SECTION 834
GRANITE CURB FOR BRIDGES

834.01 DESCRIPTION. This work consists of providing straight or circular granite curbing at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications. The two basic types of curbing are described as follows:

a. Vertical Face Granite Curbing.

b. Slope Face Granite Curbing.

834.02 MATERIALS. Granite curb for bridges shall conform to the requirements of Subsection M.09.05 of these Specifications.

834.03 CONSTRUCTION METHODS. The curb shall be set accurately to line and grade in a full mortar bed and with full mortar end joints before concrete in back of curb is placed. Anchors shall be grouted into curb stones as they are being set. Care should be taken that all spaces under stones and at joints are completely filled.

If indicated on Plans, joints between ends of individual stones shall be raked to dimensions shown on the Plans and sealed with the specified type of joint sealer. Otherwise, joints shall be carefully filled with cement mortar and neatly pointed on top and face. After pointing, curb stones shall be cleaned of all excess mortar to the satisfaction of the Engineer.

When placing concrete behind the curb stones, care should be taken to avoid disturbing line and grade of the stones.

834.04 METHOD OF MEASUREMENT. “Vertical Face Granite Curb Straight,” “Vertical Face Granite Curb Circular,” “Slope Face Granite Curb Straight,” and “Slope Face Granite Curb Circular” will be measured (along the front arris of the curb) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer.

834.05 BASIS OF PAYMENT. The accepted quantities of “Vertical Face Granite Curb Straight,” “Vertical Face Granite Curb Circular,” “Slope Face Granite Curb Straight,” and “Slope Face Granite Curb Circular” will be paid for at their respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials and equipment,
SECTION 906
CURBING FOR ROADWAYS

906.01 DESCRIPTION. This work consists of the construction of curbing on prepared gravel bases and/or the construction of bituminous berm on underlying pavement courses at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

906.01.1 Types of Curbing. The following types of curbing are designated as follows:

a. Granite Curbing.

b. Precast Concrete Curbing.

c. Bituminous Curbing.

d. Bituminous Berm.

e. Remove Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular. All Types.

906.02 MATERIALS.

906.02.1 Granite Curbing. Granite curbing shall conform to the requirements of Subsections M.09.01 and M.09.02; Granite Curb for Roadways and Granite Slope Curbing for Roadways, respectively, of these Specifications.

906.02.2 Precast Concrete Curbing. Concrete for curbing shall be Class Z(AE) and shall conform to the applicable requirements of SECTION 601; PORTLAND CEMENT CONCRETE, of these Specifications with the following exceptions.

a. Job Mix Formula. The Contractor shall submit for approval a job-mix formula for the concrete mix design in accordance with the provisions of Subsection 601.03.1; Proportioning, of these Specifications.

b. Tolerances. Precast concrete curbing, apron stones, inlets and related concrete curb products shall conform to the dimensions shown on the Plans. Said dimensions shall fall within the following tolerances:
### Dimension Tolerance ±

- Greater than 0" to 12"  1/4"
- Greater than 12" to 24"  ½"
- Greater than 24" to 72"  3/4"

Details and dimensions shall be true and square. The tolerance allowance on each precast element shall not relieve the Contractor from obtaining a suitable configuration of the various installed products.

**906.02.3 Bituminous Curbing.** Bituminous material for curbing shall conform to the requirements of Subsection M.09.04 of these Specifications.

**906.02.4 Bituminous Berm.** Bituminous material for berm shall conform to the requirements for Class I-1 Surface Course as set forth in Subsection M.03.01 of these Specifications. Tack coat shall conform to the requirements for emulsified asphalt as set forth in Subsection M.03.03.4 of these Specifications. Highway joint sealant material shall be as listed in the Department's Approved Materials List.

**906.02.5 Gravel Borrow** shall conform to the requirements of Subsection M.01.02 of these Specifications.

**906.03 CONSTRUCTION METHODS.**

**906.03.1 Granite Curbing.**

- **a. Excavation.** Excavation shall be made to a sufficient depth to allow for a gravel base course. All soft and unsuitable material shall be removed and replaced with approved granular material which shall be thoroughly compacted.

- **b. Installation.** The curb shall be set such that the front top arris line conforms to the required line and grade. The gravel base upon which the curb is to be set shall be compacted to a firm, even surface.

- **c. Joints.** Curbing stones shall be placed end-to-end as close as possible. No more than ½-inch opening shall show for the full width of the top and 8 inches down from the front.

- **d. Backfilling.** After the curb has been set, any remaining excavated areas shall be backfilled with approved material and thoroughly compacted back and front to grade.

**906.03.2 Precast Concrete Curbing.** The installation of precast concrete curbing shall conform to the requirements of Subsection 906.03.1, above.
906.03.3 Bituminous Curbing.

a. Excavation. Excavation shall conform to the requirements of Subsection 906.03.1; Para. a, above.

b. Preparation of Bed. When curbing is to be constructed on a fresh laid bituminous surface, that surface must first be cleaned.

c. Installation. Bituminous curbing shall be constructed by use of a self-propelled automatic curber or curb machine, or a paver equipped with curbing attachments. The automatic curber or curb machine shall be approved by the Engineer prior to its use. The machine shall conform to the following requirements:

1. The weight of the machine shall be such that required compaction is obtained without the machine riding above the bed on which curbing is constructed.

2. The machine shall form curbing that is uniform in texture, shape and density.

3. The Engineer may permit the construction of curbing by means other than the automatic curber when either short sections, or sections with short radii, are required or for other reasons as may be warranted. The curbing produced by such alternate means shall conform in all respects to the curbing produced by the use of the machine.

d. Painting and Sealing. Painting and/or sealing shall be applied only on curbing which is clean and dry and which has reached the ambient temperature.

906.03.4 Bituminous Berm. The bituminous berm shall be placed on the underlying pavement course in accordance with either Method A or B as described below.

Method A. The berm is placed at the same time as the asphalt surface course in one operation. The underlying pavement shall be broom cleaned and tacked prior to placement. The bituminous berm will be placed in one lift and will be compacted by a smooth steel wheel roller of a type and weight acceptable to the Engineer.

Method B. The berm is placed independent of the asphalt surface course placement.

The berm shall be founded entirely on the base course. Any adjacent binder course and surface course shall be saw cut as required to form a true and even edge. The portion of the base course on which the berm is to be placed as well as any vertical saw cut edge shall be cleaned to the satisfaction of the Engineer and covered with an approved bituminous tack coat. The berm shall be placed in one layer and shall be compacted by a smooth steel wheel roller of a type and weight
acceptable to the Engineer. After the berm is placed, the joint between the berm and the existing pavement shall be sealed with an approved highway joint sealant.

906.03.5 Remove, Handle, Haul, Trim, and Reset Curbing and Edging, Straight and/or Circular, All Types. The existing curbing or edging shall be carefully removed to minimize damage to said units and adjacent pavement or sidewalks. The curbing or edging will then be handled, hauled and stockpiled as required. The ends for jointing will be cut and squared. All curb or edging must be thoroughly cleaned prior to resetting.

If the curb or edging is to be reset in either its original or new location, excavation shall be made to the dimensions shown on the Plans or as directed by the Engineer to allow for the proper fine grading and compaction of the gravel borrow subbase. All soft or unsuitable materials shall be removed and replaced with gravel borrow material which shall be thoroughly compacted to prevent future settlement of the reset curb or edging.

The curb or edging shall be reset such that the front top arris line conforms to the required line and grade. The gravel base upon which the curb or edging is to be reset shall be placed in layers not exceeding 6 inches in depth. Each such layer shall then be compacted to 95 percent of maximum density by means of a vibratory compactor of a size and type approved by the Engineer.

Curbing and edging shall be laid with joints as narrow as possible for stone curb. The individual stones shall be trimmed and cut as necessary so that no more than ½-inch opening shall show for the full width of the top and 8 inches down from the front.

After the curbing or edging has been reset, any remaining excavation areas shall be backfilled with approved granular material and thoroughly compacted back and front to grade. Methods of compaction shall preserve the line and grade of the reset curbing or edging.

The Contractor shall replace with new material any existing curbing or edging that is to be reset which is lost, damaged, or destroyed as a result of either its construction operations or failure to properly store and protect said units, all at no additional cost to the State.

906.04 METHOD OF MEASUREMENT.

906.04.1 Granite Curbing. "Granite Curb-Straight" and "Granite Curb-Circular" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer.

"Granite Curb Corners," “Granite Curb Transitions,” "Granite Curb Apron Stones, “Granite Curb Inlet Stones" and "Granite Curb Wheelchair Ramp Transitions and Curb" will be measured by the number of each such units actually installed in accordance with the Plans and/or as directed by the Engineer.
906.04.2 Precast Concrete Curbing. "Precast Concrete Curb-Straight" and "Precast Concrete Curb-Circular" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer.

"Precast Concrete Curb Corners," and "Precast Concrete Curb Transitions," "Precast Concrete Curb Apron Stones," "Precast Concrete Curb Inlet Stones" and "Precast Concrete Curb Wheelchair Ramp Transitions and Curb," will be measured by the number of each such units actually installed in accordance with the Plans and/or as directed by the Engineer.

906.04.3 Bituminous Curbing. "Bituminous Curbing" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer. Deduction in length will be made for the presence of drainage structures installed along the curb line such as catch basins, drop inlets, etc.

906.04.4 Bituminous Berm. "Bituminous Berm" will be measured by the number of linear feet actually installed in accordance with the Plans and/or as directed by the Engineer.

906.04.5 Remove, Handle, Haul, Trim, and Reset Curbing and Edging, Straight and/or Circular, All Types. "Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing reset in accordance with the Plans and/or as directed by the Engineer.

"Curb Corners," "Curb Transitions," "Apron Stones," "Inlet Stones," and "Curb Wheelchair Ramp Transitions and Curb" will be similarly measured. Deductions in length will be made for the presence of new drainage structures installed along the curbline such as catch basins, drop inlets, etc.

906.05 BASIS OF PAYMENT.

906.05.1 Granite Curbing. The accepted quantities of "Granite Curb-Straight" and "Granite Curb-Circular" will be paid for at their respective contract unit prices per linear foot as listed in the Proposal.

The accepted quantities of "Granite Curb Corners," "Granite Curb Transitions", "Granite Curb Apron Stones." "Granite Curb Inlet Stones," and "Granite Curb Wheelchair Ramp Transitions and Curb" will be paid for at their respective contract unit prices per each as listed in the Proposal.

906.05.2 Precast Concrete Curbing. The accepted quantities of "Precast Concrete Curb-Straight" and "Precast Concrete Curb-Circular" will be paid for at their respective contract unit prices per linear foot as listed in the Proposal.
The accepted quantities of “Precast Concrete Curb Corners,” “Precast Concrete Curb Transitions,” “Precast Concrete Curb Apron Stones,” “Precast Concrete Curb Inlet Stones,” and “Precast Concrete Curb Wheelchair Ramp Transitions and Curb” will be paid for at their respective contract unit prices per each as listed in the Proposal.

906.05.3 Bituminous Curbing. The accepted quantity of “Bituminous Curbing” will be paid for at the contract unit price per linear foot as listed in the Proposal.

The prices stated above for Granite Curbing, Precast Concrete Curbing, and Bituminous Curbing constitute full and complete compensation for all labor, materials and equipment, including excavation, joints, gravel borrow, backfilling, and all other incidentals required to finish the work, complete and accepted by the Engineer.

The following work will be paid for separately under appropriate work items: saw cutting, the removal and disposal of existing pavements, both rigid and flexible, and sidewalks.

906.05.4 Bituminous Berm. The accepted quantity of “Bituminous Berm” will be paid for at the contract unit price per linear foot as listed in the Proposal. However, the quantity of bituminous material used in the berm is not included in this contract unit price, but rather is included in the unit price listed for Class I-1, Bituminous Concrete Pavement. The unit price for Bituminous Berm includes all preparatory items required for proper placement of the berm, including bituminous stack coat; placement and compaction of the berm; sealing of the joints; and all other incidentals necessary to finish the work, complete and accepted by the Engineer.

906.05.5 Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types. The accepted quantities of “Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types,” for each kind and type specified, will be paid for at the respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, and equipment, including removal and disposal of existing pavement structure, excavation for removal and setting unless otherwise noted that resetting excavation is to be paid for separately, all handling, hauling and stockpiling, cleaning all sections to be reset, cutting and trimming as necessary to provide the maximum ½-inch opening across the top and down the front of the curbing, gravel borrow subbase course including compaction and fine grading unless otherwise noted, the resetting of the curb or edging to line and grade, backfilling, compacting, and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

Saw cutting, replacement concrete base, and any concrete required between the reset curb or edging and the existing pavement structure will be paid for separately under appropriate work items.
SECTION M.09
CURBING

M.09.01 GRANITE CURB FOR ROADWAYS. Granite shall conform to ASTM C615. Granite type shall be Salt and Pepper as supplied by Structural Stone, LLC 285 Smith Street, North Kingstown, RI 02852 USA 401/667-4969 www.StructuralStoneLLC.com. The stone shall be sound, durable and free from seams; they shall be straight lined, without wind, and free from bunches or depressions; and shall not be taken from the surface of the quarry. The top of the stone shall be sawed to an approximately true plane, with no projections or depressions greater than 1/4-inch in any one piece. The front and back arris lines shall be pitched straight and true. There shall be no projections on the back face for 3 inches down from the top greater than 1/4-inch.

Circular curb to be set on a radius of 160 feet or less shall be cut to the lengths and radii shown on the Plans, and shall conform in every respect to the requirements of these Specifications.

The top surface of curbing shall be free from drill holes and shall be scabbled dressed to an approximately true plane with no projections or depressions greater than 1/2-inch. The front arris line shall be such that, when a straightedge is applied to the full length of the curb stone, there shall be no depressions under the straightedge greater than 1/2-inch.

The front face shall be at right angles to the plane of the top and shall be smooth quarry split, free from drill holes which are longer than 3 1/2-inches plus or minus 1/4-inch and deeper than 1/2-inch and with no projections greater than 3/4-inch or depressions greater than 1/2-inch measured from the vertical plane of the face through the top arris line for a distance of 8 inches down from the top.

The ends of all curbing shall be jointed square with the planes of the top and face and so finished that when stones are placed end to end as closely as possible no space greater than 3/4-inch will show in the joint for the full width of the top or down on the face for 8 inches, after which the end may break back no more than 8 inches. The arris line formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variations from the plane of the top and exposed faces greater than 1/4-inch.

M.09.02 GRANITE SLOPE CURBING FOR ROADWAYS. Granite shall conform to ASTM C615. Granite type shall be Salt and Pepper as supplied by Structural Stone, LLC 285 Smith Street, North Kingstown, RI 02852 USA 401/667-4969 www.StructuralStoneLLC.com. The curbstone shall free from seams which would impair its structural integrity and of a good smooth splitting appearance. The straight slope curbing shall be in lengths of not less than 2 feet or more than 6 feet. When the slope curbing is used on a curve of 100 feet radius or less, the length shall be as directed by the Engineer, except that when the edging is to be set on a radius of 10 feet or less, the maximum length shall be 1 foot. The curbing shall have a minimum thickness of 3 inches and a maximum thickness of 6 inches.
When the slope curbing is set, the width of the face of the curbing shall be 12 inches, with a tolerance of plus or minus 1 inch. The exposed face of all curbing shall be smooth quarry split to an approximate true plane and shall have no projections or depressions which will cause over 1 inch to show between a 2-foot straightedge and the face when the straightedge is placed as closely as possible on any part of the face. If projections on the face are more than that specified, they shall be dressed off. The top and bottom lines of the face shall be pitched off to a straight line and shall not show over 1-inch between stone and straightedge when straightedge is placed along the entire length of top and bottom lines when viewed from a direction at right angles to the plane of the face, and for the top line only not over 1-inch when viewed from a direction in the plane of the face. The ends shall be square to the plane of the face and so finished that when the stones are placed end to end as closely as possible, no space more than 1½-inches shall show in the joint for the full width of the face except that where the edging is to be used on a curve having a radius of 10 feet or less, the ends of the stone shall be cut so as to provide a finished joint for the full width of the face of not more than 3/4-inch. The arris lines at the ends shall be pitched with no variation from the plane of the face more than 1/4-inch. Drill holes not more than 3½-inches or ½-inch in depth will be permitted. The sides shall not be under the square more than 4 inches or over the square at the back more than 1 inch.

M.09.03 PRECAST CONCRETE CURBING. The curbing shall conform to the dimensions indicated on the Plans. The concrete shall conform to the requirements of SECTION 601; PORTLAND CEMENT CONCRETE.

Forms for the curbing shall be of wood or metal, or approved sand molds preformed with suitable moulding sand. Sand molds shall be constructed as directed by the Engineer and shall conform to the dimensions as specified on the Plans. All surfaces shall be clean cut, free from blow holes or pitted areas. Sand molds shall be sprayed with approved wax solution if required by the Engineer. When sand molds are used the curbing shall be removed from the sand forms as directed by the Engineer.

With the slope faced curbing the top, slope and vertical faces shall be floated smooth and the edges rounded to remove the sharp corners while the curb is still soft. Caution shall be used to remove only the sharp edges. The curbing shall then be finished as indicated on the Plans or in the Proposal.

Slope faced curbing with white faced top and slope shall be poured in two courses as indicated on the Plans. The second course shall be poured immediately after completion of pouring the first course in order that a sufficient bond between the 2 courses shall be obtained. The use of a standard white Portland cement will be required for the upper portion of the slope and top faces of the curbing. Manipulation and finishing shall be as indicated in these Specifications and as indicated on the Plans or in the Proposal.

Dog-holes shall be moulded in sections as shown on the Plans.

M.09.03.1 Reinforcement. Reinforcing materials, if and as called for, shall conform to the requirements specified under Subsection M.05.01; Bar Reinforcement.

M.09.03.2 Joint Fillers. Preformed and poured joint fillers, if and as called for, shall conform to the requirements specified under Subsection M.02.10; Joint Materials.
M.09.04 BITUMINOUS CURBING. Bituminous concrete curbing shall conform to both the applicable requirements of SECTION M.03 and the gradation requirements, physical properties and test limits indicated in the following table:

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<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation Percent by Weight</th>
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<tbody>
<tr>
<td>½&quot;</td>
<td>100</td>
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<tr>
<td>3/8&quot;</td>
<td>90-100</td>
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<td>10-22</td>
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<td>#200</td>
<td>5-12</td>
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</tbody>
</table>

___________________________________________________

Asphalt Percent by Weight 7-10

___________________________________________________

Marshall Stability lbs. (min.) 50 Blow 1000

___________________________________________________

Percent Voids 3-5

___________________________________________________

Flow (in.) .08-.16

M.09.05 GRANITE CURB FOR BRIDGES. Granite shall conform to ASTM C615.

M.09.05.1 General. Granite type shall be Salt and Pepper as supplied by Structural Stone, LLC 285 Smith Street, North Kingstown, RI 02852 USA 401/667-4969 www.StructuralStoneLLC.com. The stone for bridge curb shall be free from seams which impair its structural integrity. Natural color variations characteristic of granite at the source quarry will be permitted.

M.09.05.2 Dimensions. Unless otherwise shown on the Plans, straight curb shall be furnished in lengths of not less than 6 feet or preferably more than 8 feet, but in no case more than 10 feet, and shall be of approximately equal lengths in any run between two consecutive joints. Detailed cutting plans shall be submitted and approved before the cutting of stone is started. Curb to be set on a radius of 160 feet or less shall be cut to the curve required.

Curb which is to be set on a radius between 160 feet and 300 feet may be furnished straight if furnished in lengths not to exceed 6 feet.

M.09.05.3 Vertical Face Granite Curb Finish. The top surface shall be sawed or tooled to an approximately true plane with no projections or depressions greater than 1/8-inch.
The bottom surface shall be sawed or split to a dimensional tolerance of +0 to -1/2-inch. The front and back arris lines shall be pitched straight and true and there shall be no projections on the back surface for 3 inches down from the top which would exceed ½-inch. The remainder of the back may fall away by not more than 1½-inches. The front face shall be at right angles to the planes of the top and ends and shall be sawed or tooled to an approximately true plane, with no projections or depressions of more than 1/4-inch measured from the vertical plane of the face through the arris or pitch line.

The ends of all stones shall be cut square with the planes of the top and face. Ends of stones at joints where they are to be in contact with preformed joint filler must be held full for their entire depth and finished by sawing with a maximum variation of 1/4-inch. Ends of stones at intermediate joints shall be held full for 2 inches from all exposed surfaces with a permitted variation of 1/4-inch. Beyond this area the joint may fall away a maximum of 3 inches.

**M.09.05.4 Slope Face Granite Curb Finish.** The top face and slope face shall be sawed or tooled to an approximately true plane with no variations greater than 1/8-inch. The bottom surface shall be sawed or split to a dimensional tolerance of +0 to -1/2-inch. The face and back arris lines shall be pitched straight with no variation greater than 1/8-inch. There shall be no projections on the back surface for 3 inches down from the top which would exceed ½-inch. The remainder of the back may fall away not more than 1½-inches. The front face shall be at right angles to the planes of the top and ends and shall be sawed or tooled to an approximately true plane with no projections or depressions greater than 1/4-inch measured from the vertical plane of the face through the arris or pitch line.

The ends of all stones shall be cut square with the planes of the top and face. Ends of stones at joints where they are to be in contact with preformed joint filler must be held full for their entire depth and finished by sawing or tooling with a maximum variation of 1/4-inch. Ends of stones at intermediate joints shall be held full for 2 inches from all exposed surfaces with a permitted variation of 1/4-inch. Beyond this area the joint may fall away a maximum of 3 inches.

**M.09.05.5 Special Sloped Face Granite Curb for Bridge Railings.** The top surface shall be sawn, or dressed, equivalent to an approximately true plane with no projections or depressions greater than 1/4-inch. The bottom surface shall be sawn, or dressed, to an approximately true plane with not more than a dimensional tolerance in curb rise of +0 to -1/2-inch. The front arris lines at the top and bottom of the slope shall be straight and true with no variation greater than 1/8-inch. The sloped surface and the front vertical surface shall be sawn, or dressed to a + 1/4-inch tolerance. The back of the curb shall be either scabbled, or quarry split and shall not fall away from the vertical more than 3 inches toward the front or have any projections exceeding ½-inch.

The ends of all stones shall be cut square with the planes of the top and face. Ends of stones at joints where they are to be in contact with preformed joint filler must be held full for their entire depth and finished by sawing or tooling with a maximum variation of 1/4-inch. Ends of stones at intermediate joints shall be held full for 2 inches from all exposed surfaces with a permitted variation of 1/4-inch. Beyond this area the joint may fall away a maximum of 3 inches.
M.09.05.6 Anchors. Anchors shall be No. 6 Reinforcing Bars to the dimensions shown on the Plans. At least 3 anchors shall be furnished and installed in each stone.

M.09.05.7 Mortar. Mortar for joints shall be composed of 1 part Portland cement to 2 parts clean sand with sufficient water to form a workable mixture. Mortar shall be used within 45 minutes after its preparation.