Test. Sampling procedure instructions and test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of lightweight aggregates is determined by the Director, Materials Bureau on the basis of tests performed by the Materials Bureau on representative samples of the materials; review of Quarry Reports and Plant Flow Information; petrographic examination and other geologic studies; and performance histories where applicable. The material is incorporated into the work on the basis that it is accepted and conforms to procedural directives of the Department and the aggregate shall meet the gradation requirement at the point of use.

**TABLE 703-10**

**LIGHTWEIGHT AGGREGATE REQUIREMENTS**

(TESTING)

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Fine Aggregate</th>
<th>Coarse Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Sulfate (NYSDOT 207). Loss by Weight 5 cycles, % Max.</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>Los Angeles Abrasion Test (ASTM C131). Loss by Weight (Grading B or C), % Max.</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 704 - MASONRY UNITS**

**704-01 COMMON BRICK**

SCOPE. This specification covers the material and quality requirements for common brick made from clay or shale for use in the construction of drainage structures.

MATERIAL REQUIREMENTS. The brick shall conform to the requirements of AASHTO Specification M91 Grade MM, except as modified herein. Common brick may be furnished in any of the designated standard sizes that will produce the required dimensions in the completed structure, and the bricks shall be solid.

SAMPLING AND TESTING

Sampling. The brick shall be sampled by the Department's Representative, from production lot quantities in accordance with the following:

<table>
<thead>
<tr>
<th>Lot Size (Number of Units)</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 250,000</td>
<td>10</td>
</tr>
<tr>
<td>250,001 - 500,000</td>
<td>15</td>
</tr>
<tr>
<td>500,001 - 1,000,000</td>
<td>20</td>
</tr>
<tr>
<td>For each additional 500,000 or fraction thereof</td>
<td>5 additional samples</td>
</tr>
</tbody>
</table>

In no case shall less than 10 bricks be selected as samples. Additional specimens may be required at the discretion of the Department.

Testing. The brick shall exhibit a saturation coefficient not exceeding 0.80 except that if the average compressive strength of a lot submitted for test is greater than 55 MPa or the average water absorption is less than 8.0% after 24-hour submersion in cold water, the requirement for saturation coefficient shall be waived.

In addition, at the project site, individual brick may be culled and rejected by the Engineer for failure to satisfy the following:

A. **General Appearance.** Brick shall be rectangular in cross section with substantially straight
§704-01

edges and square corners. Kiln marks or depressions not exceeding 5 mm in depth shall be permitted on the backside of the brick.

B. Finish and Appearance

1. Sewer brick may have plain or smooth surfaces on both ends and on the face side.

2. Manhole brick may have plain, slightly or moderately textured surfaces.

C. Surface Requirements. Minor indications and surface cracks incidental to the usual method of manufacture, or the small chipping resulting from the customary methods of handling in shipment and delivery will not be grounds for rejection.

D. Soundness. The brick shall exhibit a clear metallic ring when any two bricks are struck together.

BASIS OF ACCEPTANCE. The material will be considered for acceptance either in stock for quantities at the manufacturing location in accordance with the procedural directives of the Department or on the basis of job sampling in the event samples are not taken at the plant.

704-02 CONCRETE BRICK

SCOPE. This specification covers the material and quality requirements for concrete building brick intended for use in brick masonry.

MATERIAL REQUIREMENTS. The General and Material Requirements of §706-02, Reinforced Concrete Pipe, shall apply except that all references to approved working drawings and reinforcement shall not apply.

The concrete brick shall be manufactured in an approved plant. The nominal dimensions of the brick shall be 205 mm long, 100 mm wide, and 70 mm in height. The standard dimensions of the concrete brick shall be the nominal dimension minus 10 mm. No over-all dimension (width, height, and length) shall differ more than 5 mm from the specified standard dimensions.

Concrete mix proportions shall be such that the minimum compressive strength as determined on the units themselves shall be as stated in this specification.

The transportation and placement of concrete shall be done by methods that will prevent segregation of the concrete materials.

The use of high early strength cement, calcium chloride, or any other concrete additive, not expressly approved, is prohibited.

Concrete brick shall be sound and free from cracks or other defects that would interfere with proper placing.

All concrete brick shall be subjected to curing which shall be accomplished to the satisfaction of the Department by any one of the methods described in “Curing” of §706-02 Reinforced Concrete Pipe, except Controlled Atmospheric Curing shall not be allowed. Units shall be protected from freezing from the time the concrete is placed, and until curing is completed.

SAMPLING AND TESTING

Sampling. The brick shall be sampled by the Department’s Representative, from production lot quantities in accordance with the following:

<table>
<thead>
<tr>
<th>Lot Size (Number of Units)</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10,000</td>
<td>6</td>
</tr>
<tr>
<td>10,001 - 99,999</td>
<td>12</td>
</tr>
<tr>
<td>100,000 - 150,000</td>
<td>18</td>
</tr>
<tr>
<td>For each additional 50,000 or fraction thereof</td>
<td>6 additional samples</td>
</tr>
</tbody>
</table>

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of January 2, 2002
In no case shall less than 6 brick be selected as samples. Additional specimens may be required at the discretion of the Department.

**TESTING.** The minimum average compressive strength of concrete brick samples representing any lot, as determined on full size brick(s), shall be 20 MPa of average gross area (brick flatwise). The compressive strength of any individual unit shall not be less than 15 MPa.

The maximum average absorption of concrete brick samples representing any lot shall not exceed 240 kilograms per cubic meter.

All test procedures shall be conducted in accordance with ASTM C140.

**BASIS OF ACCEPTANCE.** The material will be considered for acceptance in accordance with procedural directives of the Department for either stock lot quantities at the manufacturing location, or on the basis of job sampling in the event samples are not taken at the plant.

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**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, §501-2.03 and §501-3.02 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 25 MPa @ 28 days.

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
- 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

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**FABRICATION**

**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.
§704-03

**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 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.

**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. 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.

**Dimensional Tolerances**

- **A.** Unit dimensions shall not vary by more than 5 mm 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 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 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 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 25 MPa, whichever is less, has been reached.

Units with a compressive strength requirement greater than 25 MPa 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.

A. 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 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. 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 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 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 minimum temperature of 10°C for 7 days. Additional curing time may be necessary to meet the 28 day strength requirements. When the specified 28 day compressive strength or 25 MPa, whichever is less, has been reached the 10°C minimum curing temperature is no longer required and the unit may be exposed to freezing temperatures.
§704-03

1. Membrane Curing Compound. The membrane curing compounds used under this method shall 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 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. 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.

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. 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 4.e. 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. No minor defect shall be repaired without 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 454 gram 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.

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.

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.

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.

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.

A. Production Testing. Testing shall be performed by the manufacturer, subject to 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, 100 mm diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 200 mm 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.

B. End Product Testing. The testing of hardened concrete for both air content and compressive strength will be performed by the Materials Bureau on 100 mm diameter cores drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 200 mm 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
§704-03

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.

704-04 CONCRETE BLOCK (SLOPE PAVING)

SCOPE. This specification covers the material and quality requirements for solid concrete block for use in concrete block slope paving.

MATERIAL REQUIREMENTS. The General and Material Requirements of §706-02 Reinforced Concrete Pipe shall apply except that all references to approved working drawings and reinforcement shall not apply.

Concrete mix proportions shall be such that the minimum compressive strength as determined on the units themselves shall be as stated in this specification.

The transportation and placement of concrete shall be done by methods that will prevent segregation of the concrete materials.

The use of high early strength cement, calcium chloride, or any other concrete additive not expressly approved is prohibited.

Blocks shall be sound and free from cracks or other defects that would interfere with the proper placing of the blocks.

All blocks shall be subjected to curing by any one of the methods described in “Curing” of §706-02, Reinforced Concrete Pipe except Controlled Atmospheric Curing shall not be allowed. Curing shall be accomplished to the satisfaction of the Department. Units shall be protected from freezing from the time the concrete is placed and until curing is completed.

SAMPLING AND TESTING

Sampling. The block shall be sampled by the Department's Representative, from production lot quantities in accordance with the following:

<table>
<thead>
<tr>
<th>Lot Size (Number of Units)</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10,000</td>
<td>6</td>
</tr>
<tr>
<td>10,001 - 99,999</td>
<td>12</td>
</tr>
<tr>
<td>100,000 - 150,000</td>
<td>18</td>
</tr>
<tr>
<td>For each additional 50,000 or fraction thereof</td>
<td>6 additional samples</td>
</tr>
</tbody>
</table>

In no case shall less than 6 block be selected as samples. Additional specimens may be required at the discretion of the Department.

Testing. The minimum average compressive strength of concrete paving block samples shall be 20 MPa. This strength shall be determined on full size block samples, by load application in a direction parallel to the slope upon which the block is to be placed. The compressive strength of any individual unit shall be not less than 15 MPa.

The maximum average absorption of concrete paving block samples representing any lot shall not exceed ten percent (10%) by weight. The absorption of any individual unit shall not exceed twelve percent (12%) by weight.

All test procedures shall be in accordance with ASTM C140.

BASIS OF ACCEPTANCE. The material will be considered for acceptance in accordance with procedural directives of the Department for entire stock lot quantities at the manufacturing location, or on the basis of job sampling in the event samples are not taken at the plant.
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:

<table>
<thead>
<tr>
<th>Concrete Barrier</th>
<th>25 MPa (minimum) @ 28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Barrier for Structures</td>
<td>35 MPa (minimum) @ 28 days</td>
</tr>
</tbody>
</table>

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

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.

A. Drawings. The drawing requirements in §704-03 along with the following shall apply:

1. 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.

2. 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.

B. General. All reinforcing steel shall be epoxy coated meeting the requirements of §709-04. Reinforcing steel shall have a minimum of 40 mm of concrete cover unless noted otherwise in the contract plans or approved working drawings.

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

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

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

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

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

704-06 PRECAST CONCRETE CRIBBING

SCOPE. This specification covers the material and fabrication requirements for precast concrete cribbing. Cribbing may consist of one of the following two types:

1. Stretcher and header type.
2. Precast concrete wall unit type.
§704-06

MATERIAL REQUIREMENTS. Materials shall meet the requirements of the following Sections:

- Portland Cement 701-01
- Coarse Aggregates 703-02
- Concrete Sand 703-07
- Bar Reinforcement Grade 420 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Admixtures 711-08
- Water 712-01

The maximum allowable total chloride content in concrete shall not exceed 0.10 percent by weight of cement. Testing shall be done in accordance with written procedural directives of the Department.

Cement shall be Type 1 or Type 2. Coarse aggregate gradation shall conform to the No. 1 Size Designation §703-02 Coarse Aggregate, Table 703-4.

Pozzolans. The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15 percent of the minimum portland cement by weight.

Concrete Manufacturing. The manufacturer shall formulate a concrete mix design, with a minimum cement content of 360 kilograms per cubic meter, such that the properties of the concrete meet the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Content, %</td>
<td>5.0 - 8.0</td>
</tr>
<tr>
<td>Compressive Strength, MPa, Min., 28 days</td>
<td>25 Mpa</td>
</tr>
</tbody>
</table>

The manufacturer shall maintain at the manufacturing site a record of material used and their sources, and a copy of the concrete mix design.

Fabrication. Precast concrete cribbing shall be fabricated to conform to the shape and size shown on the standard sheet unless otherwise shown on the plans. The reinforcement shall be the size and configuration shown on the standard sheet. The manufacturer shall produce precast cribbing units that are uniform in appearance. The units shall be straight and the concrete shall be cast in steel forms unless another type of form is approved by the Regional Director or his/her representative. The concrete shall be thoroughly consolidated by external or internal vibrators or a combination of both.

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.

Curing. All cribbing shall be subjected to curing by any one of the methods described in the following paragraphs. After removal of forms and before curing begins, cribbing shall be sheltered from direct sunlight and drafts in a manner satisfactory to the Regional Director or his/her representative. The curing process shall commence no later than eight hours after the removal of the forms. Curing shall be accomplished to the satisfaction of the Regional Director or his/her representative. If at any time curing temperatures fall below the specified minimum for the chosen curing procedure, the curing period shall be increased accordingly.

A. Steam Curing. Cribbing may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between 40°F and 75°C, by the injection of steam for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the cribbing to meet the strength requirements. Steam curing shall not commence until at least two hours have elapsed since completion of placement of concrete in the forms.

When a curing chamber is not available, cribbing may be placed in an enclosure of canvas and
subjected to steam at the temperature and for the time specified above. The enclosure shall be so erected as to allow full circulation of steam around the entire cribbing section. The interior surfaces of the curing room or canvas jackets and the surfaces of the cribbing shall be entirely moist at all times.

**B. Water Spray Curing.** Under the conditions of enclosure described in the above paragraph on “Steam Curing”, cribbing may be cured by subjecting it to 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 or such additional time as may be necessary to meet the strength requirements.

**C. Saturated Cover Curing.** The sides and top of each cribbing section shall be covered with heavy burlap or other suitable material saturated with water before applying and kept at a temperature of not less than 20°C for a period of not less than 72 hours or such additional time as may be necessary to meet the strength requirements.

**D. Other Methods.** Curing by other methods is subject to the approval of the Director, Materials Bureau.

**Repair.** Cribbing sections that contain minor defects caused by manufacture or mishandling may be repaired. Minor defects are defined as those that are small holes or spalls that do not penetrate deeper than the steel reinforcement. Repairs shall be made using a concrete repair material conforming to the requirements of §701-04 and having a color similar to that of the cribbing section. The repair shall be finished to the proper shape and cured. It shall withstand a moderate blow with a 450 gram hammer.

Cribbing sections having honeycombing, cracks, or large spalls are not acceptable and shall not be repaired.

**SAMPLING AND TESTING.** Precast concrete cribbing sections manufactured under the requirements of this specification shall be separated into specific and identifiable stock lots. A lot shall consist of only one type of cribbing. However, a variety of sizes may be included in a lot.

The maximum number of sections in a lot shall be in accordance with Department directives.

The properties of the concrete will be determined on a stock lot basis, by the Department, in accordance with either of the following methods at the option of the Department:

**A. Production Testing.** Testing will be performed by the manufacturer, subject to the approval and inspection of the Materials Bureau. It will consist of testing the plastic concrete for compliance to the air content required by this 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 with units they represent. The Department reserves the right to test the hardened concrete at any time, in which case the manufacturer will drill 100 mm diameter cores at the direction of a Department representative.

**B. End Product Testing.** The testing of hardened concrete for both air content and compressive strength will be performed by the Materials Bureau on 100 mm diameter cores drilled by the manufacturer under the supervision of a Department representative.

**SHIPPING.** No units will be considered for shipment unless the units are free from defects as noted under Repairs of this specification and all specification requirements including the compressive strength requirements are achieved.

**BASIS OF ACCEPTANCE.** Precast concrete cribbing will be accepted in stock lot quantities at the manufacturing location according to the procedural directives of the Materials Bureau.
704-07 SEGMENTAL RETAINING WALL BLOCKS

SCOPE. This specification covers the material details and quality requirements for precast concrete retaining wall blocks, machine manufactured with dry cast concrete.

MATERIAL REQUIREMENTS. Provide materials used in the manufacture of precast concrete retaining wall blocks meeting the following requirements:

- Portland Cement 701-01
- Coarse Aggregate 703-01
- Mortar Sand 703-03
- Grout Sand 703-04
- Concrete Sand 703-07
- Water 712-01

Use coloring agents, when required, to fabricate blocks that are colorfast, durable and resistant to alkali. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

Provide materials meeting the shapes, sizes and colors specified on the plans.

Provide sound blocks free from cracks or other defects that would interfere with the proper placing of the blocks.

Pozzolans. Fly ash meeting the requirements of §711-10 Fly Ash, up to a maximum of 15% by weight of the total amount of cement plus pozzolan in the mix, may be substituted.

SAMPLING AND TESTING. Provide precast concrete retaining wall blocks meeting the following requirements:

Lot Size. The maximum lot size will be equal to the number of blocks required to form 550 m³ of finished wall face. All blocks in a lot shall be of the same dimensions, color and finish.

Compressive Strength. Testing will be performed in accordance with ASTM C140. The minimum acceptable average compressive strength of five (5) precast concrete retaining wall block samples is 28 MPa at 28 days. The minimum acceptable compressive strength of any individual unit is 24 MPa at 28 days.

Freeze-thaw Resistance. Testing will be performed in accordance with ASTM C 1262. The maximum acceptable average loss of 5 precast concrete retaining wall block samples, subjected to 42 freeze-thaw cycles in 3 percent NaCl solution, is 1.0 percent. The maximum acceptable loss of any individual sample is 1.5 percent.

DIMENSION. The formed dimensions of precast concrete retaining wall block units will not differ more than ± 5 mm from the nominal dimensions shown on the approved Materials Detail Drawing.

Materials Details. At the time of application to the Approved List, submit Materials Details Drawings to the Director, Materials Bureau for approval. Prepare and submit drawings in accordance with Departmental procedural directives. Submit a unique drawing(s) for each wall system under consideration.

BASIS OF ACCEPTANCE. Acceptance of the retaining wall blocks is based on the names of the manufacturer and retaining wall block appearing on the Department's Approved List, conformance to the approved Materials Details, and the sampling and testing of stock lot quantities in accordance with procedural directives of the Materials Bureau.
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704-08 BRICK PAVERS

SCOPE. This specification covers the material and quality requirements for brick pavers made from extruded fire clay or shale for use in brick paving.

MATERIAL REQUIREMENTS. Brick pavers shall be manufactured from extruded fire clay or shale and shall be the shape, size and color shown on the plans. Samples of the brick pavers shall be submitted to and approved by the Engineer prior to beginning of work.

The brick pavers shall be fired to produce a dense paver with the average water absorption less than 8.0% after 24-hour submersion to cold water and the average compressive strength in excess of 55 MPa. The paver shall be free of chinks, scoring scar, stress cracks or foreign substances. The brick pavers shall also conform to the other requirements outlined in A.S.T.M. C216 and C 62, Grade SW.

BASIS OF ACCEPTANCE. The brick pavers will be considered for acceptance either in stock lot quantities at the manufacturing location in accordance with the procedural directives of the Department, or on the basis of project sampling if samples are not taken at the plant. Samples shall be submitted for testing to the Materials Bureau a minimum of 30 days prior to the beginning of the work. A minimum of ten pavers shall be submitted from each lot of 50,000 pavers or fraction thereof. For lots of more than 50,000 pavers, five individual pavers shall be selected from each 100,000 pavers or fraction thereof contained in the lot. In no case shall less than ten pavers be submitted. Additional specimens may be required at the discretion of the Department.

704-09 STONE BLOCKS

SCOPE. This specification covers the material and quality requirements for stone blocks for use in Grouted Stone Block Paving.

MATERIAL REQUIREMENTS. Stone blocks shall be new or used granite or other stone as specified. The blocks shall be sound and durable, reasonably uniform in quality and texture throughout, free from shale, excess mica, seams, scaling or evidence of disintegration. Color shall be as specified. Samples of stone blocks shall be submitted to and approved by the Engineer prior to beginning of work.

The blocks shall be rectangular in shape, with the following approximate dimensions: 200 mm - 300 mm in length, 75 mm - 125 mm in depth, unless otherwise specified or approved, and so dressed that they may be laid with a maximum of 30 mm joints or as specified. All blocks shall have one reasonably smooth split face with no projections or depressions over 5 mm. Cutting of blocks to meet the pattern requirements will be permitted subject to the approval of the Engineer.

BASIS OF ACCEPTANCE. Stone blocks shall be inspected, by the Engineer, for dimensional and color compliance upon arrival at the project location. Blocks not in compliance with the contract documents may be rejected by the Engineer.

704-10 SPLIT FACED CONCRETE BRICK

SCOPE. This specification covers the material and quality requirements for split faced concrete brick for use in facing structural walls.

MATERIAL REQUIREMENTS

Cement. Cement used shall be Type 2 or Type 6 or combination thereof conforming with the requirements of §701-01 Portland Cement. Shipment shall be accompanied by a cement shipment certification executed by the cement manufacturer in a form and manner directed by the Materials Bureau.
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Pozzolans. The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15 percent of the minimum portland cement by weight.

Aggregates

A. Fine Aggregate. The aggregate used shall conform to the requirements of §703-01 Fine Aggregate and shall be artificial sand made from crushed rock and shall have a gradation suitable to make a unit block meeting the requirements of ASTM Designation: C55, Grade N1.  

B. Coarse Aggregate. The aggregate used shall conform to the requirements of §703-02 Coarse Aggregate and shall be Crushed Stone §703-0201 or Crushed Gravel §703-0202 having a gradation suitable to make a unit block meeting the requirements of ASTM C55, Grade N1 with maximum size of 13 mm.

Admixtures. No admixture shall be required other than a coloring agent. All coloring agents used in the mix shall be manufactured from minerals which are light-fast, durable and resistant to alkali.

Proportioning. The proportion of the mix shall be that necessary to secure unit block meeting the requirements of ASTM C55, Grade N1. An automatic proportioning plant will not be required.

Curing. Curing shall meet the requirements indicated for §706-02 Reinforced Concrete Pipe, except Controlled Atmospheric Curing shall not be allowed.

Measurement. The size of the split faced concrete bricks shall be as follows:

<table>
<thead>
<tr>
<th>Height</th>
<th>Width</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 mm</td>
<td>95 mm</td>
<td>395 mm or 450 mm</td>
</tr>
<tr>
<td>65 mm</td>
<td>95 mm</td>
<td>395 mm or 450 mm</td>
</tr>
<tr>
<td>90 mm</td>
<td>95 mm</td>
<td>395 mm or 450 mm</td>
</tr>
<tr>
<td>140 mm</td>
<td>95 mm</td>
<td>395 mm or 450 mm</td>
</tr>
<tr>
<td>195 mm</td>
<td>95 mm</td>
<td>395 mm or 450 mm</td>
</tr>
</tbody>
</table>

All bricks in each lot shall have the same length (L). The width of unsplit blocks shall be twice that of the split faced concrete bricks.

The width (W) of the split faced concrete bricks shall be the width measured at the quarter points across the top and bottom bearing surfaces from the split line to the back face of the brick.

Splitting Procedure. The splitting of the concrete masonry unit shall be made after the block has attained the required strength but not less than seven days after curing has been completed. The splitting shall be performed on an approved mechanical, self-leveling splitting machine with two steel knives, one directly above the other. The splitting shall leave relatively sharp, straight, and parallel bearing edges. Concrete masonry units prefailure by use of chamfer strips in molds or any other means, shall not be approved for use under this specification.

SAMPLING AND TESTING. The brick shall be sampled in accordance with the applicable sections of Methods of Sampling and Testing Concrete Masonry Units (ASTM C140) with the following modifications:

Sampling shall be conducted in a manner directed by the Materials Bureau. All samples shall be wrapped in 0.1 mm polyethylene for submission to the Materials Bureau.

For purposes of test, full size, unsplit concrete bricks shall be selected at the place of manufacture.

For the strength, absorption and moisture content determinations the number of specimens shall be 10 units selected from each lot.

The maximum number of unsplit units in a lot shall be 15,000. From the time of sampling, the concrete brick shall be kept in covered storage or if exposed to the elements shall be stored on pallets.
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and shall be protected from free moisture by a waterproof wrapping of 0.1 mm polyethylene. Concrete brick shall be shipped on pallets, wrapped as described above and remain protected in this manner until incorporated into the work. The brick shall be tested in accordance with the applicable sections of Method of Sampling and Testing Concrete Masonry Units (ASTM C1140).

The split faced concrete brick shall be within the range of color, quality, texture and surface finish of the standard samples on display in the office of the D.C.E.S., 1220 Washington Avenue, Albany, New York 12232.

The split faced concrete brick shall meet the physical properties, permissible variation in dimension and visual inspection as set forth in ASTM C55, Grade N1.

BASIS OF ACCEPTANCE. Brick will be considered for acceptance in stock lot quantities at the manufacturer's yard or in job lots consisting of any fraction of the contract quantity at the manufacturer's yard. Samples shall be secured for tests by a representative of the Department only from the lots of block they are to represent.

Brick shall be considered ready for acceptance when a lot conforms to the specified test requirements, regardless of age, classification and measurements. The manufacturer shall be permitted one, and only one, retest to determine specification compliance.

The manufacturer shall submit to the Materials Bureau for each lot offered for acceptance a copy of typical test results for linear shrinkage of this product. These test results need not be from the lot offered for acceptance but shall be from samples of the same product tested no more than 12 months prior to submission of the lot for acceptance. The test shall be performed by an independent testing laboratory.

704-11 PRECAST CONCRETE COPING

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

MATERIAL REQUIREMENTS. The requirements of §714-04 shall apply except as modified herein.

A. Cement Type. The cement may be Type 2 or Type 6.

B. Aggregate Size. The maximum aggregate size shall be No. 2 size designation.

C. Coloring Agents. All coloring agents used in the mix shall be manufactured from minerals; and the agents shall be light-fast, durable and resistant to alkali.

D. Source of Supplies. Sources of supply of cement, aggregate and admixtures shall not be changed during the course of production of units without approval by the Regional Director or his/her representative.

E. Concrete Mix. The concrete mix proportions shall be formulated by the precast concrete coping manufacturer to have a minimum cement content of 360 kilograms per cubic meter, and the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength, MPa, 28 days</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Air Content, %</td>
<td>5.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Absorption, %</td>
<td>-</td>
<td>7</td>
</tr>
</tbody>
</table>

FABRICATION. Precast concrete coping shall be fabricated to conform to the shape and size shown on the plans. The reinforcement shall be shaped as shown on the plans and any circumferential wire shall be lap welded prior to placement in the form. Precast concrete coping shall meet the requirements of permissible variation in dimension and visual inspection as set forth in ASTM C55, Grade U1 and the physical properties as set forth in this specification. The color of the precast concrete coping shall be
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as specified on the plans. The width of the precast concrete coping shall be that measured at the quarter points and across the top and bottom surfaces.

All surfaces exposed to view after installation except bedding surfaces shall be formed by casting a portland cement concrete mix against steel or fiber glass forms of rigid construction. All units shall be produced in such a manner that the bottom surfaces are founded on a casting bed of unyielding materials.

Castings shall be produced with a dense, smooth, uniform finished surface without rubbing or additional treatment. Consolidation of the concrete may be external or internal vibration or a combination thereof. Corners shall have a maximum radius of 3 mm and grinding will not be allowed.

The castings shall remain in the forms at least 24 hours. After 24 hours, the castings shall be removed from the forms in a manner that will prevent chipping of the edges or faces of the concrete.

Curing. Curing shall meet the requirements indicated in §706-02, Reinforced Concrete Pipe, except Controlled Atmospheric Curing shall not be allowed.

Repair. Castings with honeycomb will not be accepted regardless of the method of repair. Blow-holes on the surfaces shall be kept to a minimum. Minor blow-holes shall be repaired as follows:

The casting is to be wet and the holes shall be filled 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 with burlap until a clean, uniform appearance, with no visible coating of mortar on the concrete, is secured. The mortar repair shall be kept moist for a minimum of five days.

SAMPLING AND TESTING. Specimens for determination of strength, air content, absorption and dimension shall be 100 mm diameter cores, from each lot, obtained by the manufacturer and certified as representing a specific lot and size of precast concrete coping. A Department representative shall select the precast concrete coping units for acceptance test specimens. The minimum number of specimens shall be three cores unless otherwise directed by the Materials Bureau. The cores shall be sent to the Materials Bureau by a Department representative where they will be tested. The manufacturer will be permitted one retest to determine compliance with the absorption requirement. Test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Precast concrete coping shall be accepted in stock lot quantities at the manufacturing location on the basis of the procedural directives of the Materials Bureau.

704-12 DECORATIVE CONCRETE BLOCK

SCOPE. This specification covers the material and quality requirements for decorative concrete block for use in facing structural walls.

MATERIAL REQUIREMENTS. Details of materials shall comply with the requirements included in §501, Portland Cement Concrete - General, with the following modifications:

Cement. Cement shall be Type 2 or Type 6, or a combination thereof, conforming with the requirements of §701-01, Portland Cement except that shipment shall be accompanied by a Certified Shipment Notice executed by the cement manufacturer in a form and manner directed by the Materials Bureau. Shipment inspection and seal control by the Department will not be required.

Pozzolans. The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15 percent of the minimum portland cement by weight.
Aggregates

A. Fine Aggregate. The aggregate used shall conform to the requirements of §703-01, Fine Aggregate and shall have a gradation suitable to make a unit block meeting the requirements of ASTM C55, Grade N1. Hard durable crushed marble, the surfaces of which are not coated with any injurious materials, will be accepted.

B. Coarse Aggregate. The aggregate used shall conform to the requirements of Crushed Stone §703-0201 or Crushed Gravel, §703-0202, having a gradation suitable to make a unit block meeting the requirements of ASTM C55, Grade N1, with a maximum size of 13 mm. Hard durable crushed marble, the surfaces of which are not coated with any injurious materials, will be accepted.

Admixtures. The only admixtures permitted will be a coloring agent if required.

Coloring. All coloring agents used in the mix shall be manufactured from minerals and, be light-fast, durable and resistant to alkali.

Mix Proportions. The proportion of the mix shall be that necessary to secure a unit block meeting the requirements of ASTM C55, Grade N1.

Proportioning Equipment. An automatic proportioning plant will not be required.

Curing. Curing shall meet the requirements indicated for §706-02, Reinforced Concrete Pipe, except Controlled Atmospheric Curing shall not be allowed.

SAMPLING AND TESTING. The block shall be sampled in accordance with the applicable sections of Methods of Sampling and Testing Concrete Masonry Units (ASTM C140) with the following modifications:

A. Selection of Test Specimens. For the purpose of test, full size concrete block may be selected by representatives of the Department from stock lot quantities at the place of manufacture.

B. Number of Specimens. For the strength, absorption and moisture content determinations, the number of specimens shall be not less than 10 units selected from each lot of 5000 units, or fractions thereof, and 20 units selected from each lot of more than 5000 and less than 50,000 units. For lots of more than 50,000 units, not less than 10 units shall be selected from each 25,000 units, or fractions thereof, contained in each lot.

The block shall be tested in accordance with the applicable sections of Methods of Sampling and Testing Concrete Masonry Units, (ASTM C140).

Classification. The decorative concrete blocks shall be within the range of color, quality, texture and surface finish of the standard samples on display in the office of the Deputy Chief Engineer (Structures), 1220 Washington Avenue, Albany, New York 12232.

The decorative concrete block shall meet the physical properties, permissible variation in dimension and visual inspection as set forth in ASTM C55, Grade N1. The maximum moisture content permitted will not exceed 30.0 percent.

Splitting Procedure. When required, the splitting of the concrete masonry block shall be made after the block has attained the required strength, but not less than seven days after curing has been completed. The splitting shall be performed on an approved mechanical self-leveling splitting machine with two steel knives, one directly above the other. The splitting shall leave relatively sharp straight parallel bearing edges, a texture and surface finish with fracture of the aggregate within the range of the standard samples on display in the office of the Deputy Chief Engineer (Structures).
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Storage. Stock lot quantities of the block stored in the manufacturer's yard shall be neatly piled, preferably on shipping pallets, after curing is completed and protected from free moisture by a waterproof wrapping of 0.1 mm polyethylene. Such protection shall be maintained until the material is used.

Sample units of full-size concrete blocks shall be individually wrapped and protected from free moisture by a waterproof wrapping of 0.1 mm polyethylene immediately after selection, prior to and during shipment to the Materials Bureau.

BASIS OF ACCEPTANCE. Block will be considered for acceptance in stock lot quantities at the manufacturer's yard or in job lots consisting of any fraction of contract quantity at the manufacturer's yard. Samples shall be secured for tests by a representative of the Department only from the lots of block they are to represent. The maximum quantity in a lot shall be as directed by the Materials Bureau.

All shipments from stock lots shall be certified by a representative of the Department as directed by the Materials Bureau.

Block shall be considered ready for acceptance when a lot conforms to the specified test requirements, regardless of age, classification and measurements. The manufacturer shall be permitted one, and only one, retest to determine specification compliance.

704-13 PRECAST CONCRETE PAVERS

SCOPE. This specification covers the materials details, quality requirements and method of approval for precast concrete pavers.

MATERIAL REQUIREMENTS. Materials used in the manufacture of precast concrete pavers shall meet the requirements of the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>701-01</td>
</tr>
<tr>
<td>Fine Aggregate Mortar Sand</td>
<td>703-03</td>
</tr>
<tr>
<td>Grout Sand</td>
<td>703-04</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>703-02</td>
</tr>
<tr>
<td>Water</td>
<td>712-01</td>
</tr>
</tbody>
</table>

No admixtures are required. Coloring agents, when required, shall be formulated such that the pavers are colorfast, durable and resistant to alkali. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

The shapes, sizes and colors shall be as specified in the contract documents.

Pozzolans. The manufacturer may substitute fly ash meeting the requirements of §711-10 up to a maximum of 15 percent of the minimum portland cement by weight.

SAMPLING AND TESTING. Samples of precast concrete pavers will be obtained by the Materials Bureau for testing and consideration of approval. The manufacturing plant, equipment and facilities shall meet the approval of the Director, Materials Bureau.

Precast concrete pavers shall meet the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength, Min., 28 days</td>
<td>55 MPa Min.</td>
</tr>
<tr>
<td>24 Hour Absorption</td>
<td>5.0% Maximum</td>
</tr>
<tr>
<td>Freeze-thaw Loss (25 cycles, one per day, 10% NaCl solution)</td>
<td>1.0% Maximum</td>
</tr>
</tbody>
</table>

Satisfactory compliance with all requirements of this specification will result in the name of the manufacturer being placed on an Approved List issued by the Materials Bureau.

BASIS OF ACCEPTANCE. Precast concrete pavers will be accepted at the manufacturing facility in accordance with procedural directives of the Materials Bureau.
704-14 PRECAST CONCRETE PANEL UNITS
(Mechanically Stabilized Earth System)

SCOPE. Material and quality requirements for precast concrete panel units used to construct a mechanically stabilized earth system.

MATERIAL REQUIREMENTS. Follow §704-03, except as noted herein.

Portland Cement Concrete. Use concrete with a minimum compressive strength of 35 MPa @ 28 days, unless noted otherwise in the contract documents or approved working drawings.

Reinforcing steel. Use epoxy coated reinforcing steel, §709-04 or §709-08

Embedded items. As detailed on the working drawings. Acceptance of embedded items will be based on manufacturer's certification, unless otherwise directed by the Materials Bureau. When steel embedments are required, use steel galvanized to §719-01.

FABRICATION DETAILS. Follow §704-03, and the following:

Drawings. When the panel types proposed for use have been previously approved by the Department, indicated by the Materials Bureau stamp and signature on the drawings, submit one copy of each approved working drawing to the Engineer for information and submit a written request for panel fabrication to the Materials Bureau. In the request identify the panel types and quantities to be fabricated, the drawing numbers and the drawing approval dates.

When the panel types proposed for use have not been previously approved by the Department submit six copies of each drawing and a copy of the design calculations to the D.C.E.S. for approval. Detail all materials incorporated into the panels on the working drawings. The Department will be allowed 2 working days for the examination of each drawing in a set of working drawings, or 10 working days minimum per set.

Inspection Assignment. The Materials Bureau will make an inspection assignment after working drawings and/or fabrication requests are approved. Do not fabricate any units before receiving the inspection assignment.

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 working drawings.

Curing, Repair, Sampling and Testing, and Shipping. Follow §704-03.

BASIS OF ACCEPTANCE. According to §704-03.