

STATE OF NEW HAMPSHIRE
BRIDGE DESIGN MEMORANDUM

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FROM: Loretta Girard Doughty, PE
Administrator

DATE: November 18, 2022
AT (Office): Bureau of Bridge Design

SUBJECT: **Design Memorandum 2022-01**
NHDOT Precast Concrete Components Special Provision
(Vetted by NHDOT Specifications Committee)

TO: **Bureau of Bridge Design Staff, Bridge Design Consultants, FHWA, NHDOT Bureaus**

Through: Peter E. Stamnas, PE
Director of Project Development

Approved PES Not Approved _____
Date 11/21/2022

This memorandum incorporates a special provision to the current NHDOT Standard Specifications for Road and Bridge Construction as follows:

A. Special Provision:

- Section 529 – Precast Concrete Components
- Section 529 – Key to Item Numbers for Precast Concrete Components

B. Summary: The above noted new Special Provision is being implemented to specify the following:

- NHDOT guidance for use of precast concrete components

C. Background:

This memorandum incorporates a special provision to the current NHDOT Standard Specifications for Road and Bridge Construction.

Section 529 - Precast Concrete Components has been created due to the increased use of precast elements in projects. Section 529 includes primary components (e.g., bridge elements), secondary components (e.g., ITS elements, moment slabs), and culvert components (e.g., box culverts, arches, frames, box culvert headwalls, footings, wingwalls, cutoff walls). Currently, Section 529 does not include concrete barrier, retaining walls, or concrete drainage components (e.g., pipes, CB, DI, pipe headwalls, MSE retaining walls, precast modular retaining walls). Prestressed elements are also not included since they are covered under Section 528 – Prestressed Concrete Members.

The intention of this new special provision is to provide a consistent specification that notes the requirements for design submittals, fabrication, rejection, testing, handling and storage, and installation of the precast elements. The special provision allows the precast elements to be fabricated at a Self-Performing Contractor's Yard/Construction Site or a Precast Fabricator's Plant. This provides more flexibility for Accelerated Bridge Construction (ABC) projects.

Since the special provision combines many different precast elements, the designer will need to modify it specifically for the project (sections highlighted in yellow). If the project has a Contractor designed component, the component(s) shall be listed in Section 1.1.2.1 and N/A removed. If not, keep N/A noted in the section. Sections of the special provision that do not apply to your project shall not be removed. If the section does not apply, N/A remains as noted in the sections.

As noted in the special provision, the Contractor designed elements shall have the calculations submitted for documentation and the shop plans submitted for acceptance since it is designed by a Licensed Professional Engineer outside of the New Hampshire Department of Transportation (NHDOT). The precast

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elements designed by NHDOT or a Design Consultant for NHDOT, shall have the shop plans submitted for approval.

Precast concrete components designed by NHDOT or a Design Consultant for NHDOT, must include on the plans the reinforcing bar critical design information (e.g., minimum lap lengths, minimum embedment lengths) in addition to bar size, layout, and spacing for the Fabricator to prepare the reinforcing bar schedule that is submitted with the shop plans.

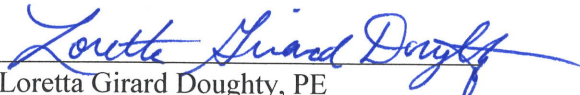
For the Precast Box Culvert (Bridge) (e.g., spans 10' or greater) item, the concrete and reinforcing items are subsidiary. All the other items (e.g., excavation, fill, barrier membrane) need to be quantified and included in the contract under the appropriate bid item. For the Precast Box Culvert (Highway) (e.g., spans less than 10') item, all the items used to construct the culvert are subsidiary to the box culvert item.

Separate special provisions shall no longer be used for precast concrete components except for the components listed previously in this memo *and* for item Precast Sound Abatement Wall. Since the precast sound abatement wall has many different components, it is a separate special provision at this time.

The most up-to-date special provision for Section 529 will be located with the Contracts and Specification Section in the Specifications special provision folder. Please contact the Specifications Section or Angela Hubbard (Bridge Design) if you have any questions.

D. Implementation:

Section 529 special provision shall be implemented as of the date of this memorandum and shall be used on all applicable projects.


Loretta Girard Doughty, PE
Administrator, Bureau of Bridge Design

Enclosures

11/4/22

SSD: 09/14/17, 2/12/20, 5/4/22, 9/14/22, 10/26/22

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PROJECT NAME
PROJECT NUMBER

DATE

SPECIAL PROVISION

SECTION 529 -- PRECAST CONCRETE COMPONENTS

Description

1.1 This work shall consist of manufacturing, storing, transporting, and erecting precast concrete items (i.e., abutments, wingwalls, approach slabs, moment slabs, box culverts, etc.; non-prestressed items), herein referred to as “primary components”, “secondary components”, and “culverts”, in accordance with these specifications and in conformance with the lines, grades, design and dimensions shown on the plans or established by the Engineer.

1.1.1 This work shall also include field placement of grout for splice couplers, shear keys, and construction joints between abutting components during field assembly, when shown on the plans.

1.1.2 This work shall also include designing precast components as described herein, or as indicated on the plans. Plans and calculations for all contractor designed components shall be provided in accordance with 1.2, 1.3, and 1.4.

1.1.2.1 Contractor designed components for this project are as follows: **N/A**

- Stairs
- Work Pad
- Moment Slab
- Box Culvert (Highway)
- Box Culvert (Bridge)
- Arch
- Frame



Designer: list component that is Contractor designed and remove N/A or delete list and keep N/A

1.2 Definitions. For the purposes of this special provision, the following terms are as defined:

1.2.1. Primary Components: Bridge components such as footings, abutments, wingwalls, approach slabs, sleeper slabs, deck slabs, piers, full-depth deck panels, and bridge railing.

1.2.2 Secondary Components: Headwalls, stairs, work pads, and moment slabs.

1.2.3 Culvert Components: Box culverts, 3-sided box culverts, arches, and frames, including headwalls, footings, wingwalls, and cutoff walls.

1.2.4 Fabricator: Self-performing Contractor or Precast Plant Fabricator

1.2.5 Shop: Self-performing Contractor’s Yard/Construction Site or Precast Fabricator’s Plant

1.3 Requirements for Contractor Designed Components. The Contractor shall submit plans for acceptance and calculations for documentation for all Contractor designed components in accordance with 105.02.

1.3.1 The plans and calculations shall be prepared, stamped and signed by a Licensed Professional Engineer registered in the State of New Hampshire.

1.3.2 The calculations shall include a complete and thorough set of hand calculations that are specific to this project to support any computer generated calculations. The calculations shall include all applicable references to the LRFD specifications. A detailed explanation of any symbols and computer programs used in the design shall be provided. Calculations shall be performed in English units, with the final calculation results shown in English units.

1.4 Design Criteria for Contractor Designed Components. Contractor designed components shall meet all requirements of the current *AASHTO LRFD Bridge Design Specifications* for the applicable Strength and Extreme Event limit states, *NHDOT Standard Specification for Road and Bridge Construction*, and the Geotechnical Report except as modified herein:

1.4.1 Primary Components: **N/A**

- a. *Traffic surcharge loads shall be determined in accordance with LRFD Section 3.11.6.4 with a soil unit weight (γ_s) equal to 125 pounds per cubic foot.*
- b. *Granular backfill (Item 209.201) and structural fill beneath footing (Item 508) shall have a soil internal friction angle (ϕ_f) equal to 34 degrees and a soil unit weight (γ_s) equal to 120 pounds per cubic foot. The existing embankment and roadway base material shall have a soil internal friction angle (ϕ_f) equal to 30 degrees and a soil unit weight (γ_s) equal to 120 pounds per cubic foot.*
- c. *The nominal bearing resistance for the footings shall be X tons per square foot. The resistance factor for bearing (ϕ_b) shall be equal to 0.45.*
- d. *Failure by sliding at the base of the footing shall be determined in accordance with LRFD Section 11.6.3.6 (10.6.3.4) for a "precast concrete footing". LRFD Equation 10.6.3.4-2 for the nominal sliding resistance between the soil and the footing shall be taken as $R_t = 0.8 V \tan \phi_f$. The resistance factor for sliding (ϕ_t) shall be equal to 0.90.*
- e. *Passive resistance from soil in front of the wingwalls shall be neglected in the stability computations.*
- f. *Buoyancy shall be included in the stability calculations in accordance with LRFD Section 3.7.2.*
- g. *Differential hydrostatic pressure of at least 3 feet of water shall be included in the stability calculations.*
- h. *The design shall include the effects of guardrail system loads, rail support slab / barrier loads, soundwall slab loads, or any other loading that causes a soil stress increase behind or within the wall, where applicable.*
- i. *The design shall include all temporary loads or conditions that may occur during the construction phase, including equipment loads, and the effects of any surface or subsurface water infiltration into the construction site.*
- j. *The minimum width of the footing shall be as shown on the plans.*
- k. *Analyses for Extreme Event limit states are not required on this project.*

*Designer:
Include
information
obtained
from
Geotech
Engineer
and delete
N/A or
delete list
and keep
N/A*

1.4.2 Secondary Components: **N/A**

Designer: Include information obtained from Geotech Engineer and delete N/A or keep N/A

1.4.3 Culvert Components:

- Minimum clear cover on reinforcement for pre-cast members shall be 1.5 inches, unless otherwise noted on the plans. Bridge Box Culverts covered by less than 2.0-ft. of fill shall have a minimum clear cover of 2.5 inches on the top mat of reinforcement in the top slab, unless otherwise noted on the plans
- All box culvert installations with clear spans greater than 6 feet shall include a cutoff wall at the inlet and outlet extending a minimum of 2 feet below the bottom of the bottom slab. The cutoff wall shall be made integral with the culvert.
- A load rating of the Box Culvert (Bridge), Arch, or Frame shall be performed in accordance with *AASHTO Manual for Bridge Evaluation (MBE)* using the Load and Resistance Factor Rating (LRFR) method. The NHDOT Form 4 - Bridge Capacity Summary completed and stamped by a Licensed Professional Structural Engineer registered in the State of New Hampshire shall be submitted with the shop drawings.

Materials

2.1 Concrete.

2.1.1 Concrete materials shall conform to the requirements of Section 520 for Class AAA with a minimum 28-day compressive strength of 5,000 psi, unless otherwise noted on the plans.

2.1.2 Concrete shall be controlled, mixed, and handled as specified in the pertinent portions of Section 520, unless otherwise specified herein.

2.1.3 Mix Design. The Contractor shall submit a concrete mix design for approval conforming to the requirements of Section 520.

2.1.4 Corrosion Inhibitor. The following precast components exposed to salt treatment, or as noted on the plans, shall have corrosion inhibitor (calcium nitrate) admixture added at the rate of 3 gallons per cubic yard:

- Bridge Rail
- Stairs
- Piers at grade crossings
- Full-depth deck panels

2.2 Reinforcement for concrete shall conform to the requirements of Section 544. Steel reinforcement shall be **uncoated unless otherwise noted on the plans.**

2.2.1 Grouted splice couplers, used to provide moment connections between components, shall develop a minimum of 125% of the specified yield strength of the reinforcing steel being spliced. Couplers shall be the same type as the steel reinforcement unless otherwise noted on the plans.

2.3 Grout and Concrete for Component Connections, Joints, and Bedding.

2.3.1 Grout for splice couplers shall be specified by the splice coupler manufacturer.

2.3.2 Grout for shear keys and construction joints between abutting components shall be an approved grout as listed in the Qualified Products List under Section 528 A High-Strength, Impact-Resistant Non-Shrink Grout. High early strength concrete conforming to the requirements of the special provision amendment to Section 520 for concrete class AA, high early strength, shall be used to fill footing shear keys and joints between approach slab components, when shown on the plans.

2.3.2.1 The compressive strength of the grout shall be equal to or greater than the joined components, unless otherwise noted on the plans.

2.3.2.2 The grout when thoroughly mixed shall be readily pourable so that it completely fills the shape of the joint.

2.3.3 Grout for bedding of components shall be an approved flowable non-shrink grout. A non-excavatable flowable fill, conforming to the requirements of the special provision amendment to Section 520 for concrete class F (non-excavatable), shall be used under the footings and approach slabs when shown on the plans.

2.4 Corrugated metal pipe (CMP) used to form voids in components as indicated on the plans shall be Type I, 16 gauge, galvanized, conforming to Section 603.

2.4.1 CMP voids in components shall be filled with field-cast concrete conforming to the requirements of the special provision amendment to Section 520 for concrete class AA, high early strength.

2.5 Profile rubber watertight gaskets between sections shall meet the requirements of ASTM C1677.

2.6 Water repellent shall be silane/siloxane and conform to Section 534.2.2.

2.7 Granular backfill material shall conform to Section 209, Item 209.20X

2.8 Barrier membrane shall conform to Section 538 with protection board.

2.9 Structural fill shall conform to Section 508.

Construction Requirements

3.1 General.

3.1.1 Specifications. Fabrication, transportation, and erection of precast concrete components shall conform to the applicable requirements of the current: *AASHTO LRFD Bridge Construction Specifications, Section 8: Concrete Structures; AASHTO LRFD Bridge Design Specifications, Section 5: Concrete Structures; AASHTO LRFD Guide Specification for Accelerated Bridge Construction; PCI MNL-116 Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products; and PCI MNL-135 Tolerance Manual for Precast and Prestressed Concrete Construction; PCINE-14-ABC Guidelines for ABC Using Precast/Prestress Concrete* except as modified herein. In the case of conflicting specifications, the most stringent shall apply.

3.1.2 Approval/Acceptance. Prior to performing any work under Section 529, the Contractor must have received approved or accepted shop drawings and any special contract requirements. The Contractor shall bear full responsibility and costs for all materials ordered or work performed prior to approval or acceptance or written authorization from the Engineer.

3.2 Special Contract Requirements.

3.2.1 Primary Components Assembly Plan. A single assembly plan describing all aspects of the work including: handling; lifting; placing; supporting / securing; adjusting; grouting; and backfilling precast components, shall be submitted for acceptance in accordance with 105.02. The plan shall include, but shall not be limited to, the following:

- a. Detailed shop drawings of all components in accordance with 3.4.
- b. A work area plan depicting temporary and permanent structures, haul roads, utilities and other relevant temporary or permanent site features.
- c. Details of all equipment to be used to lift components including: cranes; excavators; lifting slings; etc. Include crane locations, operating radii, lifting calculations, etc.
- d. Construction loading analysis including calculations to confirm that the magnitude of stress in the components during handling and erection is within acceptable limits. The Contractor shall be responsible for demonstrating that all components have adequate capacity to resist stresses imposed during construction operations.
- e. Detailed sequence of construction and schedule for all operations. Account for setting and cure time of field-cast concrete and grout.
- f. Temporary support requirements for components including leveling bolts and shims, and bracing for lateral load and moment resistance. The Contractor shall be responsible for the stability of all components during construction operations.
- g. Procedures for maintaining horizontal and vertical tolerances. Include details of all alignment brackets, jigs, templates, shims, and leveling bolts, etc.
- h. Procedures for controlling tolerances of pile driving operations to maintain proper alignment within the pile pockets of components, where applicable.
- i. Grouting plan specifying the type of grout products proposed for use and the method of installation for all grouted joints and connections, and bedding of components. Grouting of splice couplers shall be in accordance with the splice coupler manufacturer's recommendations.
- j. Loading restrictions, including minimum time period before backfilling operations may proceed, where applicable.

3.2.1.1 The assembly plan shall be submitted for acceptance a minimum of thirty (30) days prior to the start of fabrication and shall be stamped by a Licensed Professional Engineer, registered in the State of New Hampshire. Multiple professional engineer stamps may be included on the various portions of the plan; however, **ONE** engineer shall be clearly identified as the Assembly Plan Engineer for the entire assembly plan. All questions, comments, and revisions shall be coordinated with the Assembly Plan Engineer.

3.2.2 Primary Components Pre-Placement Meeting. A pre-placement meeting will be held to review the specifications, schedule, and assembly plan, and to discuss any special requirements. The meeting will be held at least forty-five (45) days prior to the scheduled casting of any member. The Contract Administrator shall schedule the meeting and invite representatives of the Contractor, Fabricator, and the Bureaus of Bridge Design and Materials and Research, along with any other party the Engineer deems appropriate.

3.2.3 All precast components covered under Section 529 shall be produced by the same fabricator.

3.3 Qualification of the Fabricator. All shops manufacturing components for the Department shall satisfy the following minimum requirements:

3.3.1 Certification. The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute Plant Certification Program in product Group B, certification category B1 or higher or National Precast Concrete Association (NPCA) Plant Certification. The Fabricator shall submit proof of certification prior to the start of production. Self-performing Contractors shall meet the qualifications of Section 102 of NHDOT Standard Specifications.

3.3.2 Engineering / Drafting. The Fabricator shall have trained, knowledgeable, and experienced drafting personnel available who can produce and check legible, complete, and accurate shop detail drawings.

3.3.3 Specifications. The Fabricator shall have available in the shop all pertinent specifications governing the work.

3.3.4 Quality Control. The Fabricator shall perform quality control functions to ensure that the work is in accordance with contract documents and specifications.

3.4 Shop Drawings. The Contractor shall prepare and submit detailed shop drawings for approval or acceptance in accordance with 105.02. Deviation from the approved or accepted shop drawings will not be permitted without written order or approval of the Engineer.

3.4.1 The shop drawings shall be properly titled as to project location and bridge components similar to the title box on the contract plans. The shop drawings shall include, but not necessarily be limited to, the following:

- a. Fully and accurately dimensioned views showing the geometry of the components including all projections, recesses, notches, openings, blockouts, connections, joints and keyways, etc. The components shall be dimensioned by working points to allow for coordination between precast and field layout components.
- b. Reinforcing bar lists, details, and bending schedules showing the size, spacing, location, and clear cover of reinforcing steel, including any reinforcing steel required, but not shown on the contract plans. Reinforcing steel or ties provided under lifting devices shall be shown in detail.
- c. Details and locations of all items to be cast in the components (whether detailed on the contract drawings or provided for the Contractor's convenience) such as inserts, lifting devices, temporary supports, CMP voids, grout ports, etc.
- d. Details and locations of all leveling bolts used to make fast and accurate adjustments to the vertical position of the components.
- e. Size and spacing of ports for placing grout for bedding of components based on component size and flowable grout characteristics. The ports shall be arranged so that the grouting operation may progress in a manner that avoids air pockets.
- f. All necessary modifications to components to resist handling stresses resulting from the proposed method of handling and erection.
- g. Quantities for each component (concrete volume, reinforcing steel weight and total weight).
- h. Description of method of curing, handling, storing, and transporting the components.

- i. Details and locations of all blocking used to support components during storage, and transportation.
- j. Description of protective measures taken to prevent damage to the concrete by freezing.
- k. Site plan detailing the inlet and outlet of the culvert. This plan shall be used to confirm the limits (elevations and lengths) of the proposed headwalls, wingwalls, cutoff walls, etc. are adequate for use at the site.

3.5 Shop Inspection. A Department representative will inspect the fabrication for quality assurance. This inspection will include the examination of materials, work procedures, and the final fabricated components.

3.5.1 Fabrication shall only be done in the presence of an authorized inspector representing the Department. The Department's authorized quality assurance inspector is herein referred to as the "Inspector".

3.5.2 Notice. A minimum of fourteen (14) days prior to the scheduled start of casting of any component, the Fabricator shall contact the Department's Bureau of Materials and Research to provide notice of the scheduled start date. The Bureau of Materials and Research will assign an Inspector to the scheduled work to provide quality assurance testing. The Inspector will coordinate directly with the Fabricator to determine the casting schedule.

3.5.2.1 In addition to the requirements of 3.5.2, the Fabricator shall contact the Department's Bureau of Materials and Research at least two (2) days before the actual work begins to allow scheduling of independent quality assurance testing.

3.5.3 Cooperation. The Fabricator shall fully cooperate with the Inspector in the inspection of the work in progress.

3.5.3.1 The Fabricator shall allow the Inspector unrestricted access to the necessary areas of the shop during work hours. Work done while the Inspector has been refused access will be automatically rejected.

3.5.4 Authority. The Inspector will have the authority to reject any material or workmanship that does not meet the requirements of the contract documents.

3.5.4.1 Inspection at the shop is intended as a means of facilitating the work and avoiding errors. It does not constitute final approval and will not relieve the Contractor from any responsibility in regard to imperfect material or workmanship and the necessity for replacing same.

3.5.5 Acceptance. The Inspector will affix an acceptance stamp to components ready for shipment. This mark will be made by paint or ink stamp in a location that will not be visible when the structure is completed.

3.5.5.1 The Fabricator shall present the Inspector with a copy of the shipping invoice to be stamped for verification of inspection and acceptance prior to shipment.

3.5.5.2 The Inspector's acceptance implies that, in the opinion of the Inspector the components were fabricated from accepted materials and processes and loaded for shipment in accordance with the contract requirements. The Inspector's stamp of acceptance for shipment does not imply that the components will not be rejected by the Engineer if subsequently found to be defective.

3.6 Fabrication of Components.

3.6.1 Reinforcing. Reinforcing shall be furnished, handled, and installed in accordance with Section 544.

3.6.1.1 All reinforcing shall be free of dirt, rust, oil, grease, and other deleterious substances.

3.6.1.2 Clearance from the forms shall be maintained by supports, spacers, or hangers in accordance with 544.3.4, and shall be of approved shape and dimension.

3.6.1.3 Matching templates shall be used for accurate placement of grouted splice couplers to ensure fit-up between joined components.

3.6.1.4 Minimum clear cover on reinforcement for precast members shall be 1.5 inches, unless noted otherwise on the plans. Clear cover for the top mat reinforcement in the top slab of box culverts shall be 2.5 inches.

3.6.2 Inserts and Hardware. All items cast in the concrete shall be accurately placed in the position shown on the approved/accepted shop drawings and firmly held during the placing and setting of the concrete.

3.6.2.1 Recesses shall be provided around lifting devices to facilitate removal and grouting after erection.

3.6.2.2 Components shall not be drilled into for attachment purposes.

3.6.2.3 All inserts and hardware shall be galvanized unless otherwise noted on the plans.

3.6.3 Forms. Forms shall conform to 520.3.2 and be subject to the approval of the Engineer.

3.6.3.1 Forms shall be made and maintained true to the shapes and dimensions shown on the approved/accepted shop drawings. The surface of forms shall be smooth, and if necessary, joints shall be treated so that a minimum of joint marks are evident in the finished component.

3.6.3.2 Forms shall be cleaned before each use.

3.6.4 Concrete Placement and Curing. Concrete shall be controlled, mixed, and handled in accordance with Section 520, unless otherwise specified herein.

3.6.4.1 Concrete shall not be deposited in the forms until the Inspector has approved the placement of the reinforcing. Concrete shall be deposited only in the presence of the Inspector, and in accordance with 520.3.5.

3.6.4.2 Consolidation of concrete shall conform to 520.3.5.4, or as ordered.

3.6.4.3 For Self-performing Contractors, continuously wet cure components utilizing water retaining material for a minimum of seven (7) days in accordance with 520.3.10. Water retaining material shall be burlap conforming to 520.2.6.1, or cotton mats conforming to 520.2.6.4. For Precast Plant Fabricators, the shop drawings shall include the method of initial and final curing, along with the proposed curing procedure as noted in Section 3.4.1 h.

3.6.4.4 When the average daily temperature falls below 35°F for more than one day, protective measures shall be taken to prevent damage to the concrete by freezing. Components shall be protected from freezing temperatures (32°F) for five days or until attaining the minimum 28-day compressive strength indicated on the plans, whichever comes first.

3.6.5 Removing Forms and Finish of Components. Forms shall not be removed without approval. Proper care and precautions shall be exercised in removing forms so that no damage results to finished surfaces.

3.6.5.1 All components shall receive a Class 1, Ordinary Finish in accordance with 520.3.12, unless otherwise noted on the plans.

3.6.5.2 All shear key and construction joint surfaces along the edges of abutting components shall be abrasive blast-cleaned prior to shipping.

3.7 Dimensional Tolerances. The PCI Northeast Region Guidelines for Accelerated Bridge Construction Using Precast / Prestressed Concrete Elements Including Guideline Details, Report Number PCINE-14-ABC, available online at PCI Northeast website: www.pci.org/PCINE, shall be used in conjunction with this specification for determining appropriate dimensional fabrication tolerances for precast components.

3.8 Component Damage / Cracking and Repair. The PCI Northeast Guidelines for Resolution of Non-Conformances in Precast Concrete Bridge Elements, Report Number PCINE-18-RNPCBE, available online at PCI Northeast website: www.pci.org/PCINE, shall be used in conjunction with this specification to help identify damage and appropriate repair procedures, and determine the potential cause and remedial action.

3.8.1 The Engineer may approve repairs to occasional, non-recurring, and isolated defects. The Contractor shall submit procedures and materials for repairs to the Engineer for approval.

3.8.2 Rejection. Any of the following are considered defects that may constitute cause for rejection of a precast concrete component:

- a. Fabrication not in conformance with the contract documents or plans.
- b. Concrete breakage, full-depth cracking, extensive partial-depth cracking, or other damage determined to be significant by the Engineer.
- c. Defects indicating concrete proportioning, placement and / or consolidation not in conformance with the contract documents or plans.
- d. Components not in conformity with the dimensional fabrication tolerances given herein.
- e. Damaged shear key or construction joint surfaces where such damage would prevent making a satisfactory joint as determined by the Engineer.
- f. Discontinuity or crack in the concrete that would permit moisture to reach the reinforcing steel.
- g. Significant component damage sustained during handling, transportation, or erection as determined by the Engineer.
- h. Rock pockets or honeycombs over 6 square inches in area and over 1 inch deep.

- i. Any section having more than one honeycomb area per side or surface even though the area is of a smaller scope than defined above.
- j. Extensive fine hair cracks or checks.
- k. Box culvert sections produced by racked or otherwise unsquared forms.

3.9 Concrete Strength Testing.

3.9.1 Each component cast shall have a minimum of two cylinders made available for testing by the Department at 28 days for quality assurance. Acceptance of the concrete for strength will be based on successfully attaining the minimum 28-day compressive strength indicated on the plans for the two cylinders.

3.9.2 The concrete test cylinders, prepared from fresh concrete at the time of placing, shall be cured under the same temperature and moisture conditions as the precast components.

3.10 Handling, Storing, and Shipping.

3.10.1 Components shall be lifted at the designated points by approved lifting devices embedded in the concrete and proper hoisting procedures.

3.10.2 Storage areas shall be smooth, well compacted, and sufficiently rigid to prevent damage due to differential settlement. Stacks of components may be supported by means of continuous blocking located as indicated on the approved/accepted shop drawings. Intermediate blocking between components shall be located directly over the blocking below.

3.10.3 Components may be loaded on a trailer as described above. Shock-absorbing cushioning material shall be used at all bearing points during transportation. Tie-down straps shall be located at the lines of blocking only.

3.10.4 Components shall not be subject to damaging torsional or impact stresses. Damaged components shall be repaired or replaced as directed by the Engineer, at no cost to the Department.

3.10.5 Shipping. Components shall not be transported from the manufacturing plant until they have reached a minimum age of seven (7) days, and the concrete has attained the minimum 28-day compressive strength indicated on the plans, as verified by test cylinders in accordance with 3.9. Components ready for shipment shall have received an acceptance stamp in accordance with 3.5.5.

3.11 Erection of Precast Concrete Components.

3.11.1 Delivery and Field Inspection. Material, workmanship and condition after shipment will be inspected after delivery to the construction site, with this and any previous inspections constituting only partial acceptance.

3.11.2 All work of erecting, supporting, adjusting, grouting, and concreting precast components shall be in accordance with the accepted assembly plan described in 3.2.1.

3.11.3 After components are in their final erected positions, they shall be subject to the inspection and approval of the Engineer. Furnish necessary facilities, including scaffolding and supports, to provide access to the structure to allow for inspection of workmanship.

3.11.4 Sealing of Lifting Holes, Grout Ports, and Leveling Bolts. After components are in their final erected positions, all lifting device recesses, grout ports, leveling bolt recesses, and other recesses used for erection purposes shall be filled with an approved high-strength non-shrink grout

3.12 Erection of Precast Box Culvert (Highway) or (Bridge):

3.12.1 Box culvert sections shall be installed as shown on the accepted shop drawings. The box culvert shall be set on a 1-foot minimum thickness of structural fill or as detailed on the plans.

3.12.2 Grout the exterior of all joints to provide a smooth surface to apply barrier membrane with protection board.

3.12.3 Culverts with fill of 5 feet or more over the top slab: a 2-foot strip of barrier membrane with protection board shall be applied to all joints in the top slab and extend 1-foot down culvert wall.

3.12.4 Culverts with fill less than 5 feet over the top slab: the entire top slab shall be covered with barrier membrane with protection board and extend 1-foot down culvert wall.

3.12.5 Excavation shall conform to Section 206.3.

3.12.6 The Contractor shall provide temporary diversion of water to construct the culvert.

3.12.7 If the plan calls for extending an existing box culvert, the Contractor shall connect the new precast box culvert to the existing box culvert using a cast-in-place collar as shown on the plans or as ordered by the Engineer.

3.12.8 End sections, headers, and other appurtenances shall be furnished and installed as precast units or constructed as cast-in-place units in accordance with the plans and specifications.

3.12.9 Coat all exposed concrete surfaces of headers and end sections (except interior of box culvert or areas covered by barrier membrane) to one foot below fill lines with silane-siloxane water repellent.

3.12.10 Box culvert sections shall be backfilled with a granular backfill material a minimum of 3 feet from the outside face of the culvert or distance detailed on the plans.

3.13 Water Repellent. Water repellent (Silane-Siloxane) treatment shall be applied to all precast concrete surfaces in accordance with Section 534.

3.14 Joints. Profile rubber gaskets shall be installed at the field joints to create a soil-tight seal unless otherwise noted on the plans or approved shop plans. The profile rubber gaskets shall be the requirements of ASTM C1677. Install a 2-foot strip of barrier membrane with protection board to all joints as noted in 3.12.3.

Method of Measurement

4.1 Precast concrete substructure (abutment), precast concrete substructure (pier), precast concrete approach slab, precast concrete sleeper slab, precast full-depth deck panels, and precast moment slab will be measured by the cubic yard of concrete placed as shown on the plans or ordered.

4.2 Precast concrete box culverts, arches, frames, headwalls, stairs, and work pads will be measured by the unit as shown on the plans or ordered. For precast concrete box culverts, a unit will consist of precast box culvert sections, headwalls, cutoff walls, wingwalls and footings.

4.3 Precast concrete bridge rail will be measured by the linear foot as shown on the plans or ordered.

Basis of Payment

5.1 The accepted quantity of precast concrete substructure (abutment), precast concrete substructure (pier), precast concrete approach slab, precast concrete sleeper slab, precast full-depth deck panels, and precast moment slab will be paid for at the Contract unit price per cubic yard complete in place.

5.2 The accepted quantity of precast concrete box culverts (See Section 5.15 for subsidiary items specific to Highway box culverts), arches, frames, headwalls, stairs, and work pads will be paid for at the Contract unit price per unit complete in place.

5.3 The accepted quantity of precast concrete bridge rail will be paid for at the Contract unit price per linear foot complete in place.

5.4 Reinforcing steel, including splice couplers, will be subsidiary.

5.5 Corrugated metal pipes for forming voids in components will be subsidiary.

5.6 Modifications to components to resist handling stresses resulting from the proposed method of handling and erection, if necessary, will be subsidiary.

5.7 Grout for component connections, keys, and joints will be subsidiary.

5.8 Concrete for filling footing keys, approach slab joints, and cmp voids will be paid separately.

5.9 Flowable fill, for bedding of components will be paid separately.

5.10 The assembly of all precast components will be subsidiary.

5.11 Temporary diversion of water, and dewatering including trenching or pumping directly from trench or sumps shall be paid for under 503. If no separate item is in the contract for this work, it will be considered incidental and shall be subsidiary to the precast installation.

5.12 Water repellent (Silane-Siloxane) applied to all precast concrete surfaces shall be subsidiary.

5.13 Form liner shall be subsidiary.

5.14 Modifications to components to resist handling stresses resulting from the proposed method of handling and erection, if necessary, shall be subsidiary.

5.15 Precast Concrete Box Culvert (Highway):

5.15.1 Excavation shall be subsidiary.

5.15.2 Waterproofing and barrier membrane shall be subsidiary.

5.15.3 Granular backfill and structural fill shall be subsidiary.

5.15.4 All rock structure excavation, and excavation of unsuitable material required below the structural fill will be paid as provided in 206.

Pay items and unit:

529.00101	Precast Concrete Box Culvert (Highway)	Unit
529.00201	Precast Concrete Box Culvert (Bridge)	Unit
529.00301	Precast Concrete Arch	Unit
529.00401	Precast Concrete Frame	Unit
529.1	Precast Concrete Substructure, Abutment (F)	CY
529.10701	Precast Concrete Substructure, Abutment (Post-Tension) (F)	CY
529.2	Precast Concrete Substructure, Pier (F)	CY
529.21	Precast Concrete Substructure, Pier (Stay-In-Place Form) (F)	CY
529.3	Precast Concrete Approach Slab (F)	CY
529.31	Precast Concrete Approach Sleeper Slab (F)	CY
529.316	Precast Concrete Approach Sleeper Slab Support (F)	CY
529.4	Precast Concrete Full-Depth Deck Panels (F)	CY
529.51	Precast Concrete Bridge Rail (F)	LF
529.511	Precast Concrete Bridge Rail (Custom Stain) (F)	LF
529.901	Precast Concrete Stairs	Unit
529.902	Precast Concrete Work Pad	Unit
529.903	Precast Concrete Moment Slab (F)	CY

KEY TO ITEM NUMBERS FOR PRECAST CONCRETE COMPONENTS

529	.A B C D E	
	A	
0	Precast Concrete Box Culverts, Arches, Frames	Unit
	B Variable	
	0 Undefined	
	1 Install Only	
	9 Modified	
	C Structure Type	
	1 Box Culvert (Highway)	
	2 Box Culvert (Bridge)	
	3 Arch	
	4 Frame	
	DE Designation (If Necessary)	
1	Precast Concrete Substructure (Abutment)	CY
	(Includes Footings, Wingwalls & Abutments)	
	B Variable	
	1 – Stay-In-Place Form	
	C Variable	
	7 Post-Tension	
	DE Designation (If Necessary)	
2	Precast Concrete Substructure (Pier)	CY
	B Variable	
	1 – Stay-In-Place Form	
	C Variable	
	7 Post-Tension	
	DE Designation (If Necessary)	
3	Precast Concrete Approach Slab	CY
	B Variable	
	1 – Sleeper Slab	
	C Variable	
	6 Sleeper Slab Support	
	7 Post-Tension	
	DE Designation (If Necessary)	

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|---|---|-------------|
| 4 | Precast Concrete Full-Depth Deck Panels | CY |
| | B Variable | |
| | C Variable | |
| | 7 Post-Tension | |
| | DE Designation (If Necessary) | |
| 5 | Precast Concrete Bridge Rail | Linear Foot |
| | B Variable | |
| | 1 Bridge Rail | |
| | C Variable | |
| | 1 Custom Stain | |
| | DE Blank | |
| 6 | Precast Concrete Sound Abatement Wall | SF |
| 7 | Blank | |
| 8 | Precast Concrete Headwalls (<i>Reserved – not in use</i>) | Unit |
| 9 | Miscellaneous Precast Concrete Items | |
| | B Type | |
| | 0 Blank | |
| | C Variable | |
| | 1 Stairs | |
| | 2 Work Pad | |
| | 3 Moment Slab | |