final estimate.

If the Contractor fails to submit a certificate of claim as described in 5-12.9, the Department will so notify the Contractor in writing. The Contractor shall have ten calendar days from receipt of the notice to resubmit the claim documentation, without change, with a certificate of claim as described in 5-12.9, without regard to whether the resubmission is within the applicable 90 or 180 calendar day deadline for submission of full and complete claim

documentation. Failure by the Contractor to comply with the ten calendar day notice shall constitute a waiver of the claim.

5-12.2.2 Claims For Delay: Where the Contractor deems that additional compensation or a time extension is due on account of delay, differing site conditions, breach of Contract, or any other cause other than for work or materials not expressly provided for in the Contract (Extra Work) or which is by written directive of the Engineer expressly ordered by the Engineer pursuant to 4-3, the Contractor shall submit a written notice of intent to the Engineer within ten days after commencement of a delay to a controlling work item expressly notifying the Engineer that the Contractor intends to seek additional compensation, and if seeking a time extension, the Contractor shall also submit a preliminary request for time extension pursuant to 8-7.3.2 within ten calendar days after commencement of a delay to a controlling work item, as to such delay and providing a reasonably complete description as to the cause and nature of the delay and the possible impacts to the Contractor's work by such delay, and a request for Contract Time extension pursuant to 8-7.3.2 within thirty calendar days after the elimination of the delay. On projects with an original Contract amount of \$3,000,000 or less within 90 calendar days after final acceptance of the project in accordance with 5-11, and on projects with an original Contract amount greater than \$3,000,000 within 180 calendar days after final acceptance of the project in accordance with 5-11, the Contractor shall submit full and complete documentation as described in 5-12.3 and duly certified pursuant to 5-12.9.

If the Contractor fails to submit a certificate of claim as described in 5-12.9, the Department will so notify the Contractor in writing. The Contractor shall have ten calendar days from receipt of the notice to resubmit the claim documentation, without change, with a certificate of claim as described in 5-12.9, without regard to whether the resubmission is within the applicable 90 or 180 calendar day deadline for submission of full and complete claim documentation. Failure by the Contractor to comply with the ten calendar day notice shall constitute a waiver of the claim.

There shall be no Contractor entitlement to any monetary compensation or time extension for any delays or delay impacts, whatsoever, that are not to a controlling work item, and then as to any such delay to a controlling work item entitlement to any monetary compensation or time extension shall only be to the extent such is otherwise provided for expressly under 4-3 or 5-12, except that in the instance of delay to a non-controlling item of work the Contractor may be compensated for the direct costs of idle labor or equipment only, at the rates set forth in 4-3.2.1(a) and (c), and then only to the extent the Contractor could not reasonably mitigate such idleness.

5-12.3 Content of Written Claim: As a condition precedent to the Contractor being entitled to additional compensation or a time extension under the Contract, for any claim, the Contractor shall submit a certified written claim to the Department which will include for each individual claim, at a minimum, the following information:

- (a) A detailed factual statement of the claim providing all necessary dates, locations, and items of work affected and included in each claim;
- (b) The date or dates on which actions resulting in the claim occurred or conditions resulting in the claim became evident;
- (c) Identification of all pertinent documents and the substance of any material oral communications relating to such claim and the name of the persons making such material oral communications;

(d) Identification of the provisions of the Contract which support the claim and a statement of the reasons why such provisions support the claim, or alternatively, the provisions of the Contract which allegedly have been breached and the actions constituting such breach;

(e) A detailed compilation of the amount of additional compensation sought and a breakdown of the amount sought as follows:

(1) documented additional job site labor expenses;
(2) documented additional cost of materials and supplies;
(3) a list of additional equipment costs claimed, including each piece of equipment and the rental rate claimed for each;

(4) any other additional direct costs or damages and the documents in support thereof;

(5) any additional indirect costs or damages and all documentation in support thereof.

(f) A detailed compilation of the specific dates and the exact number of calendar days sought for a time extension, the basis for entitlement to time for each day, all documentation of the delay, and a breakout of the number of days claimed for each identified event, circumstance or occurrence.

Further, the Contractor shall be prohibited from amending either the bases of entitlement or the amount of any compensation or time stated for any and all issues claimed in the Contractor's written claim submitted hereunder, and any circuit court, arbitration, or other formal claims resolution proceeding shall be limited solely to the bases of entitlement and the amount of any compensation or time stated for any and all issues claimed in the Contractor's written claim submitted hereunder. This shall not, however, preclude a Contractor from withdrawing or reducing any of the bases of entitlement and the amount of any compensation or time stated for any and all issues claimed in the Contractor's written claim submitted hereunder at any time.

5-12.4 Action on Claim: The Engineer will respond on projects with an original Contract amount of \$3,000,000 or less within 90 calendar days of receipt of a complete claim submitted by a Contractor in compliance with 5-12.3, and on projects with an original Contract amount greater than \$3,000,000 within 120 calendar days of receipt of a complete claim submitted by a Contractor in compliance with 5-12.3. Failure by the Engineer to respond to a claim within 90 or 120 days, respectively, after receipt of a complete claim in compliance with 5-12.3 constitutes a denial of the claim by the Engineer. If the Engineer finds the claim or any part thereof to be valid, such partial or whole claim will be allowed and paid for to the extent deemed valid and any time extension granted, if applicable, as provided in the Contract. No circuit court or arbitration proceedings on any claim, or a part thereof, may be filed until after final acceptance per 5-11 of all Contract work by the Department or denial hereunder, whichever occurs last.

5-12.5 Pre-Settlement and Pre-Judgment Interest: Entitlement to any pre-settlement or pre-judgment interest on any claim amount determined to be valid subsequent to the Department's receipt of a certified written claim in full compliance with 5-12.3, whether determined by a settlement or a final ruling in formal proceedings, the Department shall pay to the Contractor simple interest calculated at the Prime Rate (as reported by the Wall Street Journal as the base rate on corporate loans posted by at least 75% of the nations 30 largest banks) as of the 60th calendar day following the Department's receipt of a certified written claim in full compliance with 5-12.3, such interest to accrue beginning 60 calendar days following the

Department's receipt of a certified written claim in full compliance with 5-12.3 and ending on the date of final settlement or formal ruling.

5-12.6 Compensation for Extra Work or Delay:

5-12.6.1 Compensation for Extra Work: Notwithstanding anything to the contrary contained in the Contract Documents, the Contractor shall not be entitled to any compensation beyond that provided for in 4-3.2.

5-12.6.2 Compensation for Delay: Notwithstanding anything to the contrary contained in the Contract Documents, the additional compensation set forth in 5-12.6.2.1 shall be the Contractor's sole monetary remedy for any delay other than to perform extra work caused by the Department unless the delay shall have been caused by acts constituting willful or intentional interference by the Department with the Contractor's performance of the work and then only where such acts continue after Contractor's written notice to the Department of such interference. The parties anticipate that delays may be caused by or arise from any number of events during the term of the Contract, including, but not limited to, work performed, work deleted, supplemental agreements, work orders, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right-of-way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, suspensions of work by the Engineer pursuant to 8-6.1, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, special events, suspension of Contract time, or other events, forces or factors sometimes experienced in construction work. Such delays or events and their potential impacts on the performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not be deemed to constitute willful or intentional interference with the Contractor's performance of the work without clear and convincing proof that they were the result of a deliberate act, without reasonable and good-faith basis, and specifically intended to disrupt the Contractor's performance.

5-12.6.2.1 Compensation for Direct Costs, Indirect Costs, Expenses, and Profit thereon, of or from Delay: For any delay claim, the Contractor shall be entitled to monetary compensation for the actual idle labor and equipment, and indirect costs, expenses, and profit thereon, as provided for in 4-3.2.1(d) and solely for costs incurred beyond what reasonable mitigation thereof the Contractor could have undertaken.

5-12.7 Mandatory Claim Records: After giving the Engineer notice of intent to file a claim for extra work or delay, the Contractor must keep daily records of all labor, material and equipment costs incurred for operations affected by the extra work or delay. These daily records must identify each operation affected by the extra work or delay and the specific locations where work is affected by the extra work or delay, as nearly as possible. The Engineer may also keep records of all labor, material and equipment used on the operations affected by the extra work or delay. The Contractor shall, once a notice of intent to claim has been timely filed, and not less than weekly thereafter as long as appropriate, provide the Engineer a copy of the Contractor's daily records and be likewise entitled to receive a copy of the Department's daily records. The copies of daily records to be provided hereunder shall be provided at no cost to the recipient.

5-12.8 Claims For Acceleration: The Department shall have no liability for any constructive acceleration of the work, nor shall the Contractor have any right to make any claim for constructive acceleration nor include the same as an element of any claim the Contractor may otherwise submit under this Contract. If the Engineer gives express written direction for the Contractor to accelerate its efforts, such written direction will set forth the prices and other

pertinent information and will be reduced to a written Contract Document promptly. No payment will be made on a Supplemental Agreement for acceleration prior to the Department's approval of the documents.

5-12.9 Certificate of Claim: When submitting any claim, the Contractor shall certify under oath and in writing, in accordance with the formalities required by Florida law, that the claim is made in good faith, that the supportive data are accurate and complete to the Contractor's best knowledge and belief, and that the amount of the claim accurately reflects what the Contractor in good faith believes to be the Department's liability. Such certification must be made by an officer or director of the Contractor with the authority to bind the Contractor.

5-12.10 Non-Recoverable Items: The parties agree that for any claim the Department will not have liability for the following items of damages or expense:

- a. Loss of profit, incentives or bonuses;
- b. Any claim for other than extra work or delay;
- c. Consequential damages, including, but not limited to, loss of bonding capacity, loss of bidding opportunities, loss of credit standing, cost of financing, interest paid, loss of other work or insolvency;
- d. Acceleration costs and expenses, except where the Department has expressly and specifically directed the Contractor in writing "to accelerate at the Department's expense"; nor
- e. Attorney fees, claims preparation expenses and costs of litigation.

5-12.11 Exclusive Remedies: Notwithstanding any other provision of this Contract, the parties agree that the Department shall have no liability to the Contractor for expenses, costs, or items of damages other than those which are specifically identified as payable under 5-12. In the event any legal action for additional compensation, whether on account of delay, acceleration, breach of contract, or otherwise, the Contractor agrees that the Department's liability will be limited to those items which are specifically identified as payable in 5-12.

5-12.12 Settlement Discussions: The content of any discussions or meetings held between the Department and the Contractor to settle or resolve any claims submitted by the Contractor against the Department shall be inadmissible in any legal, equitable, arbitration or administrative proceedings brought by the Contractor against the Department for payment of such claim. Dispute Resolution Board, State Arbitration Board and Claim Review Committee proceedings are not settlement discussions, for purposes of this provision.

5-12.13 Personal Liability of Public Officials: In carrying out any of the provisions of the Contract or in exercising any power or authority granted to the Secretary of Transportation, Engineer or any of their respective employees or agents, there shall be no liability on behalf of any employee, officer or official of the Department for which such individual is responsible, either personally or as officials or representatives of the Department. It is understood that in all such matters such individuals act solely as agents and representatives of the Department.

5-12.14 Auditing of Claims: All claims filed against the Department shall be subject to audit at any time following the filing of the claim, whether or not such claim is part of a suit pending in the Courts of this State. The audit may be performed, at the Department's sole discretion, by employees of the Department or by any independent auditor appointed by the Department, or both. The audit may begin after ten days written notice to the Contractor, subcontractor, or supplier. The Contractor, subcontractor, or supplier shall make a good faith effort to cooperate with the auditors. As a condition precedent to recovery on any claim, the Contractor, subcontractor, or supplier must retain sufficient records, and provide full and

reasonable access to such records, to allow the Department's auditors to verify the claim and failure to retain sufficient records of the claim or failure to provide full and reasonable access to such records shall constitute a waiver of that portion of such claim that cannot be verified and shall bar recovery thereunder. Further, and in addition to such audit access, upon the Contractor submitting a written claim, the Department shall have the right to request and receive, and the Contractor shall have the affirmative obligation to provide to the Department, copies of any and all documents in the possession of the Contractor or its subcontractors, materialmen or suppliers as may be deemed relevant by the Department in its review of the basis, validity or value of the Contractor's claim.

Without limiting the generality of the foregoing, the Contractor shall upon written request of the Department make available to the Department's auditors, or upon the Department's written request for copies provide copies at the Department's expense, any or all of the following documents:

1. Daily time sheets and foreman's daily reports and diaries;
2. Insurance, welfare and benefits records;
3. Payroll register;
4. Earnings records;
5. Payroll tax return;
6. Material invoices, purchase orders, and all material and supply acquisition contracts;
7. Material cost distribution worksheet;
8. Equipment records (list of company owned, rented or other equipment used);
9. Vendor rental agreements and subcontractor invoices;
10. Subcontractor payment certificates;
11. Canceled checks for the project, including, payroll and vendors;
12. Job cost report;
13. Job payroll ledger;
14. General ledger, general journal, (if used) and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals;
15. Cash disbursements journal;
16. Financial statements for all years reflecting the operations on this project;
17. Income tax returns for all years reflecting the operations on this project;
18. All documents which reflect the Contractor's actual profit and overhead during the years this Contract was being performed and for each of the five years prior to the commencement of this Contract;
19. All documents related to the preparation of the Contractor's bid including the final calculations on which the bid was based;
20. All documents which relate to each and every claim together with all documents which support the amount of damages as to each claim;
21. Worksheets used to prepare the claim establishing the cost components for items of the claim including, but not limited to, labor, benefits and insurance, materials,

equipment, subcontractors, and all documents that establish which time periods and individuals were involved, and the hours and rates for such individuals.

5-13 Recovery Rights, Subsequent to Final Payment.

The Department reserves the right, if it discovers an error in the partial or final estimates, or if it discovers that the Contractor performed defective work or used defective materials, after the final payment has been made, to claim and recover from the Contractor or his surety, or both, by process of law, such sums as may be sufficient to correct the error or make good the defects in the work and materials.

**102 MAINTENANCE OF TRAFFIC.
(REV 10-9-12) (1-13)**

SECTION 102 (Pages 106 – 122) is deleted and the following substituted:

**SECTION 102
MAINTENANCE OF TRAFFIC**

102-1 Description.

Maintain traffic within the limits of the project for the duration of the construction period, including any temporary suspensions of the work. Construct and maintain detours. Provide facilities for access to residences, businesses, etc., along the project. Furnish, install and maintain traffic control and safety devices during construction. Furnish and install work zone pavement markings for maintenance of traffic (MOT) in construction areas. Provide any other special requirements for safe and expeditious movement of traffic specified in the Plans. MOT includes all facilities, devices and operations as required for safety and convenience of the public within the work zone.

Do not maintain traffic over those portions of the project where no work is to be accomplished or where construction operations will not affect existing roads. Do not obstruct or create a hazard to any traffic during the performance of the work, and repair any damage to existing pavement open to traffic.

Include the cost of any work that is necessary to meet the requirements of the Contract Documents under the MOT pay item, when there is not a pay item provided.

102-2 Materials.

Meet the following requirements:

- Bituminous Adhesive.....Section 970
- Temporary Retroreflective Pavement Markers...Section 990
- PaintSection 971
- Removable TapeSection 990
- Glass Spheres.....Section 971
- Temporary Traffic Control Device MaterialsSection 990
- Retroreflective and Nonreflective Sheeting
for Temporary Traffic Control DevicesSection 994

102-2.1 Temporary Traffic Control Devices: Use only the materials meeting the requirements of Section 990, Section 994, Design Standards and the Manual on Uniform Traffic Control Devices (MUTCD).

102-2.2 Detour: Provide all materials for the construction and maintenance of all detours.

102-2.3 Commercial Materials for Driveway Maintenance: Provide materials of the type typically used for base, including recycled asphalt pavement material, and having stability and drainage properties that will provide a firm surface under wet conditions.

102-3 Specific Requirements.

102-3.1 Beginning Date of Contractor's Responsibility: Maintain traffic starting the day work begins on the project or on the first day Contract time is charged, whichever is earlier.

102-3.2 Worksite Traffic Supervisor: Provide a worksite traffic supervisor in accordance with Section 105. Provide the worksite traffic supervisor with all equipment and materials needed to set up, take down, maintain traffic control, and handle traffic-related situations.

Ensure that the worksite traffic supervisor performs the following duties:

1. Performs on site direction of all traffic control on the project.
2. Is on site during all set up and take down, and performs a drive through inspection immediately after set up.
3. Is on site during all nighttime operations to ensure proper MOT.
4. Immediately corrects all safety deficiencies and does not permit minor deficiencies that are not immediate safety hazards to remain uncorrected for more than 24 hours.
5. Is available on a 24 hour per day basis and present within 45 minutes after notification of an emergency situation and is prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.
6. Conducts daily daytime and weekly nighttime inspections of projects with predominately daytime work activities, and daily nighttime and weekly daytime inspections of projects with predominantly nighttime work activities of all traffic control devices, traffic flow, pedestrian, bicyclist, and business accommodations.

Advise the project personnel of the schedule of these inspections and give them the opportunity to join in the inspection as is deemed necessary. Submit a comprehensive weekly report, using the Department's currently approved form, to the Engineer detailing the condition of all traffic control devices (including pavement markings) being used. Include assurances in the inspection report that pedestrians are accommodated with a safe, accessible travel path around work sites separated from mainline traffic in compliance with the Americans with Disabilities Act (ADA) Standards for Transportation Facilities, that existing or detoured bicyclist paths are being maintained satisfactorily throughout the project limits, and that existing businesses in work areas are being provided with adequate entrances for vehicular and pedestrian traffic during business hours. Have the worksite traffic supervisor sign the report and certify that all of the above issues are being handled in accordance with the Contract Documents. When deficiencies are found, the worksite traffic supervisor is to note such deficiencies and include the proposed corrective actions, including the date corrected.

The Department may disqualify and remove from the project a worksite traffic supervisor who fails to comply with the provisions of this Section. The Department may temporarily suspend all activities, except traffic, erosion control and such other activities that are necessary for project maintenance and safety, for failure to comply with these provisions.

102-4 Alternative Traffic Control Plan.

The Contractor may propose an alternative traffic control plan (TCP) to the plan presented in the Contract Documents. Have the Contractor's Engineer of Record sign and seal the alternative plan. Prepare the TCP in conformance with and in the form outlined in the current version of the Department's Plans Preparation Manual. Indicate in the plan a TCP for each phase of activities. Take responsibility for identifying and assessing any potential impacts to a utility that may be caused by the alternate TCP proposed by the Contractor, and notify the Department in writing of any such potential impacts to utilities.

Engineer's approval of the alternate TCP does not relieve the Contractor of sole responsibility for all utility impacts, costs, delays or damages, whether direct or indirect, resulting from Contractor initiated changes in the design or construction activities from those in the original Contract Specifications, Design Plans (including TCPs) or other Contract Documents and which effect a change in utility work different from that shown in the Utility Plans, joint project agreements or utility relocation schedules.

The Department reserves the right to reject any alternative TCP. Obtain the Engineer's written approval before beginning work using an alternate TCP. The Engineer's written approval is required for all modifications to the TCP. The Engineer will only allow changes to the TCP in an emergency without the proper documentation.

102-5 Traffic Control.

102-5.1 Standards: FDOT Design Standards are the minimum standards for the use in the development of all TCPs. The MUTCD, Part VI is the minimum national standard for traffic control for highway construction, maintenance, and utility operations. Follow the basic principles and minimum standards contained in these documents for the design, application, installation, maintenance, and removal of all traffic control devices, warning devices and barriers which are necessary to protect the public and workers from hazards within the project limits.

102-5.2 Maintenance of Roadway Surfaces: Maintain all lanes that are being used for the MOT, including those on detours and temporary facilities, under all weather conditions. Keep the lanes reasonably free of dust, potholes and rutting. Provide the lanes with the drainage facilities necessary to maintain a smooth riding surface under all weather conditions.

102-5.3 Number of Traffic Lanes: Maintain one lane of traffic in each direction. Maintain two lanes of traffic in each direction at existing four (or more) lane cross roads, where necessary to avoid undue traffic congestion. Construct each lane used for MOT at least as wide as the traffic lanes existing in the area before commencement of construction. Do not allow traffic control and warning devices to encroach on lanes used for MOT.

The Engineer may allow the Contractor to restrict traffic to one-way operation for short periods of time provided that the Contractor employs adequate means of traffic control and does not unreasonably delay traffic. When a construction activity requires restricting traffic to one-way operations, locate the flaggers within view of each other when possible. When visual contact between flaggers is not possible, equip them with 2-way radios, official, or pilot vehicles, or use traffic signals.

102-5.4 Crossings and Intersections: Provide and maintain adequate accommodations for intersecting and crossing traffic. Do not block or unduly restrict any road or street crossing the project unless approved by the Engineer. Before beginning any construction, provide the Engineer the names and phone numbers of persons that can be contacted when signal operation malfunctions.

102-5.5 Access for Residences and Businesses: Provide continuous access to all residences and all places of business.

102-5.6 Protection of the Work from Injury by Traffic: Where traffic would be injurious to a base, surface course, or structure constructed as a part of the work, maintain all traffic outside the limits of such areas until the potential for injury no longer exists.

102-5.7 Flagger: Provide trained flaggers in accordance with Section 105.

102-5.8 Conflicting Pavement Markings: Where the lane use or where normal vehicle or pedestrian paths are altered during construction, remove all pavement markings (paint, tape, thermoplastic, raised pavement markers, etc.) that will conflict with the adjusted vehicle or pedestrian paths. Use of paint to cover conflicting pavement markings is prohibited. Remove conflicting pavement markings using a method that will not damage the surface texture of the pavement and which will eliminate the previous marking pattern regardless of weather and light conditions.

Remove all pavement markings that will be in conflict with “next phase of operation” vehicle pedestrian paths as described above, before opening to vehicle traffic or use by pedestrians.

Cost for removing conflicting pavement markings (paint, tape, thermoplastic, raised pavement markers, etc.) to be included in Maintenance of Traffic, Lump Sum.

102-5.9 Vehicle and Equipment Visibility: Equip all pickups and automobiles used on the project with a minimum of one Class 2 amber or white warning light that meets the Society of Automotive Engineers Recommended Practice SAE J595, dated November 1, 2008, or SAE J845, dated December 1, 2007, and incorporated herein by reference. Existing lights that meet SAE J845, dated March, 1992, or SAE J1318, dated April, 1986, may be used to its end of service life. Lights should be unobstructed by ancillary vehicle equipment such as ladders, racks or booms. If the light is obstructed, additional lights will be required. The lights shall be operating when a vehicle is in a work area where a potential hazard exists, when operating the vehicle at less than the average speed for the facility while performing work activities, making frequent stops or called for in the Plans or Design Standards.

Equip all other vehicles and equipment with a minimum of 4 square feet of retroreflective sheeting or flashing lights.

To avoid distraction to motorists, do not operate the lights on the vehicles or equipment when the vehicles are outside the clear zone or behind a barrier.

102-5.10 No Waiver of Liability: Conduct operations in such a manner that no undue hazard results due to the requirements of this Article. The procedures and policies described herein in no way acts as a waiver of any terms of the liability of the Contractor or his surety.

102-6 Detours.

102-6.1 General: Construct and maintain detour facilities wherever it becomes necessary to divert traffic from any existing roadway or bridge, or wherever construction operations block the flow of traffic.

102-6.2 Construction: Plan, construct, and maintain detours for the safe passage of traffic in all conditions of weather. Provide the detour with all facilities necessary to meet this requirement. Where pedestrian facilities are detoured, blocked or closed during the work, provide safe alternate accessible routes through or around the work zone meeting the requirements of the ADA Standards for Transportation Facilities.

When the Plans call for the Department to furnish detour bridge components, construct the pile bents in accordance with the Plans, unless otherwise authorized by the Engineer.

Submit a letter with the following: company name, phone number, office address, project contact person, project number, detour bridge type, bridge length, span length, location and usage time frames, to the Engineer at least 30 calendar days before the intended pick-up date, to obtain the storage facility location and list of components for the project. Upon receipt of letter, the Engineer will, within ten calendar days provide an approved material list to the Contractor and the appropriate Department storage yard.

Provide a letter with an original company seal, identifying the representative with authority to pick up components, to the Engineer at least 10 calendar days before the proposed pick-up date. The Department is not obligated to load the bridge components without this notice. Take responsibility and sign for each item loaded at the time of issuance.

Provide timber dunnage, and transport the bridge components from the designated storage facility to the job site. Unload, erect, and maintain the bridge, then dismantle the bridge and load and return the components to the designated storage facility.

Notify the Engineer in writing at least 10 calendar days before returning the components. Include in this notice the name of the Contractor's representative authorized to sign for return of the bridge components. The yard supervisor is not obligated to unload the bridge components without this notice.

The Department will provide equipment and an operator at the Department's storage facility to assist in loading and unloading the bridge components. Furnish all other labor and equipment required for loading and unloading the components.

The Department's representative will record all bridge components issued or returned on the Detour Bridge Issue and Credit Ticket. The tickets must be signed by a Department and a Contractor representative, after loading or unloading each truck to document the quantity and type of bridging issued or returned.

Bind together all bridge components to be returned in accordance with the instructions given by the storage facility. The yard supervisor will repack components that are not packed in compliance with these instructions. Upon request, written packing instructions will be made available to the Contractor, before dismantling of the bridge for return to the Department's storage facility.

Assume responsibility for any shortage or damage to the bridge components. Monies due the Contractor will be reduced at the rate of \$35.00 per hour plus materials for repacking, repairs or replacement of bridge components.

The skid resistance of open steel grid decking on the detour bridge may decrease gradually after opening the bridge to traffic. The Department will furnish a pneumatic floor scabbler machine for roughening the roadway surface of the detour bridge decking. Provide an air compressor at the job site with 200 cubic foot per minute capacity, 90 psi air pressure for the power supply of the machine, and an operator. Transport the scabbler machine to and from the Department's structures shop. Repair any damage to the scabbler machine caused by operations at no expense to the Department. Perform scabbling when determined necessary by the Engineer. The Department will pay for the cost of scabbling as Unforeseeable Work in accordance with 4-4.

Return the bridge components to the designated storage facility beginning no later than 10 calendar days after the date the detour bridge is no longer needed, the date the new

bridge is placed in service, or the date Contract Time expires, whichever is earliest. Return the detour bridging at an average of not less than 200 feet per week. Upon failure to return the bridge components to the Department within the time specified, compensate the Department for the bridge components not returned at the rate of \$5.00 per 10 feet, per day, per bridge, for single lane; and \$10.00 per 10 feet, per day, per bridge, for dual lane until the bridge components are returned to the Department.

102-6.3 Construction Methods: Select and use construction methods and materials that provide a stable and safe detour facility. Construct the detour facility to have sufficient durability to remain in good condition, supplemented by maintenance, for the entire period that the detour is required.

102-6.4 Removal of Detours: Remove detours when they are no longer needed and before the Contract is completed. Take ownership of all materials from the detour and dispose of them, except for the materials on loan from the Department with the stipulation that they are returned.

102-6.5 Detours Over Existing Roads and Streets: When the Department specifies that traffic be detoured over roads or streets outside the project area, do not maintain such roads or streets. However, maintain all signs and other devices placed for the purpose of the detour.

102-6.6 Operation of Existing Movable Bridges: The Department will maintain and operate existing moveable bridges that are to be removed by the Contractor until such time as they are closed to traffic. During this period, make immediate repairs of any damage to such structures caused by use or operations related to the work at no expense to the Department, but do not provide routine repairs or maintenance. In the event that use or operations result in damage to a bridge requiring repairs, give such repairs top priority to any equipment, material, or labor available.

102-7 Traffic Control Officer.

Provide uniformed law enforcement officers, including marked law enforcement vehicles, to assist in controlling and directing traffic in the work zone when the following types of work is necessary on projects:

1. Directing traffic/overriding the signal in a signalized intersection.
2. When Design Standards, Index No. 619 is used on freeway facilities (interstates, toll roads, and expressways) at nighttime for work within the travel lane.
3. When Design Standards, Index No. 655 Traffic Pacing for overhead work is called for in the Plans or approved by the Engineer.
4. When pulling conductor/cable above an open traffic lane on limited access facilities, when called for in the Plans or approved by the Engineer.
5. When Design Standards, Index No. 625 Temporary Road Closure 5 Minutes or Less is used.

102-8 Driveway Maintenance.

102-8.1 General: Ensure that each residence and business has safe, stable, and reasonable access.

102-8.2 Construction Methods: Place, level, manipulate, compact, and maintain the material, to the extent appropriate for the intended use.

As permanent driveway construction is accomplished at a particular location, the Contractor may salvage and reuse previously placed materials that are suitable for reuse on other driveways.

102-9 Temporary Traffic Control Devices.

102-9.1 Installation and Maintenance: Install and maintain temporary traffic control devices as detailed in the Plans, Index 600 of the Design Standards and when applicable, in accordance with the approved vendor drawings, as provided on the Department's Qualified Products List (QPL) or the Department's Approved Products List (APL). Erect the required temporary traffic control devices to prevent any hazardous conditions and in conjunction with any necessary traffic re-routing to protect the traveling public, workers, and to safeguard the work area. Use only those devices that are on the QPL or the APL. Immediately remove or cover any devices that do not apply to existing conditions.

All temporary traffic control devices must meet the requirements of National Cooperative Highway Research Program Report 350 (NCHRP 350) or the Manual for Assessing Safety Hardware 2009 (MASH) and current FHWA directives. Manufacturers seeking evaluation must furnish certified test reports showing that their product meets all test requirements set forth by NCHRP 350 or the MASH. Manufacturers seeking evaluation of Category I devices for inclusion on the QPL shall include the manufacturer's self-certification letter. Manufacturer's seeking evaluation of Category II and Category III devices for inclusion on the QPL shall include the FHWA WZ numbered acceptance letter with attachments and vendor drawings of the device in sufficient detail to enable the Engineer to distinguish between this and similar devices. For devices requiring field assembly or special site preparation, vendor drawings shall include all field assembly details and technical information necessary for proper application and installation and must be signed and sealed by a Professional Engineer registered in the State of Florida. Manufacturers seeking evaluation of Category IV devices for inclusion on the QPL or APL must comply with the requirements of Section 990 and include detailed vendor drawings of the device along with technical information necessary for proper application, field assembly and installation.

Ensure that the QPL or APL number is permanently marked on the device at a readily visible location. Sheeting used on devices is exempt from this marking requirement.

Notify the Engineer of any scheduled operation which will affect traffic patterns or safety sufficiently in advance of commencing such operation to permit his review of the plan for the proposed installation of temporary traffic control devices.

Ensure an employee is assigned the responsibility of maintaining the position and condition of all temporary traffic control devices throughout the duration of the Contract. Keep the Engineer advised at all times of the identification and means of contacting this employee on a 24 hour basis.

Keep temporary traffic control devices in the correct position, properly directed, clearly visible and clean, at all times. Ensure that all traffic control devices meet acceptable standards as outlined in American Traffic Safety Services Association (ATSSA) "Quality Guidelines for Temporary Traffic Control Devices and Features". Immediately repair, replace or clean damaged, defaced or dirty devices.

102-9.2 Work Zone Signs: Provide signs in accordance with the Plans and Design Standards. Meet the requirements of 700-2.5 and 990-8 Use only approved systems, which includes sign support posts or stands and attachment hardware (nuts, bolts, clamps, brackets, braces, etc.), meeting the vendor requirements specified on the QPL drawings.

Attach the sign to the sign support using hardware meeting the manufacturer's recommendations and as specified in the Design Standards.

Provide Federal Highway Administration's (FHWA) accepted sign substrate for use with accepted sign stands on the National Highway System (NHS) under the provisions of the NCHRP Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

102-9.3 Business Signs: Provide and place signs in accordance with the Plans and Design Standards, Index No. 600 series. Furnish signs having retroreflective sheeting meeting the requirements of Section 990.

102-9.4 High Intensity Flashing Lights: Furnish Type B lights in accordance with the Plans and Design Standards.

102-9.5 Warning/Channelizing Devices: Furnish warning/channelizing devices in accordance with the Plans and Design Standards.

102-9.5.1 Retroreflective Collars for Traffic Cones: Use collars for traffic cones listed on the QPL that meet the requirements of Section 990. Use cone collars at night designed to properly fit the taper of the cone when installed. Place the upper 6 inch collar a uniform 3-1/2 inches distance from the top of the cone and the lower 4 inch collar a uniform 2 inches distance below the bottom of the upper 6 inch collar. Ensure that the collars are capable of being removed for temporary use or attached permanently to the cone in accordance with the manufacturer's recommendations. Provide a white sheeting having a smooth outer surface and that has the property of a retroreflector over its entire surface.

102-9.5.2 Barrier Wall (Temporary): Furnish, install, maintain, remove and relocate a temporary barrier wall in accordance with the Plans. Ensure that temporary concrete barrier wall for use on roadway sections, complies with Design Standards, Index Nos. 412, 415 or 414 as specified in the Plans. Ensure that temporary concrete barrier wall for use on bridge and wall sections, complies with Design Standards, Index No 414 as specified in the Plans. Ensure that temporary water filled barrier wall used on roadway sections meets the NCHRP Report 350 criteria or the MASH and is listed on the QPL. Barriers meeting the requirements of Design Standards, Index Nos. 412, 415 or temporary water filled barriers on the QPL will not be accepted as an alternate to barriers meeting the requirements of Design Standards, Index No. 414.

102-9.5.3 Glare Screen (Temporary): Use temporary glare screens listed on the QPL that meet the requirements of Section 990. Furnish, install, maintain, remove and relocate glare screen systems in conjunction with temporary barrier wall at locations identified in the Plans.

Ensure the anchorage of the glare screen to the barrier is capable of safely resisting an equivalent tensile load of 600 pounds per foot of glare screen, with a requirement to use a minimum of three fasteners per barrier section.

When glare screen is utilized on temporary barrier wall, warning lights will not be required.

102-9.6 Temporary Crash Cushion (Redirective/Gating): Furnish, install, maintain and subsequently remove temporary crash cushions in accordance with the details and notes shown in the Plans, the Design Standards, and requirements of the pre-approved alternatives listed on the QPL. Maintain the crash cushions until their authorized removal. Repair all attachment scars to permanent structures and pavements after crash cushion removal. Make necessary repairs due to defective material, work, or Contractor operations at no cost to the

Department. Restore crash cushions damaged by the traveling public within 24 hours after notification as authorized by the Engineer.

102-9.7 Guardrail (Temporary): Furnish guardrail (temporary) in accordance with the Plans and Design Standards. Meet the requirements of Section 536.

102-9.8 Arrow Board: Furnish arrow boards that meet the requirements of Section 990 as required by the Plans and Design Standards to advise approaching traffic of lane closures or shoulder work. Type B arrow boards may be used on low to intermediate speed (0 mph to 50 mph) facilities or for maintenance or moving operations on any speed facility. Type C arrow boards shall be used for all other operations on high-speed (50 mph and greater) facilities and may be substituted for Type B arrow boards on any speed facility.

102-9.9 Portable Changeable Message Sign (PCMS): Furnish PCMSs that meet the requirements of Section 990 as required by the Plans and Design Standards to supplement other temporary traffic control devices used in work zones.

A truck mounted PCMS may be used as a stand alone MOT device only when used for accident or incident management situations as defined in the MUTCD and is listed on the APL.

102-9.10 Portable Regulatory Signs (PRS): Furnish PRSs that meet the requirements of 990 as required by the Plans and Design Standards.

Activate portable regulatory signs only during active work activities and deactivate when no work is being performed.

102-9.11 Radar Speed Display Unit (RSDU): Furnish RSDUs that meet the requirements of Section 990 as required by the Plans and Design Standards to inform motorists of the posted speed and their actual speed.

Activate the radar speed display unit only during active work activities and deactivate when no work is being performed.

102-9.12 Temporary Signalization and Maintenance: Provide temporary signalization and maintenance at existing, temporary, and new intersections including but not limited to the following:

- (1) Installation of temporary poles and span wire assemblies as shown in the Plans,
- (2) Temporary portable traffic signals as shown in the Plans,
- (3) Adding or shifting signal heads,
- (4) Trouble calls,
- (5) Maintaining intersection and coordination timing and preemption devices.

Restore any loss of operation within 12 hours after notification.

Provide traffic signal equipment that meets the requirements of the Design Standards and 603-2. The Engineer may approve used signal equipment if it is in acceptable condition. Replacement components for traffic signal cabinet assemblies will be provided by the maintaining agency.

102-9.13 Temporary Traffic Detection and Maintenance: Provide temporary traffic detection and maintenance at existing, temporary, and new signalized intersections. Provide temporary traffic detection equipment listed on the APL. Restore any loss of detection within 12 hours. Ensure 90% accuracy per signal phase, measured at the initial installation and after any lane shifts, by comparing sample data collected from the detection system with ground truth data collected by human observation. Collect the sample and ground truth data for a minimum of five

minutes during a peak and five minutes during an off-peak period with a minimum three detections for each signal phase. Perform the test in the presence of the Engineer.

102-9.14 Truck Mounted Attenuators and Trailer Mounted Attenuators: Furnish, install and maintain only those attenuators that meet the requirements of NCHRP 350 or the MASH.

Use truck mounted attenuators or trailer mounted attenuators, when called for in the Design Standards. Use attenuators listed on the QPL.

When attenuators are called for, use either a truck mounted attenuator or a trailer mounted attenuator system designed and installed in accordance with the manufacturers recommendations.

Equip the attenuator cartridge with lights and reflectors in compliance with applicable Florida motor vehicle laws, including turn signals, dual tail lights, and brake lights. Ensure that lights are visible in both the raised and lowered positions if the unit is capable of being raised.

Ensure that the complete unit is painted DOT yellow (Fed. Std. 595 b, No. 13538). Stripe the rear facing of the cartridge in the operating position with the alternating 6 inch white and 6 inch safety orange 45 degree striping to form an inverted "V" at the center of the unit and slope down and toward the outside of the unit, in both directions from the center. In the raised position, place at least the same square footage of striping on the bottom of the cartridge as placed on the rear facing cartridge in the open position. Use Type III retroreflectorized sheeting for striping.

Attenuators will not be paid for separately. Include the cost of the truck with either a truck mounted attenuator or a trailer mounted attenuator in MOT Lump Sum. Payment includes all costs, including furnishing, maintaining and removal when no longer required, and all materials, labor, tools, equipment and incidentals required for attenuator maintenance.

102-9.15 Temporary Raised Rumble Strip Sets: When called for in the Plans, furnish, install, maintain, remove, and reinstall temporary raised rumble strip sets.

Install the temporary raised rumble strip sets per the manufacturer's recommendations and in accordance with Design Standards, Index No. 600.

The temporary raised rumble strip may be either a removable polymer striping tape or a molded engineered polymer material.

102-9.16 Automated Flagger Assistance Devices (AFAD): Furnish, install, maintain, remove and relocate AFADs in accordance with the Plans and Design Standards. Position AFADs where they are clearly visible to oncoming traffic and out of the lane of traffic. The devices may be operated either by a single flagger at one end of the traffic control zone, from a central location, or by a separate flagger near each device's location.

AFADs may be either a remotely controlled Stop/Slow AFAD mounted on either a trailer or a movable cart system, or a remotely controlled Red/Yellow Lens AFAD.

AFADs will not be paid for separately. AFADs may be used as a supplement or an alternate to flaggers in accordance with Index 603. Include the cost for AFADs in Maintenance of Traffic Lump Sum.

102-9.17 Temporary Lane Separator: Furnish, install, maintain, remove and relocate temporary lane separator in accordance with the Plans and Design Standards, Index No 600. Anchor the portable temporary lane separator with a removable anchor bolt. Use epoxy on bridge decks where anchoring is not allowed. Remove the epoxy from the bridge deck by hydroblasting or other method approved by the Engineer.

102-10 Work Zone Pavement Marking.

102-10.1 Description: Furnish and install work zone pavement markings for MOT in construction areas and in close conformity with the lines and details shown in the Plans and Design Standards.

Centerlines, lane lines, edge lines, stop bars and turn arrows will be required in work zones prior to opening the road to traffic.

The most common types of work zone pavement markings are painted pavement markings and removable tape. Other types of work zone pavement markings may be identified in the Plans.

102.10.2 Painted Pavement Markings:

102-10.2.1 General: Use painted pavement markings meeting the requirements of Section 710. Use standard waterborne paint unless otherwise identified in the Plans or approved by the Engineer.

102-10.3 Removable Tape:

102-10.3.1 General: Use removable tape listed on the QPL and meeting the requirements of 990-4.

102-10.3.2 Application: Apply removable tape with a mechanical applicator to provide pavement lines that are neat, accurate and uniform. Equip the mechanical applicator with a film cut-off device and with measuring devices that automatically and accumulatively measure the length of each line placed within an accuracy tolerance of plus or minus 2%. Ensure removable tape adheres to the road surface. Removable tape may be placed by hand on short sections, 500 feet or less, if it is done in a neat accurate manner.

102-10.3.3 Retroreflectivity: Apply white and yellow traffic stripes and markings that will attain an initial retroreflectivity of not less than 300 mcd/lx·m² for white and contrast markings and not less than 250 mcd/lx·m² for yellow markings. Black portions of contrast tapes and black masking tapes must be non-reflective and have a reflectance of less than 5 mcd/lx m². At the end of the six month service life, the retroreflectance of white and yellow removable tape shall not be less than 150 mcd/lx·m².

102-10.3.4 Removability: Provide removable tape capable of being removed from bituminous concrete and portland cement concrete pavement intact or in substantially large strips, either manually or by a mechanical roll-up device, at temperatures above 40°F, without the use of heat, solvents, grinding or blasting.

102-10.4 Temporary Retroreflective Pavement Markers (RPM's): Use markers listed on the QPL and meeting the requirements of 990-5. Apply all markers in accordance with the Design Standards, Index No. 600, prior to opening the road to traffic. Replace markers any time after installation when more than three consecutive markers fail or are missing, at no expense to the Department, in a timely manner, as directed by the Engineer.

102-11 Method of Measurement.

102-11.1 General: Devices installed/used on the project on any calendar day or portion thereof, within the allowable Contract Time, including time extensions which may be granted, will be paid for at the Contract unit price for the applicable pay item, except those paid for as Lump Sum.

102-11.2 Traffic Control Officers: The quantity to be paid for will be at the Contract unit price per hour (4 hour minimum) for the actual number of officers certified to be on the project site, including any law enforcement vehicles and all other direct and indirect costs.

Payment will be made only for those traffic control officers specified in the Plans and authorized by the Engineer.

102-11.3 Special Detours: When a detour facility is specifically detailed in the Plans, or is otherwise described or detailed as a special item, and an item for separate payment is included in the proposal, the work of constructing, maintaining, and subsequently removing such detour facilities will be paid for separately. Traffic control devices, warning devices, barriers, signing, and pavement markings for special detours will also be paid for separately.

When the Plans show more than one detour, each detour will be paid for separately, at the Contract lump sum price for each.

Where a separate item for a specific detour facility is included in the proposal, payment will be made under special detour.

102-11.4 Commercial Material for Driveway Maintenance: The quantity to be paid for will be the certified volume, in cubic yards, of all materials authorized by the Engineer, acceptably placed and maintained for driveway maintenance. The volume, which is authorized to be reused, and which is acceptably salvaged, placed, and maintained in other designated driveways will be included again for payment.

102-11.5 Work Zone Signs: The number of temporary post-mounted signs (temporary regulatory, warning and guide) certified as installed/used on the project will be paid for at the Contract unit price for work zone signs. When multiple signs are located on single or multiple posts, each sign panel will be paid individually. Signs greater than 20 square feet and detailed in the Plans will be paid for under Lump Sum MOT.

Temporary portable signs (excluding mesh signs) and vehicular mounted signs will be included for payment under work zone signs, only if used in accordance with the Design Standards.

102-11.6. Business Signs: The number of business signs certified as installed/used on the project will be paid for at the Contract unit price for business signs.

102-11.7 High Intensity Flashing Lights: The number of high intensity flashing lights (Type B) certified as installed/used on the project will be paid for at the Contract unit price for high intensity flashing lights (temporary - Type B).

102-11.8 Channelizing Devices: The number of Type I, Type II, direction indicator barricade, Type III, vertical panel, drum and longitudinal channelizing devices certified as installed/used on the project meeting the requirements of Design Standards, Index No. 600 and have been properly maintained will be paid for at the Contract unit prices for barricade (temporary). Payment will be made for each channelizing device that is used to delineate trailer mounted devices. Payment will be made for channelizing devices delineating portable changeable message signs during the period beginning 14 working days before Contract Time begins as authorized by the Engineer.

102-11.9 Barrier Wall (Temporary): The Contract unit price for barrier wall (temporary) will be full compensation for furnishing, installing, maintaining, and removing the barrier wall. When called for, the Contract unit price for barrier wall (temporary/relocate) will be full compensation for relocating the barrier. The certified quantity to be paid for will be determined by the number of sections times the nominal length of each section.

102-11.10 Lights, Temporary, Barrier Wall Mount: The number of Type C steady burn lights, mounted on barrier wall, certified as installed/used on the project, meeting the requirements of the Design Standards and have been properly maintained will be paid for at the Contract unit price for lights temporary, barrier wall mount.

102-11.11 Glare Screen (Temporary): The certified quantity to be paid for will be determined by the number of sections times the nominal length of each section.

102-11.12 Temporary Crash Cushions:

102-11.12.1 Redirective: The quantity to be paid for will be the number of temporary crash cushions (redirective) certified as installed/used and maintained on the project, including object marker.

102-11.12.2 Gating: The quantity to be paid for will be the number of temporary crash cushions (gating) certified as installed/used and maintained on the project, including object marker.

102-11.13 Temporary Guardrail: The quantity to be paid for will be the length, in feet, of temporary guardrail constructed and certified as installed/used on the project. The length of a run of guardrail will be determined as a multiple of the nominal panel lengths.

102-11.14 Arrow Board: The quantity to be paid at the contract unit price will be for the number of arrow boards certified as installed/used on the project on any calendar day or portion thereof within the contract time.

102-11.15 Portable Changeable Message Sign: The quantity to be paid at the Contract unit price will be for the number of portable changeable message signs certified as installed/used on the project on any calendar day or portion thereof within the contract time. Payment will be made for each portable changeable message sign that is used during the period beginning fourteen working days before Contract Time begins as authorized by the Engineer.

102-11.16 Portable Regulatory Signs: The quantity to be paid for will be the number of portable regulatory signs certified as installed/used on the project on any calendar day or portion thereof within the Contract time, will be paid for the Contract unit price for portable regulatory sign.

102-11.17 Radar Speed Display Unit: The quantity to be paid for will be the number of radar speed display units certified as installed/used on the project on any calendar day or portion thereof within the Contract Time, will be paid for the Contract unit price for radar speed display unit.

102-11.18 Temporary Signalization and Maintenance: For existing intersections, the quantity to be paid for will be the number of signalized intersections per day for the full duration of the Contract. For temporary intersections, the quantity to be paid for will be the number of signalized intersections per day for the duration of the temporary intersection. No separate payment will be made for temporary signalization and maintenance at new intersections.

102-11.19 Temporary Traffic Detection and Maintenance: For existing intersections, the quantity to be paid for will be the number of signalized intersections per day beginning the day Contract Time begins and ending the day the permanent detection is operational and the final lane configuration is in place. For temporary and new intersections, the quantity to be paid for will be the number of signalized intersections per day beginning the day the temporary detection is functional and ending the day: the permanent detection is operational and the final lane configuration is in place for a new intersection; or, when the detection is removed for a temporary intersection.

102-11.20 Work Zone Pavement Markings: The quantities, furnished and installed, to be paid for will be the length of skip and solid pavement markings, and the area of pavement markings placed as follows:

(a) The total transverse distance, in feet, of skip pavement marking authorized and acceptably applied. The length of actual applied line will depend on the skip ratio of the material

used. Measurement will be the distance from the beginning of the first stripe to the end of the last stripe with proper deductions made for unpainted intervals as determined by plan dimensions or stations, subject to 9-1.3.

(b) The net length, in feet, of solid pavement marking authorized and acceptably applied.

(c) The number of directional arrows or pavement messages authorized and acceptably applied.

(d) The number of temporary RPM's authorized and acceptably applied.

102-11.21 Temporary Raised Rumble Strips: The quantity to be paid for will be the number of temporary raised rumble strip sets certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.22 Temporary Lane Separator: The quantity of temporary lane separator to be paid for will be plan quantity, in feet, including drainage gaps, completed and accepted.

102-12 Submittals.

102-12.1 Submittal Instructions: Prepare a certification of quantities, using the Department's current approved form, for certified MOT payment items for each project in the Contract. Submit the certification of quantities to the Engineer. The Department will not pay for any disputed items until the Engineer approves the certification of quantities.

102-12.2 Contractor's Certification of Quantities: Request payment by submitting a certification of quantities no later than Twelve O'clock noon Monday after the estimate cut-off date or as directed by the Engineer, based on the amount of work done or completed. Ensure the certification consists of the following:

(a) Contract Number, FPID Number, Certification Number, Certification Date and the period that the certification represents.

(b) The basis for arriving at the amount of the progress certification, less payments previously made and less an amount previously retained or withheld. The basis will include a detail breakdown provided on the certification of items of payment in accordance with 102-13. After the initial setup of the MOT items and counts, the interval for recording the counts will be made weekly on the certification sheet unless there is a change. This change will be documented on the day of occurrence. Some items may necessitate a daily interval of recording the counts.

102-13 Basis of Payment.

102-13.1 Maintenance of Traffic (General Work): When an item of work is included in the proposal, price and payment will be full compensation for all work and costs specified under this Section except as may be specifically covered for payment under other items.

102-13.2 Traffic Control Officers: Price and payment will be full compensation for the services of the traffic control officers.

102-13.3 Special Detours: Price and payment will be full compensation for providing all detour facilities shown in the Plans and all costs incurred in carrying out all requirements of this Section for general MOT within the limits of the detour, as shown in the Plans.

102-13.4 Commercial Materials for Driveway Maintenance: Price and payment will be full compensation for all work and materials specified for this item, including specifically all required shaping and maintaining of driveways.

102-13.5 Work Zone Signs: Price and payment will be full compensation for all work and materials for furnishing signs, supports and necessary hardware, installation, relocating, maintaining and removing signs.

102-13.6. Business Signs: Price and payment will be full compensation for all materials and labor required for furnishing, installing, relocating, maintaining, and removing the signs as well as the cost of installing any logos provided by business owners.

102-13.7 High Intensity Warning Lights: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining and removing high intensity flashing lights (Type B).

102-13.8 Channelizing Devices: Prices and payment will be full compensation for furnishing, installing, relocating, maintaining and removing the channelizing devices, including the costs associated with attached warning lights as required.

102-13.9 Barrier Wall (Temporary): Price and payment will be full compensation for furnishing, installing, maintaining, and removing the barrier. When called for, barrier wall (temporary) (relocate) will be full compensation for relocating the barrier.

102-13.10 Lights, Temporary, Barrier Wall Mount: Price and payment will be full compensation for all work and materials for furnishing, installing and maintaining the warning lights mounted on barrier wall. Payment will not be made for lights that are improperly placed or are not working.

102-13.11 Glare Screen (Temporary): Price and payment will be full compensation for furnishing, installing, maintaining, and removing the glare screen certified as installed/used on the project. When called for, glare screen (relocate) will be full compensation for relocating the glare screen.

102-13.12 Temporary Crash Cushion (Redirective/Gating): Price and payment will be full compensation for furnishing, installing, maintaining and subsequently removing such crash cushions. Payment for restoring damaged crash cushions will be the manufacturer's/distributor's invoice price for the new materials/parts plus 20% markup. The 20% markup is compensation for all necessary work including; but not limited to, labor, equipment, supplies and profit, as authorized by the Engineer. Additional MOT required for the repair of the crash cushion will be paid for under the appropriate MOT pay item.

102-13.13 Temporary Guardrail: Price and payment will be full compensation for furnishing all materials required for a complete installation, including end anchorage assemblies and any end connections to other structures and for installing, maintaining and removing guardrail.

102-13.14 Arrow Board: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining and removing arrow boards.

102-13.15 Portable Changeable Message Sign: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining and removing portable changeable message signs.

102-13.16 Portable Regulatory Signs: Price and payment will be full compensation for furnishing, installing, relocating, maintaining and removing a completely functioning system as described in these Specifications portable regulatory signs. Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining and removing portable regulatory signs.

Payment will include all labor, materials, incidentals, repairs and any actions necessary to operate and maintain the unit at all times that work is being performed or traffic is being affected by construction and/or MOT operations.

102-13.17 Radar Speed Display Unit: Price and payment will be made only for a completely functioning system as described in these specifications. Payment will include all labor, hardware, accessories, signs, and incidental items necessary for a complete system. Payment will include any measurements needed to insure that the unit conforms to all specification requirements.

Payment will include all labor, materials, incidentals, repairs and any actions necessary to operate and maintain the unit at all times that work is being performed or traffic is being affected by construction and/or MOT operations. Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining and removing radar speed display unit.

102-13.18 Temporary Signalization and Maintenance: Price and payment will constitute full compensation for furnishing, installing, operating, maintaining and removing temporary traffic control signals including all equipment and components necessary to provide an operable traffic signal. Payment will be withheld for each day at each intersection where the temporary signalization is not operational within 12 hours after notification.

102-13.19 Temporary Traffic Detection and Maintenance: Price and payment will constitute full compensation for furnishing, installing, operating, maintaining and removing temporary traffic detection including all equipment and components necessary to provide an acceptable signalized intersection. Take ownership of all equipment and components. Payment will be withheld for each day at each intersection where the temporary detection is not operational within 12 hours after notification.

102-13.20 Temporary Raised Rumble Strips: Price and payment will be full compensation for all work and materials described in this Section, including all cleaning and preparing of surfaces, disposal of all debris, furnishing of all materials, application, curing, removal, reinstalling and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work.

102-13.21 Work Zone Pavement Markings: Price and payment will be full compensation for all work specified including, all cleaning and preparing of surfaces, furnishing of all materials, application, curing and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work. Final payment will be withheld until all deficiencies are corrected.

Removable tape may be substituted for work zone paint at no additional cost to the Department.

Payment for temporary RPMs used to supplement line markings will be paid for under temporary retroreflective pavement markers. Install these markers as detailed in the Design Standards.

102-13.22 Temporary Lane Separator: Price and payment will be full compensation for all work specified in this Section.

102-13.23 Payment Items: Payment will be made under:

- | | | |
|---------------|----|--|
| Item No. 102- | 1- | Maintenance of Traffic - lump sum. |
| Item No. 102- | 2- | Special Detour - lump sum. |
| Item No. 102- | 3- | Commercial Material for Driveway Maintenance - per cubic yard. |

Item No. 102- 14-	Traffic Control Officer - per hour.
Item No. 102- 60-	Work Zone Sign - per each per day.
Item No. 102- 61-	Business Sign - each.
Item No. 102- 71-	Barrier Wall - per foot.
Item No. 102- 75-	Temporary Lane Separator - per foot
Item No. 102- 94-	Glare Screen - per foot.
Item No. 102- 73-	Guardrail (Temporary) - per foot.
Item No. 102- 74-	Barricade (Temporary) - per each per day.
Item No. 102- 76-	Arrow Board - per each per day.
Item No. 102- 77-	High Intensity Flashing Lights (Temporary - Type B) - per each per day.
Item No. 102- 78-	Temporary Retroreflective Pavement Markers - each.
Item No. 102- 79-	Lights, Temporary, Barrier Wall Mount - per each per day.
Item No. 102- 81-	Crash Cushion (Gating) (Temporary) - per location.
Item No. 102- 89-	Crash Cushion (Redirective) (Temporary) - per location.
Item No. 102- 99-	Portable Changeable Message Sign (Temporary) - per each per day.
Item No. 102-104-	Temporary Signalization and Maintenance - per intersection per day.
Item No. 102-107-	Temporary Traffic Detection and Maintenance - per intersection per day.
Item No. 102-150-	Portable Regulatory Sign - per each per day.
Item No. 102-150-	Radar Speed Display Unit - per each per day.
Item No. 102-910-	Temporary Raised Rumble Strip Set - per set per day
Item No. 102-911-	Removable Tape (White/Black) - per foot.
Item No. 102-912-	Removable Tape (Yellow) - per foot.
Item No. 710-	Painted Pavement Markings.
Item No. 711-	Thermoplastic Traffic Stripes and Markings.

346 PORTLAND CEMENT CONCRETE.
(REV 10-9-12) (1-13)

SECTION 346 (Pages 305 – 325) is deleted and the following substituted:

SECTION 346
PORTLAND CEMENT CONCRETE

346-1 Description.

Use concrete composed of a mixture of portland cement, aggregate, water, and, where specified, admixtures, pozzolan and ground granulated blast furnace slag. Deliver the portland cement concrete to the site of placement in a freshly mixed, unhardened state.

Obtain concrete from a plant that is currently on the list of Producers with Accepted Quality Control Programs. Producers seeking inclusion on the list shall meet the requirements of 105-3. If the concrete production facility's Quality Control Plan is suspended, the Contractor is solely responsible to obtain the services of another concrete production facility with an accepted

Quality Control Plan or await the re-acceptance of the affected concrete production facility's Quality Control Plan prior to the placement of any further concrete on the project. There will be no changes in the contract time or completion dates. Bear all delay costs and other costs associated with the concrete production facility's Quality Control Plan acceptance or re-acceptance.

346-2 Materials.

346-2.1 General: Meet the following requirements:

Coarse Aggregate.....	Section 901
Fine Aggregate*	Section 902
Portland Cement.....	Section 921
Water.....	Section 923
Admixtures**	Section 924
Pozzolans and Slag	Section 929

*Use only silica sand except as provided in 902-5.2.3.

**Use products listed on the Department's Qualified Products List (QPL).

Do not use materials containing hard lumps, crusts or frozen matter, or that is contaminated with dissimilar material in excess of that specified in the above listed Sections.

346-2.2 Types of Cement: Unless a specific type of cement is designated elsewhere, use Type I, Type IP, Type IS, Type II, Type II (MH) or Type III cement in all classes of concrete. Use Type II (MH) for all mass concrete elements.

Use only the types of cements designated for each environmental condition in structural concrete. A mix design for a more aggressive environment may be substituted for a lower aggressive environmental condition.

TABLE 1			
BRIDGE SUPERSTRUCTURES			
Component	Slightly Aggressive Environment	Moderately Aggressive Environment	Extremely Aggressive Environment
Precast Superstructure and Prestressed Elements	Type I or Type III	Type I, Type II, Type III, Type IP, or Type IS	Type II (MH)
Cast In Place	Type I	Type I, Type II, Type IP, or Type IS	Type II (MH)
BRIDGE SUBSTRUCTURE, DRAINAGE STRUCTURES AND OTHER STRUCTURES			
All Elements	Type I or Type III	Type I, Type II, Type IP, or Type IS	Type II (MH)

346-2.3 Pozzolans and Slag: Fly ash or slag materials are required in all classes of concrete. Use fly ash or slag materials as a cement replacement, on an equal weight replacement basis with the following limitations:

(1) Mass Concrete:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 50% by weight, except where the core temperature is expected to rise above 165°F. In that case, ensure that the percentage of fly ash is 35% to 50% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 50% to 70% by weight. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultrafine fly ash and/or metakaolin.

c. Fly Ash and Slag - Ensure that there is at least 20% fly ash by weight and 40% portland cement by weight for mixes containing portland cement, fly ash and slag.

(2) Drilled Shaft:

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 33% to 37% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 58% to 62% by weight.

(3) Precast Concrete – Ensure that the precast concrete has a maximum of 25% fly ash or a maximum of 70% slag. In extremely aggressive environments, ensure that the precast concrete has a minimum of 18% fly ash or a minimum of 50% slag.

(4) For all other concrete uses not covered in (1), (2) and (3) above,

a. Fly Ash - Ensure that the quantity of cement replaced with fly ash is 18% to 30% by weight.

b. Slag - Ensure that the quantity of cement replaced with slag is 25% to 70% for slightly and moderately aggressive environments and 50% to 70% by weight when used in extremely aggressive environments. Ensure that slag is 50% to 55% of total cementitious content by weight when used in combination with silica fume, ultra fine fly ash and/or metakaolin.

c. Fly Ash and Slag (Ternary Blend) - Ensure that there is at least 20% fly ash by weight and 40% portland cement by weight for mixes containing portland cement, fly ash and slag.

(5) Blended Cements:

a. Type IS - Ensure that the quantity of slag in Type IS is less than or equal to 70% by weight.

b. Type IP - Ensure that the quantity of the pozzolan in Type IP is less than or equal to 40% by weight.

(6) Silica Fume, Metakaolin and Ultrafine Fly Ash - When silica fume, metakaolin or ultrafine fly ash is used, it must be used in combination with fly ash or slag.

a. Silica Fume - Ensure that the quantity of cementitious material replaced with silica fume is 3% to 9% by weight.

b. Metakaolin - Ensure that the quantity of cementitious material replaced with metakaolin is 8% to 12% by weight.

c. Ultrafine Fly Ash - Ensure that the quantity of cementitious material replaced with ultrafine fly ash is 8% to 12% by weight.

d. Cure in accordance with the manufacturer's recommendation and as approved by the Engineer.

346-2.4 Coarse Aggregate Gradation: Produce all concrete using Size No. 57, 67 or 78 coarse aggregate. With the Engineer's approval, Size No. 8 or Size No. 89 may be used either alone or blended with Size No. 57, 67 or 78 coarse aggregate. The Engineer will consider requests for approval of other gradations individually. Submit sufficient statistical data to establish production quality and uniformity of the subject aggregates, and establish the quality and uniformity of the resultant concrete. Furnish aggregate gradations sized larger than nominal maximum size of 1.5 inch as two components.

For Class I and Class II, excluding Class II (Bridge Deck), the coarse and fine aggregate gradation requirements set forth in Sections 901 and 902 are not applicable and the aggregates may be blended; however, the aggregate sources must be approved by the Department. Do not blend the aggregate if the size is smaller than Size No. 78.

346-2.5 Admixtures: Use admixtures in accordance with the requirements of this subarticle. Chemical admixtures not covered in this subarticle may be approved by the Department. Submit statistical evidence supporting successful laboratory and field trial mixes which demonstrate improved concrete quality or handling characteristics.

Use admixtures in accordance with the manufacturer's recommended dosage rate. Dosage rates outside of this range may be used with written recommendation from the admixture producer's technical representative. Do not use admixtures or additives containing calcium chloride (either in the raw materials or introduced during the manufacturing process) in reinforced concrete.

346-2.5.1 Water-Reducer/Water-Reducer Retardant Admixtures: When a water-reducing admixture is used, meet the requirements of a Type A. When a water-reducing and retarding admixture is used, meet the requirements of a Type D.

346-2.5.2 Air Entrainment Admixtures: Use an air entraining admixture in all concrete mixes except counterweight concrete. For precast concrete products, the use of air entraining admixture is optional for Class I and Class II concrete.

346-2.5.3 High Range Water-Reducing Admixtures:

346-2.5.3.1 General: When a high range water-reducing admixture is used, meet the requirements of a Type F or Type I. When a high range water-reducing and retarding admixture is used, meet the requirements of a Type G or Type II. Do not use Type I, II, F or G admixtures in drilled shaft concrete. When silica fume or metakaolin is incorporated into a concrete mix design, use a high range water-reducing admixture Type I, II, F or G.

346-2.5.3.2**Flowing Concrete Admixtures for Precast/Prestressed**

Concrete: Use a Type I, II, F or G admixture for producing flowing concrete. If Type F or G admixture is used, verify the distribution of aggregates in accordance with ASTM C 1610 except allow for minimal vibration for consolidating the concrete. The maximum allowable difference between the static segregation is less than or equal to 15 percent. Add the flowing concrete admixtures at the concrete production facility.

346-2.5.4 Corrosion Inhibitor Admixture: Use only with concrete containing Type II cement, or Type II (MH) cement, and a water-reducing retardant admixture, Type D, or High Range Water-Reducer retarder admixture, Type G, to normalize the setting time of concrete. Ensure that all admixtures are compatible with the corrosion inhibitor admixture.

346-2.5.5 Accelerating Admixture for Precast Concrete: The use of non-chloride admixtures Type C or Type E is allowed in the manufacturing of precast concrete products that are used in slightly aggressive environments.

346-3 Classification, Strength, Slump and Air Content.

346-3.1 General: The separate classifications of concrete covered by this Section are designated as Class I, Class II, Class III, Class IV, Class V and Class VI. Strength and slump are specified in Table 2. The air content range for all classes of concrete is 1.0 to 6.0%, except for Class IV (Drilled Shaft) which is 0.0 to 6.0%.

Substitution of a higher class concrete in lieu of a lower class concrete may be allowed when the substituted concrete mixes are included as part of the Contractor's Quality Control Plan, or for precast concrete, the Precast Concrete Producer's Quality Control Plan. The substituted higher class concrete must meet or exceed the requirements of the lower class concrete and both classes must contain the same types of mix ingredients. When the compressive strength acceptance data is less than the minimum compressive strength of the higher design mix, notify the Engineer. Acceptance is based on the requirements in Table 2 for the lower class concrete.

TABLE 2		
Class of Concrete	Specified Minimum Strength (28-day) (psi)	Target Slump Value (inches) (c)
STRUCTURAL CONCRETE		
I (a)	3,000	3 (b)
I (Pavement)	3,000	2
II (a)	3,400	3 (b)
II (Bridge Deck)	4,500	3 (b)
III (e)	5,000	3 (b)
III (Seal)	3,000	8
IV	5,500	3 (b) (d)
IV (Drilled Shaft)	4,000	8.5
V (Special)	6,000	3 (b) (d)
V	6,500	3 (b) (d)
VI	8,500	3 (b) (d)

(a) For precast three-sided culverts, box culverts, endwalls, inlets, manholes and junction boxes, the target slump value and air content will not apply. The maximum allowable slump is 6 inches, except as noted in (b). The Contractor is permitted to use concrete meeting the requirements of ASTM C 478 4,000 psi in lieu of Class I or Class II concrete for precast endwalls, inlets, manholes and junction boxes.

(b) The Engineer may allow a higher target slump when a Type F, G, I or II admixture is used, except when flowing concrete is used. The maximum target slump shall be 7 inches.

(c) For a reduction in the target slump for slip-form operations, submit a revision to the mix design to the Engineer.

(d) When the use of silica fume, ultrafine fly ash, or metakaolin is required as a pozzolan in Class IV, Class V, Class V (Special) or Class VI concrete, ensure that the concrete exceeds a resistivity of 29 KOhm-cm at 28 days, when tested in accordance with FM 5-578. Submit three 4 x 8 inch cylindrical test specimens to the Engineer for resistivity testing before mix design approval. Take the resistivity test specimens from the concrete of the laboratory trial batch or from the field trial batch of at least 3 cubic yards. Verify the mix proportioning of the design mix and take representative samples of trial batch concrete for the required plastic and hardened property tests. Cure the field trial batch specimens similar to the standard laboratory curing methods. Submit the resistivity test specimens at least 7 calendar days prior to the scheduled 28 day test. The average resistivity of the three cylinders, eight readings per cylinder, is an indicator of the permeability of the concrete mix.

(e) When precast three-sided culverts, box culverts, endwalls, inlets, manholes or junction boxes require a Class III concrete, the minimum cementitious materials is 470 pounds per cubic yard. Do not apply the air content range and the maximum target slump shall be 6 inches, except as allowed in (b).

346-3.2 Drilled Shaft Concrete: Notify the Engineer at least 48 hours before placing drilled shaft concrete. Obtain slump loss tests results demonstrating that the drilled shaft concrete maintains a slump of at least 5 inches throughout the concrete elapsed time before drilled shaft concrete operations begin, using personnel meeting the requirements of Section 105. The concrete elapsed time is defined in Section 455. Obtain the Engineer's approval for use of slump loss test results including elapsed time before concrete placement begins.

Test each load of concrete for slump to ensure the slump is within the limits of 346-6.4.

If the elapsed time during placement exceeds the slump loss test data, cast cylinders to verify the strength. Provide an engineering analysis performed by a Professional Engineer, registered in the State of Florida, knowledgeable in the area of foundations, to determine if the shaft is structurally sound and there are no voids in the drilled shaft concrete. At the direction of the Engineer, excavate the drilled shaft for inspection. Obtain approval from the Engineer before placing any additional shafts.

346-3.3 Mass Concrete: When mass concrete is designated in the Contract Documents, provide an analysis of the anticipated thermal developments in the mass concrete elements for all expected project temperature ranges using the selected mix design, casting procedures, and materials.

Use a Specialty Engineer competent in the design and temperature control of concrete in mass elements. The Specialty Engineer shall follow the procedure outlined in

Section 207 of the ACI Manual of Concrete Practice to formulate, implement, administer and monitor a temperature control plan, making adjustments as necessary to ensure compliance with the Contract Documents. The Specialty Engineer shall select the concrete design mix proportions that will generate the lowest maximum temperatures possible to ensure that a 35°F differential temperature between the concrete core and the exterior surface is not exceeded. The mass concrete maximum allowable temperature is 180°F. If either the differential temperature or the maximum allowable temperature is exceeded, the Specialty Engineer shall be available for immediate consultation.

Describe the measures and procedures intended for use to maintain a temperature differential of 35°F or less between the interior core center and exterior surface(s) of the designated mass concrete elements during curing. Submit both the mass concrete mix design and the proposed mass concrete plan to monitor and control the temperature differential to the Engineer for acceptance. Provide temperature monitoring devices to record temperature development between the interior core center and exterior surface(s) of the elements in accordance with the accepted mass concrete plan.

The Specialty Engineer, or a qualified technician employed by the Specialty Engineer, must personally inspect and approve the installation of monitoring devices and verify that the process for recording temperature readings is effective for the first placement of each size and type mass component. Submit to the Engineer for approval the qualification of all technicians employed to inspect or monitor mass concrete placements. For placements other than the first, designate an employee(s) approved by the Specialty Engineer, as qualified to inspect monitoring device installation, to record temperature readings, to be in contact at all times with the Specialty Engineer if adjustments must be made as a result of the temperature differential or the maximum allowable temperature being exceeded, and to immediately implement adjustments to temperature control measures as directed by the Specialty Engineer. Read the monitoring devices and record the readings at intervals no greater than 6 hours. The readings will begin when the mass concrete placement is complete and continue until the maximum temperature differential and the temperature is reached and a decreasing temperature differential is confirmed as defined in the temperature control plan. Do not remove the temperature control mechanisms until the core temperature is within 50°F of the ambient temperature. Furnish a copy of all temperature readings to the Engineer as they are recorded, the determined temperature differentials and a final report within three calendar days of completion of monitoring of each element.

If the 35°F differential or the 180°F maximum allowable temperature has been exceeded, take immediate action as directed by the Specialty Engineer to retard further growth of the temperature differential. Describe methods of preventing thermal shock in the temperature control plan. Use a Specialty Engineer to revise the previously accepted plan to ensure compliance on future placements. Do not place any mass concrete until the Engineer has accepted the mass concrete plan(s). When mass concrete temperature differentials or maximum allowable temperature has been exceeded, provide all analyses and test results deemed necessary by the Engineer for determining the structural integrity and durability of the mass concrete element, to the satisfaction of the Engineer. The Department will make no compensation, either monetary or time, for the analyses or tests or any impacts upon the project.

346-3.4 Flowing Concrete for Precast/Prestressed Concrete: Produce flowing concrete mix with target slump of 9 inches.

Subsequent to the laboratory trial batch, perform a field demonstration of the proposed mix design by production and placement of at least three batches, 3 cubic yard minimum size each, of concrete containing flowing concrete HRWR admixture. Take representative samples from each batch and perform slump, air content, density (unit weight), and temperature tests on these samples. Cast specimens from each sample for compressive strength tests. Record the ambient air temperature during the test. Ensure that the concrete properties are within the required specification limits. The plants that are producing concrete with batch sizes of less than 3 cubic yards are required to produce and place at least a total amount of 9 cubic yards and perform the aforementioned tests on at least three randomly selected batches.

Determine the workability of the demonstration concrete batches by performing the slump tests on the samples taken at 15 minute intervals from each batch. Continue sampling and testing until the slump measures 6 inches or less. From the plot of slump versus time, determine the time for each batch when the slump is at 7.5 inches. The shortest time period determined from three consecutive batches, at 7.5 inches slump, is considered the cutoff time of the proposed concrete mix. For production concrete, ensure that the time between the batching and depositing of each load of concrete is less than the cutoff time of the mix and also does not exceed the allowable time limit specified in this Section.

Ensure that the demonstration concrete is mixed, delivered, placed, consolidated and cured in accordance with the proposed method and sequence. Produce the flowing concrete batches at slumps between 7.5 inches to 10.5 inches.

Perform inspection of the demonstration concrete during batching, delivery, placement and post placement. During placement, ensure that the concrete batches meet all plastic property requirements of the specifications and maintain their cohesive nature without excessive bleeding, segregation, or abnormal retardation.

Dispose of concrete produced for demonstration purposes at no expense to the Department. Subject to the Engineer's approval, the Contractor may incorporate this concrete into non-reinforced concrete items and may be included for payment, provided it meets Contract requirements for slump, entrained air, and strength.

After removal of the forms, perform the post-placement inspection of the in-place concrete. Observe for any signs of honeycombs, cracks, aggregate segregation or any other surface defects and ensure that the hardened concrete is free from these deficiencies. The Engineer may require saw cutting of the mock-up products to verify the uniform distribution of the aggregates within the saw cut surfaces and around the reinforcing steel and prestressing strands. The Engineer will require saw cutting of the demonstration mock-up products for plants that are demonstrating the use of the flowing concrete for the first time. Obtain core samples from different locations of mock-up products to inspect the aggregate distribution in each sample and compare it with the aggregate distribution of other core samples. Perform surface resistivity tests on the core samples or test cylinders at 28 days.

Submit the results of the laboratory trial batch tests and field demonstration of verified test data and inspection reports to the Engineer, along with certification stating that the results of the laboratory trial batch tests and field demonstration tests indicate that the proposed concrete mix design meets the requirements of the specifications. For the proposed mix design, state the anticipated maximum time limit between the batching and when the concrete of each batch is deposited during the production.

Upon the review and verification of the laboratory trial batch, field demonstration test data, inspection reports and contractor’s certification statement, the Department will approve the proposed mix design.

The Department may approve proposed flowing concrete mixes, centrally mixed at the placement site, without the production of demonstration batches, provided that the proposed mix meets the following two criteria:

(1) A previously approved flowing concrete mix of the same class has demonstrated satisfactory performance under the proposed job placing conditions with a minimum of fifteen consecutive Department acceptance tests, which met all plastic and hardened concrete test requirements.

(2) The cementitious materials and chemical admixtures, including the flowing concrete HRWR admixture, used in the proposed mix are the same materials from the same source used in the previously approved mix, (1) above.

Do not produce or place concrete until the design mixes have been approved.

346-4 Composition of Concrete.

346-4.1 Master Proportion Table: Proportion the materials used to produce the various classes of concrete in accordance with Table 3:

TABLE 3		
Class of Concrete	Minimum Total Cementitious Materials Content pounds per cubic yard	Maximum Water to Cementitious Materials Ratio pounds per pounds*
I	470	0.53
I (Pavement)	470	0.50
II	470	0.53
II (Bridge Deck)	611	0.44
III	611	0.44
III (Seal)	611	0.53
IV	658	0.41**
IV (Drilled Shaft)	658	0.41
V (Special)	752	0.37**
V	752	0.37**
VI	752	0.37**

*The calculation of the water to cementitious materials ratio (w/cm) is based on the total cementitious material including cement and any supplemental cementitious materials that are used in the mix.
 **When the use of silica fume or metakaolin is required, the maximum water to cementitious material ratio will be 0.35. When the use of ultrafine fly ash is required, the maximum water to cementitious material ratio will be 0.30.

346-4.2 Chloride Content Limits for Concrete Construction:

346-4.2.1 General: Use the following maximum chloride content limits for the concrete application and/or exposure environment shown:

TABLE 4		
Application/Exposure Environment	Maximum Allowable Chloride Content, pounds per cubic yard	
Non Reinforced Concrete	No Test Needed	
Reinforced Concrete	Slightly Aggressive Environment	0.70
	Moderately or Extremely Aggressive Environment	0.40
Prestressed Concrete	0.40	

346-4.2.2 Control Level for Corrective Action: If chloride test results exceed the limits of Table 4, suspend concrete placement immediately for every mix design represented by the failing test results, until corrective measures are made. Perform an engineering analysis to demonstrate that the material meets the intended service life of the structure on all concrete represented by the failing chloride test results. Supply this information within 30 business days of the failing test results from a Professional Engineer, registered in the State of Florida and knowledgeable in the areas of corrosion and corrosion control.

346-5 Sampling and Testing Methods.

Perform concrete sampling and testing in accordance with the following methods:

TABLE 5	
Description	Method
Slump of Hydraulic Cement Concrete	ASTM C 143
Air Content of Freshly Mixed Concrete by the Pressure Method*	ASTM C 231
Air Content of Freshly Mixed Concrete by the Volumetric Method*	ASTM C 173
Making and Curing Test Specimens in the Field**	ASTM C 31
Compressive Strength of Cylindrical Concrete Specimens***	ASTM C 39
Obtaining and Testing Drilled Core and Sawed Beams of Concrete	ASTM C 42
Initial Sampling of Concrete from Revolving Drum Truck Mixers or Agitators	FM 5-501
Low Levels of Chloride in Concrete and Raw Materials	FM 5-516
Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete	ASTM C 138
Temperature of Freshly Mixed Portland Cement Concrete	ASTM C 1064
Sampling Freshly Mixed Concrete****	ASTM C 172
Static Segregation of Self Consolidating Concrete using Column Techniques	ASTM C 1610
Slump Flow of Self Consolidating Concrete	ASTM C 1611
Passing Ability of Self Consolidating Concrete by J-Ring	ASTM C 1621

TABLE 5	
Description	Method
Concrete Resistivity as an Electrical Indicator of its Permeability	FM 5-578
<p>*Use the same type of meter for QC tests as the Department uses for Verification testing. When using pressure type meters, use an aggregate correction factor determined by the concrete producer for each mix design to be tested. Record and certify test results for correction factors for each type of aggregate at the concrete production facility.</p> <p>** Provide curing facilities that have the capacity to store all QC, Verification, "hold" and Independent Verification cylinders simultaneously for the initial curing.</p> <p>***The Verification technician will use the same size cylinders as the Quality Control technician.</p> <p>**** Take the test sample from the middle portion of the batch in lieu of collecting and compositing samples from two or more portions, as described in ASTM C 172.</p>	

346-6 Control of Quality.

346-6.1 General: Develop a Quality Control Plan (QCP) as specified in Section 105. Meet the requirements of the approved QCP and Contract Documents. Ensure the QCP includes the necessary requirements to control the quality of the concrete.

Perform QC activities to ensure materials, methods, techniques, personnel, procedures and processes utilized during production meet the specified requirements. For precast/prestressed operations, ensure that the QC testing is performed by the producer.

Accept the responsibility for QC inspections on all phases of work. Ensure all materials and workmanship incorporated into the project meet the requirements of the Contract Documents.

Ensure the QCP includes any anticipated requirements for adjusting and controlling the concrete at the placement site. Include the testing procedures that will be implemented to control the quality of the concrete and ensure that concrete placed is within the tolerance range. Also, include provisions for the addition of water to concrete delivered to the placement site at designated level areas, to ensure the allowable amount of water stated on the concrete delivery ticket is correct and the maximum water to cementitious materials ratio on the approved design mix is not exceeded. Ensure the anticipated ranges of jobsite water additions are described and the proposed methods of measuring water for concrete adjustments are included.

Failure to meet the requirements of this Specification or the QCP will automatically void the concrete portion of the QCP. To obtain QCP re-approval, implement corrective actions as approved by the Engineer. The Engineer may allow the Contractor to continue any ongoing concrete placement but the Engineer will not accept concrete for any new placement until the QCP re-approval is given by the Engineer.

346-6.2 Concrete Design Mix: Provide concrete that has been produced in accordance with a Department approved design mix, in a uniform mass free from balls and lumps.

For slump target values in excess of 6 inches or self consolidating concrete, utilize a grate over the conveyance equipment to capture any lumps or balls that may be present in the mix. The grate must cover the entire opening of the conveyance equipment and have an opening that is a maximum of 2 1/2 inches in any one direction. Remove the lumps or balls from the grate and discard them. Discharge the concrete in a manner satisfactory to the Engineer. Perform demonstration batches to ensure complete and thorough placements in complex elements, when requested by the Engineer.

Do not place concretes of different compositions such that the plastic concretes may combine, except where the plans require concrete both with and without silica fume, ultrafine fly ash, metakaolin or calcium nitrite in a continuous placement. Produce these concretes using separate design mixes. For example, designate the mix with calcium nitrite as the

original mix and the mix without calcium nitrite as the redesigned mix. Ensure that both mixes contain the same cement, fly ash or slag, coarse and fine aggregates and compatible admixtures. Submit both mixes for approval as separate mix designs, both meeting all requirements of this Section. Ensure that the redesigned mix exhibits plastic and hardened qualities which are additionally approved by the Engineer as suitable for placement with the original mix. The Engineer will approve the redesigned mix for commingling with the original mix and for a specific project application only. Alternately, place a construction joint at the location of the change in concretes.

346-6.3 Delivery Certification: Ensure that an electronic delivery ticket is furnished with each batch of concrete before unloading at the placement site. The delivery ticket may be proprietary software or in the form of an electronic spreadsheet, but shall be printed. Ensure that the materials and quantities incorporated into the batch of concrete are printed on the delivery ticket. Include the following information on the Delivery Ticket:

- (1) Arrival time at jobsite,
- (2) Time that concrete mix has been completely discharged,
- (3) Number of revolutions upon arrival at the jobsite,
- (4) Total gallons of water added at the jobsite,
- (5) Additional mixing revolutions when water is added,
- (6) Total number of revolutions.

Items 3 through 6 do not apply to non-agitating concrete transporting vehicles.

Ensure the batcher responsible for production of the batch of concrete signs the delivery ticket, certifying the batch of concrete was produced in accordance with the Contract Documents.

Sign the delivery ticket certifying that the design mix maximum specified water to cementitious materials ratio was not exceeded due to any jobsite adjustments to the batch of concrete, and that the batch of concrete was delivered and placed in accordance with the Contract Documents.

346-6.4 Plastic Property Tolerances: Do not place concrete with a slump more than plus or minus 1.5 inches from the target slump value specified in Table 2.

Reject concrete with slump or air content that does not fall within the specified tolerances and immediately notify the concrete production facility that an adjustment of the concrete mixture is required. If a load does not fall within the tolerances, test each subsequent load and the first adjusted load. If failing concrete is not rejected or adjustments are not implemented, the Engineer may reject the concrete and terminate further production until the corrections are implemented.

Do not allow concrete to remain in a transporting vehicle to reduce slump. Water may be added only upon arrival of the concrete to the jobsite and not thereafter.

346-7 Mixing and Delivering Concrete.

346-7.1 General Requirements: Operate all concrete mixers at speeds and volumes per the manufacturer's design or recommendation as stipulated on the mixer rating plate.

346-7.2 Transit Truck Mixing: When water is added at the jobsite, mix the concrete 30 additional drum mixing revolutions. Do not add water after the total number of drum mixing revolutions exceeds 130, do not make additional mix adjustments. Discharge all concrete from truck mixers before total drum revolutions exceed 300. Seek approval from the Engineer prior to using a central mixer and depositing the batch into a truck mixer.

346-7.2.1 Transit Time: Ensure compliance with Table 6 between the initial introduction of water into the mix and completely discharging all of the concrete from the truck:

TABLE 6	
Maximum Allowable Time	
Non-Agitator Trucks	Agitator Trucks
45 minutes	60 minutes
75 minutes*	90 minutes*

*When a water-reducing and retarding admixture (Type D, Type G or Type II) is used.

346-7.2.2 Placement Time: All the concrete in a load must be in its final placement position a maximum of 15 minutes after the transit time has expired unless a time extension is approved in advance by the Engineer.

346-7.3 On-site Batching and Mixing: Include provisions in the QCP for the mixing at the site. Use a mixer of sufficient capacity to prevent delays that may be detrimental to the quality of the work. Ensure that the accuracy of batching equipment is in accordance with requirements of this Section.

346-7.4 Concreting in Cold Weather: Do not mix or place concrete when the air temperature is below 45°F. Protect the fresh concrete from freezing in accordance with Section 400. The requirements of concreting in cold weather are not applicable to precast concrete mixing and placement operations occurring in a temperature controlled environment.

346-7.5 Concreting in Hot Weather: Hot weather concreting is defined as the production, placing and curing of concrete when the concrete temperature at placing exceeds 86°F but is less than 100°F.

Unless the specified hot weather concreting measures are in effect, reject concrete exceeding 86°F at the time of placement. Regardless of special measures taken, reject concrete exceeding 100°F. Predict the concrete temperatures at placement time and implement hot weather measures to avoid production shutdown.

346-7.6 Adding Water to Concrete at the Placement Site: Perform an initial slump test before the addition of water at the jobsite. If the slump, as delivered, is outside the tolerance range, reject the load. If the slump is within the tolerance range, that load may be adjusted by adding water provided the addition of water does not exceed the water to cementitious materials ratio as defined by the mix design. After adding water, perform a slump test to confirm the concrete is within the slump tolerance range. If an adjustment is made at the concrete production facility, perform a slump test on the next load to ensure the concrete is within the slump tolerance range. Do not place concrete represented by slump test results outside of the tolerance range. Include water missing from the water storage tanks upon arrival at the project site in the jobsite water added.

346-7.7 Sample Location: Obtain acceptance samples from the point of final placement. Describe in the QCP the method to sample the plastic concrete at the point of final placement.

Where concrete buckets are used to discharge concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge of the bucket. When the concrete is discharged directly from the mixer into the bucket and the bucket is discharged within 20 minutes, samples may be obtained from the discharge of the mixer.

Where conveyor belts, troughs, pumps, or chutes are used to transport concrete directly to the point of final placement or into the hopper of a tremie pipe, samples will be obtained from the discharge end of the entire conveyor belt, trough, pump, or chute system.

Where concrete is placed in a drilled shaft or other element using a tremie pipe and a concrete pump, samples will be obtained from the discharge of the pump line at the location of the tremie hopper.

For all other placement methods, prior to each placement, obtain Department approval for sampling at the discharge of the mixer in lieu of sampling at the point of final placement. Describe the sampling correlation procedure in the QCP. Once the comparative sampling correlation is approved by the Engineer, apply this correlation to the plastic properties tolerances for samples obtained from the discharge of mixer.

Where a concrete pump is used to deposit concrete directly into a drilled shaft which is a wet excavation without the use of a tremie, or other applications as approved by the Engineer, ensure the discharge end of the pump line remains immersed in the concrete at all times after starting concrete placement.

346-8 Plastic Concrete Sampling and Testing.

QC tests include air content, temperature, slump, and preparing compressive strength cylinders for testing at later dates. In addition, calculate the water to cementitious materials ratio in accordance with FM 5-501 for compliance to the approved mix design.

Ensure that each truck has a rating plate and a valid mixer identification card issued by the Department. Ensure that the revolution counter on the mixer is working properly, and calibration of the water dispenser has been performed within the last twelve months. Reject any concrete batches that are delivered in trucks that do not have mixer identification cards. Remove the mixer identification card when a truck mixer is discovered to be in noncompliance and the mixer deficiencies cannot be repaired immediately. When the mixer identification card is removed for noncompliance, make note of the deficiency or deficiencies found, and forward the card to the District Materials and Research Engineer who has Producer QC Plan acceptance authority.

Perform plastic concrete tests on the initial delivery of each concrete design mix each day. Ensure QC technicians meeting the requirements of Section 105 are present and performing tests throughout the placement operation. Ensure one technician is present and performing tests throughout the placement operation at each placement site. If a project has multiple concrete placements at the same time, identify the number of technicians in the Quality Control Plan to ensure minimum sampling and testing frequencies are met. Ensure that the equipment used for delivery, placement and finishing meets the requirements of this Specification.

When a truck designated for QC testing arrives at the discharge site, a subsequent truck may also discharge once a representative sample has been collected from the QC truck and while awaiting the results of QC testing. Reject non-complying loads at the jobsite. Ensure that corrections are made on subsequent loads. Immediately cease concrete discharge of all trucks if the QC truck has failing test. Perform plastic properties tests on all trucks prior to the first corrected truck and the corrected truck. When more than one truck is discharging into a pump simultaneously, only the truck designated for QC testing may discharge into the pump to obtain a representative sample of concrete from the QC truck only.

Furnish sufficient concrete of each design mix as required by the Engineer for verification testing. When the Engineer's verification test results do not compare with the QC plastic properties test results, within the limits defined by the Independent Assurance (IA)

checklist comparison criteria, located in Materials Manual Chapter 5, disposition of the concrete will be at the option of the Contractor.

On concrete placements consisting of only one load of concrete, perform initial sampling and testing in accordance with this Section. The acceptance sample and plastic properties tests may be taken from the initial portion of the load.

If any of the QC plastic properties tests fail, reject the remainder of that load, and any other loads that have begun discharging, terminate the LOT and notify the Engineer. Make cylinders representing that LOT from the same sample of concrete.

Following termination of a LOT, obtain samples from a new load, and perform plastic properties tests until such time as the water to cementitious materials ratio, air content, temperature and slump comply with the Specification requirements. Initiate a new LOT once the testing indicates compliance with Specification requirements.

Suspend production when any five loads in two days of production of the same design mix are outside the specified tolerances. Make the necessary revisions to concrete operations and increase the frequency of QC testing in the QCP to bring the concrete within allowable tolerances. Obtain the Engineer's approval of the revisions before resuming production. After production resumes, obtain the Engineer's approval before returning to the normal frequency of QC testing.

If concrete placement stops for more than 90 minutes, perform initial plastic properties testing on the next batch and continue the LOT. Cylinders cast for that LOT will represent the entire LOT.

When the Department performs Independent Verification, the Contractor may perform the same tests on the concrete at the same time. The Department will compare results based on the Independent Assurance Checklist tolerances.

When the Department's Independent Verification test results do not meet the requirements of this Section, the Engineer may require the Contractor to revise the QCP.

346-9 Acceptance Sampling and Testing.

346-9.1 General: Perform plastic properties tests in accordance with 346-8 and cast a set of three QC cylinders, for all structural concrete incorporated into the project. Take these acceptance samples randomly as determined by a random number generator (acceptable to the Department). The Department will independently perform verification plastic properties tests and cast a set of verification cylinders. The verification cylinders will be the same size cylinder selected by the Contractor, from a separate sample from the same load of concrete as the Contractor's QC sample.

The Department may perform inspections in lieu of plastic properties tests of the precast plants producing Class I and II concrete, except for Incidental Precast plants.

For each set of QC cylinders verified by the Department, cast one additional cylinder from the same sample, and identify it as the QC "hold" cylinder. The Department will also cast one additional "hold" cylinder from each Verification sample. All cylinders will be clearly identified as outlined in the Sample/Lot Numbering System instructions located on the State Materials Office website. Deliver the QC samples, including the QC "hold" cylinder to the final curing facility in accordance with ASTM C 31. At this same time, the Department will deliver the Verification samples, including the Verification "hold" cylinder, to their final curing facility.

Test the QC laboratory cured samples for compressive strength at the age of 28 days, or any other specified age, in a laboratory meeting and maintaining at all times the qualification requirements listed in Section 105.

The QC testing laboratory will input the compressive strength test results into the Department’s sample tracking database within 24 hours. When the QC testing laboratory cannot input the compressive strength test results into the Department’s sample tracking database within 24 hours, the QC testing laboratory will notify the Verification testing laboratory within 24 hours of testing the cylinder and provide the Verification testing laboratory the compressive strength test results. Ensure the compressive strength results are input into the Department’s sample tracking database within 72 hours of determining the compressive strength of the cylinders.

The Department will compare the Verification sample results with the corresponding QC sample results. In the event that one set of compressive strength data for a set of cylinders falls outside the range of the other set of cylinders, use the lower Range of Average Compressive Strength to determine the comparison criteria. Based on this comparison, the Department will determine if the Comparison Criteria as shown in Table 7 has been met. When the difference between QC and Verification is less than or equal to the Comparison Criteria, the QC data is verified. When the difference between QC and Verification data exceeds the Comparison Criteria, the Engineer will initiate the resolution procedure.

Table 7	
Range of Average Compressive Strength	Comparison Criteria
Less than 3500 psi	420 psi
3,501 – 4,500 psi	590 psi
4,501 – 6,500 psi	910 psi
6,501 – 8,500 psi	1,275 psi
Greater than 8,500 psi	1,360 psi

346-9.2 Sampling Frequency:

As a minimum, sample and test concrete of each design mix for water to cementitious materials ratio, air content, temperature, slump and compressive strength once per LOT as defined by Table 8. When a mix design is used for a different application, the LOT is defined by the application. When more than one concrete production facility is used for the same mix design, describe the method of sampling, testing and LOT numbering in the QC Plan. The Engineer will randomly verify one of every four consecutive LOTs of each design mix based on a random number generator. The Department may perform Independent Verification testing to verify compliance with specification requirements. All QC activities, calculations, and inspections will be randomly confirmed by the Department.

TABLE 8	
Class Concrete*	Maximum LOT Size
I	one day’s production
I (Pavement)	2,000 square yards, or one day’s production, whichever is less

TABLE 8	
Class Concrete*	Maximum LOT Size
II, II (Bridge Deck), III, IV, V (Special), V, VI	50 cubic yards, or one day's production, whichever is less
IV (Drilled Shaft)	50 cubic yards, or two hours between the end of one placement and the start of the next placement, whichever is less
III (Seal)	Each Seal placement
*For any class of concrete used for roadway barrier wall, the lot size is defined as 100 cubic yards, or one day's production, whichever is less.	

346-9.2.1 Reduced Frequency for Acceptance Tests: The LOT size may represent 100 cubic yards when produced at the same mix design at the same concrete production facility for the same prime contractor and subcontractor on a given Contract. Submit test results indicating the average compressive strength is greater than two standard deviations above the specified minimum strength for that class of concrete. Base calculations on a minimum of ten consecutive strength test results for a Class IV or higher; or a minimum of five consecutive strength results for a Class III or lower.

The average of the consecutive compressive strength test results, based on the class of concrete, can be established using historical data from a previous Department project. The tests from the previous Department project must be within the last 60 calendar days or may also be established by a succession of samples on the current project. Only one sample can be taken from each LOT. Test data must be from a laboratory meeting the requirements of Section 105. Obtain Department approval before beginning reduced frequency LOT's.

If at any time a strength test is not verified or the average strength of the previous ten or five consecutive samples based on the class of concrete from the same mix design and the same production facility is less than the specified minimum plus two standard deviations, return to the maximum production quantity represented by the LOT as defined in Table 8. Notify the Engineer that the maximum production rate is reinstated. In order to reinitiate reduced frequency, submit a new set of strength test results.

346-9.3 Strength Test Definition: The strength test of a LOT is defined as the average of the compressive strengths tests of three cylinders cast from the same sample of concrete from the LOT.

346-9.4 Acceptance of Concrete:

Ensure that the hardened concrete strength test results are obtained in accordance with 346-9.3. Do not discard a cylinder strength test result based on low strength (strength below the specified minimum strength as per the provisions of this Section).

When one of the three QC cylinders from a LOT is lost, missing, damaged or destroyed, determination of compressive strength will be made by averaging the remaining two cylinders. If more than one QC cylinder from a LOT is lost, missing, damaged or destroyed, the Contractor will core the structure at no additional expense to the Department to determine the compressive strength. Acceptance of LOT may be based on verification data at the discretion of the Engineer. Obtain the approval of the Engineer to core, and of the core location prior to coring.

For each QC cylinder that is lost, missing, damaged or destroyed, payment for that LOT will be reduced by \$750.00 per 1,000 psi of the specified design strength [Example:

loss of two Class IV (Drill Shaft) QC cylinders that has no verification data will require the element to be cored and a pay reduction will be assessed (4,000 psi / 1,000 psi) x \$750 x 2 = \$6,000]. This reduction will be in addition to any pay adjustment for low strength.

When QC compressive strength test results are not verified, the resolution procedure will be used to accept or reject the concrete. Maintain the “hold” cylinders until the verification of the compressive strength test results.

When QC test results are verified, the Engineer will accept the concrete based on QC test results. The Engineer will accept at full pay only LOTs of concrete represented by plastic property results which meet the requirements of the approved mix design and strength test results which equal or exceed the respective specified minimum strength.

346-9.5 Resolution Procedure: The Department may initiate an IA review of sampling and testing methods. The resolution procedure may consist of, but need not be limited to, a review of sampling and testing of fresh concrete, calculation of water to cementitious materials ratio, handling of cylinders, curing procedures and compressive strength testing. Core samples of the hardened concrete may be required.

The Engineer will determine through the resolution procedure whether the QC strength test results or the verification strength test are deemed to be the most accurate. When the Engineer cannot determine which strength test results are the most accurate, the concrete represented by the four consecutive LOTs will be evaluated based on the QC data. The Engineer will inform the QC and the Verification lab within three calendar days of the acceptance compressive strength test to transport their “hold” cylinders to the resolution lab. The QC and Verification laboratories will transport their own hold cylinder to the resolution testing laboratory within 72 hours after the Engineer notifies the Contractor that a resolution is required. In addition, the Engineer will ensure that the QC and verification “hold” cylinders are tested within seven calendar days of the acceptance strength tests.

The resolution investigation will determine the strength test results for each of the four or less LOTs. When the QC strength test results are deemed to be the most accurate, the QC strength test results will represent the four or less consecutive LOTs and the Department will pay for the resolution testing and investigation. When the verification strength test results are deemed to be the most accurate, the Department will assess a \$1,000 pay reduction for the cost of the Resolution Investigation.

The results of the resolution procedure will be forwarded to the Contractor within five working days after completion of the investigation. If the Department finds deficiencies based on the Contractor’s QCP, the Engineer may suspend that part of the QCP. When the QC plan is suspended, submit corrective actions for approval to the Engineer. The Engineer may take up to five working days to review corrective actions to the QCP. The Engineer will not allow changes to contract time or completion dates. Incur all delay costs and other costs associated with QC plan suspension and re-approval.

346-9.6 Small Quantities of Concrete: When a project has a total plan quantity of less than 50 cubic yards, that concrete will be accepted based on the satisfactory compressive strength of the QC cylinders. Provide certification to the Engineer that the concrete was batched and placed in accordance with the Contract Documents. Submit a quality control plan for the concrete placement operation in accordance with Section 105. In addition, the Engineer may conduct Independent Verification (IV) testing as identified in 346-9. Evaluate the concrete in accordance with 346-10 at the discretion of the Engineer.

346-10 Investigation of Low Strength Concrete for Structural Adequacy.

346-10.1 General: When a concrete acceptance strength test result falls more than 500 psi below the specified minimum strength and the Department determines that an investigation is necessary, make an investigation into the structural adequacy of the LOT of concrete represented by that acceptance strength test result at no additional expense to the Department. The Engineer may also require the Contractor to perform additional strength testing as necessary to determine structural adequacy of the concrete.

Furnish either a structural analysis performed by the Specialty Engineer to establish strength adequacy or drilled core samples as specified in 346-10.3 to determine the in-place strength of the LOT of concrete in question at no additional expense to the Department. Obtain the Engineer's approval before taking any core samples. When the concrete is deemed to have low strength, obtain and test the cores and report the data to the Engineer within 10 calendar days of the 28 day compressive strength tests. Core strength test results obtained from the structure will be accepted by both the Contractor and the Department as the in-place strength of the LOT of concrete in question. The core strength test results will be final and used in lieu of the cylinder strength test results for determination of structural adequacy and any pay adjustment. The Department will calculate the strength value to be the average of the compressive strengths of the three individual cores. This will be accepted as the actual measured value.

346-10.2 Determination of Structural Adequacy: If core strength test results are less than 500 psi below the specified minimum strength, consider the concrete represented by the cores structurally adequate. If the core strength test results are more than 500 psi below the specified minimum strength, the Department will consider the concrete represented by the cores structurally questionable. Submit a structural analysis performed by the Specialty Engineer. If the results of the structural analysis indicate adequate strength to serve its intended purpose with adequate durability, and is approved by the Department, the Contractor may leave the concrete in place subject to the requirements of 346-11, otherwise, remove and replace the LOT of concrete in question at no additional expense to the Department.

346-10.3 Coring for Determination of Structural Adequacy: Notify the Engineer 48 hours prior to taking core samples. The Engineer will select the size and location of the drilled cores so that the structure is not impaired and does not sustain permanent damage after repairing the core holes. Sample three undamaged cores taken from the same approximate location where the questionable concrete is represented by the low strength concrete test cylinders. Repair core holes after samples are taken.

346-10.4 Core Conditioning and Testing: Test the cores in accordance with ASTM C 42. Test the cores after obtaining the samples within seven calendar days.

346-11 Pay Adjustments for Low Strength Concrete.

346-11.1 General: Any LOT of concrete failing to meet the specified minimum strength as defined in 346-3, 346-9, 346-10 and satisfactorily meeting all other requirements of the Contract Documents, including structural adequacy, the Engineer will individually reduce the price of each low strength LOT in accordance with this Section.

346-11.2 Basis for Pay Adjustments: When an acceptance strength test result falls more than 500 psi below the specified minimum strength, core samples may be obtained in accordance with ASTM C 42 from the respective LOT of concrete represented by the low acceptance strength test result for determining pay adjustments. A price adjustment will be applied to the certified invoice price the Contractor paid for the concrete or the precast product.

Do not core hardened concrete for determining pay adjustments when the 28 day acceptance cylinder strength test results are less than 500 psi below the specified minimum strength.

The results of strength tests of the drilled cores, subject to 346-11.5 and 346-11.6, will be used as the acceptance results and will be used in lieu of the cylinder strength test results for determining pay adjustments.

In precast operations, excluding prestressed, ensure that the producer submits acceptable core sample test results to the Engineer. The producer may elect to use the products in accordance with 346-11. Otherwise, replace the concrete in question at no additional cost to the Department. For prestressed concrete, core sample testing is not allowed for pay adjustment. The results of the cylinder strength tests will be used to determine material acceptance and pay adjustment.

346-11.3 Coring for Determination of Pay Adjustments: Obtain the cores in accordance with 346-10.3.

346-11.4 Core Conditioning and Testing: Test the cores in accordance with 346-10.4.

346-11.5 Core Strength Representing Equivalent 28 Day Strength: For cores tested no later than 42 calendar days after the concrete was cast, the Engineer will accept the core strengths obtained as representing the equivalent 28 day strength of the LOT of concrete in question. The Engineer will calculate the strength value to be the average of the compressive strengths of the three individual cores. The Engineer will accept this strength at its actual measured value.

346-11.6 Core Strength Adjustments: For cores tested later than 42 calendar days after the concrete was cast, the Engineer will establish the equivalency between 28 day strength and strength at ages after 42 calendar days. The Engineer will relate the strength at the actual test age to 28 day strength for the design mix represented by the cores using the following relationship:

346-11.6.1 Portland Cement Concrete without Pozzolan or Slag:

Equivalent 28 Day Strength, $f'_c(28) = 1/F$ (Average Core Strength) x 100,

where:

$$F = 4.4 + 39.1 (\ln x) - 3.1 (\ln x)^2 \quad (\text{Type I Cement})$$

$$F = -17.8 + 46.3 (\ln x) - 3.3 (\ln x)^2 \quad (\text{Type II Cement})$$

$$F = 48.5 + 19.4 (\ln x) - 1.4 (\ln x)^2 \quad (\text{Type III Cement})$$

x = number of days since the concrete was placed

\ln = natural log

346-11.6.2 Pozzolanic-Cement Concrete:

Equivalent 28 day compressive strength = $f'_c(28)$, where:

$$f'_c(28) = 0.490 f'_c(t) e^{\left(\frac{8.31}{t}\right)^{0.276}} \quad (\text{Type I Cement})$$

$$f'_c(28) = 0.730 f'_c(t) e^{\left(\frac{2.89}{t}\right)^{0.514}} \quad (\text{Type II Cement})$$

$$f'_c(28) = 0.483 f'_c(t) e^{\left(\frac{5.38}{t}\right)^{0.191}} \quad (\text{Type III Cement})$$

$f'_c(t)$ = Average Core Strength at time t (psi)

t = time compressive strength was measured (days)

346-11.6.3 Slag-Cement Concrete:

Equivalent 28 day compressive strength = $f'_c(28)$, where:

$$f'_c(28) = 0.794 f'_c(t) e^{\left(\frac{7.06}{t}\right)^{1.06}} \quad (\text{Type I Cement})$$

$$f'_c(28) = 0.730 f'_c(t) e^{\left(\frac{6.02}{t}\right)^{0.747}} \quad (\text{Type II Cement})$$

$$f'_c(28) = 0.826 f'_c(t) e^{\left(\frac{2.36}{t}\right)^{0.672}} \quad (\text{Type III Cement})$$

$f'_c(t)$ = Average Core Strength at time t (psi)

t = time compressive strength was measured (days)

346-11.7 Calculating Pay Adjustments: The Engineer will determine payment reductions for low strength concrete accepted by the Department and represented by either cylinder or core strength test results below the specified minimum strength, in accordance with the following:

Reduction in Pay is equal to the reduction in percentage of concrete cylinder strength (specified minimum strength minus actual strength divided by specified minimum strength).

For the elements that payments are based on the per foot basis, the Engineer will adjust the price reduction from cubic yards basis to per foot basis, determine the total linear feet of the elements that are affected by low strength concrete samples and apply the adjusted price reduction accordingly.

346-12 Pay Reduction for Plastic Properties

A rejected load in accordance with 346-6.4 is defined as the entire quantity of concrete contained within a single ready mix truck or other single delivery vehicle regardless of what percentage of the load was placed. If concrete fails a plastic properties test and is thereby a rejected load but its placement continues after completion of a plastic properties test having a failing result, payment for the concrete will be reduced.

The pay reduction for cast-in-place concrete will be twice the invoice price per cubic yard of the quantity of concrete in the rejected load.

The pay reduction for placing a rejected load of concrete into a precast product will be applied to that percentage of the precast product that is composed of the concrete in the rejected load. The percentage will be converted to a reduction factor which is a numerical value greater than zero

but not greater than one. The precast product payment reduction will be twice the Contractor's billed price from the Producer for the precast product multiplied by the reduction factor.

If the Engineer authorizes placement of the concrete, even though plastic properties require rejection, there will be no pay reduction based on plastic properties failures; however, any other pay reductions will apply.

**347 PORTLAND CEMENT CONCRETE – CLASS NS.
(REV 10-9-12) (1-13)**

SECTION 347 (Pages 326 – 328) is deleted and the following substituted:

**SECTION 347
PORTLAND CEMENT CONCRETE - CLASS NS**

347-1 Description.

The requirements of this Section are applicable to concrete designated as Class NS hereinafter referred to as concrete. Use concrete composed of a mixture of portland cement, aggregates, and water, with or without chemical admixtures, slag, or pozzolanic materials. Deliver concrete to placement site in a freshly mixed, unhardened state. Ensure the concrete is placed and cured in a manner to ensure that the strength and durability of the concrete is maintained.

347-2 Materials.

347-2.1 General: Certify that all materials used in concrete are from Department approved sources, and free from frozen or other detrimental matter.

Meet the following requirements:

Portland Cement.....	Section 921
Coarse Aggregate.....	Section 901
Fine Aggregate.....	Section 902
Water.....	Section 923
Chemical Admixtures	Section 924
Pozzolans and Slag	Section 929

347-2.2 Admixture Requirements: Chemical admixtures may be added at the dosage rates recommended by the manufacturer.

347-2.3 Substitution of Materials: Approved material sources may be substituted for similar materials indicated on the originally approved mix design. Use originally approved mix components and proportions, when unsatisfactory test results are obtained from the use of the substituted material(s).

347-2.4 Material Storage: Use a concrete production facility that meets the following requirements:

347-2.4.1 Cementitious Materials Storage: Provide a separate and clearly labeled weatherproof facility to store each brand or type of cementitious material without mixing or contamination. Provide a suitable, safe and convenient means of collecting cementitious material samples at each storage facility.

347-2.4.2 Aggregate Storage: Provide suitable bins, stockpiles or silos to store and identify aggregates without mixing, segregating or contaminating different grades or types of materials. Identify Department approved pit number and aggregate type/gradation. Handle the aggregates in a manner to minimize segregation and meet the specification requirements when recovered from storage. Continuously and uniformly sprinkle coarse aggregate with water, for 24 hours preceding introduction into the concrete mix. Maintain stored aggregates in a well-drained condition to minimize free water content. Provide access for the Engineer to sample the aggregates from the recovery side of the storage facility.

347-3 Production, Mixing and Delivery.

347-3.1 Concrete Production Requirements: Deliver concrete from a production facility that is certified by the National Ready-Mixed Concrete Association (NRMCA) or approved by the District Materials Office. The District Materials Office may inspect the concrete production facility's to verify compliance with the Specifications. Produce concrete utilizing equipment that is in good operating condition and operated in a manner to ensure a consistent product. Within two hours prior to each day's batching, ensure that the concrete production facility determines the free moisture for the coarse and fine aggregates. On concrete placements expected to exceed three hours, perform an additional moisture test approximately half way through the batching operations and adjust batch proportions accordingly.

Ensure that the calibration of the measuring devices of the concrete production facilities meets the requirements of Chapter 531 of the Florida Statutes. At least quarterly, ensure that all scales, meters and other weighing or measuring devices are checked for accuracy by a qualified representative of a scale company registered with the Bureau of Weights and Measures of the Florida Department of Agriculture. Have the accuracy of admixture measuring dispensers certified annually by the admixture supplier.

When Volumetric Mixers are used, deliver concrete in accordance with the requirements of Volumetric Mixer Manufactures Bureau (VMMB) and ensure that the vehicle has a VMMB registered rating plate.

Substitution of structural concrete in lieu of non-structural concrete may be used if approved by the Engineer. If structural concrete is used in lieu of non-structural concrete, obtain the concrete from a production facility meeting the requirements of Section 346. Acceptance is based on the requirements of Section 347.

347-3.2 Mixers: Ensure that mixers are capable of combining the components of concrete into a thoroughly mixed and uniform mass, free from balls or lumps of cementitious materials, and capable of discharging the concrete uniformly. Operate concrete mixers at speeds per the manufacturer's design. Do not exceed the manufacturer's rated capacity for the volume of mixed concrete in the mixer, mixing drum, or container.

347-3.3 Delivery: The maximum allowable mixing and agitation time of concrete is 120 minutes.

347-3.4 Small Quantities of Concrete: With approval of the District Materials Engineer, small quantities of concrete, less than 3 cubic yards placed in one day and less than 0.5 cubic yards placed in a single placement may be accepted using a pre-bagged mixture. The Engineer will verify that the pre-bagged mixture is prepared in accordance with the manufacturer's recommendations and will meet the requirements of this Specification.

347-4 Control of Quality.

347-4.1 Concrete Mix Design: Before producing any concrete, submit the proposed mix design to the Engineer on a form provided by the Department. A similar form containing the same information may be used. Also submit three compressive strength test results tested in accordance with ASTM C 39 demonstrating the mix meets the minimum 28 day compressive strength requirement. The test results must be within twelve months of the submittal of the mix design. Use only concrete mix designs having prior approval of the Engineer.

Materials may be adjusted provided that the theoretical yield requirement of the approved mix design is met. Show all required original approved design mix data and batch adjustments and substituted material on the Department concrete delivery ticket. The Engineer may disqualify any concrete production facility for non-compliance with Specification requirements.

347-4.2 Sampling and Testing: The Engineer may sample and test the concrete at their discretion to verify its quality. The minimum 28-day compressive strength requirement for this concrete is 2,500 psi.

347-4.3 Records: Maintain the following records for review for at least three years after final acceptance of the project:

1. Approved concrete mix designs.
2. Materials source (delivery tickets, certifications, certified mill test reports).
3. A copy of the scale company or testing agency report showing the observed deviations from quantities checked during calibration of the scales and meters.
4. A copy of the documentation certifying the admixture weighing/measuring devices.
5. Recent NRMCA, VMMB or Department inspection records certifying the plant or truck can produce concrete and documentation showing that action has been taken to correct deficiencies noted during the inspections.

347-5 Certification and Acceptance.

347-5.1 General: Furnish a Delivery Ticket with each batch of concrete before unloading at the placement site. The Department will provide an example of the Delivery Ticket Form. The concrete producer may use an alternate form provided that it contains the required information. Record material quantities incorporated into the mix on the Delivery Ticket. Ensure that the Batchers responsible for producing the concrete, certifies that the batch was produced in accordance with Specification requirements, signs the Delivery Ticket. Sign the Delivery Ticket certifying that the concrete was batched, delivered and placed in accordance with these Specifications.

Acceptance by the Department will be by Certification on the Delivery Ticket, as described herein, by the Batchers and the Contractor. The Engineer will hold the Contractor responsible for rejecting loads of concrete that do not meet the minimum compressive strength requirements. Delineate and replace, at no cost to the Department, all concrete that does not meet the 28-day compressive strength requirements or has any cracking greater than 1/4 inch in width or 1/4 inch in vertical displacement. Any spalling or flaking off of the surface layer that exposes the rough, pitted aggregate surface in excess of 10 square inches is to be removed and replaced in accordance with 347-5.2. Sidewalk, ditch pavement, slope pavement, Traffic Separator, or curb and gutter having any intersecting cracks visible in the dry concrete (regardless of size) will be removed and replaced in accordance with 347-5.2.

At the sole option of the Department, the Engineer may accept concrete at a reduced pay when it is determined that the concrete will serve its intended function.

If any uncontrolled cracks appear during the life of the Contract unacceptable to the Engineer, remove and replace the concrete in accordance with 347-5.2 at no expense to the Department.

347-5.2 Remedial Action: Remedial action will be the removal and replacement of all concrete to the full depth and width.

Sidewalk, Curb and Gutter, Ditch Pavement and Traffic Separator: Begin saw cutting 2 1/2 feet either side or above and below the crack or at the nearest joint, remove and replace the 5 foot section encompassing the crack.

Slope Pavement: Saw cut each scored joint above and below the crack and replace the entire section between the saw cuts, ensuring the section removed and replaced encompasses the crack.

400 CONCRETE STRUCTURES. (REV 10-9-12) (1-13)

SECTION 400 (Pages 357 – 395) is deleted and the following substituted:

SECTION 400 CONCRETE STRUCTURES

400-1 Description.

Construct concrete structures and other concrete members, with the exception of pavement and incidental concrete construction (which are specified in other Sections).

Refer to Section 450 for prestressed construction requirements additional to the requirements of this Section.

For precast concrete structures meet the requirements of Section 450 for inserts and lifting devices, handling, storage, shipping, and erection.

Obtain incidental precast products from a plant that is currently on the list of Producers with Accepted Quality Control Programs. Producers seeking inclusion on the list shall meet the requirements of 105-3.

400-2 Materials.

Meet the following requirements:

Concrete	Sections 346 and 347
Penetrant Sealer	Section 413
High Molecular Weight Methacrylate (HMWM)**	Section 413
Reinforcing Steel	Section 415
Water.....	Section 923
Curing Materials*	Section 925
Epoxy Bonding Compounds**	Sections 926 and 937
Joint Materials**	Section 932
Bearing Pads	Section 932
Non-Shrink Grout**	Section 934
Class 5 Applied Finish Coatings**	Section 975
Galvanizing Compound**	Section 562
Dowel Bar Assembly**	Section 931
Filter Fabric.....	Section 985

*The Engineer will allow clean sand and sawdust for certain curing, when and as specified.

**Use products listed on the Department's Qualified Products List (QPL).

400-3 Depth of Footing.

Refer to Section 455, "D. SPREAD FOOTINGS".

400-4 Falsework.

400-4.1 Plans: At the Engineer's request, furnish detailed plans for falsework or centering to the Department. The Contractor is responsible for results obtained by using these plans.

400-4.2 Design and Erection: Design and construct all falsework to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. Use screw jacks or hardwood wedges to take up any settlement in the framework, either before or during the placing of concrete. If any weakness develops and the centering shows undue settlement or distortion, stop the work, remove any masonry affected, and strengthen the falsework before resuming work. Support falsework which cannot be founded on a satisfactory footing on piling. Space, drive, and remove the piling in an approved manner.

400-4.3 Camber: Provide camber to correct for settlement and deflection of falsework. Give bridges permanent camber only when shown in the plans.

400-5 Forms.

400-5.1 General: Provide forms, either of wood or metal, that are as follows: (a) externally secured and braced where feasible; (b) substantial and unyielding; (c) of adequate strength to contain the concrete without bulging between supports and without apparent deviation from the neat lines, contours, and shapes shown in the plans. Design forms to withstand the additional forces of vibration without apparent deviation from the desired shape or position. Assemble forms to be mortar-tight. If using lumber forms, construct them of dressed wood of uniform thickness. Use form liners on wooden forms where Class 3 surface finish is specified. Construct assembled forms to render a concrete surface of smooth, uniform finish.

Make provisions to remove forms without injury to concrete surfaces. Remove blocks and bracing with the forms, and do not leave any portion of the forms in the concrete. Use the same form system for a type of work throughout.

400-5.2 Inspection and Approval: Do not place concrete in a form until the form has been inspected and approved. Although the Engineer inspects and approves the forms, the Contractor is responsible for obtaining satisfactory concrete surfaces, free from warping, bulging, or other objectionable defects. Pay special attention to the ties and bracing. Where the forms appear to be insufficiently braced or unsatisfactorily built, stop and correct defects to the satisfaction of the Engineer.

400-5.3 Non-metallic Form Materials:

400-5.3.1 Lumber: For all surfaces, use lumber that is not less than 3/4 inch in thickness, dressed, and free of knot holes, loose knots, cracks, splits, warps, and other defects. Proportion the spacing of studs, joists, and wales to exclude warps and bulges and to produce true and accurate concrete surfaces. Only use structurally sound lumber.

400-5.3.2 Form Liners: Use form liners of durable, abrasion resistant materials that are unaffected by water. Use liners with a hard surface texture capable of rendering concrete surfaces of a smooth, uniform texture, without grain marks, patterns, or blemishes. Use form liner material of sufficient thickness to eliminate the reflection of irregularities, undesirable patterns, and marks from the forms to the surfaces. Replace liners as necessary to produce a consistent concrete surface texture. Use form liners in large sheets and with true, tight-fitted joints which are logically located. Obtain the Engineer's approval of the layout of sheets. Do not use liners which have been patched. Use liner material of the same stock throughout.

400-5.3.3 Plywood: The Contractor may use plywood of not less than 5/8 inch in thickness manufactured with waterproof glue or protected with an approved impervious coating. Do not use pieces with bulged plies or raveled, untrue edges.

400-5.4 Special Requirements:

400-5.4.1 Re-entrant Angles: Use chamfered forms for exterior concrete corners and filleted forms for interior concrete corners. Use chamfers and fillets that are 3/4 by 3/4 inch and are mill-dressed on all sides to uniform dimensions. The Contractor may use plastic or metal chamfers and fillets provided they perform satisfactorily in producing uniform, smooth concrete corner surfaces without honeycomb.

400-5.4.2 Handrails and Parapets: Construct barriers and parapets in accordance with Section 521.

400-5.4.3 End-bent Caps: Do not place forms for end-bent caps until the embankment has been constructed to within 12 inches of the bottom of the cap. Place a mass of embankment that is sufficient to produce the subsidence, displacement, and settlement which may result from the construction of the total embankment.

400-5.4.4 Footings: Where footing concrete can be placed in dry excavation, the Contractor may omit cribs, cofferdams, and forms, subject to compliance with the following limitations and conditions:

(a) Use this procedure only in locations not exposed to view from traveled roadways.

(b) Obtain required elevations shown in the plans.

(c) Obtain neat line dimensions shown in the plans.

(d) Fill the entire excavation with concrete to the required elevation of the top of the footing.

(e) The Engineer will determine the volume of footing concrete to be paid for from the neat line dimensions shown in the plans.

400-5.5 Form Alignment, Bracing, and Ties: Construct forms in such manner that they may be adequately secured for alignment, shape, and grade. Use bracing systems, ties, and anchorages that are substantial and sufficient to ensure against apparent deviation from shape, alignment, and grade. Do not drive nails into existing concrete. Do not use bracing systems, ties, and anchorages which unnecessarily deface or mark, or have an injurious or undesirable effect on surfaces that will be a part of the finished surface.

If metal ties and anchorages are to remain in the concrete, construct them so as to permit the removal of metal to at least 1 inch beneath the finished surface of concrete. Use accessories for metal ties and anchorages that allow the removal of metal to the prescribed depth while leaving the smallest possible repairable cavity.

When using wire ties, cut or bend them back from the finished surface of the concrete a minimum of 1 inch. Do not use internal ties of wire when forming surfaces that are exposed to view.

400-5.6 Preparation and Cleaning: Meet the following requirements for the condition of forms at the time of beginning concrete casting:

(a) Treat all forms with an approved form-release agent before placing concrete. Do not use material which adheres to or discolors the concrete.

(b) Clean forms of all concrete laitance from previous use and all dirt, sawdust, shavings, loose wire ties and other debris.

(c) Close and secure all inspection and cleanout holes.

400-5.7 Stay-In-Place Metal Forms:

400-5.7.1 General: Utilization of stay-in-place metal forms is permitted in lieu of removable forms to form concrete bridge decks between beams and between the webs of individual box girders when designated in the plans. Stay-in-place metal forms may be of the cellular, non-cellular or non-cellular with top cover sheet type. The flutes of non-cellular stay-in-place metal forms may be filled with polystyrene foam or concrete. When polystyrene foam is used to fill the forms, fill form flutes completely; do not allow any portion of the polystyrene foam to extend beyond the limits of the flutes. Ensure that the polystyrene foam remains in its required position within flutes during the entire concrete placement process. Do not use reinforcing steel supports or other accessories in such a manner as to cause damage to the polystyrene foam. Replace all damaged polystyrene foam to the satisfaction of the Engineer.

Apply polymer sheeting to stay-in-place metal forms in accordance with the requirements in the following table. Apply polymer sheeting to all faces and edges (including sheared edges) of support angles used on bridges with Moderately and Extremely Aggressive Superstructure Environmental Classifications (as shown in the Plans). No polymer sheeting is required for beam attachment straps or clips partially embedded in concrete, and for support angles used on bridges with a Slightly Aggressive Superstructure Environmental Classification. Use polymer sheeting materials and application methods as described herein.

Polymer Sheeting Usage Requirements			
Form Type	Superstructure Environmental Classification (as shown in Plans)		
	Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
Non-cellular form with concrete	No polymer sheeting required	Polymer sheeting required on bottom side	Polymer sheeting required on bottom side

Polymer Sheeting Usage Requirements				
Form Type		Superstructure Environmental Classification (as shown in Plans)		
		Slightly Aggressive	Moderately Aggressive	Extremely Aggressive
filled flutes				
Non-cellular form with polystyrene foam filled flutes		Polymer sheeting required on inside	Polymer sheeting required on both sides*	Polymer sheeting required on both sides*
Non-cellular form with Top Cover Sheet	Top Cover Sheet	Polymer sheeting required on bottom side	Polymer sheeting required on bottom side	Polymer sheeting required on bottom side
	Non-cellular form	Polymer sheeting required on top side	Polymer sheeting required on both sides*	Polymer sheeting required on both sides*
Cellular form		No polymer sheeting allowed or required	Not permitted	Not permitted

* Polymer sheeting not required on bottom side of form located within box girders and U-beams.

Prior to using stay-in-place metal forms, submit detailed plans for approval of the forming system, including method of support and attachment and method of protecting the supporting structural steel components from welding effects. Submit design calculations for the forming system, which have been signed and sealed by the Specialty Engineer. Detail stay-in-place metal forms such that they in no way infringe upon the concrete outline of the slab shown on the plans. Use stay-in-place metal forms that provide and maintain the dimensions and configuration of the original slab in regards to thickness and slope.

Do not weld stay-in-place metal form supports and connections to the structural steel components. Do not connect polymer coated angles or other hardware that support polymer coated metal forms to the beam attachment straps or clips by welding. Electrical grounding to reinforcing steel is prohibited.

Protect structural steel components from damage by using a shield to guard against weld splatter, weld overrun, arc strikes, or other damaging effects of the welding process. Upon completion of welding, rest the metal form support flush on the supporting steel component. Should any weld spatter, weld overrun, arc strike, or other effects of the welding process be evident or occur to the structural steel component, immediately stop in-place welding of the metal form supports for the remainder of the work. In this event, weld all metal form supports off of the structure and erect the forms after prefabrication, or use an alternate approved method of attaching the form supports. Remove improper weldment, repair the supporting steel component for any improper welding. Perform all required verification and testing at no expense to the Department and to the satisfaction of the Engineer.

Do not use stay-in-place metal forms until the forming system has been approved by the Engineer. The Contractor is responsible for the performance of the stay-in-place forms.

Structures designed, detailed, and dimensioned for the use of removable forms: Where stay-in-place metal forms are permitted, the Contractor is responsible and shall obtain the approval of the Engineer for any changes in design, etc. to accommodate the use of stay-in-place forms. The Engineer will compute pay quantities of the various components of the

structure which are paid on a cubic yard basis from the design dimensions shown on the plans with no allowance for changes in deflection or dimensions necessary to accommodate the stay-in-place forms or concrete to fill the form flutes. The Engineer will limit pay quantities of other Contract items that the Contractor increases to accommodate the use of stay-in-place forms to the quantity required for the original plan design.

Submit all changes in design details of bridge structural members that support stay-in-place forms, showing all revisions necessary to enable the supporting components to withstand any additional weight of the forms and the weight of any extra concrete that may be required to fill the forms. Include with the design calculations a comparative analysis of the stresses in the supporting components as detailed on the Contract plans and as modified to support the forms. Use the identical method of analysis in each case, and do not allow the stresses in the modified components to exceed those of the component as detailed in the Contract plans. Include with the design the adjusted cambers for any changes in deflection over those shown on the original plans. Modify the beams to provide additional strength to compensate for the added dead loads imposed by the use of stay-in-place forms. Obtain the additional strength by adding strands to the pre-stressed beams or by adding steel material to increase the section modulus of steel girders. Substantiate the added strength by the comparative calculations. Do not use stay-in-place forms until the forming system and all necessary design revisions of supporting members have been approved by the Engineer.

Structures designed, detailed, and dimensioned for the use of stay-in-place metal forms:

Prior to using stay-in-place metal forms, submit detailed plans for approval of the forming system (including method of support and attachment) together with design calculations. Include an analysis of the actual unit weight of the proposed forming system over the projected plan area of the metal forms. If the weight thus calculated exceeds the weight allowance for stay-in-place metal forms and concrete required to fill the forms shown on the plans, then modify the supporting components to support the excess weight as specified by the Contractor's Specialty Engineer.

For all structures utilizing structural steel supporting components, paint the vertical sides of the top flange prior to installation of the stay-in-place metal forms in accordance with Section 560.

For non-polymer sheeting form surfaces, use zinc paint coating in accordance with Section 562 to all accessories cut from galvanized sheets, which are not embedded in concrete.

400-5.7.2 Design: Meet the following criteria for the design of stay-in-place bridge deck forms:

1. The maximum self weight of the stay in place metal forms, plus the weight of the concrete or expanded polystyrene required to fill the form flutes (where used), shall not exceed 20 psf.

2. Design the forms on the basis of dead load of form, reinforcement, and plastic concrete plus 50 lb/ft² for construction loads. Use a unit working stress in the steel sheet of not more than 0.725 of the specified minimum yield strength of the material furnished, but not to exceed 36,000 psi.

3. Do not allow deflection under the weight of the forms, reinforcement, and plastic concrete to exceed 1/180 of the form span or 1/2 inch, whichever is less, for form spans of 10 feet or less, or 1/240 of the form span or 3/4 inch, whichever is less, for form spans

greater than 10 feet. In all cases, do not use a total loading (psf) that is less than 20 plus the product of the deck thickness measured in inches times 12.5.

4. Use a design span of the form equal to the clear span of the form plus 2 inches. Measure the span parallel to the form flutes.

5. Compute physical design properties in accordance with requirements of the AISI Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.

6. For all reinforcement, maintain the design concrete cover required by the plans.

7. Maintain the plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck.

8. Do not consider the permanent bridge deck form as lateral bracing for compression flanges of supporting structural members.

9. Do not use permanent steel bridge deck forms in panels where longitudinal deck construction joints are located between stringers.

10. Secure forms to the supporting members by means other than welding directly to the member.

400-5.7.3 Materials:

400-5.7.3.1 Metal Forms: Fabricate stay-in-place metal forms and supports from steel meeting the requirements of ASTM A 653 having a coating designation G165. Do not use form materials that are less than 0.03 inch uncoated thickness.

400-5.7.3.2 Polymer Sheeting: Use polymer sheeting comprised of at least 85% ethylene acrylic acid copolymer capable of being applied to both G165 and G210 steel sheet as described in ASTM A 742. Ensure that the polymer sheeting has a nominal thickness of 12 mils as manufactured and a minimum thickness of 10 mils after lamination to the steel sheet. Ensure that the polymer sheeting remains free of holes, tears and discontinuities and sufficiently flexible to withstand the forming process without any detrimental effects to bond, durability or performance. Ensure that the polymer sheeting is UV stabilized and contains antioxidants.

Ensure that the as-manufactured polymer sheeting (prior to application) has an Oxidative Induction Time (OIT) of 60 to 75 minutes at 170°C in air when tested according to ASTM D 3895. Perform additional OIT tests on samples taken from the finished product (polymer sheeting applied to forms) resulting in a minimum OIT according to ASTM D 3895 of 32 minutes at 170°C in air. Ensure that the polymer sheeting adheres to galvanized metal sufficient to prevent undercutting at penetrations made through the polymer sheeting or metal forms to the satisfaction of the Engineer. Ensure that edges subjected to shear cutting are coated by the form manufacturer with two coats of a compatible liquid coating repair material before delivery to the site. Ensure that steel used to produce polymer laminated metal forms is appropriately cleaned and prepared per NCCA (National Coil Coating Association) standard continuous coil coating practices. Ensure that pretreatment for use in conjunction with the manufacturer's polymer sheeting material is approved as compatible by the polymer sheeting manufacturer. Apply pretreatment in accordance with the polymer sheeting manufacturer's procedures. Apply polymer sheeting in accordance with the manufacturer's recommendations and procedures. Ensure that all steel has the polymer sheeting applied prior to fabrication of the stay-in-place forms and accessories.

Ensure that the screws to be used in the fastening of the stay-in-place laminated metal forms have a corrosion resistant cladding that will not have an adverse effect to the system due to the contact of dissimilar metals.

400-5.7.3.3 Certification: Provide a written certification from the manufacturer stating the product meets the requirements of this specification along with the delivery of the coated forms to the jobsite. Ensure that the certification conforms to the requirements of Section 6. Ensure that the manufacturer has a quality control program conforming to ISO 9001:2000 standards.

400-5.7.3.4 Polystyrene Foam: Use polystyrene foam comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation. Extrude the polystyrene foam to match the geometry of the flutes and provide a snug fit. Use polystyrene foam that has a density of not less than 0.8 lbs/cubic foot. Use polystyrene foam that has water absorption of less than 2.6% when tested according to ASTM C 272. Provide a written certification from the manufacturer stating the product meets the requirements of this Specification along with the delivery of the product.

400-5.7.4 Construction: Install all forms in accordance with approved fabrication and erection plans.

Do not rest form sheets directly on the top of the stringer of floor beam flanges. Fasten sheets securely to form supports, and maintain a minimum bearing length of 1 inch at each end for metal forms. Place form supports in direct contact with the flange of the stringer or floor beam. Make all attachments for coated metal forms by bolts, clips, screws, or other approved means.

400-5.7.4.1 Form Galvanizing Repairs: For any permanent exposed steel where the galvanized coating has been damaged, thoroughly clean, wire brush, and paint it with two coats of galvanizing compound in accordance with Section 562 to the satisfaction of the Engineer. Do not touch up minor heat discoloration in areas of welds.

400-5.7.4.2 Polymer Sheeting Repairs: Inspect and identify areas for damage to the polymer sheeting and repair with liquid polymer coating similar and compatible with respect to durability, adhesion and appearance in accordance with ASTM A 762, as furnished by the stay-in-place form manufacturer. Ensure that the inspection includes checking the polymer sheeting for cuts, tears, cracking, surface pits, peeling, dirt, grease, oil, stains, rust or bare areas. Reject any panels that show coating blistering, peeling or cracking. Repair all polymer sheeting damage according to the following:

a. Surface Preparation: Ensure that all surfaces to be repaired are clean and free of any deleterious substances. Remove all traces of dirt, soil, oil deposits, greases, and other surface contaminants in accordance with the polymer sheeting and coating manufacturer's written specifications prior to touch-up and recoating.

b. Application Procedures: Ensure that the liquid polymer repair coating is applied to a clean dry surface and in accordance with the manufacturer's written specifications. Apply the repair coating using a suitable paintbrush or other means acceptable to the Engineer. Apply a first coat of product to the surface at 2-4 mils in thickness. Let the first coat air dry. Apply a second coat to form a complete layer and increase the thickness, immediately after verifying the first coat is dry to the touch (15 - 25 minutes depending on the local air drying temperature and atmospheric conditions). Apply the second coat at the same coating thickness as the first at 2-4 mils. Ensure that the total dry film thickness of the two coats

is not less than 6 mils. Apply additional coats in this same manner until desired coating thickness is achieved.

400-5.7.5 Placing of Concrete: Vibrate concrete to avoid honeycomb and voids, especially at construction joints, expansion joints, valleys and ends of form sheets. Use approved pouring sequences. Do not use calcium chloride or any other admixture containing chloride salts in the concrete.

400-5.7.6 Inspection: The Engineer will observe the Contractor's method of construction during all phases of the construction of the bridge deck slab, including the installation of the metal form system; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, remove at least one section of the metal forms in each span for this purpose. Do this as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the procedures are obtaining the desired results. Remove an additional section in any span if the Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the Engineer's judgment, inspection is needed to check for defects in the bottom of the deck or to verify soundness, sound the metal forms with a hammer as directed by the Engineer after the deck concrete has been in place a minimum of two days. If sounding discloses areas of doubtful soundness to the Engineer, remove the metal forms from such areas for visual inspection after the concrete has attained adequate strength. Remove metal bridge deck forms at no expense to the Department.

At locations where sections of the metal forms have been removed, the Engineer will not require the Contractor to replace the metal forms. Repair the adjacent metal forms and supports to present a neat appearance and to ensure their satisfactory retention and where they are polymer sheeted, coat all exposed surfaces of stay-in-place metal form system elements that are not coated or are damaged with a field applied liquid polymer coating as specified in 400-5.7.4.2. As soon as the form is removed, the Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found, and the Engineer determines that these irregularities do not justify rejection of the work, repair the concrete as directed, and provide a General Surface Finish in accordance with 400-15. If the Engineer determines that the concrete where the form is removed is unsatisfactory, remove additional metal forms as necessary to inspect and repair the slab, and modify the method of construction as required to obtain satisfactory concrete in the slab. Remove and replace all unsatisfactory concrete as directed, at no expense to the Department.

If the method of construction and the results of the inspections as outlined above indicate that sound concrete has been obtained throughout the slabs, the amount of sounding and form removal may be reduced when approved by the Engineer.

Corrosion of assembly screws will not be considered a structural or aesthetic problem and is considered acceptable.

Provide the facilities for the safe and convenient conduct of the inspection procedures.

400-5.8 Stay-In-Place Concrete Forms:

400-5.8.1 General: Permanent stay-in-place precast reinforced concrete forms may be used in lieu of removable forms to form concrete bridge deck slabs subject to the conditions contained herein. Precast reinforced concrete stay-in-place forms are not permitted to

construct a composite concrete deck. Do not use precast prestressed concrete stay-in-place forms to form any permanent bridge decks.

When detailed plans for structures are dimensioned for the use of removable forms, provide additional slab thickness, elevation changes, changes in design, etc. to accommodate the use of stay-in-place forms, subject to the Engineer's approval. The Engineer will compute pay quantities of the various component members of the structure which are paid on a cubic yard basis from the design dimensions shown on the plans with no allowance for changes in deflection and changes in dimensions necessary to accommodate the stay-in-place forms. The Engineer will limit pay quantities of other Contract items which are increased to accommodate the use of stay-in-place forms to the quantity required for the original plan design.

Prior to using stay-in-place forms, submit for approval detailed plans of the forming system and design calculations. Indicate on the plans the form panel sizes, placing patterns, type of mastic or felt bearing material and type and method of caulking between panels. Also, submit appropriate changes in design details of structural members supporting stay-in-place forms showing any revisions necessary to enable the supporting components to withstand the additional weight of the forms and perform equally as contemplated in the plans. All calculations and details submitted shall be sealed by the Contractor's Engineer of Record. Modify the beams to provide additional strength to compensate for the added dead loads imposed by the use of stay-in-place forms. Obtain this strength by adding additional strands to prestressed girders or increasing the section modulus for steel girders. Do not use stay-in-place forms until the forming system and any necessary design revisions of supporting structural members have been approved by the Engineer. The Department is not responsible for the performance of the stay-in-place forms by its approval.

400-5.8.2 Materials: Construct permanent concrete forms of precast reinforced concrete with a Class 3 Surface Finish. As a minimum, use the same class of concrete and 28-day minimum compressive strength as being used to construct the bridge deck. Use welded steel wire reinforcement meeting the requirements of Section 931.

400-5.8.3 Design: Use the following criteria for the design of permanent bridge deck forms:

(1) Design the forms on the basis of deadload of form, reinforcement, and plastic concrete plus an unfactored live load of 50 psf for construction loads. Meet the AASHTO design requirements for service loads and ultimate loads as applicable.

(2) Deflection under the weight of the forms, reinforcement, and the plastic concrete shall not exceed 1/180 of the form span or 1/2 inch, whichever is less. In all cases, do not use a loading that is less than 120 psf total.

(3) Use a design span of the form equal to the clear span of the form between supports. Measure the span of concrete forms parallel to the centerline of the form panels.

(4) Compute physical design properties of concrete forms in accordance with current AASHTO design procedures.

(5) Ensure that all steel reinforcement contained in the cast-in-place concrete has the minimum cover shown on the plans or not less than 1 inch, whichever is greater. Measure the minimum cover normal to the plane of the bottom of the cast-in-place concrete. For stay-in-place concrete forms with other than plane surfaces in contact with the cast-in-place concrete, such as regularly spaced geometrical shapes projecting above the plane of the bottom of the cast-in-place concrete, meet the following special requirements:

(a) Space geometrical shapes projecting above the bottom plane of the cast-in-place concrete used to provide support for reinforcement no closer than 3 feet apart and of sufficient height to maintain the required concrete cover on the bottom mat of reinforcing steel.

(b) Construct all other geometrical shapes projecting above the plane of the bottom of the cast-in-place concrete to provide a minimum vertical clearance of 3/4 inch between the closest surface of the projections and the secondary longitudinal reinforcing steel in the deck slab.

(c) Do not allow a minimum horizontal distance from the surface of any transverse reinforcing steel to surfaces of the stay-in-place form of less than 1 1/2 inches.

For all steel reinforcement for the stay-in-place form panels, provide a minimum of 1 inch concrete cover except that, for construction in a salt or other corrosive environment, provide a minimum of 1 1/2 inches concrete cover.

(6) Maintain the plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck. Measure the minimum cover of the bottom mat of steel normal to the top of the precast concrete form panel.

(7) Do not consider the permanent bridge deck form as lateral bracing for compression flanges of supporting structural members.

(8) Do not use permanent concrete bridge deck forms in panels where longitudinal deck construction joints are located between stringers.

(9) Do not allow the maximum weight of the concrete form to exceed 40 lb/ft² of form surface.

400-5.8.4 Construction: Install all forms in accordance with approved fabrication and erection plans.

For concrete forms, provide a minimum bearing length of at least 1 1/2 inches but not exceeding 2 1/2 inches. Support concrete forms on the beams or girders by continuous layers of an approved mastic or felt bearing material that will provide a mortar tight uniform bearing. Use a mastic or felt bearing material that has a minimum width of 1 inch and a maximum width of 1 1/2 inches. Seal joints between concrete form panels with caulking, tape, or other approved method.

400-5.8.5 Placing of Concrete: Place the concrete in accordance with the requirements of 400-5.7.5. Immediately prior to placing the slab concrete, saturate concrete stay-in-place form panels with water.

400-5.8.6 Inspection: Inspect the concrete in accordance with the requirements of 400-5.7.6.

After the deck concrete has been in place for a minimum period of two days, inspect the forms for cracks and excessive form deflection, and test for soundness and bonding of the forms by sounding with a hammer as directed by the Engineer. Remove, for visual inspection, form panels found to be cracked that show evidence of leakage and form panels which have a deflection greater than adjacent panels by 1/2 inch or more which show signs of leakage. If sounding discloses areas of doubtful soundness to the Engineer, remove the form panels from such areas for visual inspection after the concrete has attained adequate strength. Remove permanent bridge deck form panels at no expense to the Department.

At locations where sections of the forms have been removed, the Engineer will not require the forms to be replaced. Repair the adjacent forms and supports to present a neat appearance and to ensure their satisfactory retention. As soon as the form is removed, the

Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found, and the Engineer determines that these irregularities do not justify rejection of the work, repair the concrete as directed and provide a General Surface Finish in accordance with 400-15. If the concrete where the form is removed is unsatisfactory, as determined by the Engineer, additional forms shall be removed as necessary to inspect and repair the slab, and modify the methods of construction as required to obtain satisfactory concrete in the slab. Remove and replace all unsatisfactory concrete as directed at no expense to the Department.

If the methods of construction and the results of the inspections as outlined above indicate that the Contractor has obtained sound concrete throughout the slabs, the Contractor may moderate the amount of sounding and form removal, when approved.

Provide all facilities for the safe and convenient conduct of the inspection procedures.

400-6 Underdrain and Weep Holes.

Provide weep holes in all abutments and retaining walls.

Provide a continuous underdrain for box culverts in accordance with Design Standard Index No. 289. Provide weep holes that are at least 3 inches in diameter and not more than 10 feet apart. Place the outlet ends of the weep holes just above the ground line in front of abutments and retaining walls. Cover the exterior openings of all weep holes with galvanized wire mesh and a minimum of 2 cubic feet of clean, broken stone or gravel wrapped in Type D 3 filter fabric, to allow free drainage but prevent the fill from washing through.

400-7 Placing Concrete.

400-7.1 Weather Restrictions:

400-7.1.1 Concreting in Cold Weather: Do not place concrete when the air temperature at placement is below 45°F.

Meet the air temperature requirements for mixing and placing concrete in cold weather as specified in Section 346. During the curing period, if NOAA predicts the ambient temperature to fall below 35°F for 12 hours or more or to fall below 30°F for more than 4 hours, enclose the structure in such a way that the air temperature within the enclosure can be kept above 50°F for a period of 3 days after placing the concrete or until the concrete reaches a minimum compressive strength of 1,500 psi.

Assume all risks connected with the placing and curing of concrete.

Although the Engineer may give permission to place concrete, the Contractor is responsible for satisfactory results. If the placed concrete is determined to be unsatisfactory, remove, dispose of, and replace the concrete at no expense to the Department.

400-7.1.2 Concreting in Hot Weather: Meet the temperature requirements and special measures for mixing and placing concrete in hot weather as specified in Section 346.

When the temperature of the concrete as placed exceeds 75°F, incorporate in the concrete mix a water-reducing retarder or water reducer if allowed by Section 346.

Spray reinforcing steel and metal forms with cool fresh water just prior to placing the concrete in a method approved by the Engineer.

Assume all risks connected with the placing and curing of concrete.

Although the Engineer may give permission to place concrete, the Contractor is responsible for satisfactory results. If the placed concrete is determined to be unsatisfactory, remove, dispose of, and replace the concrete at no expense to the Department.

400-7.1.3 Wind Velocity Restrictions: Do not place concrete for bridge decks if the forecast of average wind velocity at any time during the planned hours of concrete placement exceeds 15 mph. Obtain weather forecasts from the National Weather Service “Hourly Weather Graph” for the city closest to the project site.

400-7.2 Lighting Requirements: Provide adequate lighting for all concrete operations conducted at night. Obtain approval of the lighting system prior to starting the concrete operations.

400-7.3 Inspections before Placing Concrete: Do not place concrete until the depth and character of the foundation and the adequacy of the forms and falsework have been approved by the Engineer. Do not deposit any concrete until all reinforcement is in place and has been inspected and approved by the Engineer.

400-7.4 Exposure to Water: Do not expose concrete other than seal concrete in cofferdams to the action of water before final setting. Do not expose such concrete to the action of salt or brackish water for a period of seven days after placing the concrete. Protect the concrete during this period by keeping salt or brackish water pumped out of cofferdams.

400-7.5 General Requirements for Placing Concrete: Do not place any concrete prior to approval of the Contractors quality control plan in accordance with 105-3. Deposit concrete as nearly as possible in its final position. Do not deposit large quantities at one point and then run or work it along the forms. Take special care to fill each part of the forms, to work coarse aggregate back from the face, and to force concrete under and around reinforcing bars without displacing them.

Use a method and manner of placing concrete that avoids the possibility of segregation or separation of aggregates. If the Engineer determines that the quality of concrete as it reaches its final position is unsatisfactory, remove it and discontinue or adjust the method of placing until the Engineer determines that the quality of the concrete as placed is satisfactory.

Use metal or metal-lined open troughs or chutes with no aluminum parts in contact with the concrete. As an exception, chutes made of aluminum with a protective coating for ready mixed concrete trucks, no longer than 20 feet, may be used. This exception does not apply to any other means of concrete conveyance. Where steep slopes are required, use chutes that are equipped with baffles or are in short lengths that reverse the direction of movement. Where placing operations would involve dropping the concrete freely more than 5 feet, deposit it through pipes, troughs, or chutes of sheet metal or other approved material. Use troughs, chutes, or pipes with a combined length of more than 30 feet only with the Department’s authorization. Keep all troughs, chutes, and pipes clean and free from coatings of hardened concrete by thoroughly flushing them with water after each run or more often if necessary.

Place concrete against supporting material that is moist at the time of concrete placement. If additional water is required, uniformly apply it ahead of the concrete placement as directed by the Engineer. Do not place concrete on supporting material that is frozen. The Contractor may use a moisture barrier in lieu of controlling the foundation grade moisture when approved by the Engineer.

400-7.6 Placing Concrete by Belt Conveyor: Place concrete by means of a belt conveyor system with written Department authorization. Remove conveyor belt systems which produce unsatisfactory results before continuing operations. Take concrete samples for assurance testing at the discharge end of the belt conveyor system. Make available to the Engineer the necessary platform to provide a safe and suitable place for sampling and testing. Remove any

concrete placed in an unsatisfactory manner at no expense to the Department before continuing operations.

Use conveyor belt systems that do not exceed a total length of 550 feet, measured from end to end of the total assembly. Arrange the belt assembly so that each section discharges into a vertical hopper arrangement to the next section. To keep segregation to a minimum, situate scrapers over the hopper of each section to remove mortar adhering to the belt and to deposit it into the hopper. Equip the discharge end of the conveyor belt system with a hopper and a chute or suitable deflectors to cause the concrete to drop vertically to the deposit area.

In order to avoid delays due to breakdowns, provide stand-by equipment with an alternate power source prior to the beginning of the placement.

After the beginning of the placement, direct the discharge from the belt conveyor so that the concrete always falls on freshly placed concrete.

400-7.7 Placing Concrete by Pumping: In general, use concrete pumping equipment that is suitable in kind and adequate in capacity for the work proposed. Use a pump discharge line that has a minimum diameter of 4 inches. Use a pump and discharge lines that are constructed so that no aluminum surfaces are in contact with the concrete being pumped. Operate the pump to produce a continuous stream of concrete, without air pockets. When using cement slurry or similar material to lubricate the discharge line when pumping begins, collect such material at the point of discharge. Dispose of the collected slurry in areas provided by the Contractor. Control the pump discharge locations so that the placement locations of the various LOTs of concrete represented by strength test cylinders can be identified in the event the test cylinders indicate deficient strength. When concrete is placed by pumping, take all test samples of concrete at the end of the discharge line, except in accordance with the provisions of Section 346.

400-7.8 Consolidation: Consolidate the concrete by continuous working with a suitable tool in an acceptable manner, or by vibrating as set forth in 400-7.11. When not using vibrators, thoroughly work and compact all thin-section work with a steel slicing rod. Spade all faces, and flush the mortar to the surface by continuously working with a concrete spading implement.

400-7.9 Obstructions: In cases where, because of obstructions, difficulty is encountered in puddling the concrete adjacent to the forms, bring the mortar content of the mix into contact with the interior surfaces by vibrating the forms. Produce the vibrations by striking the outside surfaces of the forms with wooden mallets or by other satisfactory means. In placing concrete around steel shapes place it only on one side of the shape until it flushes up over the bottom flange of the shape on the opposite side, after which place it on both sides to completion. After the concrete has taken its initial set, exercise care to avoid jarring the forms or placing any strain on the ends of projecting reinforcing bars.

400-7.10 Requirements for Successive Layers: Generally, place concrete in continuous horizontal layers, approximately 12 inches thick. To avoid obtaining a plane of separation between batches, do not allow the time before placing the next successive layer to exceed 20 minutes, unless the Engineer determines that adequate fluidity exists in the underlying layer. Generally, leave each layer of concrete unfinished to secure efficient bonding with the overlying layer. To minimize the visibility of joints on exposed faces, finish the top surface of the concrete immediately adjacent to the forms of the exposed face, smoothing with a plaster mason's trowel. Where required, use inset form work to eliminate featheredges and to obtain concrete layers with a minimum thickness of 6 inches. Conduct the operation of depositing and consolidating the concrete so as to form a dense, impervious mass of uniform texture with smooth faces on

exposed surfaces. Remove, dispose of, and replace defective concrete as directed by the Engineer and at no expense to the Department.

400-7.11 Vibration of Concrete:

400-7.11.1 General: Consolidate all concrete except seal, steel pile jackets, and concrete for incidental construction by the use of mechanical vibrators.

400-7.11.2 Vibrators: Provide adequate vibrators on the project that are approved by the Engineer before beginning concrete work. Generally, provide vibrators of the internal type. For thin sections, where the forms are especially designed to resist vibration, the Contractor may use external vibrators. Use a vibrator with a minimum frequency of 4,500 impulses per minute with sufficient intensity and duration to cause complete consolidation of the concrete without causing segregation of the materials. For vibrating thin, heavily reinforced sections, use heads of such size to secure proper vibration of the concrete without disturbance of either the reinforcing steel or the forms.

400-7.11.3 Number of Vibrators Required: Use a sufficient number of vibrators to secure the compaction of each batch before the next batch is delivered, without delaying the delivery. In order to avoid delays due to breakdowns, provide at least one stand-by vibrator, with an appropriate power source.

400-7.11.4 Method of Vibration: Use vibrators to consolidate properly placed concrete. Do not use them to move concrete about in the forms. Insert the vibrators in the surface of concrete at points spaced to ensure uniform vibration of the entire mass of the concrete. Insert the vibrator at points that are no further apart than the radius over which the vibrator is visibly effective. Allow the vibrator to sink into the concrete by its own weight, and allow it to penetrate into the underlying layer sufficiently so that the two layers are thoroughly consolidated together. After thoroughly consolidating the concrete, withdraw the vibrator slowly to avoid formation of holes.

400-7.11.5 Hand Spading: When necessary in order to secure well-filled forms, free from aggregate pockets, honeycomb, bubbles, etc., spade the concrete by hand, along the surfaces of the forms and in all corners, following the vibration.

400-7.12 Columns: Place concrete in columns in one continuous operation for each lift as shown in the plans.

400-7.13 Slabs and Bridge Decks:

400-7.13.1 Bulkheads, Screed Rails, and Screeding Devices: Strike-off the concrete using an approved metal screed operating on rails or bulkheads. Use devices which do not contain aluminum parts. Prior to placing concrete, provide an approved screed capable of striking-off and screeding the surface of the slab or deck to the required shape. Set all necessary bulkheads and screed rails to the required grade. Use bulkheads, screed rails, and screeding devices that permit vertical profile adjustment to the grade, satisfactory for providing straight transverse slopes, differing transverse slopes broken as shown in the plans and/or transverse slopes with changing grade along the longitudinal length of slab or deck. Locate the screed rails so the entire placement surface can be screeded to grade without using intermediate screed rails, unless approved otherwise by the Engineer.

Use a screed consisting of a truss or heavy beams that will retain its shape under all working conditions, and a set of rotating drums with a diameter sufficient to carry a 2 inch mortar roll in front of and parallel to the axis of the drums, while making an initial pass. Adjust the drums to prevent mortar buildup forming behind the trailing edges of the drums. For long bridges, as defined in 400-15.2.5.1, provide a device that automatically smoothes the

concrete surface to an untextured finish and that is attached to, and is moved by, the rolling drum screed. As an alternate to the drum type screed, a mechanical screed with a metal strike-off may be used. Equip the mechanical screed with mechanical vibrators to provide continuous uniform vibration to the entire length unless otherwise authorized by the Engineer. Small and irregularly shaped areas that cannot be mechanically screeded may be screeded in a manner approved by the Engineer.

400-7.13.2 Screed Demonstration: Subsequent to the placement of all reinforcing steel and prior to placing any slab or deck concrete, demonstrate that the proposed equipment and methods can finish the concrete to the specified grades while maintaining the specified cover over the reinforcement. Provide the demonstration over the entire length and width of the spans to be placed.

400-7.13.3 Screeding Operations: Perform concrete placement and screeding as independently controlled mechanical operations. Ensure that the passing of the screed and forward movement of the screeding equipment are independent of the movement of concrete placement equipment.

Level the concrete in front of the screed as near to the finished grade as possible to prevent the screed from rising off the rail and forming uneven ridges behind the screed. Pass the screed over the slab or deck as many times as necessary to obtain a satisfactory surface and provide a concrete surface true to grade and crown, and free of irregularities.

Do not add water to the concrete surface to assist in finishing operations unless specifically authorized by the Engineer. If the Engineer permits the addition of water, apply only a fog mist, above the concrete surface, by means of approved power driven spray equipment.

For long bridges, as defined in 400-15.2.5.1, do not manually or mechanically float the concrete surface or apply a texture by broom or any other device to the concrete surface produced by the screeding process. Correct isolated surface irregularities in accordance with 400-15.2.5.3.

400-7.13.4 Placing Operations: Select an approved concrete design mix which ensures complete placement of all slab or deck concrete between construction joints before initial set begins in the plastic concrete. On placements of 50 yd³ or less, the minimum placement rate is 20 yd³/h. On placements of greater than 50 yd³, the minimum placement rate is 30 yd³/h.

The Engineer will not permit slab or deck placements until an acceptable plan for meeting the minimum placement rate is approved.

400-7.13.5 Concrete Decks on Steel Spans: Where concrete decks are placed on steel spans, release the temporary supports under the bridge before placing any concrete.

400-7.13.6 Concrete Decks on T-Beams: For cast-in-place T-beam construction, cast the slabs and beams in one continuous operation. As an exception, where special shear anchorage or keys are provided for in the plans or approved by the Engineer, the beams and slabs may be constructed in successive placements.

400-7.13.7 Diaphragms: Place concrete diaphragms at least 48 hours before the bridge deck slabs are placed unless otherwise indicated in the plans.

400-7.13.8 Weather Protection: Provide an approved means of protecting unhardened concrete from rain. Position the protection system to shield the concrete from rain and running water. Provide a shield impervious to water over the slab or deck concrete, of sufficient size to protect all areas of slab or deck concrete subject to water damage, and include a means of intercepting and diverting water away from freshly placed concrete. Arrange the

equipment so that the weather protection system can be erected over unhardened concrete. When there is a possibility of rain during concrete placement operations, place the weather protection system in stand-by readiness, capable of being deployed in a timely manner. Use the weather protection immediately when rain begins so that slab or deck concrete damage will not occur. Do not place concrete during rain.

Assume responsibility for damage to the slab or deck in the case of failure of the weather protection system.

Describe the weather protection materials and methods in the Contractor's quality control plan.

400-7.14 Concrete Box Culverts: In general, place the base slab or footing of concrete box culverts, and allow them to set before constructing the remainder of the culvert. In this case, make suitable provision for longitudinal keys. Construct bottom slabs, footings, and apron walls as a monolith if practicable. Where transverse construction joints are necessary, place them at right angles to the culvert barrel, and make suitable provision for keys.

In the construction of box culverts having walls 6 feet or less in height, the sidewalls and top slab may be constructed as a monolith or may place the concrete in the walls and allow it to set before placing the top slab concrete.

Where the height of the box culvert walls exceed 6 feet, place the walls, and allow the concrete to set at least 12 hours before placing the top slab concrete. In such cases, form keys in the sidewalls.

When casting the walls and top slabs of box culverts as a monolith, ensure that any necessary construction joints are vertical. Design all construction joints with formed keys. Provide keys that are beveled as shown in the plans or as directed, but do not allow the edge of the beveled material forming the key to be less than 1 1/2 inches from the edge of the concrete.

Construct each wingwall, if possible, as a monolith. Ensure that construction joints, where unavoidable, are horizontal and so located that no joints will be visible in the exposed face of the wing above the ground line.

Precast box culvert sections may be used in lieu of cast-in-place box culvert construction provided the provisions in Section 410 are satisfied.

400-8 Seals.

400-8.1 General: Wherever practicable, dewater all foundation excavations, and deposit the concrete in the dry as defined in 455-15.2. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, the Engineer may authorize the construction of a concrete foundation seal of the required size. Then, dewater the foundation, and place the balance of the concrete in the dry.

When required to place seal concrete, the Contractor is responsible for the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete. The Department will provide and pay for the seal concrete as an aid to the construction of the structure. Repair seal concrete as necessary to perform its required function at no expense to the Department.

400-8.2 Method of Placing: Carefully place concrete deposited under water in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than 1 yd³ capacity, or other approved method. Do not disturb the concrete after depositing it. Deposit all seal concrete in one continuous placement. Do not place any concrete in running water, and ensure that all form work designed to retain concrete under water is watertight.

400-8.3 Use of Tremie: Use a tremie consisting of a tube having a minimum inside diameter of 10 inches, constructed in sections having water-tight joints. Do not allow any aluminum parts to have contact with the concrete. Ensure that the discharge end is entirely seated at all times, and keep the tremie tube full to the bottom of the hopper. When dumping a batch into the hopper, keep the tremie slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper. Stop the flow by lowering the tremie. Support the tremie such as to permit the free movement of the discharge end over the entire top surface of the work and to permit its being lowered rapidly when necessary to choke off or retard the flow. Provide a continuous, uninterrupted flow until completing the work. Exercise special care to maintain still water at the point of deposit.

400-8.4 Time of Beginning Pumping: Do not commence pumping to dewater a sealed cofferdam until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72 hours after placement of the concrete.

400-9 Construction Joints.

400-9.1 Location: Make construction joints only at locations shown in the plans or in the placement schedule, unless otherwise approved in writing. If not detailed in the plans or placement schedule, or in case of emergency, place construction joints as directed.

400-9.2 Provisions for Bond and Transmission of Shear: Use shear key reinforcement where necessary to transmit shear or to bond the two sections together.

400-9.3 Preparations of Surfaces: Before depositing new concrete on or against concrete which has hardened, re-tighten the forms. Roughen the surface of the hardened concrete in a manner that will not leave loosened particles, aggregate, or damaged concrete at the surface. Thoroughly clean the surface of foreign matter and laitance, and saturate it with water.

400-9.4 Placing Concrete: Continuously place concrete from joint to joint. Carefully finish the face edges of all joints which are exposed to view true to line and elevation.

400-9.5 Joints in Sea Water or Brackish Water: For concrete placed in sea water or brackish water, do not place any construction joints between points 2 feet below the mean low water elevation and 6 feet above the mean high water elevation.

400-9.6 Joints in Long Box Culverts: For long concrete box culverts, vertical construction joints may be placed at a spacing not less than 30 feet. When using transverse construction joints, ensure that longitudinal reinforcing steel is continuous through the joint and that the joint is vertical.

400-9.7 Crack Control Grooves in Concrete Bridge Decks: When the plans require crack control grooves in the top surface of decks, either install a tooled "V" groove prior to initial concrete set or saw a groove using an early entry dry cut saw. When using an early entry dry cut saw, operate in accordance with the manufacturer's recommendations. Commence sawing as soon as the concrete has hardened enough to permit standing on the surface without leaving visible tracks or impressions and before uncontrolled concrete cracks occur.

400-10 Expansion Joints.

400-10.1 General: After meeting the smoothness criteria in 400-15, construct expansion joints to permit absolute freedom of movement. Carefully remove all loose or thin shells of mortar likely to cause a spall with movement at a joint from all expansion joints as soon as possible.

400-10.2 Sealed Joints: Fill expansion joints with a preformed joint filler. Cut the filler to conform to the cross-section of the structure, and furnish it in as few pieces as practicable,

using only a single piece in each curb section. Do not use small pieces that would tend to come loose. Prepare joints to be sealed and apply the sealer in accordance with approved manufacturer's directions.

400-10.3 Joint System Installation: Install expansion joints before or after the deck planing required by 400-15.2.5.5 following the manufacturer's instructions. When installed after deck planing, install the edge rail assemblies in the blockouts on a profile tangent between the ends of the deck and/or approach slab to within a plus 0 and minus 1/4 inch variation.

When installed before deck planing, install the edge rail assemblies 3/8 inch, plus or minus 1/16 inch, below the top surface of the deck or approach slab to compensate for concrete removal during planing.

400-11 Contact and Bearing Surfaces.

400-11.1 Separation of Surfaces: In general, separate all contact surfaces between superstructure and substructure or end walls and between adjacent superstructure sections by a layer of 55 lb roofing felt.

400-11.2 Finishing of Bearing Surfaces: Construct bearing surfaces (areas) to the tolerances as specified herein and in the other parts of the Contract Documents. When using neoprene bearing pads, finish the concrete surface to a uniform 'rough' texture using a burlap drag, fine bristle broom or float. For metal or high load rotational bearings, fill minor depressions, 1/8 inch maximum, caused by finishing, bush hammering, or grinding with a low-viscosity epoxy meeting the requirements of 926-1, Type F-2, applied by the use of a squeegee. Bearing surfaces may be ground to final position with carborundum. Check all bearing surfaces with a metallic straightedge prior to setting bearings or neoprene pads.

400-11.2.1 Deviation from Specified Elevations for Steel Beam

Superstructures: Construct to the elevation shown on the plans plus or minus 0.01 feet and do not exceed a 0.01 feet difference between specified elevations of bearing areas of adjacent bearings measured between the centerlines of bearing areas.

400-11.2.2 Deviation from Specified Elevations for Concrete Beam

Superstructures: Construct to the elevation shown on the plans plus or minus 0.02 feet.

400-11.2.3 Projecting Irregularities: Projecting irregularities will not exceed 1/16 inch.

400-11.2.4 Variations in Flatness for Neoprene Pads: In any direction, the pad is to be flat to within 1/16 inch. Pads designated to be sloped are not to deviate from the theoretical slope by the same amount.

400-11.2.5 Variations in Flatness for Metal or High Load Rotational

Bearings: Construct the bearing area to the tolerance indicated for the measured length along the orthogonal axes.

Bearing area length up to 30 inches long to plus or minus 1/16 inch.

Bearing area length over 30 inches up to 45 inches long to plus or minus 3/32 inch.

Bearing area length over 45 inches long to plus or minus 1/8 inch.

400-11.3 Bearing Pads: Use bearing pads for seating bridge shoes, ends of beams, and slabs of the types specified or required in the Plans.

Furnish and install composite neoprene pads as detailed in the Plans. Place neoprene pads, where specified or required, directly on masonry surfaces finished in accordance with the requirements of this Article. Ensure that pads, bearing areas of bridge seats, and metal bearing plates are thoroughly cleaned and free from oil, grease, and other foreign materials.

Exercise care in fabrication of related metal parts to avoid producing conditions detrimental to the performance of the pads, such as uneven bearing, excessive bulging, etc.

The Engineer will evaluate the degree of deformation and condition of bearing pads in the completed bridge on or before the final inspection required by 5-10 or when requested by the Contractor. As directed by the Engineer, correct horizontal bearing pad deformations that at the time of inspection exceed 50% of the bearing pad thickness or that the Engineer predicts will exceed 50% of the bearing pad thickness during future high or low temperature periods. Payment for this correction effort will be considered extra work in accordance with 4-3.

400-12 Anchor Bolts and Dowels.

Set anchor bolts and dowels as specified in Section 460.

Galvanize all anchor bolts as specified in Section 962.

400-13 Epoxy Bonding Compounds.

Where epoxy bonding compounds for bonding concrete are specified or required, apply the epoxy bonding materials only to clean, dry, structurally sound concrete surfaces. Provide surface preparation, application, and curing of epoxy bonding compound in strict accordance with the manufacturer’s recommendations for each particular application. Use an epoxy bonding compound listed on the Department’s Qualified Products List.

400-14 Removal of Forms.

Use the table below as the criterion for minimum time or compressive strength required before removal of forms or supports.

When using the time period criterion, include in the time period all days except days in which the temperature falls below 40°F.

Use the specified 28-day minimum compressive strength value as stated in 346-3.1 for each Class of Concrete utilized.

Location of Concrete Placement	Minimum Time for Form Removal for any Strength Concrete*	Minimum (%) of 28-day Compressive Strength for Form Removal
(1) Deck slabs, top slabs of culverts and bottom of caps, forms under sidewalks, and safety curb overhangs extending more than 2 feet		
(a) Class II (Bridge Deck)	7 days**	75**
(b) Class II (Other than Bridge Deck)	7 days	75
(c) Class III	7 days	70
(d) Class IV	7 days	60
(e) Class V	7 days	50
(2) Walls, piers, columns, sides of beams and other vertical surfaces	24 hours***	50***
(3) Front face form of curbs	6 hours	70
* For mass concrete, remove forms in accordance with 346-3.3 ** Reference 400-16.4 ***Do not place additional load on the section until 70% of the specified 28-day concrete strength is attained. Also, refer to 400-7.4.		

When using the percent of required strength, cast test cylinders for each mix for compressive strength determination or develop a curing concrete strength versus time curve (S/T Curve) which can be used in lieu of multiple test cylinders to determine when percent of required strength has been met.

Prior to curve use; obtain the Engineer's approval of the S/T Curve and its supporting data. An approved testing laboratory may be used to provide this information with approval of the Engineer. Plot S/T Curves using at least three different elapsed times that begin once test cylinders are cast; however, one of the elapsed times must be prior to the Contractor's intended form removal. Each elapsed time plotted must have a corresponding compressive strength computed by averaging the compressive strength of two test cylinders.

Cure such test cylinders as nearly as practical in the same manner as the concrete in the corresponding structural component, and test them in accordance with ASTM C 39 and ASTM C 31. Perform cylinder casting, curing, and testing at no expense to the Department and under the observation of the Engineer. When the S/T Curve indicates a compressive strength equal to or greater than the percentage of specified strength shown in the table above for form removal, the Contractor may remove the forms. When the ambient air temperature falls 15°F or more below the ambient air temperature that existed during development of a S/T Curve, use a S/T Curve that corresponds to the lower temperature and that is developed in accordance with this section.

Do not remove forms at any time without the consent of the Engineer. Even when the Engineer provides consent to remove the forms, the Contractor is responsible for the work.

400-15 Finishing Concrete.

400-15.1 General Surface Finish (Required for All Surfaces): After placing and consolidating the concrete, strike-off all exposed surfaces to the lines and grades indicated in the plans in a manner that will leave a surface of uniform texture free of undesirable surface irregularities, cavities, and other defects. Cut back metal ties supporting reinforcement, conduit, and other appurtenances a minimum of 1 inch from finished surface. After removing excess mortar and concrete and while the concrete is still in a workable state, carefully tool all construction and expansion joints. Leave joint filler exposed for its full length with clean edges. Ensure that finished work in addition to that specified above is compatible and complementary to the class of surface finish required.

Immediately after removing forms from any exposed concrete surface, remove all fins and irregular projections flush with the surface. Clean, saturate with water, and point all holes, tie cavities, honeycomb, chips and spalls with an approved high-strength, non-metallic, non-shrink grout meeting the requirements of Section 934, mixed and applied in accordance with the manufacturer's recommendations. Exercise care during the roughening process to prevent additional defacement and damage to the formed surface.

In the event unsatisfactory surfaces are obtained, repair these surfaces by methods approved by the Engineer or the affected concrete will be rejected. Repair any surface or remove rejected concrete at no expense to the Department.

400-15.2 Surface Finishes:

400-15.2.1 General: In addition to the general surface work specified for all exposed concrete surfaces, the Engineer may require one of the classes of surface finish listed below. For all such exposed surfaces, begin finish work for the applicable class specified, along with the general finish work, immediately after removal of the forms. In order to further ensure the required quality of the finish, remove forms no later than the minimum time specified for the

forms to remain in place. Satisfactorily repair finished concrete surfaces which are subsequently disfigured or discolored at no expense to the Department.

Provide the required class of surface finish for the various items of structural concrete as shown in the plans.

400-15.2.2 Class 1 Surface Finish: As soon as the pointing has sufficiently set, thoroughly saturate the exposed surfaces with water, and rub them with a medium coarse carborundum stone. Continue rubbing until the surface has been ground to a paste and remove all form marks, irregularities, and projections. In this process, do not introduce any additive material other than water. After the rubbing has produced a smooth surface of uniform color, allow the material which has been ground to a paste to reset under proper curing conditions. Subsequently, as a second operation, re-saturate the concrete surfaces with water, and thoroughly rub them with a fine carborundum stone. Continue this rubbing until the surface has a smooth, fine grain texture of uniform color.

The Contractor may substitute a Class 5 applied finish coating in accordance with 400-15.2.6 as an alternate surface finish on all areas where Class 1 surface finish is specified.

400-15.2.3 Class 2 Surface Finish: As soon as pointing has sufficiently set, thoroughly saturate the exposed concrete surfaces with water and rub them with a medium coarse carborundum stone. Continue rubbing until the surface has been ground to a paste and remove all form marks, irregularities, and projections. In this process, do not introduce any additive material other than water.

After rubbing has produced a smooth surface finish, of uniform color, carefully brush the material which has been ground to a paste to a uniform texture, and allow it to reset under proper curing conditions. Carefully protect these surfaces from disfigurement and discoloration during subsequent construction operations.

400-15.2.4 Class 3 Surface Finish: Where this surface finish is specified, use metal forms or timber forms with a form liner. Where specified or required on the plans, use No. 89 coarse aggregate for concrete.

After concrete has been placed in the forms and compacted, finish all exposed surfaces which are not contained by the forms to produce a surface texture as nearly equal to that produced by the form as practicable. Generally, finish unformed surfaces to a smooth, dense surface with a steel trowel.

Perform all work, including general surface finish work, in a manner that will preserve the same surface texture and color produced by the form. Pointed areas may be rubbed with a dry carborundum stone.

400-15.2.5 Class 4 Deck Finish:

400-15.2.5.1 General: Apply a Class 4 finish on bridge decks and concrete approach slabs. On Short Bridges (bridges having a length less than or equal to 100 ft), and on Miscellaneous Bridges (Pedestrian, Trail and Movable Spans) regardless of length, meet the finish and smoothness requirements of 400-15.2.5.2 and 400-15.2.5.4. On Long Bridges (bridges having a length greater than 100 ft) meet the finish and smoothness requirements of 400-15.2.5.3 and 400-15.2.5.5. When an existing bridge deck is widened, see the plans for the finish and smoothness requirements of the existing bridge deck and its new widened section. After meeting the screeding requirements of 400-7.13 and curing requirements of 400-16 and the smoothness requirements, herein, groove the bridge deck and approach slabs.

Regardless of bridge length, finish decks with less than 2 1/2 inches of top cover in accordance with the requirements for Short Bridges.

400-15.2.5.2 Plastic Surface Finish for Short and Miscellaneous

Bridges: After screeding is completed, check the surface of the plastic concrete with a 10 foot straightedge, positioning and half-lapping the straightedge parallel to the centerline to cover the entire surface. Immediately correct deficiencies of more than 1/8 inch, measured as an ordinate between the surface and the straightedge.

Finish the concrete surface to a uniform texture using a burlap drag, fine bristle broom or float. Finish the deck to a smooth surface having a sandy texture without blemishes, marks or scratches deeper than 1/16 inch.

400-15.2.5.3 Plastic Surface Finish for Long Bridges: Do not moisten, manually float or apply texture to the concrete surface after the screed, with attached smoothing device, has passed unless correction of isolated surface irregularities is warranted and this should be done as soon as possible after screeding while the concrete is plastic. Correct all flaws such as cavities, blemishes, marks, or scratches that will not be removed by planing.

If the Engineer permits the addition of water when correcting flaws, apply moisture to the concrete surface only if required and only in the immediate vicinity of the isolated irregularity. Apply a quantity of moisture not greater than what is needed to facilitate correction of the irregularity and apply only a fog mist, above the concrete surface, by power driven spray equipment approved by the Engineer.

400-15.2.5.4 Smoothness Requirements for Short Bridges and Miscellaneous Bridges (including approach slabs): Perform a final straightedge check with a 10 foot straightedge, positioning and half-lapping the straightedge parallel to the centerline, approximately 5 feet apart to cover the entire surface. Correct all irregularities greater than 3/16 inch measured as an ordinate to the straightedge, by grinding. Perform grinding by the abrasive method using hand or power tools or by machine, to leave a smooth surface within a 1/8 inch tolerance.

400-15.2.5.5 Smoothness Evaluation and Concrete Surface Planing, Long Bridges (including approach slabs): Prior to planing, provide a smoothness evaluation of the completed bridge deck and exposed concrete surfaces of approach slabs by a computerized Cox California-type profilograph in accordance with the criteria herein and FM 5-558E. Furnish this evaluation through an independent provider approved by the Engineer, using equipment calibrated by the Engineer. All bridge deck and concrete approach slab surfaces to within 2 feet of gutter lines are subject to this smoothness evaluation.

Prior to initial profilograph testing, complete work on the bridge deck and approach slabs. Thoroughly clean and clear the bridge deck and approach slab areas to be evaluated for smoothness of all obstructions and provide the smoothness evaluation. Ensure that no radio transmissions or other activities that might disrupt the automated profilograph equipment are allowed during the evaluation.

Average the Profile Index Value for the bridge deck, including the exposed concrete surfaces of the approach slabs, for the left and right wheel path of each lane. The maximum allowable Profile Index Value for acceptable smoothness is 10 inches per mile utilizing the 0.2 inch blanking band. Apply these criteria to a minimum of 100 feet of each lane. Additionally, correct individual bumps or depressions exceeding a cutoff height of 0.3 inch from a chord of 25 feet (see ASTM E-1274) on the profilograph trace. Ensure that the surface meets a 1/4 inch in 10 feet straightedge check made transversely across the deck and approach slabs if

determined necessary by the Engineer. Provide additional profilograph testing as necessary following longitudinal planing and any other actions taken to improve smoothness, until a profile meeting the acceptance criteria is obtained.

Regardless of whether expansion joints are installed before or after deck planing is complete, plane off the concrete deck surface to a minimum depth of 1/4 inch and also meet or exceed the profilograph smoothness criteria. Longitudinally plane the entire bridge deck and exposed concrete surfaces of the approach slabs using a self-propelled planing machine with gang mounted diamond saw cutting blades specifically designed for such work. Use the profilograph generated smoothness data, to establish the optimum planing machine settings. Plane the deck surface to within 2 feet of the gutter line so that there is a smooth transition, without vertical faces or sudden surface discontinuities, from the fully planed surface to the unplaned surface. Use a machine with a minimum wheel base length of 15 feet, constructed and operated in such manner that it does not cause strain or damage to deck or approach slab surfaces, excessive ravels, aggregate fractures or spalling. The equipment shall be approved by the Engineer. Perform longitudinal planing parallel to the roadway centerline, and provide a consistent, textured surface. Clean the surface of all slurry/debris generated during this work concurrently with operation of the machine.

After the deck has been planed the minimum 1/4 inch, reevaluate the surface smoothness using the profilograph testing described above. Perform cycles of planing and profilograph retesting as necessary until the deck and exposed concrete surfaces of approach slabs are in compliance with the smoothness criteria but do not exceed the maximum concrete removal depth of 1/2 inch.

400-15.2.5.6 Grooving: After the concrete surface profile, as required by 400-15.2.5, has been accepted by the Engineer, and prior to opening the bridge to traffic, groove the bridge deck and approach slabs perpendicular to the centerline of the structure. Do not groove the deck surface of pedestrian or trail bridges unless otherwise shown in the Contract Documents. Cut grooves into the hardened concrete using a mechanical saw device which will leave grooves nominally 1/8 inch wide and 3/16 inch deep. Space the grooves apart in random spacing center of grooves in the following sequence: 3/4 inch, 1-1/8 inch, 5/8 inch, 1 inch, 5/8 inch, 1-1/8 inch, 3/4 inch in 6 inch repetitions across the width to be grooved in one pass of the mechanical saw device. One 6 inch sequence may be adjusted by 1/4 sequence increments to accommodate various cutting head widths provided the general pattern is carried out. The tolerance for the width of the grooves is plus 1/16 inch to minus 0 inch and the tolerance for the depth of grooves is plus or minus 1/16 inch. The tolerance for the spacing of the grooves is plus or minus 1/16 inch.

Cut grooves continuously across the deck or approach slab to within 18 inches of gutter lines at barrier rail, curb line and median divider. At skewed metal expansion joints in bridge deck surfaces, adjust groove cutting by using narrow width cutting heads so that all grooves of the bridge deck surface or approach slab surface end within 6 inches, measured normal to centerline of the joint, leaving no ungrooved surface adjacent to each side of the joint greater than 6 inches in width. Ensure that the minimum distance to the first groove, measured normal from the edge of the concrete joint or from the junction between the concrete and the metal leg of the armored joint angle, is 1 inch. Produce grooves that are continuous across construction joints or other joints in the concrete surface less than 1/2 inch wide. Apply the same procedure described above where the gutter lines at barrier rails, curb lines and median dividers are not parallel to the centerline of the bridge to maintain the 18 inches maximum

dimension from the grooves to the gutter line. Cut grooves continuously across formed concrete joints.

400-15.2.6 Class 5 Applied Finish Coating:

400-15.2.6.1 General: Place an applied finish coating upon all concrete surfaces where the plans indicate Class 5 Applied Finish Coating. Apply the finish coating after completion of the general surface work specified for all exposed concrete surfaces. Select an Applied Finish Coating from the Departments Qualified Products List meeting the requirements of Section 975.

400-15.2.6.2 Material: For the coating material, use a commercial product designed specifically for this purpose. Use only coating material that is manufactured by one manufacturer and delivered to the job site in sealed containers bearing the manufacturer's original labels. Submit a copy of the manufacturer's printed instructions to the Engineer.

400-15.2.6.3 Surface Preparation: Prepare the surface prior to the application of an applied finish coating by providing a surface finish in accordance with the requirements of 400-15.1. The Engineer will not require surface voids that are 1/4 inch or less in width and depth to be grouted prior to application of the finish coating. Fill surface void larger than 1/4 inch in width and depth an approved high strength, non metallic, non shrink grout meeting the requirements of Section 934, mixed and applied in accordance with the manufacturer's recommendations. Apply the grout by filling the surface voids using burlap pads, float sponges, or other acceptable methods. As soon as the grout has taken its initial set, brush the surface to remove all loose grout, leaving the surface smooth and free of any voids. Ensure that the surface to be coated is free from efflorescence, flaking coatings, curing compound, dirt, oil, and other substances deleterious to the applied finish coating. Prior to application of the finish coating onto precast or cast-in-place concrete surfaces, test the concrete surface at 30 foot intervals for the presence of curing compound using one or two drops of muriatic acid placed on the concrete surface. If curing compound is present, there will be no reaction between the acid and the concrete. If there is no reaction, remove the compound by pressure washing the concrete surfaces. Prepare the surfaces in accordance with the manufacturer's recommendations, and ensure that they are in a condition consistent with the manufacturer's requirements. Clean surfaces of existing structures in accordance with 400-19.

400-15.2.6.4 Application: Apply the finish coating utilizing a method recommended by the manufacturer. When applying the finish coating by spraying, supply heavy duty spray equipment capable of maintaining a constant pressure necessary for proper application. Mix and cure all coating materials in accordance with the manufacturer's printed instructions. Apply the finished coating at a rate of 50, plus or minus 10 ft²/gal.

400-15.2.6.5 Finished Product: Produce a texture of the completed finish coat that is generally similar to that of rubbed concrete. Ensure that the completed finished coating is tightly bonded to the structure and presents a uniform appearance and texture. If necessary, apply additional coats to produce the desired surface texture and uniformity.

Upon failure to adhere positively to the structure without chipping, flaking, or peeling, or to attain the desired surface appearance, remove coatings entirely from the structure, and reapply the finish coating after surface preparation until achieving the desired finished product. Do not allow the average thickness of the completed finish coating to exceed 1/8 inch.

400-15.2.6.6 Material Tests and Certification: Before any portion of any shipment of finish coating is applied on the project, furnish the Engineer with a certificate from

the manufacturer attesting that the commercial product furnished conforms to the same formula as that previously subjected to the tests specified in Section 975. In addition, submit the following product analysis, obtained from the manufacturer, for each batch of the material used:

- (a) Weight per gallon.
- (b) Consistency (Krebs Units).
- (c) Weight percent pigment.
- (d) Weight percent vehicle solids.
- (e) Infra-red spectra of vehicle solution.

400-15.2.7 Final Straightedging for Surfaces to Receive Asphalt Concrete

Surface: Test the slab surfaces of poured-in-place decks which are to be surfaced with an asphalt concrete wearing course for trueness with a 10 foot straightedge, as specified above. As an exception, correct only irregularities of more than 1/4 inch measured as an ordinate (either above or below the general contour of the surface). The Engineer will not require belting or brooming of slabs that are to be surfaced with an asphalt concrete wearing course. For curing, meet the requirements specified for other deck slabs.

400-15.2.8 Finishing Bridge Sidewalks: Finish bridge sidewalks in accordance with the applicable requirements of Section 522.

400-16 Curing Concrete.

400-16.1 General: Cure cast-in-place and precast (non-prestressed) concrete as required herein for a minimum duration of 72 hours. If forms are loosened or removed before the 72 hour curing period is complete, expand the curing to cover these surfaces by either coating with curing compound or extending the continuous moist cure area.

Until curing has begun, retain concrete surface moisture at all times by maintaining a surface moisture evaporation rate less than 0.1 lb/ft²/hr. Periodically, at the site of concrete placement prior to and during the operation, measure the ambient air temperature, relative humidity and wind velocity with industrial grade weather monitoring instruments to determine the on-site evaporation rate. If the evaporation is, or is likely to become 0.1 lb/ft²/hr or greater, employ measures to prevent moisture loss such as application of evaporation retarder, application of supplemental moisture by fogging or reduction of the concrete temperature during batching. Compute the evaporation rate by using the nomograph in the ACI manual of Concrete Practice Part 2, Section 308R Guide to Curing Concrete, or by using an evaporation rate calculator approved by the Engineer.

400-16.2 Methods: Except where other curing methods are specified, select from the following options the chosen method(s) for curing all concrete components and indicate the method to be used in the Quality Control Plan.

(a) Continuous Moisture: Place burlap on the surface and keep it continuously saturated for the curing period by means of soaker hoses or automatic sprinklers. Water flow may be metered to cycle repetitively for five minutes on and five minutes off during the 72 hour curing period. Do not apply moisture manually. If side forms are loosened or removed during the curing period, extend the burlap so as to completely shield the sides of the members.

(b) Membrane Curing Compound: Apply a white Type 2 curing compound to all surfaces at a uniform coverage as recommended by the manufacturer but not less than 0.06 gal/yd². Allow surfaces covered by the membrane curing compound to remain undisturbed for the curing period. Recoat any cracks, checks or other defects in the membrane seal which are detected during the curing period within one hour. If side forms are loosened during the curing period, maintain surface moisture and remove the forms within one hour and immediately coat

the formed surfaces with a membrane curing compound. Bottom surfaces shall be similarly coated after removal of or from the forms.

If curing compound is to be applied by spraying, use a compressor driven sprayer of sufficient size to provide uniform mist. Standby equipment is required in case of mechanical failure and hand held pump-up sprayers may be used only as standby equipment.

(c) Curing Blankets: Curing blankets may be used for curing the top surfaces of members while the member side forms remain in place. Do not use curing blankets which have been torn or punctured. Securely fasten all edges to provide as tight a seal as practical. Should the system fail to maintain a moist condition on the concrete surface, discontinue use of the blankets and continue curing using another method. Keep curing blankets in place for the duration of the curing period.

(d) Accelerated Cure:

(1) General: Accelerated curing of the concrete can be achieved by use of either low pressure steam curing, radiant heat curing or continuous moisture and heat curing. If accelerated curing is completed before the 72 hour curing period has elapsed, continue curing for the remaining part of the 72 hour curing period in accordance with one of the curing methods listed above.

If accelerated curing is used, furnish temperature recording devices that will provide accurate, continuous and permanent records of the time and temperature relationship throughout the entire curing period. Provide one such recording thermometer for each 200 feet of placement length or part thereof. Initially calibrate recording thermometers and recalibrate at least annually.

The preheating period shall equal or exceed the time of initial set as determined by ASTM C 403 and shall not be less than 4 hours. When the ambient air temperature is above 50°F, allow the member to remain undisturbed in the ambient air for the preheating period. If the ambient air temperature is below 50°F, apply heat during the preheating period to hold the air surrounding the member at a temperature of 50 to 90°F.

To prevent moisture loss from exposed surfaces during the preheating period, enclose members as soon as possible after casting or keep the surfaces wet by fog mist or wet blankets. Use enclosures for heat curing that allow free circulation of heat about the member with a minimum moisture loss. The use of tarpaulins or similar flexible covers may be used provided they are kept in good repair and secured in such a manner to prevent the loss of heat and moisture. Use enclosures that cover the entire placement.

During the application or removal of the heat, do not allow the temperature rise or fall within the enclosure to exceed 40°F/hr. Do not allow the curing temperature throughout the enclosure to exceed 160°F. Maintain the curing temperature within a temperature range of 130 to 160°F until the concrete has reached the required form removal strength for precast and cast-in-place components or the required release strength for prestressed concrete components.

(2) Low-Pressure Steam: The steam used shall be in a saturated condition. Do not allow steam jets to impinge directly on the concrete, test cylinders, or forms. Cover control cylinders to prevent moisture loss and place them in a location where the temperature is representative of the average temperature of the enclosure.

(3) Curing with Radiant Heat: Apply radiant heat by means of pipes circulating steam, hot oil or hot water, or by electric heating elements. Do not allow the heating elements to come in direct contact with the concrete or the forms. Distribute sources of heat in a

manner that will prevent localized high temperatures above 160°F. To prevent moisture loss during curing, keep the exposed surfaces wet by fog mist or wet blankets.

(4) Continuous Moisture and Heat: This method consists of heating the enclosure in combination with the continuous moisture method described above.

In addition to the curing blankets, an auxiliary cover for retention of the heat will be required over the entire placement. Support this cover at a sufficient distance above the placement being cured to allow circulation of the heat.

400-16.3 Silica Fume Concrete: Cure silica fume concrete a minimum of 72 hours using continuous moisture cure. No substitution of alternative methods nor reduction in the time period is allowed. After completion of the 72 hour curing period, apply a membrane curing compound to all concrete surfaces. Apply curing compound according to 400-16.2.

400-16.4 Bridge Decks: Cure bridge decks for a duration of seven days. Apply a membrane curing compound to the deck top surface in accordance with 400-16.2 using a compressor driven sprayer. In general, apply curing compound to a concrete deck when the surface is damp and after all pooled water has evaporated. For Short bridges, begin applying curing compound immediately after the initially placed concrete has been floated, straightedged, textured and a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. For Long bridges, begin applying curing compound to the initially placed concrete as soon as a damp surface condition exists and continue applying compound as concrete placement progresses with as little interruption as possible until the entire deck surface has been coated with compound. However, for both Short and Long bridges, the elapsed time between the initial placement of deck concrete and the completed application of curing compound must not exceed 120 minutes. The 120 minute limit may be extended by the Engineer if project specific factors (cool temperatures, high humidity, retarding admixtures, etc.) are prolonging wet surface conditions.

Prior to the first deck placement, submit to the Engineer the method that will be used to periodically measure the rate of application of curing compound in, gallons/sq ft as the deck placement progresses. Prior to the placement of each deck, submit to the Engineer the anticipated quantity of curing compound in gallons along with the corresponding square feet of deck to be covered to meet the coverage rate in 400-16.2. Compute the actual quantity of curing compound applied at the conclusion of each deck placement and submit the quantity to the Engineer. Apply the curing compound from a work platform.

Place curing blankets on all exposed surfaces which are not formed as soon as possible with minimal effect on the surface texture. Place the curing blankets with sufficient overlapping seams to form an effective moisture seal. Before using curing blankets, mend tears, splits, or other damage that would make them unsuitable. Discard curing blankets that are not repairable. Wet all curing blankets immediately after satisfactorily placing them and maintain them in a saturated condition throughout the seven day curing period. Supply sufficient quantity of potable water at the job site for wetting the blankets.

Where a bridge deck slab is to be subjected to walking, wheeling or other approved construction traffic within the seven day curing period, protect the curing blankets and the slab surface from damage by placing wooden sheeting, plywood or other approved protective material in the travel areas.

When the ends of the curing blankets are rolled back to permit screeding of adjacent bridge deck slabs, keep the exposed surfaces wet throughout the period of exposure.

Removal of bottom and side forms after 72 hours is acceptable upon compliance with 400-14. Apply membrane curing compound to all surfaces stripped of forms within one hour of loosening. Apply curing compound according to 400-16.2.

400-16.5 Construction Joints: Cure construction joint areas using either the continuous moisture or curing blankets method.

400-16.6 Traffic Barriers, Railings, Parapets and End Post: Ensure concrete is cured in accordance with 400-16.2(b). When construction is by the slip form method, coat all concrete surfaces with a curing compound that meets the requirements of 925-2, either within 30 minutes of extrusion or before the loss of water sheen, whichever occurs first. Ensure a curing compound coating period of not less than seven days after application. Prior to each concrete placement, submit to the Engineer the method that will be used to periodically measure the rate of application in gallons/sq ft. Also, prior to each placement, submit to the Engineer the anticipated quantity of curing compound in gallons that will be used to meet the coverage rate specified in 400-16.2 along with the corresponding square footage of barriers, railings, parapets and end posts to be coated with that quantity. Compute the actual quantity of curing compound that is applied during each concrete placement and submit the quantity to the Engineer. Applied Finish Coatings, that are on the Qualified Products List and that are flagged as permitted for use as a curing compound, may be used in lieu of a curing compound; If an Applied Finish Coating is used in lieu of a curing compound, have a backup system that is in full compliance with 400-16.2(b) available at all times to ensure that an effective alternative system will be immediately available if the Applied Finish Coating cannot be applied within 30 minutes of extrusion or before the loss of water sheen.

400-16.7 Removal of Membrane Curing Compounds: Provide the longest possible curing duration; however, remove curing compound on portions of members to be bonded to other concrete. Compounds may be removed by either sand or water blasting. Water blasting requires the use of potable water and a minimum nozzle pressure of 2,900 psi.

400-17 Protection of Concrete.

400-17.1 Opening to Traffic: Close concrete bridge decks and culverts to traffic for a period of at least 14 days after placing and for such additional times as deemed advisable. In the operation of placing, the Contractor may wheel concrete across previously poured slabs after they have set for 24 hours, provided plank runways are used to keep the loads over the beams.

400-17.2 Storing Materials on Bridge Slabs: Do not store heavy equipment or material, other than light forms or tools, on concrete bridge slabs until 14 days after they have been poured. For all stockpiles, tools, and equipment stored on bridge slabs at any time, obtain prior approval by the Department, and the Engineer will require any such stored materials or equipment to be dispersed in order to avoid overloading any structural part.

400-17.3 Time of Placing Superstructure: In the case of piers or bents with concrete caps, do not place the weight of the superstructure or of beams on the caps until they have reached the age of 10 days.

400-17.4 Alternate Procedure: As an alternate procedure, in lieu of the time delay periods set forth in 400-17.1 and 400-17.3, test beams or cylinders may be cast from representative concrete and cured identically with the concrete in the corresponding structural component. Make the test beams in accordance with ASTM C31 and test them in accordance with ASTM C78. When the test results indicate a minimum flexural strength of 550 psi for beams or the minimum 28 day compressive strength shown in the Plans, concrete bridge decks and culverts may be opened to traffic or the superstructure and beams may be placed on caps.

However, regardless of beam or cylinder break results, fully comply with the bridge deck curing provisions of 400-16.4, including the requirement for curing blankets to remain in place for seven days.

400-18 Precast Planks, Slabs, and Girders.

400-18.1 General: Where so shown in the Contract Documents, the Contractor may construct concrete planks, slabs, girders, and other structural elements by precasting. In general, use a method that consists of casting structural elements in a casting yard, curing as specified in 400-16, transporting them to the site of the work, installing them on previously prepared supports and, where so shown in the plans, joining them with poured-in-place slabs or keys. Handle and install precast prestressed members as specified in Section 450.

400-18.2 Casting: Cast precast elements on unyielding beds or pallets. Use special care in casting the bearing surfaces on both the elements and their foundations in order that these surfaces shall coincide when installing the elements. Check bearing surfaces on casting beds with a level and a straightedge prior to the casting. Similarly check corresponding surfaces on the foundations during finishing operations.

400-18.3 Poured-in-Place Keys: Where precast elements are to be joined with poured-in-place keys, carefully align the elements prior to pouring the keys.

400-18.4 Surface Finish: Finish the surface as specified in 400-15, except that where precast slabs and poured-in-place keys form the riding surface, give the entire surface a broomed finish.

400-18.5 Moving, Placing, and Opening to Traffic: Reinforced precast members may be moved from casting beds, placed in the structure, and opened to traffic at the ages shown in the following table:

Handling from casting beds to storage areas	7 days
Placing in structure	14 days
Opening to traffic:	
Precast elements.....	14 days
Cast-in-place slabs over precast girders.....	14 days
Cast-in-place keys joining precast slabs	7 days

As an alternate procedure, in lieu of the time delay periods set forth above, test beams may be cast from representative concrete, and cure them identically with the concrete in the corresponding structural component. Test the test beams in accordance with ASTM C 31 and ASTM C 78. When the test results indicate a flexural strength of 550 psi, or more, any of the operations listed above may proceed without completing the corresponding time delay period.

400-18.6 Setting Prestressed Slabs: Before permitting construction equipment on the bridge to erect slab units, submit sketches showing axle loads and spacing and a description of the intended method of setting slab units to the Engineer for approval. Do not use axle loads, spacing, and methods of setting which produce stresses in the slab units greater than the allowable stress.

400-18.7 Protection of Precast Elements: The Contractor is responsible for the safety of precast elements during all stages of construction. The Engineer will reject any precast elements that become cracked, broken, seriously spalled, or structurally impaired. Remove rejected precast elements from the work at no expense to the Department.

400-18.8 Form Material: Form material used to form hollow cores may be left in place. Ensure that the form material is neutral with respect to the generating of products harmful to the

physical and structural properties of the concrete. The Contractor is responsible for any detrimental effects resulting from the presence of the form material within the precast element.

400-19 Cleaning and Coating Concrete Surfaces of Existing Structures.

For the purposes of this article, an existing structure is one that was in service prior to the start of the project to which this specification applies. For existing structures, clean concrete surfaces that are designated in the Contract Documents as receiving Class 5 applied finish coating by pressure washing prior to the application of coating. Use pressure washing equipment producing a minimum working pressure of 2,500 psi when measured at or near the nozzle. Do not damage or gouge uncoated concrete surfaces or previously coated concrete surfaces during cleaning operations. Remove all previously applied coating that is no longer adhering to the concrete or that is peeling, flaking or delaminating. Ensure that after the pressure wash cleaning and the removal of non-adherent coating, that the cleaned surfaces are free of efflorescence, grime, mold, mildew, oil or any other contaminants that might prevent proper adhesion of the new coating. After cleaning has been successfully completed, apply Class 5 Applied Finish Coating in accordance with 400-15.2.6 or as otherwise specified in the Plans.

400-20 Approach Slabs.

Construct approach slabs at the bridge ends in accordance with the applicable requirements of Section 350 using Class II (Bridge Deck) concrete. Place the reinforcement as specified in 350-7 and Section 415.

The approach slab may be opened to traffic, vehicular or construction equipment, 14 days after concrete placement or after the prescribed curing period has elapsed and the concrete has attained the required 28 day cylinder strength.

400-2 Disposition of Cracked Concrete.

400-21.1 General: The disposition of cracked concrete is described in this Article and applies to all cast-in-place concrete members, and once installed, to the precast and prestressed concrete members that are produced in accordance with 410, 450, 521, 534, 548 and 641.

400-21.2 Investigation, Documentation and Monitoring: The Engineer will inspect concrete surfaces as soon as surfaces are fully visible after casting, with the exception of surfaces of precast concrete products produced in offsite plants, between 7 and 31 days after the component has been burdened with full dead load, and a minimum of 7 days after the bridge has been opened to full unrestricted traffic. The Engineer will measure the width, length and depth of each crack and establish the precise location of the crack termination points relative to permanent reference points on the member. The Engineer will determine if coring of the concrete is necessary when an accurate measurement of crack depth cannot be determined by use of a mechanical probe. The Engineer will monitor and document the growth of individual cracks at an inspection interval determined by the Engineer to determine if cracks are active or dormant after initial inspection. The Engineer will perform all final bridge deck crack measurements once the deck is free of all debris and before transverse grooves are cut and after planing is complete for decks that require planing.

Provide the access, equipment and personnel needed for the Engineer to safely perform this work at no expense to the Department. Core cracks for use by the Engineer in locations and to depths specified by the Engineer at no expense to the Department.

400-21.3 Classification of Cracks: The Engineer will classify cracks as either nonstructural or structural and determine the cause. In general, nonstructural cracks are cracks

1/2 inch or less deep from the surface of the concrete; however, the Engineer may determine that a crack greater than 1/2 inch deep is nonstructural. In general, structural cracks are cracks that extend deeper than 1/2 inch. A crack that is fully or partially underwater at any time during its service life will be classified as a structural crack unless the Environment note on the General Notes sheet in the plans categorizes the substructure as slightly aggressive, in which case, the nonstructural crack criteria may apply as determined by the Engineer.

Review and comment on the Engineer's crack classification; however, the Engineer will make the final determination.

400-21.4 Nonstructural Cracking Significance: The Engineer will determine the Cracking Significance. The Cracking Significance will be determined on the basis of total crack surface area as a percentage of total concrete surface area. Cracking significance will be categorized as Isolated, Occasional, Moderate or Severe according to the criteria in Tables 1 and 2. Cracking Significance will be determined on a LOT by LOT basis. A LOT will typically be made up of not more than 100 square feet and not less than 25 square feet of concrete surface area for structures other than bridge decks or typically not more than 400 square feet or not less than 100 square feet for bridge decks. A LOT will not extend beyond a single Elevation Range as shown in Table 1 or 2.

Review and comment on the Engineer's determination of Cracking Significance; however, the Engineer will make the final determination.

400-21.5 Repair Method: Repair or remove and replace cracked concrete as directed by the Engineer. Additional compensation or a time extension will not be approved for repair or removal and replacement of cracked concrete when the Engineer determines the cause to be the responsibility of the Contractor.

400-21.5.1 Nonstructural Cracks: Repair each crack using the method as determined by the Engineer for each LOT in accordance with Table 1 or 2. When further investigation is required to determine repair or rejection, either remove and replace the cracked concrete or provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Upon approval by the Engineer use epoxy injection in accordance with Section 411 to repair cracks in a member inside a dry cofferdam prior to flooding of the cofferdam. "Reject and Replace" in Table 1 or 2 means there is no acceptable repair method.

400-21.5.2 Structural Cracks: Provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Complete all repairs to cracks in a member inside a cofferdam prior to flooding the cofferdam.

Table 1
DISPOSITION OF CRACKED CONCRETE OTHER THAN BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) ⁽²⁾ x = crack width	Cracking Significance Range per LOT ⁽¹⁾												
		Isolated Less than 0.005%			Occasional 0.005% to<0.017%			Moderate 0.017% to<0.029%			Severe 0.029% or gr.			
		Environment Category												
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA	
Elevation: 0 to 6 ft AMHW	$x \leq 0.004$	NT	NT	PS ₍₆₎	NT	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎					
	$0.004 < x \leq 0.008$	NT	PS ₍₆₎	EI ₍₃₎	PS ₍₆₎	EI ₍₃₎	EI ₍₃₎	PS ₍₆₎						
	$0.008 < x \leq 0.012$	NT	PS ₍₆₎	EI										
	$0.012 < x \leq 0.016$	PS ₍₆₎	Investigate to Determine Appropriate Repair ^(4,5) or Rejection											
	$0.016 < x \leq 0.020$													
	$0.020 < x \leq 0.024$										Reject and Replace			
	$0.024 < x \leq 0.028$													
	$x > 0.028$													
Elev.: More Than 6 ft to 12 ft AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA	
	$x \leq 0.004$	NT	NT	PS ₍₆₎	NT	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎			
	$0.004 < x \leq 0.008$	NT	PS ₍₆₎	EI ₍₃₎	PS ₍₆₎	PS ₍₆₎	EI ₍₃₎	PS ₍₆₎	EI ₍₃₎					
	$0.008 < x \leq 0.012$	NT	PS ₍₆₎	EI	EI	EI								
	$0.012 < x \leq 0.016$	PS ₍₆₎	EI	EI	EI									
	$0.016 < x \leq 0.020$	EI												
	$0.020 < x \leq 0.024$		Investigate to Determine Appropriate Repair ^(4,5) or Rejection									Reject and Replace		
	$0.024 < x \leq 0.028$													
	$x > 0.028$													
Elev.: Over Land or More Than	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA	
	$x \leq 0.004$	NT	NT	NT	NT	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎			
	$0.004 < x \leq 0.008$	NT	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	PS ₍₆₎	EI ₍₃₎	PS ₍₆₎	EI ₍₃₎	EI ₍₃₎	PS ₍₆₎			

	$0.008 < x \leq 0.012$	NT	PS ⁽⁶⁾	EI	EI	EI	EI	EI	EI						
	$0.012 < x \leq 0.016$	PS ⁽⁶⁾	EI	EI	EI	EI	EI								
	$0.016 < x \leq 0.020$	EI	EI	EI	EI										
	$0.020 < x \leq 0.024$	EI	Investigate to Determine Appropriate Repair ^(4,5) or Rejection												
	$0.024 < x \leq 0.028$											Reject and Replace			
	$x > 0.028$														

Table 2
DISPOSITION OF CRACKED CONCRETE BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) ⁽²⁾ x = crack width	Cracking Significance Range per LOT ⁽¹⁾											
		Isolated less than 0.005%			Occasional 0.005% to <0.017%			Moderate 0.017% to <0.029%			Severe 0.029% or gtr.		
		Environment Category											
		S A	MA	EA	SA	M A	EA	SA	MA	EA	S A	M A	E A
Elevation: 12 feet or Less AMHW	$x \leq 0.004$	N T	NT	NT	NT	NT	NT	NT	NT	NT			
	$0.004 < x \leq 0.008$	N T	NT	EI/ M	NT	NT	EI/M	EI/ M	EI/ M	EI/M			
	$0.008 < x \leq 0.012$	N T	NT	EI/ M	NT	EI/ M	EI/M	EI/ M	EI/ M				
	$0.012 < x \leq 0.016$	N T	NT	EI/ M	NT	EI/ M							
	$0.016 < x \leq 0.020$	EI /M	EI/ M	EI	EI								
	$0.020 < x \leq 0.024$	EI /M	EI	EI			Investigate to Determine Appropriate Repair ^(4,5) or Rejection				Reject and Replace		
	$0.024 < x \leq 0.028$	EI /M	EI										
	$x > 0.028$												
Elevation: Over Land or More Than 12 feet AMHW	Crack Width	S A	MA	EA	SA	M A	EA	SA	MA	EA	S A	M A	E A
	$x \leq 0.004$	N T	NT	NT	NT	NT	NT	NT	NT	NT			
	$0.004 < x \leq 0.008$	N T	NT	NT	NT	NT	EI/M	NT	EI/ M	EI/M			
	$0.008 < x \leq 0.012$	N T	NT	EI/ M	NT	NT	EI/M	EI/ M	EI/ M				
	$0.012 < x \leq 0.016$	N T	NT	EI/ M	NT	EI/ M							
	$0.016 < x \leq 0.020$	N T	EI/ M	EI	EI/ M		Investigate to Determine Appropriate Repair ^(4,5) or Rejection						
	$0.020 < x \leq 0.024$	N T	EI/ M	EI							Reject and Replace		
	$0.024 < x \leq 0.028$	N T	EI/ M										
	$x > 0.028$												

Key of Abbreviations and Footnotes for Tables 1 and 2		
Type Abbreviation	Abbreviation	Definition
Repair Method	EI	Epoxy Injection
	M	Methacrylate
	NT	No Treatment Required
	PS	Penetrant Sealer
Environment Category	EA	Extremely Aggressive
	MA	Moderately Aggressive
	SA	Slightly Aggressive
Reference Elevation	AMHW	Above Mean High Water
<u>Footnotes</u>		
<p>(1) Cracking Significance Range is determined by computing the ratio of Total Cracked Surface Area (TCSA) to Total Surface Area (TSA) per LOT in percent [(TCSA/TSA) x 100] then by identifying the Cracking Significance Range in which that value falls. TCSA is the sum of the surface areas of the individual cracks in the LOT. The surface area of an individual crack is determined by taking width measurements of the crack at 3 representative locations and then computing their average which is then multiplied by the crack length.</p> <p>(2) Crack Width Range is determined by computing the width of an individual crack as computed in (1) above and then identifying the range in which that individual crack width falls.</p> <p>(3) When the Engineer determines that a crack in the 0.004 inch to 0.008 inch width range cannot be injected then for Table 1 use penetrant sealer unless the surface is horizontal, in which case, use methacrylate if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.</p> <p>(4) (a) Perform epoxy injection of cracks in accordance with Section 411. Seal cracks with penetrant sealer or methacrylate as per Section 413. (b) Use only methacrylate or penetrant sealer that is compatible, according to manufacturer's recommendations, with previously applied materials such as curing compound or paint or remove such materials prior to application.</p> <p>(5) When possible, prior to final acceptance of the project, seal cracks only after it has been determined that no additional growth will occur.</p> <p>(6) Methacrylate shall be used on horizontal surfaces in lieu of penetrant sealer if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.</p> <p>(7) Unless directed otherwise by the Engineer, repair cracks in bridge decks only after the grinding and grooving required by 400-15.2.5 is fully complete.</p>		

400-22 Method of Measurement.

400-22.1 General: The quantities of concrete to be paid for will be the volume, in cubic yards, of each of the various classes shown in the plans, in place, completed and accepted. The quantity of precast anchor beams to be paid for will be the number in place and accepted. The quantity of bridge deck grooving to be paid for will be the area, in square yards of bridge deck and approach slab, completed and accepted. The quantity of bridge deck grooving and planing to be paid for will be the area, in square yards of bridge deck and approach slab, completed and accepted.

Except for precast anchor beams, for any item of work constructed under this Section and for which measurement for payment is not to be made by the volume of concrete, measurement and payment for such work will be as specified in the Section under which the work is specified in detail.

No separate payment will be made for obtaining the required concrete finish.

400-22.2 Calculation of Volume of Concrete:

400-22.2.1 Dimensions: The quantity will be computed by the plan dimensions of the concrete, within the neat lines shown in the plans, except that no deduction will be made for weep holes, deck drains, or encroachment of inlets and pipes in box culverts, and no chamfers, scorings, fillets, or radii 1 1/2 in² or less in cross-sectional area will be taken into account.

400-22.2.2 Pay Quantity: The quantity to be paid for will be the original plan quantity, measured as provided in 400-22.2.1, except that where the plans call for an estimated quantity of miscellaneous concrete for contingent use, the contingent concrete will be measured as the actual quantity in place and accepted.

400-22.2.3 Items not Included in Measurement for Payment: No measurements or other allowances will be made for work or material for forms, falsework, cofferdams, pumping, bracing, expansion-joint material, etc. The volume of all materials embedded in the concrete, such as structural steel, pile heads, etc., except reinforcing steel, will be deducted when computing the volume of concrete to be paid for. For each foot of timber pile embedded, 0.8 ft³ of concrete will be deducted. The cost of furnishing and placing dowel bars shall be included in the Contract unit price for the concrete.

400-22.2.4 Deck Girders and Beam Spans: In computing the volume of concrete in deck girders and beam spans, the thickness of the slab will be taken as the nominal thickness shown on the drawings and the width will be taken as the horizontal distance measured across the roadway. The volume of haunches over beams will be included in the volume to be paid for.

400-22.2.5 Stay-in-Place Metal Forms: When using stay-in-place metal forms to form the slab of deck girder and beam spans, the volume of concrete will be computed in accordance with the provisions of 400-20.2.4 except that the thickness of the slab over the projected plan area of the stay-in-place metal forms will be taken as the thickness shown on the drawings above the top surface of the forms. The concrete required to fill the form flutes will not be included in the volume of concrete thus computed.

400-22.3 Bridge Deck Grooving: The quantity to be paid for will be plan quantity in square yards, computed, using the area bound by the gutter lines (at barrier rails, curbs and median dividers) and the beginning and end of the bridge or the end of approach slabs, whichever is applicable, constructed, in place and accepted.

400-22.4 Bridge Deck Grooving and Planing: The quantity to be paid for will be plan quantity in square yards, computed, using the area bound by the gutter lines (at barrier rails, curbs and median dividers) and the beginning and end of the bridge or the end of approach slabs, whichever is applicable, constructed, in place and accepted.

400-22.5 Composite Neoprene Pads: The quantity to be paid for will be the original plan quantity, computed using the dimensions of the pads shown in the plans.

400-22.6 Cleaning and Coating Concrete Surfaces: The quantity to be paid for will be the plan quantity in square feet for the areas shown in the plans.

400-23 Basis of Payment.

400-23.1 Concrete:

400-23.1.1 General: Price and payment will be full compensation for each of the various classes of concrete shown in the proposal.

400-23.1.2 Concrete Placed below Plan Depth: Authorized concrete placed in seal or footings 5 feet or less below the elevation of bottom of seal or footing as shown in the plans will be paid for at the Contract price set forth in the proposal under the pay items for substructure concrete.

Authorized concrete used in seal (or in the substructure where no seal is used) at a depth greater than 5 feet below the bottom of seal or footing as shown in the plans will be paid for as Unforeseeable Work.

Such payment will be full compensation for the cofferdam construction, for excavation, and for all other expenses caused by the lowering of the footings.

400-23.1.3 Seal Concrete Required but Not Shown in Plans: When seal concrete is required as provided in 400-8 and there is no seal concrete shown in the plans, it will be paid for as Unforeseeable Work.

400-23.2 Precast Anchor Beams: Price and payment will be full compensation for the beams, including all reinforcing steel and materials necessary to complete the beams in place and accepted.

No separate prices will be allowed for the various types of anchor beams.

400-23.3 Reinforcing Steel: Reinforcing steel will be measured and paid for as provided in Section 415, except that no separate payment will be made for the fabric reinforcement used in concrete jackets on steel piles or reinforcement contained in barriers, traffic separators or parapets. Where so indicated in the plans, the Department will not separately pay for reinforcing steel used in incidental concrete work, but the cost of such reinforcement shall be included in the Contract unit price for the concrete.

400-23.4 Bridge Deck Grooving: Price and payment will be full compensation for all grinding, grooving, equipment, labor, and material required to complete the work in an acceptable manner.

400-23.5 Bridge Deck Grooving and Planing: Price and payment will be full compensation for all grooving, planing, equipment, labor, and material required to complete the work in an acceptable manner.

400-23.6 Composite Neoprene Pads: Price and payment will be full compensation for all work and materials required to complete installation of the pads.

400-23.7 Cleaning and Coating Concrete Surfaces: Price and payment will be full compensation for all work and materials required. The cost of coating new concrete will not be paid for separately, but will be included in the cost of the item to which it is applied.

400-23.8 General: The above prices and payments will be full compensation for all work specified in this Section, including all forms, falsework, joints, weep holes, drains, pipes, conduits, bearing pads, setting anchor bolts and dowels, surface finish, and cleaning up, as shown in the plans or as directed. Where the plans call for water stops, include the cost of the water stops in the Contract unit price for the concrete.

Unless payment is provided under a separate item in the proposal, the above prices and payments will also include all clearing and grubbing; removal of existing structures; excavation, as provided in Section 125; and expansion joint angles and bolts.

The Department will not change the rate of payment for the various classes of concrete in which steel may be used due to the addition or reduction of reinforcing steel.

The Department will not make an allowance for cofferdams, pumping, bracing, or other materials or equipment not becoming a part of the finished structure. The Department will not pay for concrete placed outside the neat lines as shown in the plans.

When using stay-in-place metal forms to form bridge decks, the forms, concrete required to fill the form flutes, attachments, supports, shoring, accessories, and all miscellaneous items or work required to install the forms shall be included in the Contract unit price of the superstructure concrete.

400-23.9 Payment Items:

Payment will be made under:

Item No. 400- 0- Class NS Concrete – per cubic yard.

Item No. 400- 1-	Class I Concrete - per cubic yard.
Item No. 400- 2-	Class II Concrete - per cubic yard.
Item No. 400- 3-	Class III Concrete - per cubic yard.
Item No. 400- 4-	Class IV Concrete - per cubic yard.
Item No. 400- 6-	Precast Anchor Beams - each.
Item No. 400- 7-	Bridge Deck Grooving - per square yard.
Item No. 400- 9-	Bridge Deck Grooving and Planing - per square yard.
Item No. 400-143-	Cleaning and Coating Concrete Surfaces - per square foot.
Item No. 400-147-	Composite Neoprene Pads - per cubic foot.

**425 INLETS, MANHOLES, AND JUNCTION BOXES.
(REV 10-9-12) (1-13)**

SECTION 425 (Pages 430 – 432) is deleted and the following substituted:

**SECTION 425
INLETS, MANHOLES, AND JUNCTION BOXES**

425-1 Description.

Construct inlets, manholes, and junction boxes from reinforced concrete as shown in the Design Standards and the plans. Brick masonry may be used if the structure is circular and constructed in place. Furnish and install the necessary metal frames and gratings. Construct yard drains from concrete meeting the requirements of Section 347. Adjust structures shown in the plans to be adjusted or requiring adjustment for the satisfactory completion of the work.

425-2 Composition and Proportioning.

425-2.1 Concrete: For inlets, manholes, and junction boxes, use Class II or IV concrete, as designated in the plans and Design Standards and as specified in Section 346. For yard drains use concrete as specified in Section 347.

425-2.2 Mortar: For brick masonry, make the mortar by mixing one part portland cement to three parts sand. Miami Oolitic rock screenings may be substituted for the sand, provided the screenings meet the requirements of 902-5.2.3 except for gradation requirements. Use materials passing the No. 8 sieve that are uniformly graded from coarse to fine.

Masonry cement may be used in lieu of the above-specified mortar provided it is delivered in packages properly identified by brand name of manufacturer, net weight of package, and whether it is Type 1 or Type 2, and further provided that it has not been in storage for a period greater than six months.

425-3 Materials.

425-3.1 General: Meet the following requirements:

Sand (for mortar).....	902-3.2
Portland Cement.....	Section 921
Water.....	Section 923
Reinforcing Steel	931-1.1 and 415-3
Brick and Concrete Masonry Units.....	Section 949
Castings for Frames and Gratings.....	962

425-3.2 Gratings, Covers, and Frames: Use gratings and frames fabricated from structural steel or cast iron as designated in the appropriate Design Standard. When “Alt. G” grates are specified in the plans, provide structural steel grates that are galvanized in accordance with the requirements of ASTM A-123.

Use rigid frames and covers either 24 inches or 36 inches or optional three-piece adjustable frames and covers as indicated in Design Standards Index No. 201.

For three-piece adjustable frames, the inner frame may include replaceable resilient seats to support the cover. In addition, the inner frame shall indicate it is adjustable, by clearly having the word “adjustable” imprinted into the exposed portion of the inner frame so “adjustable” is visible from the roadway after installation.

425-4 Forms.

Design and construct wood or metal forms so that they may be removed without damaging the concrete. Build forms true to line and grade and brace them in a substantial and unyielding manner. Obtain the Engineer’s approval before filling them with concrete.

425-5 Precast Inlets, Manholes, and Junction Boxes.

Precast inlets, manholes and junction boxes, designed and fabricated in accordance with the plans, the Design Standards and Section 449 may be substituted for cast-in-place units.

425-6 Construction Methods.

425-6.1 Excavation: Excavate as specified in Section 125.

Where unsuitable material for foundations is encountered, excavate the unsuitable material and backfill with suitable material prior to constructing or setting inlets, manholes and junction boxes.

As an option to the above and with the Engineer’s approval, the Contractor may carry the walls down to a depth required for a satisfactory foundation, backfill to 8 inches below the flowline with clean sand and cast a non-reinforced 8 inch floor.

425-6.2 Placing and Curing Concrete: Place the concrete in the forms, to the depth shown in the plans, and thoroughly vibrate it. After the concrete has hardened sufficiently, cover it with suitable material and keep it moist for a period of three days. Finish the traffic surface in accordance with 522-7.2, or with a simulated broom finish approved by the Engineer.

425-6.3 Setting Manhole Castings: After curing the concrete as specified above, set the frame of the casting in a full mortar bed composed of one part portland cement to two parts of fine aggregate.

425-6.3.1 Standard Castings: Set manhole frames in a mortar bed and adjust to grade using brick or concrete grade rings, with a maximum 12 inch adjustment.

425-6.3.2 Optional Adjustable Castings: When using a three-piece adjustable frame and cover, install the frame and cover with brick or concrete grade rings to the base course height. Make adjustments using the inner frame in accordance with the manufacturer’s

installation recommendations so the inner frame and cover meet the grade and slope of the pavement surface opened to traffic.

425-6.4 Reinforcing Steel: Follow the construction methods for the steel reinforcement as specified in Section 415.

425-6.5 Laying Brick: Saturate all brick with water before laying. Bond the brick thoroughly into the mortar using the shovejoint method to lay the brick. Arrange headers and stretchers so as to bond the mass thoroughly. Finish the joints properly as the work progresses and ensure that they are not less than 1/4 inch or more than 3/4 inch in thickness. Do not use spalls or bats except for shaping around irregular openings or when unavoidable at corners.

425-6.6 Backfilling: Backfill as specified in Section 125, meeting the specific requirements for backfilling and compaction around inlets, manholes, and junction boxes detailed in 125-8.1 and 125-8.2. However, for outfall lines beyond the sidewalk or future sidewalk area, where no vehicular traffic will pass over the pipe, inlets, manholes, and junction boxes, compact backfill as required in 125-9.2.2.

425-6.7 Adjusting Structures: Cut down or extend existing manholes, catch basins, inlets, valve boxes, etc., within the limits of the proposed work, to meet the finished grade of the proposed pavement, or if outside of the proposed pavement area, to the finished grade designated on the plans for such structures. Use materials and construction methods which meet the requirements specified above to cut down or extend the existing structures.

The Contractor may extend manholes needing to be raised using adjustable extension rings of the type which do not require the removal of the existing manhole frame. Use an extension device that provides positive locking action and permits adjustment in height as well as diameter and meets the approval of the Engineer. When adjusting structures in flexible pavement, restore final road surface in accordance with Standard Index No. 307.

425-7 Method of Measurement.

The quantities to be paid for will be (1) the number of inlets, manholes, junction boxes, and yard drains, completed and accepted; and (2) the number of structures of these types (including also valve boxes) satisfactorily adjusted.

425-8 Basis of Payment.

425-8.1 New Structures: Price and payment will be full compensation for furnishing all materials and completing all work described herein or shown in the plans, including all clearing and grubbing outside the limits of clearing and grubbing as shown in the plans, all excavation except the volume included in the measurement designated to be paid for under the items for the grading work on the project, all backfilling around the structures, the disposal of surplus material, and the furnishing and placing of all gratings, frames, covers, and any other necessary fittings.

425-8.2 Adjusted Structures: When an item of payment for adjusting manholes, valve boxes, or inlets is provided in the proposal, price and payment will be full compensation for the number of such structures designated to be paid for under such separate items, and which are satisfactorily adjusted, at the Contract unit prices each for Adjusting Inlets, Adjusting Manholes, and Adjusting Valve Boxes.

For any of such types of these structures required to be adjusted but for which no separate item of payment is shown in the proposal for the specific type, payment will be made under the item of Adjusting Miscellaneous Structures.

425-8.3 Payment Items: Payment will be made under:

Item No. 425- 1- Inlets - each.
Item No. 425- 2- Manholes - each.
Item No. 425- 3- Junction Boxes - each.
Item No. 425- 4- Adjusting Inlets - each.
Item No. 425- 5- Adjusting Manholes - each.
Item No. 425- 6- Adjusting Valve Boxes - each.
Item No. 425- 8- Adjusting Miscellaneous Structures - each.
Item No. 425- 10- Yard Drains - each.

APPENDICES

TECHNICAL SPECIAL PROVISIONS.

The following Technical Special Provisions are individually signed and sealed but are included as part of this Specifications Package.

Osterberg Load Cell Test

TECHNICAL SPECIAL PROVISION

For

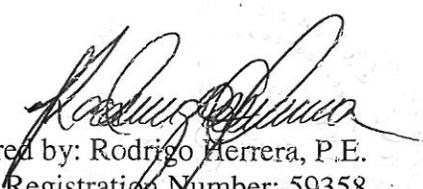
OSTERBERG LOAD CELL TEST
US-90 OVER LITTLE RIVER AND HURRICANE CREEK

Financial Project ID: 422823-1-52-01

FDOT District 3

Gadsden County

The official record of this package is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.



Prepared by: Rodrigo Herrera, P.E.
Florida Registration Number: 59358
Date: September 25, 2012

T455
OSTERBERG LOAD CELL TEST

T455-1 Description.

T455-1.1 General: After construction and Department approval of the method shaft (Test Hole), construct a load test shaft and conduct an Osterberg Cell (O-Cell) load test at the non-production location shown on the Plans, employing an approved Specialty Contractor experienced in the field. The work includes: (a) furnishing all materials, equipment and labor necessary for performing an O-Cell Load Test on site, and reporting the results; (b) supplying all material and labor as specified prior to, during and after the load test; and (c) employing the services of a Specialty Contractor to provide the necessary load testing equipment, required submittals, and instrumentation, and to conduct the load test. The work is more specifically described below.

Notify the Specialty Contractor at least 45 days in advance of load testing. Provide all necessary auxiliary equipment and services to support the Specialty Contractor.

Unless otherwise directed or approved by the Engineer, perform the O-Cell load test (Load Test Shaft) on a drilled shaft installed at the location specified in the Plans.

Perform the O-Cell load test (initial loading sequence and re-load) on one 48-inch diameter, non-production location drilled shaft to a static bi-directional test load of at least 1,750 kips and 2,250 kips, to generate a minimum equivalent top load of 3,500 kips and 4,500 kips during the initial loading sequence and the re-load sequence, respectively.

Submit shop-drawings detailing the Load test Shaft reinforcement, O-Cell configuration, reinforcement, instrumentation, and any other applicable details. Provide a load test plan in accordance with T455-3.

T455-2 Definitions:

Specialty Contractor: The firm responsible for performing the static load test and reporting the results.

T455-3 Submittals: Submit a load testing plan with working drawings (shop drawings) that outlines the test setup, including details of all system elements, instrumentation, materials, data collection systems and procedures. Develop this testing submittal with review and input from the Specialty Contractor, and submit for review and approval by the Engineer at least 30 working days prior to Load Test Shaft construction.

Provide load test reports as required by this Technical Special Provision.

T455-2 Materials.

Furnish all materials, labor, and equipment required to install the O-Cell and to conduct the load test. Required equipment, labor, and materials include, but are not limited to:

1. Bi-directional Osterberg Cell embedded-type jack capable of applying the required test load specified in this Technical Special Provision.
2. The O-Cell must have a minimum bi-directional capacity of 2,250 kips or an equivalent top-load capacity of 4,500 kips. Provide a signed certification of calibration.
3. Linear Vibrating Wire Displacement Transducers (LVWDT's) having a range of at least 6 inches, with signed certificates of calibration. Transducers must be capable of reading to within 0.001-inch of displacement.
4. Sister Bar Vibrating Wire Strain Gages, with signed certification of calibration.
5. Tell-tale extensometer assemblies, with signed certificates of calibration, having a range of at least 1 inch capable of measuring movement in increments of 0.001-inch.

Utilized embedded compression tell-tales below the bottom O-Cell plate capable of measuring movement in increments of 0.001-inch.

6. Automated survey levels and related equipment, with signed certificates of calibration, to measure upward top of shaft displacement to within 0.001-inch.

7. All necessary data acquisition equipment.

8. Fresh, clean, potable water from an approved source to be used as hydraulic fluid to pressurize the O-Cell.

9. Equipment, labor and materials sufficient to construct a stable reference beam system for monitoring movement of the shaft during testing. Support the reference system from a minimum distance of 3 shaft diameters or 12 feet, whichever is greater, from the center of the test shaft to minimize disturbance of the reference system.

10. Equipment, labor and materials sufficient to construct a protected work area including provisions such as a tent or shed for protection from inclement weather for the load test equipment and personnel.

11. A stable electric power source, as required for lights, electronic instruments, etc.

12. Welding equipment, certified welding personnel and labor, as required, to assemble the test equipment under the supervision of the Specialty Contractor, attach instrumentation to the O-Cell, and prepare the work area.

13. Equipment and operators for handling the O-Cell, instrumentation and placement frame or steel reinforcement during the installation of the O-Cell and during the test, including, but not limited to, a crane or other lifting devices, manual labor and hand tools.

T455-3 Installation.

T455-3.1 General: Carry out the Load Test Shaft in accordance with Section 455 of the FDOT Standard Specifications. Use the same means and method of construction that will be used for production drilled shafts. Use drilling equipment and methods suitable for drilling through the conditions encountered, with minimal disturbance to these conditions and any overlying or adjacent structure or services.

Extend the Load Test Shaft excavation to elevation +8.0 feet (shaft tip elevation), and construct the top of shaft to elevation +82.0 feet. Install permanent casing to elevation +65.0 feet.

Upon excavation and bottom cleaning of the shaft, the Specialty Contractor will generate a profile of the excavation using a caliper tool or system to measure accurately and continuously the actual shape of the shaft. The Specialty Contractor will verbally communicate the results of the shaft excavation profile to the Contractor and the Engineer immediately upon completion of the profiling procedure. If necessary, the Contractor will condition the fluid in the excavation as required to obtain caliper tool information and will correct any measured deficiencies to conform with the FDOT's Standard Specifications prior to inserting the reinforcing cage with attached O-Cell assembly. Include results of caliper tool soundings in the Load Test report.

Assemble the O-Cell, hydraulic supply lines and instrumentation and make ready for installation in an area protected from weather adjacent to the test element. Weld the O-Cell assembly to the reinforcing steel, with the plane of the bottom plate of the O-Cell set at right angles to the long axis of the reinforcing steel assembly. Install the O-Cell and instrumentation assembly under the direction and supervision of the Specialty Contractor.

The intent of the load test internal instrumentation is to measure the test load and its distribution along the shaft and at the tip. Incorporate the O-Cell and vibrating wire strain gages into the reinforcing steel assembly as shown on Table 1 below. Uniformly space the strain gages around the circumference of the shaft reinforcing cage. The Engineer may require revisions to the location of the instrumentation based on the results of the pilot hole boring.

Table 1		
Elevation (ft)	Instrument Description	Number of Instruments
+80.0	Upper compression tell-tales	2 LVWDT's
+80.0	Top of shaft displacement	2 Automated Survey Levels
+65.0	Strain Gage Level 9	4 SG's
+59.0	Strain Gage Level 8	2 SG's
+53.0	Strain Gage Level 7	4 SG's
+47.0	Strain Gage Level 6	2 SG's
+41.0	Strain Gage Level 5	4 SG's
+37.0	O-Cell Expansion	4 LVWDT's
+36.5	Lower compression tell-tales	2 Embedded LVWDT's
+33.0	Strain Gage Level 4	4 SG's
+26.0	Strain Gage Level 3	2 SG's
+19.0	Strain Gage Level 2	2 SG's
+12.0	Strain Gage Level 1	4 SG's

Note: Strain gage levels shown are preliminary. Final strain gage locations to be determined after excavation of the test shaft by the Engineer and the Specialty Contractor.

Once the instrumentation locations have been approved and the shaft excavation has been completed, tested, inspected and accepted by the Engineer, the O-Cell and reinforcing steel assembly (including CSL tubes) may be lowered into the excavation. Take responsibility for any instrumentation damage, and for any necessary corrective measures including, if necessary, replacement test shafts and instrumentation.

After the O-Cell and steel assembly have been set, confirm that the proper elevation of the reinforcing cage has been attained. The shaft will then be concreted using the same concrete mix specified for production shafts.

Obtain at least four concrete cylinders for compressive strength testing, in addition to those required by the Contract Documents from the concrete used in the shaft. Test at least one cylinder prior to the O-Cell load test to establish the minimum concrete strength, and test two cylinders on the day of the load test. Submit results to the Specialty Contractor and the Engineer, and include the values in the load test report.

Begin O-Cell load testing a minimum of one week after construction of the load test shaft, and concrete attains a minimum compressive strength of 3,400 psi.

T455-3.2 Load Testing: The Specialty Contractor will collect all test data during O-Cell load testing and provide assistance as necessary during all aspects of the load test. During the initial loading cycle (i.e., equivalent top load of 3,500 kips/bi-directional load of 1,750 kips), apply the load in increments of 87.5 kips (5% of the maximum test load). If approaching failure, reduce loading increments to 2.5% of the maximum test load. Maintain the load constantly at each increment for a period of at least 8 minutes. Maintain the maximum test load for a period of at least 1 hour. If requested by the Engineer, maintain an equivalent top load of 3,500 kips/bi-

direction load of 1,750 kips for a 12 hour period. At the end of the holding period, remove the load in decrements of about 10% of the maximum test load (i.e., equivalent top load of 3,500 kips). Maintain each decrement for approximately 4 minutes.

At a minimum, record the following direct movement indicator measurements from tell-tales and LVWDT's of:

1. O-Cell expansion,
2. upward top of shaft displacement,
3. top and bottom O-Cell plates, and
4. compression of the shaft portion below the O-Cell.

At each load increment (or decrement) tell-tales, record the reading of LVWDT's and strain gages at 1, 2, 4, and 8 (or 4)-minute intervals while the load is maintained constant. After the maximum load is reached, record the reading of movement indicators, transducers and strain gages at 10 minute intervals. Record final rebound readings after a minimum of 1 hour after removal of the test load.

At the completion of the load test (initial sequence), reload the test shaft to the maximum sustainable O-Cell pressure. Perform the reloading in increments of 20% of the reload maximum test load of 4,500 kips, with each increment held for a period of at least 5 minutes, until reaching the maximum test load. Continue loading in 150-kip equivalent top load increments (75-kip bi-directional increments) held for 8 minutes each until the maximum jack pressure is attained or the maximum O-Cell expansion (i.e., 6 inches) occurs. Unload in four 4-minute decrements with the final rebound reading taken 1 hour after removal of the test load.

T455-3.3 Reporting: Provide four hard copies of the report and an electronic version to the Engineer for evaluation. Provide an initial data report containing the load-movement curves and data tables to the Engineer within three working days of the completion of load testing to allow evaluation of the test results. Submit the final report, signed and sealed by a Professional Engineer registered in the State of Florida, within seven working days after completing the O-Cell load test. At a minimum, the report shall include:

1. Pilot hole boring results;
2. Copies of drilled shaft installation logs;
3. Caliper tool measured profile of shaft excavation;
4. Calibration documentation for all instrumentation, jacks and load cells used in load testing;
5. Copies of field data logs of load and displacement measurements;
6. Location of all instrumentation;
7. CSL results;
8. Summary of the load test procedures;
9. Data tables and load vs. top and bottom of shaft movement plots;
10. Plots of axial load vs. displacement for all tell-tale locations;
11. Provide net unit side shear curves, and unit end bearing vs. displacement curves.

T455-3.4 Disposition of Tested Shaft: Once the load test is approved and accepted by the Engineer, remove the top of the shaft to at least 2 feet below finished grade. Take ownership and dispose of the cut off section.

T455-4 Method of Measurement.

The quantity to be paid for will be the number of 2-cycle Osterberg Cell load tests, completed and accepted by the Engineer.

T455-5 Basis of Payment.

Price and payment will be full compensation for furnishing all materials, providing all tools, equipment, labor and incidentals, conducting the load test, providing assistance to the Specialty Contractor and the Department, providing submittals, and reporting the results.

Payment will be made under:

Pay Item No. 455-101- 1 Load Test – Osterberg (each)

**THIS COMPLETES
THIS
SPECIFICATIONS
PACKAGE**