

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: June 10, 2014

Special Provision No. 12-0942(2)

EFFECTIVE DATE: November 1, 2014

SUBJECT: Precast Concrete Bridge Members.

Alabama Standard Specifications, 2012 Edition, SECTION 512 and SECTION 513 shall be modified as follows:

SECTION 512 PRECAST NON-PRESTRESSED CONCRETE BRIDGE MEMBERS

512.01 Description.

This Section shall cover the work of furnishing and installing precast non-prestressed concrete bridge members.

512.02 Materials.

(a) ALDOT PROCEDURE.

Material requirements for the production of precast non-prestressed concrete bridge members are given in this Section and also in ALDOT-367 "Production and Inspection of Precast Non-Prestressed and Prestressed Concrete".

(b) REINFORCING STEEL.

Reinforcing steel shall meet the requirements given in SECTION 835. Reinforcing steel shall be Grade 60 {Grade 420}.

(c) CONCRETE MIXTURE REQUIREMENTS.

1. GENERAL.

The precast concrete producer shall establish the proportion of materials following the guidelines given in ALDOT-170, "Method of Controlling Concrete Operations for Structural Portland Cement Concrete" and ALDOT-367, "Production and Inspection of Precast Non-Prestressed and Prestressed Concrete".

The concrete producer shall submit the proposed concrete mixture proportions to the Materials and Tests Engineer for approval following the guidelines given in ALDOT-170. The distribution of the approved concrete mixture shall be in accordance with the requirements given in ALDOT-170 and ALDOT-367. Any changes of the materials and/or proportions of the approved concrete mixture, excluding chemical admixture dosages, shall require a concrete mixture re-submittal and approval.

2. CONCRETE COMPRESSIVE STRENGTH.

The 28-day compressive strength of bridge substructure members (bent caps, abutment caps, panels, etc.) shall be 3000 psi {21 MPa} unless the 28-day compressive strength is shown otherwise on the plans.

The 28-day compressive strength of bridge superstructure members (deck, curb, barrier rail, etc.) less than 20 feet {6 meter} in length shall be 4000 psi {28 MPa} unless the 28-day compressive strength is shown otherwise on the plans.

The 28-day compressive strength of bridge superstructure members (deck, curb, barrier rail, etc.) 20 feet {6 meter} and over in length shall be 5000 psi {35 MPa} unless the 28-day compressive strength is shown otherwise on the plans.

3. CONVENTIONAL CONCRETE MIXTURE DESIGN REQUIREMENTS.

The mixture design shall be based on the following requirements:

| REQUIRED DESIGN PROPERTIES OF CONVENTIONAL CONCRETE MIXTURES | |
|---|-------------|
| Property | Requirement |
| Minimum Cementitious Factor (Lbs/Yd ³) {kg/m ³ } | 550 {330} |
| Maximum Water/Cementitious Material Ratio | 0.45 |
| Maximum Slump (prior to admixture) (in) {mm} | 4.0 {100} |

The maximum allowable total air content is 6.0 % by volume. The concrete mixture design shall be based on a target total air content of 4.5 %.

Chemical Admixtures for the production of conventional concrete shall be selected from List II-1 of the Department's "Materials, Sources, and Devices with Special Acceptance Requirements" Manual. Refer to Subarticle 106.01(f) and ALDOT-355 concerning this list. Chemical admixtures may be used to increase the slump of the concrete to a maximum of 9 inches {225 mm} if this is proposed in the mixture design submittal and approved for inclusion in the mixture. The approved water/cementitious material ratio shall not be exceeded in order to increase the slump.

4. SELF-CONSOLIDATING CONCRETE MIXTURE DESIGN REQUIREMENTS.

Self-consolidating concrete (SCC) for the production of precast non-prestressed concrete bridge members shall meet the additional requirements of this Item. SCC is utilized to fill the formwork and encapsulate the reinforcing steel without, or with only minimal, applied vibratory consolidation.

The concrete producer shall establish the SCC mixture proportion in accordance with the guidelines given in ALDOT 170 with the exception that the producer shall determine the SCC mixture proportion to meet the required design properties given in the following table.

| REQUIRED DESIGN PROPERTIES OF SCC MIXTURE | |
|---|---|
| Properties shall be measured from a minimum size batch of 3 cubic yards {2 cubic meters}. | |
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall meet Item 512.02(c)2. |
| Cementitious Materials Content | Minimum 600 lb/yd ³ {355 kg/m ³ } of concrete. |
| Water/Cementitious Materials Ratio | Maximum 0.45. |
| Nominal Aggregate Size | Maximum ¾ inches {20 millimeters}. |
| Fine/Total Aggregate Ratio | 0.45 to 0.55 by volume. |
| Total Air Content | Maximum 6.0 % by volume. The design of the mixture shall be based on a target total air content of 4.5 %. |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367. |
| Slump Flow ¹ | Minimum 25 inches {635 millimeters} and maximum 29 inches {735 millimeters}. |
| Passing Ability ¹ | Difference between slump flow and J-Ring flow 3.0 inches {75 millimeters} or less. |
| Stability ¹ | VSI 1.0 or less. |
| Robustness | Slump flow 29 inches {735 millimeters} or less and VSI 1.0 or less. |
| NOTE: 1. Test shall be completed within 10 minutes after completion of mixing. | |

Chemical Admixtures for the production of SCC shall be selected from List II-1 of the Department's "Materials, Sources, and Devices with Special Acceptance Requirements" Manual. Refer to Subarticle 106.01(f) and ALDOT-355 concerning this list. Approved viscosity modifying admixtures (VMA) may be used as a part of the chemical admixtures if they are shown in the approved mixture design.

5. CEMENTITIOUS MATERIALS.

The cementitious materials used in the prestressed concrete mixture shall meet the requirements given in Sections 806 and 815. Fly ash, ground granulated blast furnace slag, and microsilica can be substituted for a portion of portland cement. Various options of maximum percent allowable mineral admixture substitutions for portland cement are defined in the following table.

| MAXIMUM PERCENT OF ALLOWABLE MINERAL ADMIXTURE SUBSTITUTION FOR PORTLAND CEMENT (BY WEIGHT) | | | |
|--|----------------------------|--------------------------------------|-------------|
| Substitution Option | Class C or Class F Fly Ash | Ground Granulated Blast Furnace Slag | Microsilica |
| 1 | 30 % | - | - |
| 2 | - | 50 % | - |
| 3 | - | - | 10 % |
| 4 | 20 % | - | 10 % |
| 5 | 20 % | 30 % | - |

512.03 Construction Requirements.

(a) MANUFACTURING PLANT AND PERSONNEL REQUIREMENTS.

The precast concrete bridge member manufacturing plant shall be certified by either the Precast/Prestressed Concrete Institute (PCI) Plant Certification Program or the National Precast Concrete Association (NPCA) Plant Certification Program. Certification of plants under PCI shall be at least Category B1 (Precast Bridge Products). The manufacturer shall submit proof of the plant certification to the Materials and Tests Engineer prior to the start of production.

The manufacturing plant shall have on site, at the time of manufacturing bridge components for ALDOT, at least one technician that is certified as an ALDOT Concrete Technician. This technician shall also have a NPCA certification or be certified as PCI Level I/II. The manufacturer shall submit proof of this certification to the Materials and Tests Engineer prior to the start of production and during production when required by the Engineer.

The manufacturer's laboratory and laboratory personnel shall be qualified in accordance with the requirements given in ALDOT-405, "Certification and Qualification Program for Concrete Technicians and Concrete Laboratories".

(b) CONCRETE TESTING.

The producer's Quality Control (QC) technician shall be responsible for concrete Sampling and testing. The QC technician shall determine and document the point of sampling and testing and the testing schedule for each line of production. Sampling and testing shall be done as close as possible to the casting bed and in accordance with the requirements of ALDOT-367.

1. CONVENTIONAL CONCRETE TESTING REQUIREMENTS DURING PRODUCTION.

Conventional concrete shall be in compliance with the requirements given in the following table during production.

| REQUIRED PROPERTIES OF CONVENTIONAL CONCRETE MIXTURES DURING PRODUCTION | |
|---|---|
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall meet Item 512.02(c)2 |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367 |
| Total Air Content | Maximum 6.0 % by volume. |
| Slump | Maximum 4.0 in {100 mm} without chemical admixtures Maximum 9.0 in {225 mm} with chemical admixtures |

2. SCC TESTING REQUIREMENTS DURING PRODUCTION.

SCC shall be in compliance with the requirements given in the following table during production.

| REQUIRED PROPERTIES OF THE SCC MIXTURE DURING PRODUCTION | |
|---|--|
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall meet Item 512.02(c)2. |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367. |
| Total Air Content | Maximum 6.0 % by volume. |
| Slump Flow | Minimum 25 inches {635 millimeters} and maximum 29 inches {735 millimeters}. |
| Stability | VSI 1.0 or less, or Sieved fraction 7.5 % or less for gradation with ½" nominal aggregate size or smaller, or sieved fraction 15 % or less for gradation with ¾" nominal aggregate size. ¹ |
| NOTE: 1. The sieve fraction is determined by the Sieve Stability Test in accordance with ALDOT-452. | |

(c) SURFACE FINISH OF PRECAST BRIDGE MEMBERS.

The roadway surface of bridge deck span sections shall be finished with either a wood float finish or with a broom finish done with a broom with medium to stiff bristles. A broom finish shall be applied in a transverse direction and shall penetrate the surface approximately 1/8 of an inch.

Curb and barrier rail sections shall have a Class 3 surface finish in accordance with the requirements given in Section 501. All other surfaces shall have a Class 1 surface finish in accordance with the requirements given in Section 501.

(d) HANDLING, STORING, AND TRANSPORTING MEMBERS.

The Contractor shall be fully responsible for handling, storing and transporting precast concrete bridge members in a manner that will prevent damage to the members.

Members shall be lifted and stored in an upright position. Lifting hooks or similar devices for lifting shall be placed at points close to each end of each member or at the locations shown on the plans. Devices shall be of sufficient strength and embedment to provide safe handling of the members. Blocking under units during storage and handling shall be placed to prevent damage.

Precast concrete bridge members shall be held at the plant for a minimum of 4 days after casting. Precast concrete bridge members shall not be transported until the minimum 28-day compressive strength is obtained and verified by test cylinders.

(e) INSTALLATION OF PRECAST BRIDGE MEMBERS.

1. DAMAGED MEMBERS.

Members that are damaged in any way shall be replaced or repaired without extra compensation.

2. INSTALLATION OF DECK MEMBERS.

Deck members shall be installed so that the difference in the surface of the deck across adjacent members does not exceed 1/4 of an inch {6 mm}. Deck members shall be replaced without extra compensation if the difference in the surface is not within the allowable 1/4 of an inch {6 mm} difference. Members not meeting the installation tolerance may be installed in other locations in the structure if this results in an acceptable deck surface.

Deck members shall be bolted together as shown on the plans to provide snug tight fit. Beveled washers shall be provided if the flat washers, bolt heads and nuts are not in full bearing on each other after tightening. Snug tight is defined as the tightness that can be produced by one or two solid blows from an impact wrench or by full effort of a person using an ordinary 2 foot {610 mm} spud wrench. The threads of the bolts shall be burred to prevent removal after the members have been acceptably bolted together.

The concrete keyway shall be filled with concrete after the members have been acceptably installed. The keyway shall be filled with a 1:2:3 concrete mixture, by weight {mass}, of cement, fine aggregate, and coarse aggregate, respectively. The maximum size of the coarse aggregate shall be 3/8 of an inch {9.5 mm}, and the maximum amount of water allowed shall be 6 gallons per 100 pounds {1 liter per 2 kg} of cement.. The keyways shall be filled in accordance with the following:

- Standard mixing of the concrete shall be completed a minimum of 45 minutes in advance of placement;
- The mixture shall be retempered by remixing the concrete without additional water just prior to placing;
- The concrete mixture shall be placed in the keyway, tamped, and packed as necessary to insure complete filling of the joint;
- The exposed surface of the newly place concrete keyway shall be struck to the same elevation as the adjacent deck sections;
- The surface shall be given a wood float finish
- The concrete keyway shall be cured as per Subarticle 501.03(j).

3. INSTALLATION OF BENT AND ABUTMENT CAPS.

All piling shall be properly aligned (transversely and longitudinally) prior to the establishment of the pile cutoff elevations.

Gaps anywhere between the cap anchor plate and the top of the pile are unacceptable without adequate correction. The Contractor shall submit a written procedure for providing a structurally acceptable connection when a gap is greater than 3/16 inch {4 mm}. The corrective procedure shall be submitted in accordance with the requirements for Working Drawings given in Article 105.02.

Where all gaps between the cap anchor plate and the top of the pile are less than or equal to 3/16 inch {4 mm}, attachment welds shall be provided in accordance with the requirements given in the following table.

| WELD REQUIRED FOR THE ATTACHMENT OF PRECAST CONCRETE CAP ANCHOR PLATE TO THE TOP OF A STEEL PILE | |
|--|---|
| Size of Largest Gap Anywhere At Top of Pile | Size of Fillet Weld Required All Around the Top of the Steel Pile |
| Full Contact-No Gap | 1/4 inch {6 mm} (per Standard Details on Plans) |
| Less Than or Equal to 1/16 inch {2 mm} | 1/4 inch {6 mm} (per Standard Details on Plans) |
| Less Than or Equal to 1/8 inch {3 mm} | 5/16 inch {8 mm} |
| Less Than or Equal to 3/16 inch {4 mm} | 3/8 inch {10 mm} |

The connection between the top of the pile and the steel plate embedded in the cap shall be made by a welder that is ALDOT certified 4F (qualified for fillet welding in the overhead position) using the manual Shielded Metal Arc Welding (SMAW) method. Welding shall be done in accordance with the requirements given in Section 836.

(f) PLACEMENT OF CRANES ON BRIDGE DECKS.

Cranes shall not be placed on a bridge deck unless approved by the Engineer. The Contractor shall submit a placement plan for review prior to placing a crane on a bridge deck. The placement plan shall be submitted in accordance with the requirements given in Section 510.

(g) PILE PAINTING.

All exposed surfaces of piles shall be painted in accordance with the requirements given in Sections 505 and 521. The surface of the piling that is in contact with the abutment panels shall be painted with the coating applied to the other surfaces of the piling or with a System 3 coating if the abutment panels are installed prior to the painting of the other surfaces.

512.04 Method of Measurement.

Precast concrete bridge members will be measured per each for each type and size of member.

512.05 Basis of Payment.

(a) UNIT PRICE COVERAGE.

A precast concrete member will be paid for at the contract unit price for the required type and size (depth, width, and length). This unit price shall be full compensation for manufacturing, delivery and installation, accessories, all items cast into the concrete, tie bolts, expansion materials, cover concrete over fittings, grout and grouting, surface finishing and for all other materials, equipment, labor, and incidentals required to make the bridge member a part of the completed bridge. Structural steel, handrail and bearings will be paid for under other items of work.

(b) PAYMENT WILL BE MADE UNDER ITEM NO.:

512-A Precast Concrete Abutment Caps, ____ Wide by ____ Deep by ____ Long - per each

512-B Precast Concrete Intermediate Bent Caps, ____ Wide by ____ Deep by ____ Long
- per each

512-C Precast Concrete Type * Span Section, ____ Wide by ____ Deep by ____ Long
- per each

512-D Precast Concrete ** Section, ____ Long - per each

512-E Precast Concrete Abutment Panels, Type ____ - per each

512-F Precast Concrete Wing Panels, Type ____ - per each

512-G Precast Concrete Abutment Wing Cap Panels - per each

* Types of Span Sections

Type 1 - Interior Span Section

Type 2A - Exterior Span Section for Curb A Section

Type 2B - Exterior Span Section for Curb B Section

Type 2C - Exterior Span Section for Barrier Rail

Type 2D - Exterior Span Section with Curb D Section

Type 2E - Exterior Span Section with Curb E Section

** Types of Sections

Curb A

Curb B

Barrier Rail Intermediate

Barrier Rail End

NOTE: See plan details for size, shape, dimensions, etc. of the various types of span, curbs, and barrier rail sections.

SECTION 513 PRESTRESSED CONCRETE BRIDGE MEMBERS

513.01 Description.

This Section shall cover the furnishing and installation of prestressed concrete bridge members. The required details of the members and the required details for the installation of the members in the structure will be shown on the plans.

513.02 Materials.

(a) ALDOT PROCEDURE.

Material requirements for the production of precast prestressed concrete bridge members are given in this Section and also in ALDOT-367 "Production and Inspection of Precast Non-Prestressed and Prestressed Concrete".

(b) REINFORCING STEEL AND PRESTRESSING STEEL.

Reinforcing steel and prestressing steel shall meet the requirements given in SECTION 835. Reinforcing steel shall be Grade 60 {Grade 420}. Prestressing steel strands and bars shall be the type shown on the plans.

(c) CONCRETE MIXTURE REQUIREMENTS.

1. GENERAL.

The prestressed concrete producer shall establish the proportion of materials following the guidelines given in ALDOT-170, "Method of Controlling Concrete Operations for Structural Portland Cement Concrete" and ALDOT-367, "Production and Inspection of Precast Non-Prestressed and Prestressed Concrete".

The prestressed concrete producer shall submit the proposed concrete mixture proportions to the Materials and Tests Engineer for approval following the guidelines given in ALDOT-170. The distribution of the approved concrete mixture shall be in accordance with the requirements given in ALDOT-170 and ALDOT-367. Any changes of the materials and/or proportions of the approved concrete mixture, excluding chemical admixture dosage, shall require a concrete mixture re-submittal and approval.

The 28-day compressive strength for prestressed concrete bridge members shall be 5000 psi {35 MPa} or the 28-day compressive strength shown on the plans.

2. CONVENTIONAL CONCRETE MIXTURE DESIGN REQUIREMENTS.

The mixture design shall be based on the following requirements:

| MIXTURE DESIGN CRITERIA | ALL MEMBERS |
|---|-------------|
| Minimum Cementitious Factor (Lbs/Yd ³) {kg/m ³ } | 550 {330} |
| Maximum Water/Cementitious Material Ratio | 0.45 |
| Maximum Slump (prior to admixture) (in) {mm} | 4.0 {100} |

The maximum allowable total air content is 6.0 % by volume. The concrete mixture design shall be based on a target total air content of 4.5 %.

Chemical admixtures may be used to increase the slump of the concrete to a maximum of 9 inches {225 mm} if this is proposed in the concrete mixture design submittal and approved for inclusion in the mixture. The approved water-to-total cementitious material ratio shall not be exceeded in order to increase the slump.

3. SELF-CONSOLIDATING CONCRETE MIXTURE DESIGN REQUIREMENTS.

Self-consolidating concrete (SCC) for the production of prestressed concrete members (including piles) shall meet the additional requirements of this Item. SCC is utilized to fill the formwork and encapsulate the reinforcing steel without, or with only minimal, applied vibratory consolidation.

The concrete producer shall establish the SCC mixture proportion in accordance with the guidelines given in ALDOT 170 with the exception that the producer shall determine the SCC mixture proportion to meet the required design properties given in the following table.

| REQUIRED DESIGN PROPERTIES OF THE SCC MIXTURE | |
|---|---|
| Properties shall be measured from a minimum size batch of 3 cubic yards {2 cubic meters}. | |
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall be 5,000 psi {35 MPa} or the compressive strength shown on the plans. |
| Cementitious Materials Content | Minimum 600 lb/yd ³ {355 kg/m ³ } of concrete. |
| Water/Cementitious Materials Ratio | Maximum 0.40. |
| Nominal Aggregate Size | Maximum ¾ inches {20 millimeters}. |
| Fine/Total Aggregate Ratio | 0.45 to 0.55 by volume. |
| Total Air Content | Maximum 6.0 % by volume. The design of the mixture shall be based on a target total air content of 4.5 %. |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367. |
| Drying Shrinkage | Maximum of 0.04 % after 28 days of drying. |
| Slump Flow ¹ | Minimum 25 inches {635 millimeters} and maximum 29 inches {735 millimeters}. |
| Passing Ability ¹ | Difference between slump flow and J-Ring flow 3.0 inches {75 millimeters} or less. |
| Stability ¹ | VSI 1.0 or less. |
| Robustness | Slump flow 29 inches {735 millimeters} or less and VSI 1.0 or less. |
| NOTE: 1. Test shall be completed within 10 minutes after completion of mixing. | |

Chemical Admixtures for the production of SCC shall be selected from List II-1 of the Department's "Materials, Sources, and Devices with Special Acceptance Requirements" Manual. Refer to Subarticle 106.01(f) and ALDOT-355 concerning this list. Approved viscosity modifying admixtures (VMA) may be used as a part of the chemical admixtures if they are shown in the approved mixture design.

4. CEMENTITIOUS MATERIALS.

The cementitious materials used in the prestressed concrete mixture shall meet the requirements given in Sections 806 and 815. Fly ash, ground granulated blast furnace slag, and microsilica can be substituted for a portion of portland cement. Various options of maximum percent allowable mineral admixture substitutions for portland cement are defined in the following table.

| MAXIMUM PERCENT OF ALLOWABLE MINERAL ADMIXTURE SUBSTITUTION FOR PORTLAND CEMENT (BY WEIGHT) | | | |
|---|----------------------------|--------------------------------------|-------------|
| Substitution Option | Class C or Class F Fly Ash | Ground Granulated Blast Furnace Slag | Microsilica |
| 1 | 30 % | - | - |
| 2 | - | 50 % | - |
| 3 | - | - | 10 % |
| 4 | 20 % | - | 10 % |
| 5 | 20 % | 30 % | - |

5. SPECIAL REQUIREMENTS FOR PILES CONSTRUCTED IN SEVERE EXPOSURE CONDITIONS.

Piles constructed in a marine environment, within 10 miles {16 kilometers} from coastline, completely or partially submerged in seawater, located within the tidal and splash zones,

exposed to seawater spray, exposed to brackish water, or as shown on the plans shall meet the requirements of this Item.

Cement for piles shall be Type II and thus low in tricalcium aluminate content. If requested by the Contractor and approved by the Materials and Tests Engineer, Type I or Type III cement containing a maximum of 8 % tricalcium aluminate may be used.

Concrete mixtures used in piles shall have a maximum permeability of 2,000 coulombs.

The concrete for piles shall contain Class "F" fly ash and microsilica as components of the cementitious material. The required percentage of fly ash and microsilica by weight {mass} of the total cementitious material content shall be as follows:

| CEMENTITIOUS MATERIAL CONTENT IN PILES | |
|--|-------|
| Cement (Type II) | 70 % |
| Fly Ash (Class "F") | 20 % |
| Microsilica | 10 % |
| Total Cementitious Materials Content | 100 % |

513.03 Construction Requirements.

(a) MANUFACTURER'S PLANT, LABORATORY AND PERSONNEL REQUIREMENTS.

The concrete bridge member manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute (PCI) Plant Certification Program. Certification of the production plants shall be Category B4 (Prestressed Deflected Strand Bridge Members). The manufacturer shall submit proof of the plant certification to the Materials and Tests Engineer prior to the start of production.

The manufacturing plant shall have on site, at the time of manufacturing bridge components for ALDOT, at least one technician that is certified as an ALDOT Concrete Technician. This technician shall also be certified as PCI Level I/II. The manufacturer shall submit proof of this certification to the Materials and Tests Engineer prior to the start of production and during production when required by the Engineer.

The manufacturer's laboratory and laboratory personnel shall be qualified in accordance with the requirements given in ALDOT-405, "Certification and Qualification Program for Concrete Technicians and Concrete Laboratories".

(b) SHOP DRAWINGS AND NOTIFICATION OF MANUFACTURER.

The Contractor shall submit shop drawings to the Bridge Engineer for approval prior to production. The complete details of prestressed concrete members shall be submitted as Shop Drawings in accordance with the requirements given in Article 105.02. The submittal shall include the proposed tensioning and de-tensioning procedures.

Within 30 days after the award of the contract, the Contractor shall notify the Materials and Tests Engineer in writing of the name and address of the manufacturer of the prestressed concrete bridge members. The notification shall include the manufacturer's proposed fabrication schedule.

(c) CONCRETE TESTING.

Sampling and testing shall be done in accordance with the requirements of ALDOT-367. The Department's inspector will determine the point of sampling and testing schedule for each line of production.

Sampling and testing shall be performed as close as possible to the casting bed in the presence of a Department inspector.

1. CONVENTIONAL CONCRETE TESTING REQUIREMENTS DURING PRODUCTION.

Conventional concrete shall be in compliance with the requirements given in the following table during production.

| REQUIRED PROPERTIES OF CONVENTIONAL CONCRETE MIXTURES DURING PRODUCTION | |
|---|--|
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall be 5,000 psi {35 Mpa} or the compressive strength shown on the plans. |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367 |
| Total Air Content | Maximum 6.0 % by volume. |
| Slump | Maximum 9 inches if chemical admixtures are used. |

2. SCC TESTING REQUIREMENTS DURING PRODUCTION.

SCC shall be in compliance with the requirements given in the following table during production.

| REQUIRED PROPERTIES OF THE SCC MIXTURE DURING PRODUCTION | |
|---|--|
| Property | Requirement |
| Compressive Strength at 28 days | The compressive strength shall be 5,000 psi {35 MPa} or the compressive strength shown on the plans. |
| Temperature | Freshly mixed concrete temperature as limited in ALDOT-367. |
| Total Air Content | Maximum 6.0 % by volume. |
| Slump Flow | Minimum 25 inches {635 millimeters} and maximum 29 inches {735 millimeters}. |
| Stability | VSI 1.0 or less, or Sieved fraction 7.5 % or less for gradation with ½" nominal aggregate size or smaller, or sieved fraction 15% or less for gradation with ¾" nominal aggregate size. 1 |
| NOTE: 1. The sieve fraction is determined by the Sieve Stability Test in accordance with ALDOT-452. | |

(d) CAMBER OF GIRDERS AND BRIDGE DECK SPANS.

The theoretical camber of girders will be shown on the plans. The camber of girders shall be a minimum of ½ inch {13 mm} at the time of shipment. The camber of span sections shall be a minimum of ¼ inch {6 mm} at the time of shipment.

(e) SURFACE FINISH.

All surfaces shall, except as noted below in this Subarticle, have a Class 1 surface finish in accordance with the requirements given in Section 501.

The outside of all exterior girders shall have a Class 2 surface finish in accordance with the requirements given in Section 501 if a Class 3 is not shown to be required on the plans. The final Class 2 finish shall not be applied until after the completion of the construction of the bridge deck on the girders.

A Class 2 surface shall be applied to the final exposed surface of concrete piles if shown to be required on the plans.

Girder top surfaces shall be intentionally roughened with transverse grooves that penetrate the concrete surface to a minimum depth of ¼ of an inch {6 mm} spaced at no more than ½ of an inch {13 mm} in the hardened concrete.

Riding surfaces, cast integrally as part of the precast member, for example in bridge deck span sections, shall be finished with either a wood float finish or with a broom finish done with a broom with medium to stiff bristles. A broom finish shall be applied in a transverse direction and shall penetrate the surface approximately ¼ of an inch. Surfaces of precast bridge deck span sections that will be bonded to an overlay shall be raked in a transverse direction to provide a roughened surface for

the application of the overlay. The roughened surface shall have a minimum of $\frac{1}{4}$ inch {6 mm} ridges raised in the hardened concrete.

(f) HANDLING, STORING, AND TRANSPORTING MEMBERS.

The Contractor shall be fully responsible for handling, storing and transporting prestressed concrete bridge members in a manner that will prevent damage to the members.

Girders shall be handled and stored in an upright position. Lifting hooks or similar devices for lifting shall be placed at points close to each end of each member or at the locations shown on the plans. Devices shall be of sufficient strength and embedment to provide safe handling of the members. Blocking under units during storage and handling shall be placed to prevent damage.

Piles shall be lifted, stored, transported, and placed in the pile driving leads in a manner that will eliminate the possibility of damaging bending stresses, cracking and spalling. Piles shall be lifted by means of a suitable bridle or sling attached to the pile at pickup points designated on the plans. Cracked piles will be rejected and shall be immediately removed and replaced without additional compensation.

All prestressed concrete bridge members except piles shall be held at the plant for a minimum of 4 days after casting. Piles shall be held at the plant for a minimum of 21 days after casting. All prestressed concrete bridge members shall not be transported until the minimum 28-day compressive strength is obtained and verified by test cylinders.

(g) INSTALLATION OF PRESTRESSED CONCRETE MEMBERS.

1. DAMAGED MEMBERS.

Members that are damaged in any way shall be replaced or repaired without extra compensation.

2. PRESTRESSED CONCRETE GIRDERS.

Prestressed girders shall be lifted by attachment at the lifting points shown on the shop drawings. Girders shall be supported at the bearing points shown on the plans when they are put into the structure.

The Contractor shall be fully responsible for the stability of the girders during construction. The Contractor shall submit working drawings in accordance with the requirements given in Article 105.02 for temporary bracing installed to provide stability for the girders.

3. INSTALLATION OF DECK SPAN MEMBERS.

Deck span members that will not be covered by an overlay shall be installed so that the difference in the top surface of adjacent members does not exceed $\frac{1}{4}$ of an inch {6 mm}. Deck members shall be replaced without extra compensation if the difference in the surface is not within the allowable $\frac{1}{4}$ of an inch {6 mm} difference. Members not meeting the installation tolerance may be installed in other locations in the structure if this results in an acceptable deck surface.

Deck span members shall be bolted together as shown on the plans to provide snug tight fit. Beveled washers shall be provided if the flat washers, bolt heads and nuts are not in full bearing on each other after tightening. Snug tight is defined as the tightness that can be produced by one or two solid blows from an impact wrench or by full effort of a person using an ordinary 2 foot {610 mm} spud wrench. The threads of the bolts shall be burred to prevent removal after the members have been acceptably bolted together.

At the completion of the bolting together of the members, the concrete keyway shall be filled with a 1:2:3 concrete mixture, by weight {mass}, of cement, fine aggregate, and coarse aggregate, respectively. The maximum size of the coarse aggregate shall be $\frac{3}{8}$ of an inch {9.5 mm}, and the maximum amount of water allowed shall be 6 gallons per 100 pounds {1 liter per 2 kg} of cement. The keyways shall be filled in accordance with the following:

- Standard mixing of the concrete shall be completed a minimum of 45 minutes in advance of placement;

- The mixture shall be retempered by remixing the concrete without additional water just prior to placing;

- The concrete mixture shall be placed in the keyway, tamped, and packed as necessary to insure complete filling of the joint;

- The exposed surface of the newly placed concrete keyway shall be struck to the same elevation as the adjacent deck sections;

- The surface shall be given a wood float finish.
- The concrete keyway shall be cured as per Subarticle 501.03(j).

(h) PLACEMENT OF CRANES ON BRIDGE DECKS.

Cranes shall not be placed on a bridge deck unless approved by the Engineer. The Contractor shall submit a placement plan for review prior to placing a crane on a bridge deck. The placement plan shall be submitted in accordance with the requirements given in Section 510.

513.04 Method of Measurement.

(a) ITEM NO. 513-A.

Girders will be measured per each girder of each type and length.

(b) ITEM NO. 513-B.

Each type of girder will be measured per linear foot of casting length shown on the approved shop drawings minus the length of elastic shortening and shrinkage. This will be the length recorded on the Shipping Notice (BMT-139) prepared by the Department's Plant Inspector. A copy of BMT-139 shall be sent with the shipment of the girders.

(c) ITEMS 513-C and 513-D.

Concrete span sections will be measured per each type and size.

513.05 Basis of Payment.

(a) UNIT PRICE COVERAGE.

1. ITEMS 513-A and 513-B.

Concrete girders will be paid for at the contract unit price for each type of girder. This price shall be full compensation for furnishing all materials, accessories, tools and labor necessary to manufacture and install the girders.

This price shall also be full compensation for premolded bituminous filler, for all items cast into the concrete including metal bearing plates and studs welded to these plates, and for obtaining a Class 2 surface finish on the outside of all exterior girders.

2. ITEMS 513-C and 513-D.

Concrete deck span sections will be paid for at the contract unit price for each type and size. This price shall be full compensation for furnishing all materials, accessories, tools and labor necessary to manufacture and install the span sections.

This price shall also be full compensation for all items cast into the concrete, for the tie bolts, for expansion and bearing materials, for cover concrete over fittings, for grout and grouting, for placement of keyways, and for surface finishing. Other structural steel items and handrail will be covered under other items of work.

3. PARTIAL PAYMENT.

Partial payments will be made in accordance with the following schedule:

- Fabrication and **delivery** to **approved storage site**. (Approved storage sites and partial payment for stored materials are addressed in Article 109.07);
- Erected and the **required finish applied** to **girder units** or the **bolting up** and **casting** Of Keyway on Deck Units - 100%.

Partial payments for members that are unacceptable because of damage, improper installation or any other reason will be recovered by the Department on the next monthly estimate or final estimate, whichever is applicable.

(b) PAYMENT WILL BE MADE UNDER ITEM NO. :

513-A * Pretensioned-prestressed Concrete Girders, Type ** (SPECIALTY ITEM)
- per each

513-B Pretensioned-prestressed Concrete Girders, Type ** (SPECIALTY ITEM)
- per linear foot {meter}

513-C Prestressed Concrete Interior Span Sections, ____ Wide by ____ Deep by ____ Long
(SPECIALTY ITEM) - per each

513-D Prestressed Concrete Exterior Span Sections, ____ Wide by ____ Deep by ____ Long
(SPECIALTY ITEM) - per each

* Length

** Type I, II, III, etc., as per AASHTO Classification.