MODIFIED BY EI 03-003
EFFECTIVE 5/8/03

To: SUPERSEDED BY EB06-057 EFFECTIVE 5/3/07		*New York State Department of Transportation* ENGINEERING INSTRUCTION	EI 02-039

Title: **REVISED MATERIALS SPECIFICATIONS FOR THE IMPLEMENTATION OF PRECAST CONCRETE QC/QA PROCEDURES**

Distribution:		Approved:
☐ Manufacturers (18)	☐ Surveyors (33)	Robert L. Sack — 5 DEC 02
☒ Main Office (30)	☒ Consultants (34)	Robert L. Sack, Deputy Chief Engineer, Technical Services Division — Date
☒ Local Govt. (31)	☒ Contractors (39)	
☒ Regions/Agencies (32)	☐ _____( )	

ADMINISTRATIVE INFORMATION.

- This Engineering Instruction (EI) is effective with projects submitted for the letting of 05/08/03. On ongoing projects, the Engineer may immediately approve Contractor requests to supply precast concrete items in accordance with the attached specifications and at no additional cost to the state.
- This EI supersedes: EI 95-010, EI 97-005, and EI 99-022.
- The specifications transmitted with this EI will be incorporated into the Standard Specifications.

PURPOSE. To issue revised standard materials specifications for precast concrete products and disapprove a number of special specifications.

TECHNICAL INFORMATION.

Specification Changes: The basis of acceptance for precast products that are under the administrative responsibility of the Materials Bureau has changed. The attached specifications revise, in their entirety, the specifications contained in the Standard Specifications of January 2, 2002. The pay item numbers with which these specifications are associated have not been changed. Under the revised specifications affected precast products will be accepted at the job site based on a manufacturer's certification, the appearance of the manufacturer's name on the Department's Approved List for the product being certified and a final product evaluation by the Engineer. These changes only apply to wet cast concrete products that are under the administrative responsibility of the Materials Bureau, including: box culvert, drainage units, pull boxes, pipe, median barrier, retaining wall, noise wall, curb and gutter, coping, drainage outlet headwalls, right of way markers, light pole bases, guide rail anchor blocks and pipe end sections. Machine made (dry cast) concrete products such as precast pavers, retaining wall block and machine made pipe are not affected.

Construction Inspection Manual: A new section will be added to the Construction Inspection Manual (CIM) to provide guidance to the Engineer regarding the job site inspection of precast items supplied in accordance with QC/QA Procedures. Revisions to the CIM, prepared jointly by the Materials Bureau and the Construction Division, will be distributed in a separate issuance.

Materials Inspection Manual: The affected sections of the Materials Inspection Manual (MIM) will be updated to reflect the new basis of acceptance requirements contained in the revised precast specifications. Revisions to the MIM, prepared by the Materials Bureau, will be distributed in a separate issuance.

Cost Impact: Initially there will be a slight to moderate cost increase for precast items supplied under the revised specifications. The cost increases reflect the need for precasters to update plant equipment and hire and

train additional quality control personnel. It is anticipated that the addition of trained quality control personnel to the precaster's work force will result in an overall improvement in quality with fewer repairs and rejections needed. As precasters become familiar with producing under the revised specifications the cost for precast products should come down.

IMPLEMENTATION. The Design Quality Assurance Bureau will insert the revised specifications into proposals for contracts, beginning with proposals submitted for the letting of 05/08/03, as follows:

SPECIFICATIONS TO BE INSERTED	CORRESPONDING ITEM NUMBERS
704-05 & 704-03	606.30 series, 606.90 series, 606.94 series, 08569.20, 08619.17, 11619. series, 11661.1802, 15606.32 series, 15606.3801, 16569. series, 93606.35 series
704-06 & 704-03	632.01 series, 17632. series
704-11 & 704-03	560.07, 11631.1404
704-14 & 704-03	554 series
706-01 & 704-03	603.02
706-02 & 704-03	603.60 series, 603.61 series, 603.62 series, 603.72 series, 603.74 series
706-03 & 704-03	603.66 series, 603.67 series, 603.68 series, 603.69 series, 603.70 series, 603.71 series
706-04 & 704-03	604.01, 604.06, 604.30 series, 604.31 series, 604.32 series, 604.40 series, 604.50 series, 02604.0407 series, 03662.10, 07615.0110, 08604.07 series, 09634.9998, 10604.0724, 10604.04 series, 10660.97, 11655.17, 11604. series
706-07 & 704-03	603.73 series
706-17 & 704-03	15603.63 series, 15603.64 series, 15603.65 series, 15603.66 series, 01603.81 series, 06603.81, 09603.67
712-05 & 704-03	625.03, 625.04
714-04 & 704-03	609.08 series, 609.09 series, 05620.50 series, 08609.1229, 09608.0105, 15609.40, 63609.13 series
714-07 & 704-03	624.03
723-45 & 704-03	670.01 series, 670.30 series, 680.50 series, 680.51 series, 08680.9901, 10670.8630, 10680.5105
704-03	01660.9801, 01634.8201, 05555.99, 05615.9997, 05615.66, 07680.9901, 07660.98 series, 08632.40, 09604.51 series, 09560.36, 09645.98, 09663.9801, 09634.82, 09664.20, 10604.5102, 10607.9962, 10607.9969, 10670.5130

Disapproved specifications: The following special specifications are disapproved for use as of the effective date of this engineering instruction. In addition all other special specifications which reference precast concrete

items being sampled, tested or accepted by the Materials Bureau are also disapproved. Disapproved specifications will have to be revised by those responsible for, or wanting to incorporate a specification into a project.

04607.990101 M - Precast Concrete Noise Barrier System, Exposed Aggregate Finish, Pier Mounted

06607.990101 M - Precast Concrete Noise Barrier System, Exposed Aggregate Finish, Pier Mounted

08604.5101 M - Stormwater Treatment System (Oil/Grit Separator)

08607.990501 M - Precast Concrete Noise Barrier/retaining Wall System, Exposed Aggregate Finish

08607.9906 M - Precast Concrete Noise Barrier Wall System

08607.9908 M - Precast Concrete Panel And Cap Wall System

10555.99 M - Precast Concrete Fascia Panels (Retaining Wall)

10562.81 M - Precast Reinforced Concrete Cut-off Walls

10562.82 M - Precast Reinforced Concrete Cradles

10606.3016 M - Concrete Median Barrier

10606.3116 M - Concrete Median Barrier End Section

10606.3216 M - Half Section Concrete Barrier

10606.3316 M - Half Section Concrete Barrier End Section

10606.37 M - Wood Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing)

10606.3705 M - Wood Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing) (Shop Curved)

10606.3710 M - Approach Anchorage Units For Wood Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing)

10606.3715 M - Wood Post Blocked-out Corrugated Beam Guide Railing Connections to Walls - Trailing Ends (Controlled Oxidizing)

10606.3720 M - Terminal Anchorage Units For Wood Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing)

10606.3730 M - Heavy Steel Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing)

10606.3735 M - Heavy Steel Post Blocked-out Corrugated Beam Guide Railing (Controlled Oxidizing) (Shop Curved)

10606.3740 M - Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing)

10606.3742 M - Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing) (Shop Curved)

10606.3744 M - Approach Anchorage Units For Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing)

10606.3902 M - Approach Anchorage Units For Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing)

10606.4771 M - Steel Backed Timber Guide Rail With Timber Posts And Block-outs

10606.4772 M - Approach Anchorage Units For Steel Backed Timber Guide Rail With Timber Posts And Block-outs

10606.4774 M - Steel Backed Timber Guide Rail With Timber Posts And Block-outs Connection to Walls

10606.4789 M - Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing)

10606.4790 M - Wood Post Blocked-out Corrugated Beam Median Barrier (Controlled Oxidizing) (Shop Curved)

10606.4791 M - Steel Backed Timber Median Barrier With Timber Posts And Block-outs

10606.4792 M - Approach Anchorage Units For Steel Backed Timber Median Barrier With Timber Posts And Block-outs

10606.4794 M - Steel Backed Timber Median Barrier With Timber Posts And Block-outs Connection to Walls

10607.9960 M - Noise Barrier System (Highway)

10607.9970 M - Noise Barrier System (Structures)

11551.0463nn M - Installing Lagging For Soldier Pile And Lagging Wall

11651.0503 M - Fire Department Manhole (New York City) - Type a

11651.0504 M - Fire Department Manhole (New York City) - Type B

11660.0907 M - Concrete Roadway Box, Type 1812 (Bureau of Electric Control)

11660.0908 M - Concrete Roadway Box, Type 2418 (Bureau of Electric Control)

11660.0909 M - Concrete Roadway Box, Type 3018 (Bureau of Electric Control)

11660.0910 M - Concrete Roadway Box, Type 3618 (Bureau of Electric Control)

11660.0911 M - Concrete Roadway Box, Type 3624 (Bureau of Electric Control)

11660.0912 M - Concrete Roadway Box, Type 4824 (Bureau of Electric Control)

11661.3410 M - Barrier Foundation For Aluminum Lamppost Without Transformer Base

17551.0460nn M - Holes in Earth For Soldier Pile And Lagging Wall

17551.0461nn M - Rock Sockets For Soldier Pile And Lagging Wall

17551.0462nn M - Installing Soldier Piles For Soldier Pile And Lagging Wall

17551.0463nn M - Installing Lagging For Soldier Pile And Lagging Wall

17620.20 M - Armor Units (Sta-pods) 2 Metric Ton Class

17620.21 M - Armor Units (Sta-pods) 5 Metric Ton Class

18605.2501 M - Precast Concrete Headwalls For 100 mm Lateral Outlet Pipes

18605.2502 M - Precast Concrete Headwalls For 100 mm Lateral Outlet Pipes

63620.20xx M - Armor Units (Sta-pods) 2 Metric Ton Class, Emergency Standby Contract Work

TRANSMITTED MATERIALS. Attached are the following standard materials specifications:

704-03	Precast Concrete-General
704-05	Precast Concrete Barrier
704-06	Precast Concrete Cribbing
704-11	Precast Concrete Coping
704-14	Precast Concrete Panel Units (Mechanically Stabilized Earth System)
706-01	Non-Reinforced Concrete Pipe
706-02	Reinforced Concrete Pipe Classes II, III, IV, V
706-03	Reinforced Concrete Elliptical Pipe Classes HE-II, HE-III, HE-IV, VE-IV, VE-V, VE-VI
706-04	Precast Concrete Drainage Units
706-07	Reinforced Concrete Pipe End Sections
706-17	Precast Concrete Box Culverts
712-05	Precast Concrete Right-Of-Way Markers
714-04	Precast Concrete Curb
714-07	Precast Concrete Gutter
723-45	Precast Reinforced Concrete Foundations And Pullboxes

BACKGROUND. In October 2000 Materials Procedure No. 00-01M (MP 00-01M) "Procedures For Achieving And Maintaining Precast Concrete Manufacturer's Approved List Status" was issued. This document is the product of a joint committee made up of representatives from the Materials Bureau, Regional Materials Offices and the Precast Concrete Association Of New York (PCANY). MP 00-01M contains the requirements for the supply of precast concrete items in accordance with Quality Control/Quality Assurance (QC/QA) procedures. Under QC/QA procedures the precast manufacturer will be responsible for all quality control activities while the Materials Bureau will maintain it's role of providing quality assurance. In order to supply precast products to Department Contracts precast manufacturer's will have to comply with the requirements detailed in MP 00-01M. Major points of the MP 00-01M QC/QA procedure include the following:

Approved List - Precast manufacturers must appear on the Department's Approved List for the item being supplied.

Manufacturer's Certification - A manufacturer's certification will accompany each delivery of precast product.

Plant Certification - Precast plants will have to be certified by either the National Precast Concrete

Association (NPCA) or the Precast/Prestressed Concrete Institute (PCI).

Automated Batch Plant - Precast plants will have DOT approved automated concrete batching controls and recordation.

Trained Personnel - Manufacturers will have staff that are trained and certified by the American Concrete Institute (ACI) and NPCA or PCI.

Quality Control Plan - Manufacturers will have and be required to follow a quality control plan which has been reviewed and approved by the Department.

Unannounced Inspections - Manufacturers will undergo unannounced plant visits by the Department to evaluate production activities and verify compliance with their Department approved quality control plan. Minimum standards must be met to maintain Approved List Status.

Monitor Cores - Monitor cores will be taken from precast products to verify concrete properties. Minimum standards must be met annually to maintain Approved List Status.

The attached specifications will implement MP 00-01M.

CONTACTS. Direct questions regarding this EI and attached specifications to the Field Engineering 1 section of the Materials Bureau, phone: 518-457-5956.

704-03 PRECAST CONCRETE - GENERAL

SCOPE. This specification covers the general material and quality requirements for precast concrete items produced in accordance with the current Materials Procedure for precast concrete QC/QA titled "Procedures For Achieving And Maintaining Precast Concrete Manufacturer's Approved List Status". 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; §501-2.02, §501-2.03 and §501-3.02 except as noted herein.

Type 1, 2 or 3 cement may be used. The manufacturer may substitute pozzolans up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Certain aggregates appear in the Approved List of Sources of Fine & Coarse Aggregates that have use limitations with a high alkali portland cement. When requested, the Materials Bureau may approve this combination when 15-20% by mass of the cement in the mix is replaced with fly ash.

The concrete shall have an air content of 5.0 to 9.0%. Unless noted otherwise in the contract documents, approved fabrication drawings or item specification, the minimum compressive strength of concrete used in precast units shall be 25 MPa @ 28 days.

Threaded inserts used to connect reinforcing steel to precast concrete shall be non-corrosive and shall have a tensile capacity of at least 50% of the yield strength of the reinforcing steel.

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

Concrete Repair Material	701-04
Bar Reinforcement, Grade 420	709-01
Wire Fabric For Concrete Reinforcement	709-02
Epoxy Coated Bar Reinforcement, Grade 420	709-04
Epoxy Coated Wire Fabric Reinforcement	709-08
Cold-Drawn Wire For Concrete Reinforcement	709-09
Mechanical Connectors for Reinforcing Bar Splices (Epoxy Coated)	709-10
Quilted Covers (for curing)	711-02
Plastic Coated Fiber Blankets (for curing)	711-03
Polyethylene Curing Covers (White Opaque)	711-04
Membrane Curing Compound (Clear w/Fugitive Dye)	711-05
Burlap	711-06
Corrosion Inhibitor	711-13

DRAWINGS. Precast concrete units shall be fabricated to conform to the details contained in the plans and contract documents. Fabrication Drawings shall be one of the following:

A. Contract Plan Sheets. When the contract plans contain enough detail to properly fabricate and inspect the precast element they may be used as the fabrication drawings. The Materials Bureau will determine wether or not the contract plans contain enough detail.

B. Department Standard Sheets. When Department Standard Sheets are referenced in, and are in compliance with the contract plans, the Standard Sheet shall be used as the fabrication drawing.

C. Fabricator Working Drawings. When the contract plans do not contain enough detail to be used as fabrication drawings and there is no Department Standard Sheet for the precast element or the Standard Sheet is not in compliance with the contract plans, Fabricator Working Drawings shall be used as the fabrication drawings.

D. Fabricator Standard Drawing. Fabricator Standard Drawings, previously approved by the Director, Materials Bureau, which meet the requirements of the contract plans, may be used as the fabrication drawings in place of Contract Plan Sheets, Department Standard Sheets or Fabricator Working Drawings.

Fabrication Drawings shall be prepared and processed in accordance with the current Materials Procedure for Preparing And Processing Fabrication Drawings For Precast Concrete Products.

FABRICATION. The manufacturer shall produce precast units that conform to the details of the approved fabrication drawings. The precast units shall be uniform in appearance. All concrete surfaces which will be exposed to view after installation shall be flat and smooth, free from irregularities and uniform in color and texture. The Department, and it's representatives, shall have free access to the manufacturing facility and all products produced for the Department.

Formwork. 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 approved fabrication 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. Form coatings, appearing on the Department's Approved List, shall be applied to all forms.

Lifting Devices. Lifting devices shall be a recessed type designed for use in precast concrete. The precast manufacturer shall ensure that the lifting devices selected for use have an adequate capacity to safely handle the precast product. Reinforcing steel shall not be used as a lifting device. Lifting devices that are used for turning or rotating a unit at the precast facility but are not necessary for further handling or installation shall be filled with concrete repair material before the unit is shipped. All other lifting devices shall be filled with concrete repair material after the unit is installed.

Reinforcing. Unless noted otherwise in the contract documents, approved fabrication drawings or item specification, the minimum concrete cover over reinforcing steel shall be 38 mm. Reinforcing steel shall be tied and supported to keep it in position during the concrete placement. 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. Chairs, tie wires and other devices used to support, position or fasten epoxy coated reinforcement shall be made of or coated with a dielectric material. 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.

Corrosion Inhibitor. When allowed by the individual item specification, corrosion inhibitor may be used in lieu of epoxy coated reinforcing. When corrosion inhibitor is selected for use it shall be clearly noted on the fabricator working drawing or in the fabrication request when standard sheets, contract plan sheets, etc are used as the fabrication drawings. When selected for use, corrosion inhibitor shall be used in all units produced to the referenced fabrication drawings. The corrosion inhibitor shall be added to the concrete as an aqueous solution at a dosage rate of 20.0 liters per cubic meter.

The calcium nitrite, which acts as an accelerator, may be used in conjunction with compatible retarding admixtures to control setting time and workability of the concrete, however the use of a formulation of calcium nitrite solution which includes a set control ingredient may be used if setting times and increased water demands are of concern, consult the manufacturer of the product. The corrosion inhibitor must be added to the mix immediately after air entraining and retarding admixtures have been introduced into the batch.

When a batching problem exists or is perceived the Department reserves the right to test the hardened concrete at any time to verify the quantity of calcium nitrite present. Units with less than the specified amount of calcium nitrite shall be subject to rejection. If hardened concrete is tested, 100 mm diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 100 mm in length unless otherwise approved by the Materials Bureau. Core holes shall be plugged and repaired in accordance with the requirements of repair indicated below.

Concrete Placement And Consolidation. 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, unless otherwise approved by the Materials Bureau. Vibrators shall not be used to move concrete within the forms. Concrete shall be placed and consolidated in a way that minimizes the presence of surface voids or bug holes on the formed surfaces.

Cold Weather. When concrete is cast in ambient temperatures less than 10°C the following requirements shall apply:

A. Immediately before concrete placement the minimum temperature inside the forms shall be 5°C.

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 indirect heat supply or by utilizing the heat of hydration. Curing temperatures shall not exceed 30°C unless units are steam cured in accordance with this specification. When an external heat supply is used the enclosure shall be properly vented to prevent surface disintegration of the fresh concrete due to an accumulation of carbon dioxide gas.

D. The plastic concrete shall not be exposed to freezing temperatures after it has been placed into the forms or during the curing period.

Dimensional Tolerances

A. Unit dimensions shall not vary by more than 5 mm from those shown on the approved fabrication drawings unless noted otherwise in the contract documents, approved fabrication drawings or item specification.

B. Variations in the required spacing of reinforcing steel shall not be more than 50 mm and are not cumulative. Concrete cover over reinforcing steel shall not be more than 10 mm greater than, and in no case be less than, the amount specified in the contract documents, approved fabrication drawings, or item specification.

Architectural Treatments

A. Architectural Patterned And Textured Precast Concrete. The architectural pattern or textured effect called for in the contract plans shall be obtained by using form liners, stamping equipment or other texturing tools recommended by the manufacturer. Details of the architectural pattern or texture and the fabrication method used shall be shown on the fabrication drawings for the precast item. Concrete surfaces treated with form liners or by stamping shall have a repeatable, seamless pattern such that when installed the units will form a continuous, natural looking, matching and repeatable pattern. Surfaces treated with texturing tools shall be uniform in appearance. When form liners are used, a high quality release agent compatible with the form liner material shall be used. Form liners which are worn or damaged resulting in a non-uniform appearance or damage to the concrete during form removal shall be replaced. Fabrication drawings shall clearly show the design thickness of the precast element and the thickness being added by the architectural pattern or texturing. The architectural pattern or texturing shall not penetrate into the required concrete cover over the reinforcing steel at any point.

B. Exposed Aggregate Precast Concrete. Coarse aggregate shall meet the color and size requirements in the plans. When no size is specified a Type CA1 gradation, or equal approved by the Director, Materials Bureau, shall be used. A set retarder designed for use in exposed aggregate applications shall be used. Surfaces requiring an exposed aggregate finish shall be uniform in appearance with the surface completely covered with exposed aggregate. A set retarder shall be applied, in accordance with the manufacturers recommendations, to the surfaces receiving the exposed aggregate finish. Alternate methods of obtaining the exposed aggregate finish require prior approval of the Director, Materials Bureau. Unless otherwise shown in the contract plans, the depth of exposure shall be 30% of the primary size of the coarse aggregate. The depth of exposure shall be measured by laying a straight edge across the plane of the concrete face and measuring back to the concrete matrix.

C. Integral Coloring. Integrally colored concrete shall be produced by use of a pigment coloring system meeting the requirements of ASTM C979. For each color used the pigment shall be from the same batch or lot unless otherwise approved by the Director, Materials Bureau. Pigment will be approved based on a manufacturers certification of compliance with these requirements. Type 6 white

cement, meeting the requirements of §701-01, may be used to achieve the desired color. Coloring pigment shall be added to the concrete mix per manufacturer's recommendations, at a dosage rate to achieve the desired color as specified in the contract documents. The manufacturer's recommended maximum dosage rate shall not be exceeded.

D. Visual Standards. The Contractor shall construct visual samples that are the same general size and shape as the production units they represent. The samples must be submitted to the Regional Landscape Architect for written approval. Each of the patterns, textures and colors identified in the plans shall be represented by the samples. Only one pattern or texture shall be used per sample face. When multiple patterns or textures are called for, additional samples will be required. Materials and fabrication techniques used in the samples, including curing, concrete pigment and sealers, shall be the actual materials and techniques to be used in the construction of the final product. If the samples are rejected by the Landscape Architect, the Contractor shall construct additional samples as required to obtain the Landscape Architect's approval. The approved samples shall be made available at the precast plant, for use by the inspector as visual standards, throughout production of the units. When surface coatings are to be field applied additional samples, without the surface coatings, shall be prepared and retained at the precast plant for use as visual standards. The fabrication of precast concrete units shall not begin until written approval of the visual standards has been received from the Department.

E. Visual Evaluation. When comparing production units against the visual standards there shall be minimal color and texture variations, from the standard, when viewed in good typical lighting at a 6m distance. When viewed alone, production units shall show no obvious imperfections or evidence of repairs other than minimal color and texture variations when viewed in good typical lighting at a 6m distance.

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 D. 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 21 MPa, whichever is less, has been reached.

Cylinders shall be cured in the same manner and maintained in the same temperature and environmental conditions as the units they represent until being tested.

A. Steam Curing. The units shall be cured in a suitable enclosure. 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 the initial temperature of the concrete. The maximum temperature inside the enclosure during the preset period shall be the initial temperature of the concrete +5°C.

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 20°C per hour. A moist atmosphere shall be maintained at a temperature between 40°C and 85°C for a period of not less than 12 hours. The temperature inside the enclosure shall then be decreased at a rate not exceeding 20°C 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.

B. Water Spray Curing. Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the water spray but not more than 2 hours after the completion of finishing.

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 20°C for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

C. Saturated Cover Curing. The saturated covers used under this method shall be burlap. Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the saturated burlap but not more than 2 hours after the completion of finishing. 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 20°C for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

D. Moisture Retention Curing. Units cured in accordance with these methods shall be maintained at a temperature of not less than 10°C for a period of not less than 7 days except as noted below. Additional curing time may be necessary to meet the 28 day strength requirements. When the specified 28 day compressive strength or 21 MPa, whichever is less, has been reached the unit may be exposed to freezing temperatures however the membrane curing compound or curing covers must still be maintained for a minimum of 7 days.

1. Membrane Curing Compound. The membrane curing compounds used under this method 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 liter per 3.5 square meters 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 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.

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, grout or mortar bonded to it or on any concrete surface that will have a penetrating or coating type treatment such as a sealer or stain applied to it. Another approved method of curing shall be used when this condition exists.

2. 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 300 mm.

E. 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. When repairs are made to a unit that has been sprayed with curing compound, the compound must be removed from the repair area before making the repair as it will act as a bond breaker between the precast concrete and the repair material. Major defects and non repairable defects in a unit will be cause for rejection of the unit. Defects are defined as follows:

A. Surface Defects. Surface voids or bugholes which are less than 15 mm in diameter and less than 5 mm deep are acceptable, except as noted under D. of this section. Surface defects need not be repaired.

B. Minor Defects. Minor defects are defined as: spalls, honeycombing and surface voids which have no dimension greater than 300 mm, when measured along a straight line, and do not expose the reinforcing steel. Minor defects shall be repaired by removing all unsound concrete from the defect, square cutting the edges of the defect to prevent feather edging of the repair 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 450 g hammer. The blow shall produce a sharp ring indicating proper bonding of the repair.

C. Major Defects. Major defects are defined as: spalls, honeycombing and surface voids which have any dimension greater than 300 mm, when measured along a straight line, or expose the reinforcing steel. Cracks which go through the section or are greater than 0.25 mm in width are also major defects.

No major defect shall be repaired without prior approval of the Department. Requests to repair major defects shall be made in accordance with the requirements contained in the current Materials Procedure for precast concrete.

D. 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 3 m 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.

SAMPLING AND TESTING. Sampling and testing shall be done by the precast manufacturer in accordance with Materials Bureau requirements contained in the current Materials Procedure for precast concrete.

MARKING. All precast units shall be clearly marked with permanent waterproof paint. Unless noted otherwise in the item specification, units shall be marked on an inside or back surface which will not be exposed to view after installation. The following information shall be included:

- Name or trademark of the manufacturer.
- Date of manufacture.
- Unique piece identification number.
- NYSDOT Contract number.

FINAL PRODUCTION INSPECTION. A final production inspection shall be performed by the precast manufacturer on every precast unit produced for the Department. An inspection will be considered satisfactory when it verifies that the precast unit is in compliance with the appropriate Department specifications. The specific requirements and procedures for the inspection are contained in the precast manufacturer's Department approved Quality Control Plan.

SHIPPING. Upon completion of a satisfactory final production inspection the precast unit may be shipped from the manufacturing location except that units produced between the dates of October 31st and April 1st shall not be shipped for a minimum of 72 hours following the completion of casting.

BASIS OF ACCEPTANCE. Precast units will be accepted at the job site based on the following:

- The manufacturer's name must appear on the Department's Approved List for the item being supplied.
- A manufacturer's certification.
- An acceptable product evaluation made by the Engineer.

704-05 PRECAST CONCRETE BARRIER

SCOPE. This specification covers the material and quality requirements for precast concrete barrier used in highway applications 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 fabrication drawings the compressive strength of concrete used in precast concrete barrier shall be as follows:

Concrete Barrier	25 MPa (minimum) @ 28 days
Concrete Barrier for Structures	35 MPa (minimum) @ 28 days

Concrete mixtures used under this specification shall have a maximum cement content of 445 kg per cubic meter.

Reinforcing steel shall be epoxy coated meeting the requirements of §709-04.

DRAWINGS. The drawing requirements contained in §704-03 shall apply except as noted herein.

Concrete Barrier For Structures. Units shall be fabricated to conform to the details shown on DCES approved Fabricator Standard Drawings for the barrier system. When site conditions require modification of the approved Fabricator Standard Drawings, job specific Fabricator Working Drawings are required.

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

Dimensional Tolerances. The requirements of §606-3.05 A. Precast Concrete Barrier shall apply.

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

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on one end of each barrier unit such that they will not be exposed to view after installation.

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

704-06 PRECAST CONCRETE CRIBBING

SCOPE. This specification covers the material and fabrication requirements for precast concrete cribbing.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

704-11 PRECAST CONCRETE COPING

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

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply except as noted herein.

Coping shall be produced with a dense, smooth, uniform finished surface without rubbing or additional treatment. Corners shall have a maximum radius of 3 mm and grinding will not be allowed. Coping shall be removed from the forms and handled in a manner that will prevent chipping of the edges and faces of the concrete.

Repair. Surface defects, regardless of size, shall be repaired by wetting the surface to achieve a damp condition with no standing water in the holes and then filling the holes with a mortar composed of an appropriate proportion of sand and cement having the same color and physical characteristics of the original mix. The mortar shall be allowed to partially harden and then be rubbed until a clean, uniform appearance, with no visible coating of mortar on the concrete, is obtained. The mortar repair shall be cured in the same manner as the coping unit.

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

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on one end of each unit such that they won't be exposed to view after installation.

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

704-14 PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

SCOPE. This specification covers the material and quality requirements for precast concrete panel units used to construct a mechanically stabilized earth system.

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

Unless noted otherwise in the contract documents or approved fabrication drawings the concrete used to fabricate panel units shall have a minimum compressive strength of 35 MPa @ 28 days.

Reinforcing steel shall be epoxy coated meeting the requirements of §709-04 or §709-08.

Embedded items shall be as detailed on the fabrication drawings. Acceptance of embedded items will be based on manufacturer's certification, unless otherwise directed by the Materials Bureau. When steel embeddments are required, they shall be galvanized to §719-01.

DRAWINGS. The drawing requirements contained in §704-03 shall apply.

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

Corrosion Inhibitor. When required in the contract plans the concrete used shall contain a corrosion inhibitor. The use of corrosion inhibitor does not replace the requirement for epoxy coated reinforcing.

Dimensional Tolerances

• Panel dimensions (edge-to-edge of concrete).	±5 mm
• Panel thickness.	±5 mm
• Length difference between two diagonals (squareness).	±10 mm
• Distance between the centerline of dowel and dowel sleeve.	±5 mm
• Dimension from the face of panel to centerline of dowel and dowel sleeve, and to centerline of reinforcing steel.	±5 mm.
• Warping of the exposed panel face.	≤ 5 mm in 1.5 m.
• Location of tie strips.	± 25 mm
• Location of coil embeds.	±5 mm
• Location of connection slots.	±25 mm
• Contact surfaces of each fabricated embedment assembly.	±2 mm from a straight line.
• Miscellaneous tolerances.	as detailed on the fabrication drawings.

Coating of Concrete Units. When required in the contract plans, panel units shall be coated on all surfaces with a penetrating sealer meeting the requirements of §717-03 Penetrating Type Protective Sealers. Surfaces to be coated must be prepared by blast cleaning, removing all laitance, loose particles, etc. The surface shall be allowed to dry for 24 hours after wetting for any reason. All surface preparation work shall be completed before sealer application can commence. The coating of units shall take place prior to shipping unless otherwise approved by the Engineer.

Sealer materials shall not be applied during wet weather conditions. Any unit exposed to wetting within 12 hours of being sealed shall be recoated. Ambient and surface temperatures shall be a minimum of 4°C during application and until the sealed concrete is dry to the touch. Application by spray methods shall not be used during windy conditions.

The sealer shall be used as supplied by the manufacturer without thinning or alterations, unless specifically required in the manufacturer's instructions. Thorough mixing of the sealer before and during use shall be accomplished as recommended by the manufacturer. Equipment for sealer application shall be clean of foreign materials. A minimum of two coats of sealer shall be applied. The total quantity of sealer applied by each coat shall be equal to the quantity required at the application rate specified in the Approved List. Each coat shall be allowed to dry before the next coat is applied. On sloping and vertical surfaces, sealer

application shall progress from the bottom to the top. Care shall be taken to ensure that the entire surface of the concrete is covered and all pores filled.

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

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

706-01 NON-REINFORCED CONCRETE PIPE

SCOPE. This specification covers the material and quality requirements for non-reinforced concrete pipe 600 mm and smaller used for culverts.

GENERAL. The provisions of §706-02, Reinforced Concrete Pipe, shall apply except that all references to reinforcing steel shall be deleted. In addition, physical and dimensional requirements of concrete pipe under 300 mm in diameter shall be as stated in Table 1, Class 1, of ASTM C14. Plain concrete pipe 300 mm to 600 mm in diameter shall conform to Table 1, Class 2, of ASTM C14.

MATERIAL REQUIREMENTS. The Material Requirements contained in §706-02 shall apply except that all references to reinforcing steel shall be deleted.

FABRICATION REQUIREMENTS. The Fabrication Requirements contained in §706-02 shall apply except as noted herein.

Marking. No pipe class or wall designation shall be marked on the pipe.

PHYSICAL REQUIREMENTS. The Physical Requirements contained in §706-02 shall apply except as noted herein.

Strength. The strength requirements for the respective diameter pipe sizes shall be as stated in Table 1 of ASTM C14M. Details of the three-edge bearing test shall comply with ASTM C14M.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §706-02 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §706-02 shall apply.

SHIPPING. The Shipping requirements contained in §706-02 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §706-02 shall apply.

706-02 REINFORCED CONCRETE PIPE CLASSES II, III, IV, V

SCOPE. This specification covers the material, fabrication, and physical requirements of reinforced concrete pipe and cattle pass.

GENERAL. Apply the requirements of AASHTO M 170M, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, Classes II, III, IV, and V, except as modified by this specification. Produce reinforced concrete pipe by either machine made or wet cast methods in accordance with working drawings approved by the Department and in full compliance with the details of this specification. Pipe manufactured for a specific class will be acceptable for any class having a lower design strength.

Methods of manufacture include the following:

A. Wet Cast Pipe And Cattle Pass. Wet cast units are those made from concrete placed and consolidated by conventional equipment. These units develop resistance to freeze-thaw damage through the use of entrained air in the concrete. Air content in wet cast concrete shall range between 5.0% and 9.0%.

Manufacture wet cast pipe, for Department acceptance, in accordance with this specification and the current Materials Procedure for precast concrete titled "Procedures For Achieving And Maintaining Precast Concrete Manufacturer's Approved List Status".

B. Machine Made Pipe. Machine made units use very low slump concrete and methods of consolidation which produce a dense product with low permeability and good resistance to freeze-thaw damage.

Manufacture machine made pipe, for Department acceptance, in accordance with this specification and the current Materials Method titled "Quality Assurance Procedure For Concrete Pipe Items".

MATERIAL REQUIREMENTS

A. Materials

Portland Cement (Type 1, Type 2 or Type 3)	701-01
Concrete Repair Material	701-04
Coarse Aggregate	703-02
Concrete Sand	703-07
Bar Reinforcement, Grade 420 (Reinforcement & Stirrups)	709-01
Wire Fabric for Concrete Reinforcement	709-02
Bar Reinforcement, Grade 300	709-03
Cold Drawn Wire for Concrete Reinforcement	709-09
Admixtures	711-08
Water	712-01
Concrete Pipe Joint Sealing Compound	705-16
Concrete Pipe Joint Elastomeric Gaskets	705-17
Fly Ash	711-10
Ground Granulated Blast Furnace Slag	711-12

B. Cementitious Content. Use a minimum combined cementitious content of 335 kilograms per cubic meter. This includes the Portland Cement and pozzolan (fly ash and/or ground granulated blast furnace slag). The maximum allowable total chloride content in concrete shall not exceed 0.10 percent by weight of cementitious material tested in accordance with written procedural directives of the Materials Bureau.

C. Pozzolans. Fly ash and/or ground granulated blast furnace slag may, in total, be substituted for cement up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix.

D. Admixtures. Calcium Chloride is not allowed in concrete. Admixtures, other than an approved Air Entraining agent for wet cast pipe, are not allowed unless otherwise approved by the Materials Bureau.

E. Reinforcement. Sample the reinforcement in accordance with the written directives of the Materials Bureau. Accept stirrups based on the manufacturer's certification, unless otherwise directed by the Materials Bureau.

F. Pipe Joint Materials

1. Elastomeric Gaskets. The gaskets used in the installation of round pipe shall meet the specification requirements of §705-17 and only those types and sizes designated by the pipe manufacturer on the approved drawings of the particular pipe.

2. Sealing Compounds. Concrete pipe joint sealing compound, meeting the specification requirements of §705-16, shall be used only on elliptical pipe and reinforced cattle pass.

FABRICATION REQUIREMENTS

Drawings. Submit detailed working drawings conforming to the Materials Bureau concrete pipe templates. All diameter sizes of a particular geometric shape can be included on one drawing. Separate drawings are required for cattle pass, jacking pipe and special designs.

Full approval of the working drawings is required prior to the manufacture of any concrete pipe.

Design, Reinforcement and Dimensions

A. General. Apply the Design, Reinforcement and Permissible Variations requirements of AASHTO M 170M for Class II, III, IV and V pipe, walls B & C. The AASHTO tables show minimum reinforcement. The manufacturer may submit drawings detailing alternatives to the specified reinforcement and/or wall thickness for Materials Bureau consideration. To gain full approval of alternate designs, manufacture and test pipe samples in accordance with the written procedural directives of the Materials Bureau.

B. Reinforced Concrete Cattle Pass. Apply the requirements of NYSDOT Standard Sheet M603-4 with the following modification. A minimum length of 1200 mm is required for each section. The maximum allowable variation in laying lengths of two opposite sides of a cattle pass section is 3 mm per 300 mm of diameter, not to exceed 16 mm in any length of cattle pass, except where beveled or curved cattle pass lengths have been specified.

Concrete Batch Placement

A. Machine Made Pipe. Clean and properly assemble the forms prior to placing any concrete. Transport and place the concrete mixture such that no segregation of the concrete materials or displacement of the reinforcing steel occurs within the form.

B. Wet Cast Pipe And Cattle Pass. Apply the Concrete Placement And Consolidation requirements contained in §704-03.

Curing. Include the type of curing, curing time and any temperature requirements on the drawing.

A. Machine Made Pipe. Cure the pipe in accordance with AASHTO M 170M. Other methods of curing are subject to approval by the Director, Materials Bureau.

B. Wet Cast Pipe And Cattle Pass. Apply the Curing requirements contained in §704-03.

Joints. Use either bell and spigot or tongue and groove design. Design the joints so as to permit effective jointing to reduce leakage and infiltration and to permit placement without irregularities.

Marking. The pipe markings must be identified on the inside barrel for pipe diameters of 450 mm and greater. If the diameter is less than 450 mm the markings may be stenciled on the outside of the pipe. Mark each piece of pipe with the following information, as applicable.

- Name or trademark of manufacturer.
- Date of manufacture.
- Pipe class.
- Wall designation.
- Pipe diameter.

- NYSDOT lot number ("NYSDOT _____") (Machine made pipe only.)
- Indelibly mark the word "TOP" on the inside and outside of the barrel at the appropriate location on each pipe length with elliptical or quadrant reinforcing.

Repair

A. Machine Made Pipe. Pipe may be repaired at the plant or in the field using 701-04 Concrete Repair Material. Repairs to more than 10% of a lot will not be permitted. Repairs will be acceptable if, in the opinion of the Department, the repairs are sound, properly finished and cured, and the repaired pipe conforms to the requirements of these Specifications and the written procedural directives of the Materials Bureau.

B. Wet Cast Pipe And Cattle Pass. Apply the Repair requirements contained in §704-03.

PHYSICAL REQUIREMENTS

Strength. Apply the requirements of AASHTO M 170M except that the compressive strength requirements do not apply except for cattle pass. Conduct such number and type of three edge bearing tests as the Materials Bureau deems necessary to establish the quality of pipe.

Reinforced concrete cattle pass will not require a three-edge bearing test. The minimum 28 day compressive strength for cattle pass, as determined by concrete cylinders, is 25 MPA.

Absorption Requirements For Machine Made Pipe. The maximum average absorption for all pipe is 8.0% by weight for the last three specimens tested.

Freeze-Thaw Requirements. The Materials Bureau reserves the right to test the pipe for durability by freeze-thaw testing. The test will be run in accordance with written procedural directives of the Materials Bureau.

SAMPLING AND TESTING. It is required that each manufacturer have a testing machine, of a type approved by the Materials Bureau, to carry out three edge bearing tests. Employ a commercial testing agency to calibrate the testing machine according to ASTM E4 at a minimum of once a year. Upon request of the Materials Bureau, furnish a record of this calibration. Sample and test reinforced concrete pipe and cattle pass units, manufactured under the requirements of this specification, as follows.

A. Machine Made Pipe. Separate machine made reinforced concrete pipe into specific and identifiable production lots. Follow the written procedural directives of the Materials Bureau to determine the maximum number and type of units in a lot and the number of samples to be taken per lot. Test each lot of machine made reinforced concrete pipe as follows:

1. Three Edge Bearing Test. Follow the requirements for strength testing indicated above using the test procedure identified in the procedural directives issued by the Materials Bureau. Perform tests in the presence of a representative of the Department.

2. Absorption Test. Cores from each lot, drilled by the manufacturer in the presence of a representative of the Department, will be used for this test. The cores will be tested by the Materials Bureau in accordance with the test method specified in ASTM C497 except that under "absorption test" the drying period will be 48 hours at a temperature of 110°C.

Plug the holes when cores are taken. Ensure that plugs are sound, properly finished and cured according to the requirements of "Pipe Repair."

In addition to the above tests, pipe will be subject to inspection at any time prior to placing, and rejection may be made through failure to comply with the criteria shown in the written procedural directives of the Materials Bureau.

B. Wet Cast Pipe And Cattle Pass. Sample and test wet cast reinforced concrete pipe and cattle pass in accordance with Materials Bureau requirements contained in the current Materials Procedure for precast concrete, titled "Procedures For Achieving And Maintaining Precast Concrete Manufacturer's Approved List Status".

FINAL PRODUCTION INSPECTION. For wet cast units only, follow the Final Production Inspection requirements contained in §704-03.

SHIPPING

A. Machine Made Pipe. No units will be considered for shipment unless the units are free from defects as noted under Pipe Repair in this specification and according to the written procedural directives of the Materials Bureau.

B. Wet Cast Pipe And Cattle Pass. Follow the Shipping requirements contained in §704-03.

BASIS OF ACCEPTANCE

A. Machine Made Pipe. Units will be accepted in stock lot quantities at the manufacturing location in accordance with the current version of Materials Method 1 titled "Quality Assurance Procedure For Concrete Pipe Items".

B. Wet Cast Pipe And Cattle Pass. Follow the Basis Of Acceptance requirements contained in §704-03.

706-03 REINFORCED CONCRETE ELLIPTICAL PIPE; CLASSES HE-II, HE-III, HE-IV, VE-IV, VE-V AND VE-VI

SCOPE. This specification covers the material and quality requirements for both horizontal and vertical elliptical reinforced concrete pipe of the classes noted above for use as culvert pipe. Pipe designed for placement with the major axis horizontal is designated as horizontal elliptical pipe. Pipe designed for placement with the major axis vertical is designated as vertical elliptical pipe.

GENERAL. The provisions of §706-02, Reinforced Concrete Pipe Classes II, III, IV, V shall apply except as noted herein.

All references to AASHTO M 170M, contained in §706-02, shall be replaced with AASHTO M 207M. All reference to Classes II, III, IV and V, contained in §706-02, shall be deemed to include all classes of elliptical pipe.

MATERIAL REQUIREMENTS. The Material Requirements contained in §706-02 shall apply except that the pipe joint material shall be a sealing compound meeting the requirements of §705-16.

FABRICATION REQUIREMENTS. The Fabrication Requirements contained in §706-02 shall apply except as noted herein.

Design, Reinforcement and Dimensions. In the case of elliptical pipe, the working drawings indicate the equivalent round pipe diameter, rise, span and class. A tolerance of plus or minus 2% from the nominal rise and span of the pipe, as shown on the approved working drawing, will be permitted. Variations in laying lengths of two opposite sides of a pipe section shall not be more than 10 mm/m of equivalent diameter, with a maximum of 16 mm in any length of pipe, except where beveled or curved lengths have been specified.

Marking. No wall designation shall be marked on the pipe. An equivalent round pipe diameter shall be used for markings.

PHYSICAL REQUIREMENTS. The Physical Requirements contained in §706-02 shall apply.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §706-02 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §706-02 shall apply.

SHIPPING. The Shipping requirements contained in §706-02 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §706-02 shall apply.

706-04 PRECAST CONCRETE DRAINAGE UNITS

SCOPE. This specification covers the material and fabrication requirements for precast concrete drainage units including transverse drainage interceptors.

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

The concrete used to fabricate round precast concrete drainage units shall have a minimum compressive strength of 30 Mpa @ 28 days. The concrete used to produce machine made units shall have a maximum absorption of 8.0% by weight and is not required to be air entrained.

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

Frames And Grates	655
Concrete Grouting Material	701-05
Concrete Pipe Joint Sealing Compound	705-16
Concrete Pipe Joint Elastomeric Gaskets	705-17
Mortar For Concrete Masonry	705-21
Steps For Manholes	725-02

DRAWINGS. The Drawing requirements contained in §704-03 along with the following shall apply.

Fabricator Working Drawings are required for all round drainage structures. Cut sheets, showing structure heights, the size and location of pipe openings and step locations are required for all drainage structures.

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

Manufacturing Process. Precast concrete drainage units shall be wet cast or machine made.

A. Wet Cast. Wet cast units are manufactured from concrete, placed and consolidated by conventional equipment, containing entrained air to develop resistance to freeze-thaw damage.

B. Machine Made. Machine made units are manufactured with very low slump concrete, consolidated to produce a dense product with low permeability and good resistance to freeze-thaw damage. Machine made units are those made by the following methods:

- Packerhead
- Roller suspension
- Centrifugal
- Machine tamped
- Machine vibrated
- Other methods as approved by the Materials Bureau

Reinforcing. Reinforcing bar splices shall be lapped a minimum of 30 bar diameters and tied securely. Wire fabric splices shall be secured by one of the following methods:

A. Tying. Under this method the ends shall lap to a length of not less than 30 diameters of the reinforcement and the lap shall contain a longitudinal member. A sufficient number of laps shall be tied to maintain continuity of the cage through the period of placement and curing of the concrete.

B. Welding. Each circular member shall be lapped a minimum of 50 mm and welded. The weld shall develop a minimum of 50 percent of the specified strength of the wire.

Round Units. Precast bases, floors, risers, conical top sections, grade rings and flat slab tops shall conform to the design, dimension and reinforcement requirements of ASTM C478M. The C478M requirements for splices, laps and welds shall not apply.

Transverse Drainage Interceptors. Bar reinforcement shall be epoxy coated meeting the requirements of §709-04.

Joints. Joints between precast riser sections shall be formed with male and female ends so that when the sections are assembled they will make a continuous and uniform unit.

Joint Sealant Materials. Joints between precast sections are to be sealed with flexible watertight Elastomeric Gaskets, Pipe Joint Sealing Compounds, Mortar for Concrete Masonry, Concrete Grouting Material or Concrete Repair Material meeting the requirements of the Standard Specifications. If elastomeric Gasket Sealers are used the shape, size and placement shall be recommended by the precast manufacturer.

Steps for Drainage Units. Steps for drainage units shall conform to §725-02, Steps for Manholes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed unit at a maximum spacing of 400 mm. All steps in a completed drainage unit shall be the same size. Steps shall be embedded into the walls of the section a minimum of 75 mm. The rung shall project a minimum clear distance of 100 mm from the walls of the section measured from the point of embedment. If the steps are grouted, the grouting material shall conform to §701-04 Concrete Repair Materials or §701-05 Concrete Grouting Material. If plastic inserts are used for installing steps, they shall be approved by the Materials Bureau. Steps which are damaged during installation or handling shall be replaced.

Frames for Grates. Frames cast into the top slab or top of the uppermost riser shall be secured and held in place by a minimum of 4 stirrups or studs per frame, welded to the frame near the corners. Parallel bar frames shall contain shear stud anchors, for the purpose of transferring loads, as required and detailed on the standard sheet for parallel bar grates and frames. Shear stud anchors, when required, shall replace the frame securing stirrups or studs.

Dimensional Tolerances. The inside width and length dimensions shall not vary by more than 10mm from the design dimensions.

SAMPLING AND TESTING. The sampling and testing requirements contained in 704-03 shall apply except as noted herein.

A. Machine Made Units. Testing for air content is not required. Cores shall be taken from the hardened concrete and tested for absorption. A minimum of 3 cores per 5 batches of a single mix with a minimum of three cores per day per mix shall be used to measure absorption. The average absorption of the 3 cores shall not exceed the maximum absorption specified herein. Testing shall be in accordance with ASTM C497 M except that the drying period shall be 48 hours at a temperature of 110° C.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the inside face of all precast pieces. Each flat slab top that doesn't have an integral frame or a design that readily indicates the top surface shall have the words "INSTALL THIS SIDE UP" placed on its top surface.

The markings on rectangular drainage units, including base slabs, bases and risers, shall include the maximum placement depth in mm ("MPD...mm"). The maximum placement depth is based on wall thickness and reinforcement and shall be in accordance with the Department's Standard Sheets or the contract plans.

Instead of marking the contract number on each unit they may be marked with "NYSDOT".

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

706-07 REINFORCED CONCRETE PIPE END SECTIONS

SCOPE. This specification covers the material and fabrication requirements for reinforced concrete pipe end sections.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

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

The barrel portion of the end section shall meet the Design, Reinforcement and Permissible Variations requirements of AASHTO M 170M for Class III Pipe, Wall Designation B.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

SHIPPING. The Shipping requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §704-03 shall apply, unless otherwise approved by the Director, 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 35 MPA @ 28 days. Joint gasket material shall meet the requirements of ASTM D1056, Grade # 2A1 or # 2A2.

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 shall meet the requirements of the "NYSDOT Reinforced Concrete Box Culvert Design Guidelines". Design details for bridge size culverts shall also include load rating information. Design calculations shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. The transmittal, processing and approval of box culvert designs will be in accordance with procedural directives of the Materials Bureau.

DRAWINGS. The Drawing requirements contained in §704-03, along with the following shall apply.

All fabrication drawings for Contractor provided designs shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. Fabrication drawings for bridge size culverts shall include load rating information. Reproducible drawings are required for bridge size culverts only.

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

Reinforcing. Unless noted otherwise in the contract plans or approved fabrication drawings the concrete cover over reinforcing steel shall be 25 mm minimum on the walls, floor slab and roof slab of culverts and 38 mm minimum on wingwalls. When fill heights over the box culvert are less than 600 mm the concrete cover on the outside face of the roof slab shall be 50 mm minimum and all reinforcing steel in the top mat of the roof slab shall be epoxy coated or the concrete shall contain corrosion inhibitor. Fill heights shall be measured from the top of pavement to the top of the culvert roof slab. All reinforcing steel in the wall section of wingwalls shall be epoxy coated or the concrete shall contain corrosion inhibitor.

Joints. 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 50 mm and a maximum of 105 mm. The ends of longitudinal reinforcing steel shall have 15 mm minimum concrete cover at the mating surface of the joint. The circumferential reinforcing steel shall have 25 mm 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 fabrication drawings. Joints shall be fabricated such that when box culvert sections are fully drawn together the gap between adjacent culvert sections is 20 mm maximum. The outside mating surface of the joint shall have a continuous 25 mm x 25 mm gasket installed at the precast plant.

Corrosion Inhibitor. Corrosion inhibitor may be used in lieu of epoxy coated reinforcing.

Dimensional Tolerances

- Internal and external unit dimensions shall not vary by more than 10 mm from the design dimensions.
- Slab and wall thickness shall not vary from the design dimension by more than 5 mm for thicknesses less than 250 mm and 10 mm for thicknesses of 250 mm or greater.
- The length of section shall not vary more than 10 mm from the design dimension.
- Variations in laying lengths of two opposite surfaces of the box section shall not be more than 10 mm.

Repair. Minor defects in the mating surface of the joint, that do not come in contact with the joint gasket material and are 5 mm or less in depth, do not require repair.

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

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the inside face of one wall of each culvert barrel section.

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

712-05 PRECAST CONCRETE RIGHT-OF-WAY MARKERS

SCOPE. This specification covers the material and fabrication requirements for precast concrete right-of-way markers.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

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

Precast right-of-way markers shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the bottom end face of each unit such that they won't be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with "NYSDOT".

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

714-04 PRECAST CONCRETE CURB

SCOPE. This specification covers the material and fabrication requirements for precast concrete curb.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

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

Precast curb shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

Minimum curb lengths shall be 1.75 meters except for radial curb and closures. Maximum curb lengths shall be 3.05 meters. Curb to be set on a radius of 30 meters or less shall be cast to the curve required and the ends shall be formed or sawed on radial lines. Curbs to be set on a radius of 31 meters to 60 meters may be cast or cut in 1 or 1.25 meter straight lengths, if approved by the Engineer.

Reinforcing. Reinforcement is optional, however if the manufacturer chooses to reinforce the curb for handling the reinforcement shall be epoxy coated or the concrete shall contain corrosion inhibitor.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on an end face of each unit such that they won't be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with "NYSDOT".

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

714-07 PRECAST CONCRETE GUTTER

SCOPE. This specification covers the material and fabrication requirements for precast concrete gutter.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

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

Precast concrete gutter shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

Reinforcing. Wire mesh reinforcement shall consist of one layer of Size 102x102 - MW26 x MW26 embedded midway between the upper and lower surfaces, unless otherwise shown on the plans. Reinforcing bars of equivalent area may be substituted for the wire mesh reinforcement. Reinforcement shall be epoxy coated or the concrete shall contain corrosion inhibitor.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on an end face of each unit such that they won't be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with "NYSDOT".

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.

723-45 PRECAST REINFORCED CONCRETE FOUNDATIONS AND PULLBOXES

SCOPE. This specification covers the material and quality requirements for precast concrete foundations and pullboxes.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply.

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

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the inside face of all pullboxes. Instead of marking the contract number on each unit they may be marked with "NYSDOT".

FINAL PRODUCTION INSPECTION. The Final Production Inspection 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.