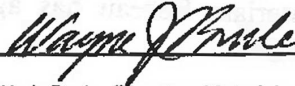
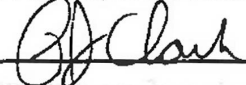


MODIFIED BY EI 97-005 EFFECTIVE 6/12/97 & EI 98-009 EFFECTIVE 9/10/98 SUPERSEDED BY EI 02-039 EFFECTIVE 5/8/03		ENGINEERING INSTRUCTION <i>New York State Department of Transportation</i>	95-010 Supersedes: EI 90-010 EI 94-006
Title: NEW PRECAST CONCRETE GENERAL SPECIFICATION AND REVISED PRECAST CONCRETE BARRIER AND PRECAST CONCRETE BOX CULVERT SPECIFICATIONS			
Distribution: ☒ Main Office(30) ☒ Regions(32) ☒ Consultants(34) ☐ Local Gov.(31) ☐ Contractors/AGC(39) ☐ _____		Approved:  W. J. Brule, Director, Materials Bureau 2/17/95 Date  P. J. Clark, Director, Design Division 2/17/95 Date	

EFFECTIVE DATE:

This Engineering Instruction is effective beginning with the lettings of 7/6/95.

PURPOSE:

The following documents are being transmitted with this instruction and will be inserted into proposals, by the Main Office Design Quality Assurance Bureau, effective with lettings of 7/6/95.

1. New §704-03 Precast Concrete-General.
2. Revised §706-17 Precast Concrete Box Culverts.
3. Revised §704-05 Precast Concrete Barrier.
4. Special specification 16555.5006 - Permanent Concrete Barrier For Structures (Full Section) and 16555.5506 - Permanent Concrete Barrier For Structures (Half Section).

The following documents are superseded or deleted as of 7/6/95:

1. §718-29 Precast Concrete Barrier Units - Bridges
2. Special Specification 16555.5005 and 16555.5505

BACKGROUND:

The Materials Bureau maintains several materials specifications for the fabrication of precast concrete items such as box culvert, median barrier, drainage units, cribbing etc. The specifications

for each of these items contain much of the same information with some variations in the fabrication requirements. The fabrication requirements for these items should be consistent.

Under Item 16555.5005 and 16555.5505 the Structures Division is responsible for the fabrication and acceptance of precast concrete traffic barrier for structures. This item is fabricated by many of the same producers who make precast concrete median barrier under the jurisdiction of the Materials Bureau. In order to consolidate the inspection effort for precast concrete barrier, median and structures, the Materials Bureau has agreed to assume the fabrication and acceptance responsibility for both items.

IMPLEMENTATION:

In order to make the fabrication of precast items, which are under the jurisdiction of the Materials Bureau, more uniform, a new §704-03 Precast Concrete-General has been prepared. This subsection incorporates all the requirements common to each precast item into one subsection. The individual precast item subsections will contain references to the appropriate parts of the general subsection along with additional information which is unique to the item.

§706-17 Precast Concrete Box Culverts has been revised to reference the new §704-03.

§704-05 has been renamed Precast Concrete Barrier and revised to reference the new §704-03. In addition the requirements for precast concrete barrier for structures have been added.

The specification for Items 16555.5005 Permanent Concrete Barrier For Structures (Safety Shape - Full Section) and 16555.5505 Permanent Concrete Barrier For Structures (Safety Shape - Half Section) has been revised. Effective with the lettings of 7/6/95 the new item numbers are 16555.5006 and 16555.5506 respectively. The specification for these items was revised to eliminate reference to §718-29 Precast Concrete Barrier Units - Bridges and replace it with a reference to §704-03 and §704-05. This transfers the responsibility for the fabrication and acceptance of precast concrete barrier for structures from the Structures Division to the Materials Bureau. The Structures Division will retain responsibility for the evaluation and approval of new structures barrier systems and any modifications to the pre-approved fabricator standard sheets for previously approved barrier systems.

CONTACTS:

Jim Reidy of the Materials Bureau, (518) 457-5956, for assistance with new §704-03 or revised §704-05 and §706-17. Al Kelly of the Structures Division, (518) 457-4534, for assistance with Special Specification 16555.5006 and 16555.5506.

704-03. PRECAST CONCRETE-GENERAL

SCOPE. This specification covers the general material and quality requirements for precast concrete items. It is intended for use in conjunction with the individual item specifications.

MATERIAL REQUIREMENTS. The Portland Cement Concrete shall meet the requirements in §501, Portland Cement Concrete - General; §501-2, §501-3.02 and §501-3.03 except as noted herein.

The requirements of §501-2.01 shall not apply. Type 1, 2 or 3 cement may be used. The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15% by weight of the total amount of cement plus pozzolan in the mix. The concrete shall have an air content of 5.0 to 9.0%. Unless noted otherwise in the contract documents, approved working drawings or item specification, the minimum compressive strength of concrete used in precast units shall be 3000 psi @ 28 days.

Additional materials, listed below, shall meet the requirements of the following subsections:

Concrete Repair Material	701-04
Bar Reinforcement, Grade 60	709-01
Wire Fabric For Concrete Reinforcement	709-02
Epoxy Coated Bar Reinforcement, Grade 60	709-04
Epoxy Coated Wire Fabric Reinforcement	709-08
Cold-Drawn Wire For Concrete Reinforcement	709-09
Quilted Covers (for curing)	711-02
Plastic Coated Fiber Blankets (for curing)	711-03
Polyethylene Curing Covers (White Opaque)	711-04
Membrane Curing Compound	711-05
Burlap	711-06

Fabrication

1. **Drawings.** Precast concrete units shall be fabricated to conform to the details contained in the plans and contract documents. When contract documents specify precast units conforming to Department Standard Sheets, working drawings are not required and will not be processed. On such contracts, Department Standard Sheets or Pre-Approved Fabricator Standard Sheets shall be used as the working drawings. When contract documents contain details that deviate from the Department Standard Sheets or Pre-Approved Fabricator Standard Sheets, working drawings are required. The incorporation of lifting devices into a unit shall not be considered a deviation from the standard sheet. Working drawings, when required for fabrication of the units shall be prepared by the precast manufacturer in accordance with procedural directives of the Materials Bureau.

2. **General.** The manufacturer shall produce precast units that conform to the details of the applicable Department Standard Sheets, Approved Fabricator Standard Sheets or approved working drawings. The precast units shall be uniform in appearance. All concrete surfaces which will be exposed to view after installation shall be flat and

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smooth, free from irregularities and uniform in color and texture. Concrete shall be cast in rigidly constructed forms which will maintain the units within specified tolerances to the shapes, lines and dimensions shown on the Department Standard Sheets, Approved Fabricator Standard Sheets or approved working drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of mortar. When wood forms are used all faces in contact with the concrete shall be laminated with a non-absorbent material. All worn or damaged forms which cause irregularities on the concrete surface or damage to the concrete during form removal shall be repaired or replaced before being reused.

Suitable means shall be used for placing concrete to prevent segregation. The concrete shall be thoroughly consolidated by external or internal vibrators or a combination of both. Vibrators shall not be used to move concrete within the forms.

Tack welding or any other welding of specified steel reinforcement will not be allowed. Welding for cage stability will be permitted provided that redundant steel is added in each direction and tied to the cage. The redundant steel shall be thirty (30) bar diameters, minimum, in length and shall be positioned so that the midpoint is located at the weld. All welds to epoxy coated steel shall be repaired with an epoxy repair material meeting the requirements of §709-04 or §709-08. The ends of chairs or spacers, used to support or locate reinforcing steel, that bear on the faces of forms, shall be made of, or coated with, non-corrosive material so that no discoloration will show on the face of the units.

The Director, Materials Bureau will designate inspection at the precast concrete facility. This designee will hereafter be referred to as the Inspection Authority. The Inspection Authority shall have free access to the manufacturing facility and product produced for Department evaluation.

3. Cold Weather. When concrete is cast in ambient temperatures less than 45°F the following requirements shall apply:

- a. Immediately before concrete placement the minimum temperature inside the forms shall be 35°F. When enclosures are required to maintain this temperature, they shall meet the approval of the Inspection Authority.
- b. Immediately following completion of the placement the requirements of the chosen curing method shall be followed.
- c. Concrete temperatures required by the chosen curing method shall be maintained by means of an external heat supply or by utilizing the heat of hydration.
- d. The plastic concrete shall not be exposed to freezing temperatures after it has been placed into the forms.

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4. Dimensional Tolerances.

a. Unit dimensions shall not vary by more than $\frac{1}{4}$ " from those shown on Department Standard Sheets or approved working drawings unless noted otherwise in the contract documents, approved working drawings or item specification.

b. Variations in the required spacing of reinforcing steel shall not be more than 2" and are not cumulative. Concrete cover over reinforcing steel shall not be more than $\frac{1}{2}$ " greater than, and in no case be less than, the amount specified in the contract documents, approved working drawings, standard sheets or item specification.

Curing. All precast concrete units shall be subjected to curing by any one of the methods described in the following paragraphs. The manufacturer shall provide minimum/maximum temperature thermometers to monitor curing temperatures unless otherwise specified. If, at any time, curing temperatures fall below the specified minimum for the chosen curing procedure, the curing period shall be increased accordingly.

Except as noted under 4. Moisture Retention Curing, no unit shall be subjected to freezing temperatures until the following two conditions are met:

- The chosen curing cycle has been completed.
- The specified 28 day compressive strength or 3500 psi, whichever is less, has been reached.

Units with a compressive strength requirement greater than 3500 psi which are exposed to freezing temperatures before the required 28 day compressive strength is reached may require additional testing for compressive strength as directed by the Materials Bureau. Additional testing, when required, will be performed on cores taken from the hardened concrete.

1. Steam Curing. The units shall be cured in a suitable enclosure as approved by the Inspection Authority. The enclosure shall be designed to minimize the loss of heat and moisture while allowing for the uniform circulation of steam around the entire unit. The interior surfaces of the enclosure and the surface of the unit shall be moist at all times. Steps shall be taken to prevent localized "hot spots" caused by the steam lines. The enclosure shall be free from outside drafts.

Steam curing shall not begin until a preset period has been completed. The preset period begins when the last concrete has been placed and continues until the concrete obtains initial set. Prior written approval from the Director, Materials Bureau is required when preset periods of less than two hours are to be used.

During the preset period, moderate heat may be applied to the enclosure to maintain

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the initial temperature of the concrete. The maximum temperature inside the enclosure during the preset period shall be the initial temperature of the concrete + 10°F.

After the preset period is complete, steam shall be injected into the curing enclosure. The temperature inside the enclosure shall not be increased at a rate greater than 40°F per hour. A moist atmosphere shall be maintained at a temperature between 100°F and 180°F for a period of not less than 12 hours. The temperature inside the enclosure shall then be decreased at a rate not exceeding 40°F per hour until the ambient temperature outside the enclosure is reached. The manufacturer shall provide automatic temperature recorders to continuously record the curing temperature inside the enclosure.

2. Water Spray Curing. Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the water spray. All exposed surfaces of the precast unit shall be kept wet with a continuous fine spray of water in an enclosure maintained at a temperature of not less than 70°F for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

3. Saturated Cover Curing. The saturated covers used under this method shall be burlap meeting the requirements of §711-06. Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the saturated burlap. All exposed concrete surfaces on the precast unit shall be covered with burlap, saturated with water before applying. The burlap shall be kept saturated and the units kept at a temperature of not less than 70°F for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

4. Moisture Retention Curing. Units cured in accordance with these methods shall be maintained at a minimum temperature of 45°F for 7 days. Additional curing time may be necessary to meet the 28 day strength requirements. When the specified 28 day compressive strength or 3500 psi, whichever is less, has been reached the 45°F minimum curing temperature is no longer required and the unit may be exposed to freezing temperatures.

a. Membrane Curing Compound. The membrane curing compounds used under this method must meet the requirements of §711-05 and must appear on the Department's current Approved List of Membrane Curing Compounds under B. Clear (with fugitive dye). The compound shall be properly agitated immediately before each use. A minimum coverage rate of one gallon per 150 square feet shall be used.

The membrane curing compound shall be applied to the concrete surface after finishing as soon as the free water on the surface has disappeared and no water

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sheen is visible, but not so late that the liquid curing compound will be absorbed into the concrete. When curing compound cannot be applied within the above requirements, the manufacturer shall instead immediately begin curing the unit in accordance with one of the other curing methods contained in this specification, until curing compound can be applied. When curing compound is to be used in conjunction with any other method of cure the Inspection Authority shall be notified prior to the start of production.

If the forms are left on for a minimum of 7 days, curing compound is not required on any formed surfaces. When the forms are removed prior to 7 days, the exposed concrete surfaces shall be wet with water within one half hour of form removal and shall be kept moist until the curing compound is applied. Before application, the concrete shall be allowed to reach a uniformly damp appearance with no free water on the surface and then the compound shall be applied immediately.

This method of curing shall not be used on any concrete surface which is to have plastic concrete bonded to it. Another approved method of curing shall be used when this condition exists.

b. Curing Covers. The curing covers used under this method shall be either Plastic Coated Fiber Blankets, §711-03, appearing on the Department's Approved List or Polyethylene Curing Covers meeting the requirements of §711-04. Curing covers shall be placed immediately following the finishing operation or form removal, whichever is applicable. Care shall be taken not to damage any exposed concrete surfaces during cover placement. Curing covers shall be placed and secured and be of such condition as to minimize the loss of moisture and temperature. When it is necessary to use more than one curing cover the edges shall be lapped a minimum of 12".

5. Other Methods. Other Methods of curing are subject to approval by the Director, Materials Bureau.

Repair. Precast concrete units that contain minor defects caused by manufacture or mishandling shall be repaired at the manufacturing site. In addition, units that contain minor defects caused by mishandling during shipment or installation shall be repaired at the project site. Major defects and non repairable defects in a unit will be cause for rejection of the unit. Defects are defined as follows:

- 1. Surface Defects.** Surface voids or bugholes which are less than $\frac{5}{8}$ " in diameter and less than $\frac{1}{4}$ " deep are acceptable, except as noted under 4.c. of this section. Surface defects need not be repaired.
- 2. Minor Defects.** Minor defects are defined as: spalls, honeycombing and surface voids which have no dimension greater than 12", when measured along a straight line, and do not expose the reinforcing steel. No minor defect shall be repaired without

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prior approval of the Inspection Authority. Minor defects shall be repaired by removing all unsound concrete from the defect and then filling the void with concrete repair material meeting the requirements of §701-04. Concrete repair material shall have a color similar to that of the precast unit. The repair shall be finished to the proper shape and cured in accordance with the repair material manufacturer's recommendations. It shall withstand a moderate blow with a 16 ounce hammer. The blow shall produce a sharp ring indicating proper bonding of the repair. The repairs shall be made to the satisfaction of the Department.

3. Major Defects. Major defects are defined as: spalls, honeycombing and surface voids which have any dimension greater than 12", when measured along a straight line, or expose the reinforcing steel. Cracks which go through the section or are greater than 0.01" in width are also major defects.

The Materials Bureau will consider specific requests to repair major defects. No major defect shall be repaired without prior approval of the Materials Bureau. Requests to repair major defects shall be made in writing, through the Inspection Authority, to the Director, Materials Bureau and shall include a complete repair procedure along with detailed sketches of the defect showing all dimensions and any exposed reinforcing steel. The Inspection Authority shall verify the information contained in all such requests and then forward them to the Director, Materials Bureau. The Materials Bureau shall determine whether repairs can be made or the unit will be rejected.

4. Non Repairable Defects. Non repairable defects are defined as: cracks in a concrete surface, which will be exposed to view after installation, that are visible when viewed in good typical lighting with the naked eye at a 10 foot distance; minor defects which in total make up more than 5% of the surface area of the unit and excessive surface defects on more than 5% of the surface area which will be exposed to view after installation.

The Inspection Authority will evaluate all defects and determine which of the above defect categories apply.

Sampling and Testing. Precast concrete units shall be separated into specific identifiable lots. The maximum number of units in a lot shall be in accordance with Department Quality Assurance Procedures. Precast units shall be sampled and tested to assure that the concrete is in conformance with the specification requirements. The Materials Bureau shall determine the sampling and testing frequencies. Copies of the Department's quality assurance procedures and test methods may be obtained from the Materials Bureau. Sampling and testing shall be performed by one of the following methods as determined by the Department.

1. Production Testing: Testing shall be performed by the manufacturer, subject to

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the approval and inspection of the Materials Bureau. It shall consist of testing the plastic concrete for compliance to the air content required by the specification and the casting and testing of concrete cylinders for compressive strength determination. Test cylinders used to determine the required compressive strength shall be cured in the same manner and location as the units they represent. Testing equipment and facilities shall meet the approval of the Materials Bureau. The Department reserves the right to test the hardened concrete at any time. If hardened concrete is tested, 4" diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 8" in length unless otherwise approved by the Materials Bureau. Core holes shall be plugged and repaired in accordance with the requirements of Repair, under 2. Minor Defects.

2. End Product Testing: The testing of hardened concrete for both air content and compressive strength will be performed by the Materials Bureau on 4" diameter cores drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 8" in length unless otherwise approved by the Materials Bureau. Core holes shall be plugged and repaired in accordance with the requirements of Repair, under 2. Minor Defects.

Shipping. No units will be considered for shipment until they have been accepted by the Department. This acceptance shall include verification that the units are free from defects as noted under Repairs and all specification requirements including the compressive strength and tolerance requirements have been achieved. In addition units produced between the dates of October 31st and April 1st will not be considered for shipment for a minimum of 72 hours following the completion of casting.

BASIS OF ACCEPTANCE. Precast concrete units will be accepted in specific identifiable lots at the manufacturing location in accordance with procedural directives of the Materials Bureau.

706-17 PRECAST CONCRETE BOX CULVERTS

SCOPE. This specification covers the material and quality requirements for precast concrete box culverts.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply except as noted herein.

The concrete used to fabricate precast concrete box culverts shall have a minimum compressive strength of 5000 psi @ 28 days. Additional material listed below shall meet the requirements of the following subsection:

Mechanical Connectors for Reinforcing Bar Splices (Epoxy Coated) 709-10

Fabrication. Fabrication requirements contained in §704-03, along with the following shall apply.

1. **Design.** When the contract plans contain complete design details for the culvert, alternate designs will not be considered. When the contract plans do not contain complete design details for the culvert the contractor shall be responsible for providing them. Precast concrete box culvert designs, submitted by the contractor, shall meet the requirements of the NYS DOT Reinforced Concrete Box Culvert Design Guidelines.

All box culvert designs shall be submitted by the contractor, to the Department, for approval. The processing, approval and transmittal of box culvert designs will be in accordance with procedural directives of the Materials Bureau. Designs shall be submitted at least 45 days prior to the start of fabrication and shall include a complete set of working drawings and a complete set of design calculations. The drawings and design calculations shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. When the contract plans contain a complete design for the culvert, working drawings are still required. However, they do not have to be stamped by a Professional Engineer and design calculations are not required.

2. **Drawings.** Working drawings shall include complete and accurate details for connecting headwalls, cut-off walls, wingwalls, apron slabs and when required, bridge railing to the box culvert. Working drawings, and when required design calculations, shall be submitted to the Department for approval at least 45 days prior to the start of fabrication. The processing, approval and transmittal of working drawings will be in accordance with procedural directives of the Materials Bureau.

3. **General.** Unless noted otherwise in the contract plans or approved working drawings the concrete cover over reinforcing steel shall be 1" minimum on the walls, floor slab and roof slab. When fill heights over the box culvert are less than 2'-0" the concrete cover on the outside face of the roof slab shall be 2" minimum and all reinforcing steel in the top mat of the roof slab shall be epoxy coated. Fill heights

706-17 PRECAST CONCRETE BOX CULVERTS

shall be measured from the top of pavement to the top of the culvert roof slab. Details for connecting headwalls, cut-off walls, wingwalls, apron slabs and when required, bridge railing to the box culvert shall be as shown in the contract plans or approved working drawings. Precast concrete box culvert sections shall be fabricated with a female joint on the upstream end and male joint on the downstream end. Joint depth shall be a minimum of 2" and a maximum of 4". The ends of longitudinal reinforcing steel shall have $\frac{1}{2}$ " minimum concrete cover at the mating surface of the joint. The circumferential reinforcing steel shall have 1" minimum concrete cover, as measured to the outermost bars, at the mating surface of the joint. When interferences occur which prevent this, the concrete cover shall be increased accordingly as shown on the approved shop drawings. Joints shall be fabricated such that when box culvert sections are fully drawn together the gap between adjacent culvert sections is $\frac{3}{4}$ " maximum.

4. Dimensional Tolerances. The dimensional tolerances contained in §704-03 shall apply except as noted herein.

- a. Internal and external unit dimensions shall not vary by more than $\frac{1}{2}$ " from the design dimensions.
- b. Slab and wall thickness shall not vary from the design dimension by more than $\frac{1}{4}$ " for thicknesses less than 10", or $\frac{1}{2}$ " for thicknesses of 10" or greater.
- c. The length of section shall not vary more than $\frac{1}{2}$ " from the design dimension.
- d. Variations in laying lengths of two opposite surfaces of the box section shall not be more than $\frac{1}{2}$ ".

Curing. The Curing requirements contained in §704-03 shall apply.

Repair. The Repair requirements contained in §704-03 shall apply except surface voids or "bug holes" that are less than 2" in diameter and less than $\frac{1}{2}$ " deep, need not be repaired.

Sampling and Testing. The Sampling and Testing requirements contained in §704-03 shall apply.

Shipping. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

704-05 PRECAST CONCRETE BARRIER

SCOPE. This specification covers the material and quality requirements for precast concrete barrier and precast concrete barrier for structures.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply except as noted herein.

Unless noted otherwise in the contract documents or approved working drawings the compressive strength of concrete used in precast concrete barrier shall be as follows:

- | | |
|------------------------------------|------------------------------|
| 1. Concrete Barrier | 3000 psi (minimum) @ 28 days |
| 2. Concrete Barrier for Structures | 5000 psi (minimum) @ 28 days |

Concrete mixtures used under this specification shall have a maximum cement content of 750 pounds per cubic yard.

Fabrication. The Fabrication requirements contained in §704-03, along with the following shall apply. The manufacturer shall not begin fabrication of any barrier units until an inspection assignment has been made by the Materials Bureau.

1. **Drawings.** The drawing requirements contained in §704-03 along with the following shall apply.

a. **Concrete Barrier.** Working drawings, when required for manufacture of the units, shall be approved by the Director, Materials Bureau, prior to the start of fabrication. The Materials Bureau will require at least 30 working days for the evaluation of each drawing submission.

b. **Concrete Barrier For Structures.** Units shall be fabricated to conform to the details shown on DCES approved precast barrier system drawings. When site conditions require modification of the approved precast barrier system drawings job specific working drawings are required. Working drawings, when required for fabrication of the units, shall be approved by the D.C.E.S. prior to the start of fabrication. The D.C.E.S. will require at least 20 working days for the evaluation of each drawing submission.

2. **General.** All reinforcing steel shall be epoxy coated meeting the requirements of §709-04. Reinforcing steel shall have a minimum of 1 1/2" of concrete cover unless noted otherwise in the contract plans or approved working drawings.

704-05 PRECAST CONCRETE BARRIER

3. Dimensional Tolerances.

- a. Cross sectional dimensions shall not vary by more than 1/4".
- b. The vertical centerline shall not be out of plumb by more than 1/4".
- c. When checked with a 10' straight edge surface irregularities shall not exceed 1/4".
- d. Longitudinal dimensions shall not vary from the dimensions shown by more than 1/4" per 10' of barrier.

Curing. The Curing requirements contained in §704-03 shall apply.

Repair. The Repair requirements contained in §704-03 shall apply.

Sampling and Testing. The Sampling and Testing requirements contained in §704-03 shall apply.

Shipping. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

ITEM 16555.5006 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(FULL SECTION)

ITEM 16555.5506 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(HALF SECTION)

DESCRIPTION.

- A. **WORK.** The work shall consist of constructing concrete barrier of the configuration and at the locations indicated on the Contract Plans.
- B. **METHODS.** Construction of the barrier shall be accomplished by cast-in-place or precast methods. Slip forming will be allowed as an acceptable cast-in-place method, unless the plans show anchor bolts projecting beyond concrete limits; in this instance slipforming procedures will require approval of the D.C.E.S.
- C. **SHAPE MODIFICATION.** The barrier shape indicated on the plans shall not be altered. Minor modifications, to allow slip-forming, will be submitted to the Regional Construction Engineer for approval.
- D. **APPROVALS.** For approval requirements and procedures refer to the Construction Details.

MATERIALS.

- A. **MATERIALS.** Materials used for this work shall meet the following requirements:
 - 1. **CONCRETE.**
 - a. **Precast.** Precast barrier shall be fabricated in accordance with the requirements of §704-03 and §704-05.
 - b. **Cast-in-Place - Constructed Forms.** The requirements of §501 pertaining to Class A Concrete shall apply.
 - c. **Cast-in-Place - Slip Formed.** The requirements of §501 pertaining to Class J concrete shall apply.
 - 2. **EPOXY COATED REINFORCING.** 709-04
 - 3. **PORTLAND CEMENT BONDING GROUT.** Portland cement bonding grout shall meet the requirements of §705-22 except that air entrainment is required. The air content shall be 8.0% ± 2.0%.
 - 4. **STEEL TUBES.** ASTM A500, Grade B or C
 - 5. **STEEL PLATES, OR BARS.** ASTM A36
 - 6. **ANCHOR BOLTS (FULLY THREADED).** ... ASTM A449
 - 7. **NUTS.** ASTM A563 Grade DH

ITEM 16555.5006 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(FULL SECTION)

ITEM 16555.5506 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(HALF SECTION)

8. WASHERS Plain, Hardened
 9. CONCRETE GROUTING MATERIAL 701-05
 10. CONCRETE REPAIR MATERIAL 701-04
 11. JOINT FILLER 705-08 Type I, or Type II
 12. CURING COMPOUND 711-05
 13. LOCKING AND ANCHORING DEVICES. Locking and anchoring devices for precast units shall be made of steel conforming to the requirements of §715-01 and §709-04, as applicable.
- B. GALVANIZING. Galvanizing shall be done in accordance with the requirements of §719-01. All steel, except reinforcing steel, shall be galvanized.
- C. FABRICATION TOLERANCES. All cast-in-place concrete barrier, regardless of the method of construction, shall conform to the following finished tolerances:

Bar Reinforcement Cover	-0" + 1/2"
Width (top)	-0" + 1/4"
Width (Bottom)	-0" + 1/2"
Surface Straightness (Deviation from theoretical centerline of individual section of unit)	1/2" in 20 feet
Vertical Alignment (Deviation from a line parallel to the theoretical grade line)	1/2" in 20 feet
Horizontal and Vertical Misalignment between adjacent precast units	±3/16"

All precast concrete barrier shall conform to the tolerances contained in §704-03, §704-05 and to the foregoing misalignment tolerance.

Reinforcement cover shall be verified while the concrete is still plastic, except in the case of cured precast units. In that case, cover will be verified in accordance with established Department procedures. These procedures may include coring.

ITEM 16555.5006 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(FULL SECTION)

ITEM 16555.5506 - PERMANENT CONCRETE BARRIER FOR STRUCTURES

(HALF SECTION)

CONSTRUCTION DETAILS.

A. APPROVALS.

1. **CAST-IN-PLACE CONCRETE MODIFICATIONS TO CONTRACT PLANS.** The D.C.E.S. shall be supplied with three copies of pertinent details and necessary design computations. Every effort will be made to render a decision, in a timely manner, after all pertinent information has been received. However, the time required to render a determination will not be taken into account should the Contractor request an extension of time as provided for under §108-04.

2. **PRECAST CONCRETE.** Precast barrier systems shall be approved by the DCES prior to the contract award in order to be used in this contract.

B. GENERAL: CAST-IN-PLACE CONCRETE.

1. **CLEANING.** Surfaces against which barrier is to be placed shall be thoroughly cleaned and vacuumed to remove any dirt or other foreign substances, laitance or partially loose chips of concrete.

2. **DEFECTS.** Defects are divided into two categories (minor defects and major defects). Minor defects in the barrier shall be repaired. Major defects shall be cause for rejection of the section. Such rejected sections shall be removed and replaced or, upon approval of the Engineer, the section shall be repaired to the satisfaction of the Engineer.

a. **Minor Defects.** Minor defects are defined as:

1. Holes, honeycombing or spalls which are six inches, or less, in diameter, and which do not expose the outermost surface of the steel reinforcement.
2. Surface voids 5/8", or less, in diameter, and 1/4", or less in depth are not considered defects and do not require repair.

b. **Major Defects.** Major defects are defined as:

1. Any defect which does not meet the definition of minor defect in B. **GENERAL: CAST-IN-PLACE CONCRETE., 2.a.**
2. Minor defects which, in aggregate, comprise more than five percent (5%) of the surface of the barrier section.

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3. **REPAIR.** Repair shall be made with a material acceptable under §701-04. Methods of repair shall be acceptable to the Engineer. The color of the repaired portion shall match, as nearly as practicable, the color of the surrounding concrete. Repaired portions shall exactly match shape requirements. The repaired portion shall withstand a moderate blow from a 16 ounce hammer. Repair shall be done at no cost to the State.

- C. **GENERAL: PRECAST CONCRETE.** The definition of defects and the repair requirements contained in §704-03 shall apply.

- D. **CAST-IN-PLACE CONCRETE: CONSTRUCTED FORMS.** The requirements of §555, and §556 shall apply with the following modification:

If the forms are removed before seven curing days have passed curing shall be continued in the following manner:

Concrete shall be cured by means of a clear curing compound. No curing blankets will be required. Curing compound shall be sprayed on the concrete surface immediately following the slipforming and handfinishing operations. The compound shall be applied by means of pressure spraying or distributing equipment at the rate directed by the Engineer, but not less than one gallon per 150 square feet of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide for adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the method of applying the compound produce a non-uniform film, or should the spraying equipment fail and duplicate equipment not be immediately available, the application of curing compound shall be discontinued immediately and the curing shall be accomplished by another method acceptable to the Engineer. The Contractor shall stockpile sufficient approved coverings for protection of the concrete in the event of rain, non-uniform film application, or breakdown of spray equipment.

- E. **CAST-IN-PLACE CONCRETE: SLIPFORMED.** The requirements of §555, §556 and the following, shall apply:

1. The forming of the barrier shall be accomplished by self-propelled equipment approved by the Engineer. The requirements of §555-3.03 shall not apply.
2. After all reinforcing bars have been placed, all bridge joints installed, and all other hardware placed in the area of the barrier, the Contractor shall perform a "dry run" over the entire length of the barrier installation location. It is necessary only to "dry run" a single day's placement during any given day; however, the entire barrier length shall be traversed.

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The "dry run" may be made with either the actual slip forming equipment, or with an exact "mock-up" of the equipment. The "mock-up"; if utilized, shall be the exact size, shape and dimensions of the slip forming equipment. It shall be a minimum of four feet long. Its movement shall be able to be correlated with a string, or survey, line indicating the correct offset location of the barrier.

3. After the "dry run" portion of the work has been completed and all obstructions have been cleared, the slip-forming equipment shall be demonstrated for capability. The demonstration shall be done in the presence of the Engineer. The Contractor shall make all adjustments, or alterations, to ensure that the equipment has the capability to produce an acceptable product. No work shall be done without the Engineer's approval. The capability demonstration will be required only once for each piece of forming equipment used on the project.
4. The Engineer's approval is for equipment capability only. The Contractor shall be entirely responsible for meeting the tolerances given under MATERIALS., C. FABRICATION TOLERANCES. Sections which do not meet tolerance requirements are subject to removal and replacement at no cost to the State, at the discretion of the Engineer.
5.
 - a. Central and Transit Mixed Concrete. The provisions of §501-3.04 C and D shall apply for Central Mixed and Transit Mixed Concrete respectively, except that water may be added to the mixture one additional time at the point of deposition to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range. When the water addition is made after discharge the total number of revolutions shall not be more than 190.
 - b. Truck Mixed Concrete. The provisions of §501-3.04 E shall apply except that after initial slump has been achieved, water may be added to the mixture one additional time to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range.
6. Concrete supply shall be sufficient to produce a continuous, completely shaped barrier. If concrete placement is interrupted, for any reason, the placement shall be protected from drying by several layers of wet burlap. A

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construction dam, or bulkhead, shall be installed if the interruption exceeds 30 minutes. If the interruption exceeds 90 minutes, further placement shall be discontinued. Concrete placement at this location may then resume only after 12 hours, measured from the time of delay, has elapsed.

7. Concrete placement may begin at the joint beyond the bulkhead without time constraints. If the length of placement between the bulkhead and the next joint is such that, in the opinion of the Engineer, it may not be slipformed, he will require the Contractor to form the section by methods other than slipforming.
8. Cold joints in the barrier, that is, joints formed due to the attachment of fresh concrete to set concrete, shall be made in the following manner. The set concrete shall have its surface cut to remove all loose, and otherwise unsatisfactory materials. Tools used for this purpose shall be approved by the Engineer, prior to use. The surface shall be scrubbed with wire brooms and shall be kept wet until new concrete is placed. Immediately prior to placing fresh concrete, the set surface shall be completely coated with portland cement bonding grout, §705-22, thoroughly brushed in.
9. The Contractor shall make provisions to allow hand finishing, should it be necessary, on all surfaces. Hand finishing, if done, shall be done immediately after the passage of the slipforming equipment. Curing compound shall be applied only after hand finishing has been completed at any particular location.
10. Concrete shall be cured by means of a clear curing compound in accordance with the requirements of CONSTRUCTION DETAILS, D. CAST-IN-PLACE CONCRETE: CONSTRUCTED FORMS.
11. Joints and construction grooves shall be introduced at the locations indicated on the Contract Plans. If sawcutting methods are employed the following requirements shall apply:
 - a. The equipment shall be demonstrated, for capability, to the Engineer.
 - b. No sawcuts, for any purpose, shall be made in the structural slab.
 - c. In order to avoid sawcuts in the structural slab, the portion of the joint directly above the structural slab (3") shall be hand tooled immediately after finishing.
 - d. All sawcuts shall be made normal to the structural slab surface. The joints shall be sawcut as soon as no damage to the concrete will result