

450 RIGID PAVEMENT AND CONCRETE

ITEM 451 REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

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451.01 Description. This item shall consist of a pavement composed of reinforced portland cement concrete constructed on a prepared subgrade or base course in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

451.02 Materials. Materials shall be:

Concrete (Class C).....	499
Joint sealer.....	705.01, 705.02
Preformed filler	705.03
Curing materials	705.05, 705.06, 705.07(Type II, Class B)
Reinforcing steel.....	709.09, 709.10, 709.12
Dowel bars.....	709.01 thru 709.05
Expansion shield anchors	712.01

451.03 Equipment. Equipment shall be as follows:

(a) Finishing Equipment. Regular finishing machines for finishing concrete pavement shall be mechanical, self-propelled spreading and finishing machines of

approved types, and shall be capable of compacting and finishing the concrete. If a machine has only one screed, the screed shall be not less than 18 inches in width and shall be equipped with compensating springs to minimize the effect of the momentum of the screed on the side forms. If the machine has two screeds, they shall be independently operated. The number of driving wheels, power of motor, and weight of the finishing machine shall be so coordinated as to prevent slippage. Any machine which causes displacement of the side forms from the line or grade or causes undue delay due to mechanical difficulties shall be removed from the work.

(b) Vibrators, for full width vibration of concrete paving slabs, shall be internal type with either immersed tube or multiple spuds. They may be attached to the spreader, the finishing machine, or may be mounted on a separate carriage. They shall not come in contact with the joint, load transfer devices, subgrade, or side forms. The frequency of the internal type shall not be less than 5,000 impulses per minute for tube vibrators, and not less than 7,000 impulses per minute for spud vibrators.

(c) Forms. Side forms shall be of steel, straight, and of a depth equal to the thickness of the pavement at the edge, except forms of greater depth than specified pavement thickness may be used by written permission of the Engineer. Any additional cost caused by the use of forms of a greater depth shall be included in the bid price for this item. The use of bent or damaged side forms or forms with damaged joint locks or pin pockets shall not be permitted. All forms shall be cleaned and oiled each time they are used. They shall be furnished in sections not less than 10 feet in length, with horizontal joint and a base width equal to the depth of the forms. Flexible or curved forms shall be of a design acceptable to the Engineer and shall be used for construction of circular pavement edges where the radius is 100 feet or less. Forms shall be provided with adequate devices for secure setting so that, when in place, they will withstand the operation of the paving equipment. Built-up forms shall not be used except where the total area of pavement of any specified thickness on the project is less than 600 square yards. The forms shall contain adequate joint locks for joining the ends of abutting form sections together tightly.

451.04 Setting Forms. All forms shall be set with reasonable conformance to the required grade and alignment, and be supported on thoroughly compacted material for their entire length during the entire operation of placing and finishing of the concrete. After the setting of side forms, the top face of the form shall not vary from a true plane

more than 1/8 inch in 10 feet, and the vertical face shall not vary more than 1/4 inch in 10 feet, and they shall be tested by the Contractor and variations from the above requirements shall be eliminated by resetting the forms. Shimming with loose earth, pebbles, etc., will not be permitted. The alignment and grade of all forms set shall be approved by the Engineer before and immediately prior to the placing of concrete.

451.05 Finegrading of Subgrade or Subbase. After side forms have been set to line and grade and securely fastened, the subgrade or subbase shall be brought to final grade by means of subgrader or subgrade planer. This finegrading operation

451.06

should involve a slight removal of the subbase material and bring the subbase material to a smooth dense condition. The subgrade or subbase shall be checked using a multiple pin template operated on the forms. Any high or low spots found shall be corrected and rechecked.

In lieu of the above operation, an automatic subgrader operating from a preset grade line may be used prior to the setting of the side forms. After the grade has been made by the automatic subgrader, the forms shall be set and checked as outlined in 451.04. The multiple pin template shall be operated on the forms and any necessary corrections of the subbase shall be made.

The grade shall be constructed sufficiently in advance of the placing of the concrete to permit checking. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of the placing of the concrete. If satisfactory stability of the subbase material cannot be obtained, it shall be stabilized by addition of admixes or angular aggregate particle at no additional cost to the City.

451.06 Placing Concrete. The subgrade or subbase shall be sprinkled at such times and in such manner as directed by the Engineer so that it will be in a thoroughly moistened condition, free of standing water, when the concrete is deposited thereon.

The concrete shall have a slump in accordance with 499.03 and shall be deposited on the grade in a manner that requires as little rehandling as possible. Workers shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign material.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless hopper is well centered on the assembly. Concrete shall be consolidated around expansion and construction joints by means of internal vibration.

No concrete shall be mixed, placed, or finished after dark, unless approved by the Engineer and an adequate and approved artificial lighting system is operated.

When the air temperature is above 35° F before placing, concrete temperature shall be maintained at not more than 90° F.

451.07 Cold Weather Protection. When concrete is being placed in cold weather and temperature may be expected to drop below 35°F, a supply of straw, hay, insulated curing blankets or other approved material shall be provided along the line of the work. At any time when the air temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the concrete to a sufficient depth to prevent freezing of the concrete. Concrete shall be protected from freezing temperatures until it is at least 5 days old. Any day

that the temperature does not exceed 35°F for a minimum of 6 hours shall not be counted as one of the 5 days. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.

Except by specific written authorization, concreting shall cease when the descending air temperature in the shade and away from artificial heat falls below 40°F. It shall not be resumed until the ascending air temperature in the shade and away from artificial heat rises to 35°F.

When concreting is permitted during cold weather, the temperature of the mixed concrete shall be not less than 50°F, nor more than 80°F at the time of placing in the forms. The aggregates or water, or both, may be heated. The aggregates may be heated by steam or dry heat prior to being placed in the mixer. The water temperature shall not exceed 175°F. In no case shall concrete be deposited on a frozen subgrade nor shall frozen materials be used in concrete.

The size and arrangement of paving operations shall be so planned as to facilitate protection of the work from rain. An adequate supply of waterproof covering shall be available on the job site at all times. The Contractor shall replace, at his expense, any pavement damaged by rain.

Concrete test specimens will be in accordance with Section 499.

451.08 Placing Reinforcement. When reinforced concrete pavement is placed in two layers, the entire width of the bottom layer shall be struck off at such length and depth that the mat of reinforcement may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed as specified directly upon the concrete, after which the top layer of concrete shall be placed, struck off and screeded. The top layer of concrete shall be placed as soon as possible while the bottom layer is still plastic, but in no case shall the interval of time exceed 30 minutes. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement, or it may be placed in the plastic concrete, after spreading, by mechanical or vibratory means.

The mats of reinforcement forming each lap, in addition to being overlapped as specified, shall be securely fastened together at the edges of the sheets and at two additional points along the lap.

Reinforcing steel shall be as per Plans and shall be free from dirt, oil, paint and grease.

451.09 Joints. Joints shall be constructed of the type, dimensions, and at locations specified.

(a) Longitudinal Joint. The longitudinal joint shall be constructed by sawing or by forming. If the longitudinal joint between simultaneously placed lanes is made with

451.09

a concrete saw, the sawing shall be done to a minimum depth of one-third of the specified pavement thickness as soon as the saw can be operated without damaging the concrete. The width shall be approximately 1/8 inch.

If the longitudinal joint between separately placed lanes is made with a concrete saw, the sawing shall be done to a minimum depth of one inch. The width shall be approximately 1/8 inch.

If the longitudinal joint is formed, the groove for sealing shall be formed in the lane placed last.

Hook bolts, when used, shall be securely fastened to the form of the longitudinal construction joint.

Expansion bolt joints shall be constructed by installing expansion shield anchors in the center of the existing pavement slab in accordance with the manufacturer's recommendation after which hook bolts shall be threaded firmly into the expansion shield anchors.

(b) Load Transfer Devices. Dowels shall be held in position parallel to the surface and centerline of the slab by an approved metal device that is left in the pavement. Dowels may be placed in the full thickness of pavement by a mechanical device approved by the Engineer. Deformed steel tiebars, when used for longitudinal joints, shall be placed by approved mechanical equipment or rigidly secured by chairs or other approved supports to prevent displacement.

(c) Expansion Joint. Transverse expansion joints shall be provided on each approach to a bridge, or bridge approach slab at distances of approximately 20 feet and 60 feet, or as specified. If the pavement is constructed in two or more separately placed lanes, the joints shall form a continuous line for the full width of the pavement.

An opening 1 inch in width by 1 inch in depth shall be formed for installation of 705.01 joint sealer.

(d) Contraction Joint. Contraction joints shall be sawed as specified to a minimum depth of one-third of the specified pavement thickness, and a width of one-fourth inch (plus or minus 1/16 inch) determined at the time of sawing. If the pavement is constructed in two or more separately poured lanes, the joints shall be continuous for the full width of the pavement. Sawing shall be done with sawing equipment approved by the Engineer. Joints shall be sawed as soon as the saw can be operated without damaging the concrete. Saws shall be equipped with adequate guides, blade guards, and a method of controlling the depth of cut. Sawing shall be done wet and the joint must be cleaned, after having been sawed, by a jet of water under pressure. A standby saw in working condition with an adequate supply of blades shall be maintained at the site of the work during the sawing of contraction joints.

(e) Construction Joints. Construction joints shall be constructed as specified at the end of each day's work, and whenever necessary to suspend the work for a period of more than 30 minutes. In no case shall an emergency construction joint be placed closer than 10 feet to a parallel joint.

(f) Pressure Relief Joints. Pressure relief joints shall be located and constructed as designated in the plans.

451.10 Consolidating and Finishing. Concrete shall be placed in accordance with 511.08. Internal vibration shall be required for consolidating full width pavements. This type of consolidation is not mandatory for tapered sections and variable width sections of pavement. The method and equipment used for internal vibration shall be approved by the Engineer. An automatic cutoff is required to stop vibration when the equipment is stopped.

Retempering or the application of water to the surface of the concrete shall not be allowed.

The pavement shall be finished by an approved finishing machine operated over each section of pavement as many times and at such intervals as will produce the desired results. During the operation of the finishing machine, a uniform roll of concrete shall be maintained ahead of each screed for its entire length. Floating shall be accomplished by means of a cutting or smoothing float or floats suspended from and guided by a rigid frame riding on, and constantly in contact with, the side forms.

Small or irregular areas which are inaccessible to finishing equipment may be hand finished by methods approved by the Engineer.

The surface shall be continuously checked for trueness with ten foot straightedges.

Before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, shall be worked with an approved tool and rounded to the radius specified. Any tool marks left by the edging shall be eliminated by texturing the surface.

The pavement shall be textured to provide a surface satisfactory to the Engineer. The surface shall be textured by the use of a broom or artificial turf drag in the longitudinal direction, followed by an approved device that will produce a relatively uniform pattern of grooves in the transverse direction. The grooves shall be spaced at approximately 5/8-inch centers and shall be approximately 0.15 inches deep and 0.10 inches wide. Variation from the texturing requirements will be permitted only with the written permission of the Engineer. The curbing shall be finished in accordance with 455.03 (e).

451.11

451.11 Curing. Immediately after the finishing operations have been completed, and after the free water has disappeared, all exposed surfaces of the concrete shall be sealed by spraying thereon a uniform application of curing membrane in such a manner as to provide a continuous uniform film without marring the surface of the concrete. The material shall be applied with an approved mechanical sprayer. Wind protection to the spray fog shall be provided by an adequate shield. A minimum of one gallon of material shall be used for each 150 square feet of surface treated. Curing material shall be thoroughly agitated immediately prior to use.

On pavement with integral curb, or small and irregular areas which are inaccessible to the mechanical spray machine, the curing material may be applied by a hand spray.

As soon as the forms have been removed, any honeycomb areas shall be immediately corrected, and the edges of the pavement coated with the curing material. Any areas of pavement film that may have been damaged during the sawing shall be resprayed during this operation.

The above requirements for curing are minimum requirements only. Any concrete showing injury or damage due to inadequate curing shall be repaired or replaced by the Contractor at no additional cost to the City.

451.12 Removing Forms. Forms shall be removed in such a manner that no damage will occur to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in 451.11.

451.13 Surface Smoothness. After the final curing of the concrete, the surface shall be cleaned, and may be tested for smoothness by means of a surface testing machine which will test one or more lines on each side of the pavement as determined by the Engineer. All surface variations so indicated shall be corrected to within the specified tolerance in a manner that will provide the required texture specified in 451.10. Pavement surface variations, except as hereinafter stated, shall not exceed 1/8 inch in a 10 foot length of pavement. For ramp pavements and for those pavements with curvature greater than 8 degrees, or with grades exceeding 6 percent, the surface variation shall not exceed 1/4 inch in 10 feet.

Sections of pavement containing depressions which cannot be corrected by grinding shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

451.14 Sealing Joints. Joints shall be sealed before the pavement is opened to traffic or to use by construction equipment, and as soon after completion of the sawing as is feasible. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material, using approved equipment, and the joint faces shall be clean and surface dry when the seal is applied.

Sawed and formed joints shall be filled with joint sealer conforming to 705.01. The joint sealer shall be placed with proper equipment to obtain a neat workmanlike joint free from excess and unsightly filler.

451.15 Opening to Traffic. The completed pavement may be used for traffic, including construction traffic, when 7 days have elapsed.

451.16 Slip Form Placement. With the written permission of the Engineer, the pavement may be constructed without the use of fixed forms and the following provisions shall apply:

(a) Grade. After the subbase has been placed and compacted to the required density, the areas on which the pavement is to be constructed and the areas which will support the paving machine shall be cut to the plan elevation by means of a properly designed machine. If the density of the base is disturbed by the grading operations, it shall be corrected by methods satisfactory to the Engineer before concrete is placed.

(b) Placing Concrete. The concrete shall be placed with an approved slipform paver or combination of pavers designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with the plans and specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed.

The concrete shall be held at a uniform consistency, having a slump of not more than 3 inches. The slipform paver shall be operated with as nearly a continuous forward movement as possible, and all operations of mixing, delivering and spreading concrete shall be coordinated as to provide uniform progress, with stopping and starting of the paver held to a minimum. If for any reason it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

The finish grade of the pavement shall be accurately controlled from a grade line pre-set parallel to the finish grade. Slip form paving equipment shall have controls that will trace the grade line and automatically adjust the grade of the screeds or extension meters.

(c) Finishing. The surface smoothness and texture shall meet the requirements of 451.10 and 451.13. The edges of the pavement shall not vary more than 1/4 inch below the typical section.

(d) Curing. Curing shall be done in accordance with 451.11. The curing shall be applied at the appropriate time, and shall be applied uniformly and completely to all surfaces and edges of the pavement.

451.17

(e) Joints. All joints shall be constructed in accordance with 451.09.

451.17 Pavement Thickness. Thickness of concrete at any point, determined by the measurement of cores cut as hereinafter specified, shall not be more than 1/2 inch less than the specified thickness, nor shall the average thickness of the concrete, determined as hereinafter specified, be more than 0.2 inches less than the specified thickness. The length of the cores will be determined in accordance with AASHTO T 148.

The entire pavement shall be considered a unit for the purpose of coring. One core shall be taken at random for every 600 square yards of pavement or major fraction thereof; however, a minimum of three cores shall be taken from any pavement cored. Should any core show a deficiency in thickness of more than 1/2 inch, additional cores shall be cut 5 feet, measured longitudinally, on each side of the location of the core deficient in thickness. If both these additional cores are within the 1/2 inch tolerance, no further special borings for this particular zone of deficiency shall be made. If either or both of the cores are outside the 1/2 inch tolerance, special borings shall be continued 25 feet and 50 feet, measured longitudinally from the location of the first core found to be deficient in thickness, and thence at 50 foot intervals longitudinally, until pavement thickness within the 1/2 inch tolerance is found in both directions or the end of the pavement is reached, thus establishing the longitudinal boundaries of the zone of deficiency, but in no case shall additional cores be cut longitudinally beyond the location of any boring in that lane at which the pavement thickness has been found to be within the 1/2 inch tolerance.

Where the separately poured width of pavement consists of two or more traffic lanes and a scheduled core shows a deficiency of more than 1/2 inch, an additional core or cores shall be cut to determine the extent of the zone of deficiency in a direction transverse to the center line. The additional core or cores shall be cut approximately in the center of the traffic lane or lanes. Where a transverse core or cores are within the 1/2 inch tolerance, the zone of deficiency shall be limited to the traffic lane or lanes found to have deficient thickness. However, where any of the transverse core or cores is outside the 1/2 inch tolerance, the zone of deficiency shall include all traffic lanes where such deficiency was found and the longitudinal boundaries for each deficient lane shall be determined as above.

When any core shows a deficiency of more than 1/2 inch, the area of the pavement for which payment shall be withheld shall be the sum of the areas found to be deficient as determined above. Deductions will be determined and applied to each separately poured width of pavement.

All thickness measurements which are more than 1/2 inch greater than the specified thickness shall be regarded as the specified thickness plus 1/2 inch.

The average thickness of concrete pavement shall be the mean thickness, in inches, of the cores taken from the pavement with the provision that wherever a total deduction occurs, the mean thickness of the two cores limiting the zone of deficiency longitudinally shall be used in lieu of the original core (in the zone) in the average thickness calculation. The other cores within a zone of deficiency shall be disregarded in this calculation.

Any widening less than five feet in width, or any pavement of less than 600 square yards in area, shall not be cored unless requested by the Engineer.

All core holes shall be filled by the Contractor with concrete of the same proportions and materials used in the pavement.

Price Adjustments. Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than one inch, payment will be made at an adjusted price as specified in the following table:

<u>Deficiency in Thickness as Determined by Cores.</u>	Concrete Pavement Deficiency	<u>Proportional Part of Contract Price</u>
0.0 to 0.2 inch		100 percent
0.3 inch to 0.5 inch.....Ratio	$\left[\frac{\text{Average Thickness}}{\text{Specified Thickness}} \right]^2$	
Greater than 1.0 inch		None

When the thickness of pavement is deficient by more than 1/2 but less than one inch and the judgment of the Engineer is that the area of such deficiency should not be removed and replaced, payment will be made at 1/2 of contract price.

451.18 Method of Measurement. The quantity under this item will be the number of square yards of concrete pavement completed and accepted in place. The width for measurements will be the width of the pavement shown on the typical cross section of the plans, plus additional widening where called for, or as otherwise directed in writing by the Engineer. The length will be measured horizontally along the center line of each street, roadway or ramp. Integral curb will be included in the measurements for concrete pavement. The quantities as adjusted for changes, errors and deviation in excess of allowable tolerances will be the method of measurement.

451.19 Basis of Payment. The accepted quantities of concrete pavement will be paid for at the contract unit price per square yard, which price and payment shall be full compensation for furnishing and placing all materials, including reinforcing steel, dowels and joint materials; provided, however, that for pavement found deficient in thickness only the reduced price as determined in 451.17 shall be paid.

452.01

No additional payment over the unit contract bid price will be made for any pavement which has an average thickness in excess of that shown on the plans.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
451	Square Yard	___ inch Reinforced portland cement concrete pavement

ITEM 452 PLAIN PORTLAND CEMENT CONCRETE PAVEMENT

452.01 Description

452.02 Method of Measurement

452.03 Basis of Payment

452.01 Description. This item shall consist of constructing a portland cement concrete pavement on prepared subgrade or base course in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer. This item shall conform to the same specifications and requirements prescribed in 451 except that fabricated steel reinforcement is not required.

Load transfer devices are required only at transverse expansion and construction joints.

Transverse construction joints shall be constructed in accordance with standard drawings. Longitudinal joints shall be constructed between lanes in accordance with 451.09(a).

All sawed or formed joints shall be sealed with joint filler conforming to 705.01 or 705.02.

452.02 Method of Measurement. The yardage under this item will be the number of square yards completed and accepted in place. The width for measurement will be the width of the pavement shown on the typical cross sections of the plans and additional widening where called for, or as otherwise directed in writing by the Engineer. The length will be measured horizontally along the center line of each street, roadway or ramp. Integral curb will be included in the measurements for concrete pavement. The quantities as adjusted for changes, errors, and deviations in excess of allowable tolerances will be the method of measurement.

452.03 Basis of Payment. The accepted quantities of concrete pavement will be paid for at the contract unit price per square yard, which price and payment shall be full compensation for furnishing and placing all materials, including joints; provided, however, that for pavement found deficient in thickness only the reduced price as determined in 451.17 shall be paid.

No additional payment over the unit contract bid price will be made for any pavement which has an average thickness in excess of that shown on the plans.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
452	Square Yard	___ inch Plain portland cement concrete pavement

ITEM 453 APPROACH SLABS

- 453.01 Description**
- 453.02 Materials**
- 453.03 Forms**
- 453.04 Placing**
- 453.05 Finishing**
- 453.06 Side Curbs**
- 453.07 Method of Measurement**
- 453.08 Basis of Payment**

453.01 Description. This item shall consist of constructing reinforced concrete approach slabs for bridges on the completed and accepted subgrade or subbase, according to the dimensions, lines and grades specified.

453.02 Materials. Materials shall be:

Concrete (Class C)	499
Reinforcing steel	509.02
Joint material.....	705.03
Joint sealer.....	705.01 or 705.02

453.03 Forms. Side forms shall be of steel or wood, they shall be true and straight, and be rigidly held to line and grade, and shall at no time deviate more than 1/8 inch in 10 feet. They shall be cleaned and oiled each time after they are used. They shall not be removed within 24 hours after the concrete is placed.

453.04 Placing. The subgrade or subbase shall be thoroughly moistened immediately prior to placing the concrete. The concrete shall be placed as required under 451 or 511.

453.05 Finishing. If the approach slab is to serve as a base for a top course, the finishing, smoothness and curing shall conform to the requirements set forth under 305. If the approach slab is to serve as a wearing surface, the finishing, smoothness and curing shall conform to 451.

453.06

453.06 Side Curbs. When the adjacent pavement is of a type requiring curbs, and the same type of pavement is to be carried on the approach slabs, side curbs shall be tapered the length of the approach slab from the bridge curb to the pavement curb and shall be constructed monolithic with the approach slab using the same proportioned concrete as specified for the approach slab. The finish of the curb shall conform to 455.

453.07 Method of Measurement. The yardage measured will be the number of square yards complete in place.

453.08 Basis of Payment. Accepted quantities will be paid for at the contract unit price per square yard complete in place. This price shall include full compensation for all concrete, curbs, reinforcing steel, dowels, joints and other materials.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
453	Square Yard	___ inch Reinforced concrete approach slab

ITEM 454 CONCRETE BARRIER

- 454.01 Description**
- 454.02 Materials**
- 454.03 Placing Concrete**
- 454.04 Portable Concrete Barrier**
- 454.05 Joints**
- 454.06 Finish**
- 454.07 Curing**
- 454.08 Method of Measurement**
- 454.09 Basis of Payment**

454.01 Description. This item shall consist of furnishing and placing portland cement concrete barrier on the accepted, prepared subgrade, subbase course or existing pavement in accordance with these specifications and in reasonably close conformity with the lines, grades and dimensions shown on the plans.

This item shall include furnishing, placing, maintaining, and removal of portable concrete barrier.

This item also includes all inserts, sleeves, fittings, connectors, reinforcement, dowels, preformed filler, excavation, backfill and all incidentals necessary to complete the item.

454.02 Materials. Materials shall be:

Concrete (Class C)	499
Reinforcing steel and wire fabric	509.02
Curing materials	705.05, 705.06 or 705.07(Type II, Class B)
Preformed filler	705.03
Forms.....	515.05
Dowel bars.....	709.01, 709.03, 709.05
Precast concrete	706.13
Steel.....	711.01

454.03 Placing Concrete. This item may be cast-in-place, precast, or slipformed. If slipformed, concrete may be placed with a self-propelled machine. The proper density and cross section shall be obtained by forcing the concrete through a mold of the proper cross section. Where a track is used, the track on which the machine operates shall be set and held to the exact line and grade given by the Engineer. The concrete shall be of such consistency that it can be molded into the desired shape and then will remain as placed, without slumping of the vertical face.

454.04 Portable Concrete Barrier. The individual sections shall be not less than 10 feet in length and shall be positively joined by either a connecting pin or a tongue and groove joint. Portable concrete barrier may be slipformed in place without joints, or with grooved or sawed joints to facilitate removal, if the barrier is to be utilized at only one location on the project. Barrier sections which have been damaged during handling or by traffic during the life of the project shall be repaired or replaced as directed by the Engineer. Repair or replacement of sections will not be measured for payment.

454.05 Joints. Joints for cast-in-place or slipformed barriers shall be constructed of the type, dimensions, and at the locations specified.

(a) **Contraction Joints.** Unsealed contraction joints shall be constructed by sawing, by metal inserts inside the forms, by the use of a grooving tool or by full width 3/4 inch preformed joint filler 705.03. The joints formed by sawing, tooling or forming by inserts shall be a minimum of 1/8 inch wide and 1-1/2 inches deep.

(b) **Expansion Joints.** Expansion joints shall be constructed at the centerline of and around each bridge pier column and on either side of each sign support foundation by use of 3/4 inch preformed joint filler 705.03.

454.06 Finish. Immediately following the removal of fixed forms or construction by the slipformed method, the surface of the barrier shall be checked with a straightedge, and any irregularities of more than 1/4 inch in 10 feet shall be corrected. The barrier surface shall receive such additional finishing as necessary to present a smooth or lightly textured finish. The surface shall be free of any honeycomb, broken corners or edges, and surface voids larger than 1/4 inch in

454.07

diameter. Any surface which is not satisfactory to the Engineer as to color, texture and smoothness shall be corrected in accordance with 511.15.

454.07 Curing. Immediately after the free water has disappeared on surfaces not protected by forms, and immediately after the removal of forms, all exposed surfaces of the concrete shall be sealed by spraying thereon a uniform application of white curing compound 705.07. This shall be applied in such a manner as to provide a continuous film without marring the surface of the concrete. The material shall be applied with an approved mechanical sprayer. For small areas, other acceptable methods may be used. Wind protection to the spray fog shall be provided for by an adequate shield. For rate of application and other precautions necessary in application of this compound, see 511.14 Method (b).

Curing of precast sections may also be performed in accordance with the requirements of 515.06. Radiant heated forms may also be used for curing if approved by the Engineer.

When the foundation portion of the barrier is placed first so that the top part will be doweled to it, the foundation shall be cured in accordance with 511.14 Method (a) or (b). Method (a) may be used for initial cure of short length barrier leave-outs., however, before the curing is completed for leave-outs, material meeting 705.07, Type II Class B shall be applied at the normal rate.

454.08 Method of Measurement. The quantity measured shall be the number of linear feet along the centerline of the top of the barrier, including all transitions, end terminals and bridge pier sections as specified complete in place.

454.09 Basis of Payment. Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
454	Linear Foot	Concrete barrier
454	Linear Foot	Portable concrete barrier, _____”

ITEM 455 CURBING

- 455.01 Description**
- 455.02 Materials**
- 455.03 Concrete Curbing**
- 455.04 Concrete Combination Curb and Gutter**
- 455.05 Method of Measurement**
- 455.06 Basis of Payment**

455.01 Description. This item shall consist of furnishing and constructing curb and combination curb and gutter of the specified materials and types, in reasonably close conformity with the lines, grades and cross sections shown on the plans or established by the Engineer. This item shall also include necessary excavation and backfill, furnishing and installing joint materials, and the disposal of surplus excavation and discarded materials in accordance with 203. All removal and restoration related to curb reconstruction shall be included in this item.

455.02 Materials. Materials shall be:

Concrete, Class C	499
Bituminous joint sealers	705.01 or 705.02
Expansion joint material.....	705.03
Reinforcing steel	509.02

455.03 Concrete Curbing. (a) Forms and joints. Curb forms shall be approved metal forms. They shall be securely braced and held to line and grade specified. The inner surface of the forms shall be clean and coated with a suitable oil immediately before the concrete is placed.

All curb not constructed integral with the base or pavement shall have 1/4 inch contraction joints constructed at 10 foot intervals or as directed. The joint may be constructed with the use of metal separator plates or sawed in accordance with 451. The depth of sawcut joints shall be no less than 2" for combination curb and gutter, and 4" for 6" x 18" curb. The bottom of the saw kerf shall slope to the pavement from the curb. Where expansion joints occur in the abutting pavement, they shall be provided for by separation of the curb section being placed with 1 inch 705.03 preformed joint filler. One-half inch expansion joints shall be provided at the points of curvature, points of tangency, at inlet approaches and at no greater than 300 foot intervals.

When the curb is integral with the base or pavement, joints of the type used in the pavement shall be constructed in the curb. The joints shall be spaced identically with the joints in the base or pavement.

Curb forms shall be left in place for such length of time that the removal of forms does not crack, shatter, allow to slump or otherwise injure the concrete.

Where the curbs built under this item are to later serve as a support for finishing machine in the placing of a surface course, the alignment of the supporting edges shall be such that the distance between the curbs shall nowhere vary more than 1/2 inch from that specified.

Approved flexible forms of steel or wood shall be used for construction of circular curb where the radius is 100 feet, or less.

455.04

(b) Placing. The concrete shall be placed in accordance with 511.08. Internal vibrators shall be used to consolidate the concrete.

Concrete for curb which is to be integral with the concrete base or pavement shall be placed while the base or pavement concrete is plastic.

(c) Curb Cuts. The top of each curb shall be depressed for driveways such that the back of curb is 1 ½ inches above the surface of the pavement or gutter and the face of the curb is 1 inch above the surface of the pavement or gutter. Top of curb ramps shall be flush with the surface of pavement or gutter and shall be sloped as directed.

(d) Finishing. The top of the curb shall be floated in such a manner as to thoroughly compact the concrete and produce a smooth and even surface. The addition of extra mortar to secure this result will not be permitted. The upper edge of the face of curb shall be rounded, by the use of a tool especially designed for the purpose, to a radius of 3 inches. All other edges shall be finished to a 1/4 inch radius. The face of the curb shall be rubbed with a float immediately after removing the forms. Unnecessary tool marks shall be eliminated. The finished surface shall be free of irregularities and waves and shall be uniform in texture as finished with light brooming. In case of curb reconstruction on improved streets, face of the curb shall be finished to a depth of 6" minimum.

(e) Protection. Concrete curb, and combination curb and gutter shall be cured in accordance with 451, except that membrane cure shall be applied at a rate of not less than 1 gallon per 200 square feet of surface. Cold weather protection shall be as per 451.07.

455.04 Combination Curb and Gutter. Combination curb and gutter shall be in accordance with 455.03 except that:

Contraction joints shall be provided at intervals of 10 feet unless otherwise directed by the Engineer.

At inlets, approach slabs, or other locations where a transition is required, the curb and gutter shall be shaped as directed.

Four-inch subbase shall be placed and compacted in accordance with Item 310 and payment shall be included in the price bid for Item 455 Combination Curb and Gutter.

455.05 Method of Measurement. The footage measured will be the actual number of linear feet of curb or combination curb and gutter complete in place, measured along the front face of the curb section, whether the curbing is laid on a straight line or on a curve.

No distinction will be made between curbing laid in a straight line and curbing laid on a curve.

455.06 Basis of Payment. The accepted quantities of specific items of curb and combination curb and gutter will be paid for at the contract price. The unit price shall include all removal and restoration related to the curb reconstruction.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
455	Linear Foot	Curb, Type_____
455	Linear Foot	Combination Curb and Gutter
455	Lineal Foot	Combination Curb and Gutter, Modified
455	Linear Foot	4" Rolled Curb and Gutter

ITEM 456 SIDEWALKS, DRIVEWAYS AND STEPS

456.01 Description

456.02 Materials

456.03 Concrete Walks, Driveways and Driveway Aprons

456.04 Concrete Steps

456.05 Curb Ramps

456.06 Sidewalk Relaid

456.07 Method of Measurement

456.08 Basis of Payment

456.01 Description. This item shall consist of constructing sidewalks, driveways, driveway aprons, curb ramps, and steps of specified materials in reasonably close conformity with lines, grades and dimensions shown on the plans or established by the Engineer. All removal and restoration related to construction of the items listed herein shall also be included in this item.

456.02 Materials. Materials shall be:

Concrete (Class C)	499 and 511
Expansion joint material.....	705.03
Reinforcing steel	509.02

456.03 Concrete Walks, Driveways and Driveway Aprons. (a) Excavation shall be made to the required depth and to a width that will permit the installation of forms. Excavation to the finished surface of the sidewalk, driveway or apron shall be included under 203. Embankment to the top of subgrade shall be included under 203. The entire subgrade shall be uniformly compacted to a surface conforming to the plans or as directed. The Contractor shall provide and use a

template, riding on the forms, for checking the subgrade before the concrete is placed. A subbase course, if specified in the plans, shall be as required in 310.

(b) Forms shall be of metal, unless otherwise permitted by the Engineer, and shall extend for the full depth of the concrete and be of sufficient strength to resist the pressure of the concrete without deflection. Forms shall be kept clean and shall be oiled just before placing the concrete.

Unless otherwise shown on the plans or ordered by the Engineer, forms shall be set so that the back edge of the walk will be on the property line, at the designated grade, and the walk will have a uniform cross slope of 1/4 inch per foot of width toward the street center line.

Steel plates, 1/8 inch thick, shall be used to divide the walk for its full width and thickness into blocks five or six feet in length or as directed by the Engineer. In lieu of using divider plates, the walks may be saw cut to a minimum depth of 2 inches. Sawing shall be done as soon as practicable but no later than 24 hours after the concrete is placed. Driveway aprons shall be divided in a similar manner. If the driveway apron and sidewalk are placed integrally, joints in the sidewalk shall be in line with the edges and joints of the apron, and one of the two joints in line with the edge of the apron shall be an expansion joint. A longitudinal joint in line with the front edge of the walk shall be sawed between the sidewalk and apron.

All covers of shut-off boxes, manhole or coal hole covers, valves, platforms or area covers, and other similar fixtures, shall be adjusted to the grade of the completed walk prior to pouring the concrete.

Where the sidewalk concrete surrounds posts, poles, fire hydrants, gratings, castings, and the like, the concrete immediately adjacent to such objects shall be separated from the remaining concrete by means of 1/2 inch expansion joints extending through the full depth of the sidewalk concrete. In general, these joints shall be placed about 6 inches from poles, hydrants, etc., and arranged in the form of squares or rectangles or as directed by the Engineer.

(c) Placing and Finishing. The subgrade shall be moistened thoroughly, immediately prior to placing concrete. The concrete shall be deposited in a single layer. It shall be struck off with a template and smoothed with a float and a uniform broom finish applied. No plastering will be permitted. All outside edges and joints shall be edged with a 1/4 inch radius edging tool. Premolded expansion material 1/2 inch thick, extending the full depth of the walk, shall be installed between the new concrete and existing curbs, drives, aprons, walks, any fixed structure and at intervals of approximately 30 feet.

All concrete walks shall have the name of the Contractor or person constructing the walk, together with the year the walk is constructed, stamped in the surface of the walk in front of each lot. When single blocks of walk are constructed, they shall

be separated from the existing walk by means of at least one expansion joint 1/2 inch in thickness. All such isolated blocks shall be stamped with the Contractor's name.

Where drain pipes cross underneath sidewalks, the walk shall be marked near the edge with a small circle, not less than 1 inch in diameter, impressed into the concrete.

(d) Concrete shall be cured as required in 451 except that membrane cure shall be applied at a rate of not less than 1 gallon per 200 square feet of surface. Cold weather protection shall be in accordance with 451.07.

456.04 Concrete Steps. (a) Excavation and forms shall conform to 456.03 (a) and (b) where applicable.

(b) Placing and finishing shall be in accordance with 511 except that treads of steps shall be finished to produce a sandy texture.

(c) Slopes of step treads shall be 1/4 inch per foot toward the next lower step.

(d) Curing shall be in accordance with 511.

(e) Hand railing, when specified, shall be in accordance with pertinent provisions of 517.

456.05 Curb Ramps. Excavation, forming, placing and finishing and curing shall conform to 456.03. The final surface texture shall be obtained by coarse brooming or other method approved by the Engineer. This item includes furnishing and installing approved detectable warnings, unless paid for under a separate item. All curb ramps shall conform to all requirements of the American Disabilities Act (ADA) and the City of Akron Standard Construction Drawings.

456.06 Sidewalk Relaid. Existing concrete or flagstone sidewalk slabs that are suitable for relaying will be designated on the plans or by the Engineer. Slabs that are to be relaid shall be carefully removed, and a new bed of cushion sand spread and tamped to such elevation as is necessary to bring the relaid walk to proper grade. Then the slab shall be placed upon the new bed and tamped to line and grade, care being exercised not to break the slab. Any slabs broken by the Contractor while being relaid shall be replaced with new concrete sidewalk at the price bid for relaying. If the Contractor so elects, he may, at the price bid for relaying, provide new concrete sidewalks, constructed as specified above, in lieu of relaying the existing slabs.

456.07 Method of Measurement. Walks, aprons, driveway reconstruction and sidewalk will be measured by the square foot of finished surface complete in place. Steps will be measured by the linear foot, along the front edge of each tread. Where steps are constructed with integral walls, each tread will be considered to extend from out to out of such walls.

456.08

Curb ramps in concrete walk will be measured as the number of each complete and shall include the cost of any additional materials, grading, forming and finishing not included in the walk which is measured through the curb ramp area. New curbs required for curb ramps shall be constructed and paid for in accordance with Item 455 Curbing.

456.08 Basis of Payment. The accepted quantities of specific items will be paid for at the contract prices designated for each pay item listed. Excavation, backfill, base course material, reinforcing steel, hand railing, expansion joint material and other related miscellaneous items will not be paid for separately, but the cost thereof shall be included in the cost of the item of which they are a part.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
456	Square Foot	Concrete walk, _____ inches thick
456	Square Foot	Sidewalk relaid
456	Each	Curb ramps
456	Linear Foot	Concrete steps
456	Square Foot	Concrete Driveway Reconstruction, _____ inches thick
456	Square Foot	Concrete aprons, _____ inches thick

ITEM 457 CONCRETE MEDIAN AND TRAFFIC ISLAND

457.01 Description

457.02 General

457.03 Method of Measurement

457.04 Basis of Payment

457.01 Description. This item shall consist of medians and islands composed of portland cement concrete constructed on the accepted, prepared subgrade, subbase or the completed and accepted base course or old pavement.

457.02 General. Materials and other requirements shall be the same as 451 except as follows:

- (a) Membrane cure shall be applied at a rate of not less than 1 gallon per 200 square feet of surface.
- (b) Medians may also be constructed by machine as provided in 454.03.

457.03 Method of Measurement. The quantity measured shall be the number of square yards or the number of cubic yards as specified complete in place.

457.04 Basis of Payment. Accepted quantities will be paid for at the contract unit price per square yard or per cubic yard as specified. These prices shall be full compensation for all concrete, joints, dowels and other material necessary for completion of the items.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
457	Square Yard or Cubic Yard	Concrete traffic island
457	Square Yard or Cubic Yard	Concrete median

ITEM 458 TRAFFIC DIVIDERS

458.01 Description

458.02 Materials

458.03 Construction

458.04 Method of Measurement

458.05 Basis of Payment

458.01 Description. This item shall consist of furnishing traffic dividers of the kind and size specified and installing such dividers at the locations specified.

458.02 Materials. Cement shall be white portland cement conforming to 701.01, 701.04, or 701.05. In addition, it shall be white without tint and shall have a minimum luminous (daylight) reflectance of 75.

Fine aggregate shall meet the grading and physical property requirements of 703.02 except as hereinafter noted.

Coarse aggregate shall be No. 8, except as hereinafter noted.

Modification of aggregate sizes within the above gradings may be made providing that the concrete produced will possess flexural strength and durability at least equal to that of concrete produced of the grading specified above.

The fine and coarse aggregates shall be silica or marble. Under no circumstances may different sizes from the same source or different sources be mixed to obtain a soundness loss within the specified limits.

The fine and coarse aggregates shall be combined in the proportion of 30 to 45 percent by weight of fine aggregate. Within these limits the proportions shall be regulated so as to provide a workable mix.

458.03

The minimum cement factor shall be 750 pounds per cubic yard of concrete. The maximum water-cement ratio shall be 0.45. The maximum allowable slump shall be 1 inch. The plastic concrete shall contain 5 to 8 percent entrained air.

458.03 Construction. When the traffic dividers are to be placed in bituminous concrete, they shall not be placed until the bituminous concrete surface has been completed. The opening remaining between the bituminous concrete and the traffic dividers shall be filled with 1:2 cement mortar or 705.01 or 705.02 joint sealer.

When the traffic dividers are to be placed in portland cement concrete, the openings into which the traffic dividers are to be set shall be formed at the time the portland cement concrete pavement is being placed by a method acceptable to the Engineer. The opening remaining between the portland cement concrete pavement and the traffic dividers shall be filled with 1:2 cement mortar or 705.01 or 705.02 joint sealer.

After the traffic dividers have been set in the pavement, the lifting holes shall be filled to within 3/4 inch of the surface with dry sand and sealed with 705.01 or 705.02 joint sealer.

Throughout the work, the Contractor shall keep the traffic dividers free of any material tending to deface them.

458.04 Method of Measurement. The number of traffic dividers measured will be the actual number of traffic dividers furnished and installed as specified.

458.05 Basis of Payment. The number of traffic dividers measured will be paid for at the contract unit price per each complete in place. This price shall constitute full compensation for furnishing, preparing and installing traffic dividers as specified.

Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
458	Each	Traffic dividers

ITEM 459 CORE HOLES IN WALK

- 459.01 Description**
- 459.02 Construction Method**
- 459.03 Measurement**
- 459.04 Basis of Payment**

459.01 Description. This item shall consist of providing circular holes in walk at locations designated on the plan, or as directed by the Engineer.

459.02 Construction Method. The holes of size and location as specified on plan shall be provided through the walk by drilling, using a method approved by the Engineer. The workmanship must be of a high quality and the walk must not be injured.

459.03 Measurement. The quantity of core holes complete to be paid shall be the actual number of holes through the walk, satisfactorily completed and accepted.

459.04 Basis of Payment. Payment for accepted quantities complete in place shall be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
459	Each	Core Holes in Walk, _____ inch

ITEM 460 BRICK WALK

460.01 Description

460.02 Materials

460.03 Execution

460.04 Method of Measurement

460.05 Basis of Payment

460.01 Description. This item shall consist of furnishing the necessary labor, material and equipment required to install bricks on a prepared base in areas shown on the plans or as directed by the Engineer.

460.02 Materials. Bricks shall be new beveled edge paving bricks (4"x2¼"x8" nominal size). Brick manufacturer and color shall be as shown on Standard Construction Drawing No. LA-1. If blending into existing brick walk, materials shall match existing as directed by the Engineer. New bricks shall be in accordance with ASTM C-902 Type 1, Class SX. Bricks shall be manufactured by extrusion, not by dry-stamping.

The base course material shall be class "C" concrete meeting the requirements of 499.03.

The aggregate for cushion and joint filler shall be concrete sand per 703.02.

460.03 Execution. Installation of the bricks shall not start until the construction of adjacent sidewalk and curb has been completed. The Contractor

460.04

shall correct any and all deficiencies in the subgrade as necessary in a manner acceptable to the Engineer.

The subgrade shall be tamped or rolled to secure a firm foundation. The concrete base shall then be placed three inches thick, and screeded to the proper depth and elevation so that after the concrete sand cushion and bricks are placed and compacted, the bricks shall meet adjacent elevations of surrounding concrete walk and curb.

After the concrete base is cured the concrete sand shall be spread and leveled at 1/2"-1" thickness.

The bricks shall be laid in straight courses to form a "running bond" pattern, as shown on the drawings or as directed by the Engineer, hand tight, with a smooth finished surface. All objectionable bricks shall be removed and replaced with acceptable bricks. The bricks shall be brought to firm bearing and finished grade with the adjacent curb and sidewalk by means of a rubber mallet and wood blocks. Driving or ramming of the bricks shall not be permitted. A maximum of 1/8 inch shall be permitted for whole or cut brick joints. Concrete sand shall be swept over the brick to fill all joints, and the area saturated by fine spraying with water.

The brick surface shall not vary more than 1/8" inch in ten (10) feet and shall not be more than 1/16 inch above or below the adjacent curb or sidewalk.

Brick Walk Relaid shall consist of installing or reinstalling bricks on an existing base.

Broken bricks, unused brick pieces, sand, cement and other debris shall be removed from the site at the end of each workday.

460.04 Method of Measurement. The quantity to be paid shall be the number of square feet of brick walk installed and accepted, as determined from the Engineer's final measurements.

460.05 Basis of Payment. Payment for completed work will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
460	Square Foot	Brick Walk
460	Square Foot	Brick Walk Relaid

This price shall include compensation for all labor, materials, equipment, tools and incidentals required to complete the work as specified herein, including all excavation, concrete base, concrete sand cushion and joint filler, and bricks.

ITEM 461 BRICK PAVEMENT

461.01 Description

461.02 Materials

461.03 Execution

461.04 Method of Measurement

461.05 Basis of Payment

461.01 Description. This item shall consist of furnishing the necessary labor, material and equipment required to construct or reconstruct brick pavement on a prepared base in areas shown on the plans or as directed by the Engineer. Unless paid for separately, this item shall also include the removal of any existing pavement as necessary to complete the work or as directed by the Engineer.

461.02 Materials. Bricks shall be standard paving bricks (4" x 4" x 8" nominal size), which have been salvaged from old brick streets, or new bricks acquired by the Contractor, as noted below. For brick pavement reconstruction, the Contractor shall reuse as much of the existing brick as possible. Replacement bricks may be obtained from the City at no cost to the Contractor. Old paving bricks are stockpiled at the Municipal Services Center, 1420 Triplett Boulevard, Akron, Ohio. The contractor shall contact the Public Works Bureau (330 375-2834) to make arrangements to pick up the bricks. If necessary, the Contractor shall clean the bricks prior to use.

If new bricks are required to complete the work, the manufacturer of the new bricks will be as designated on the plans or as directed by the Engineer. New bricks shall be in accordance with ASTM C-1272 Type F, color to match that of the existing or salvaged bricks, and shall be of the same nominal size (4" x 4" x 8"). New bricks supplied by the Contractor shall be manufactured by the extrusion process, not by dry stamping.

The base course material shall be class "C" concrete meeting the requirements of 499.03. For reconstructed brick pavement, the concrete base shall be the same thickness as the adjoining concrete base, with a minimum thickness of six inches. Concrete base for new brick pavement shall be 6 inches thick unless otherwise specified on the plans.

The aggregate for cushion and joint filler shall be concrete sand per 703.02.

461.03 Execution. The Contractor shall correct any and all deficiencies in the subgrade as necessary, in a manner acceptable to the Engineer. The subgrade shall be compacted to secure a firm foundation. The concrete base shall then be placed and screeded to the proper depth and elevation so that after the cushion material and paving bricks are placed and compacted, the bricks shall meet adjacent elevations of surrounding brick pavement or proposed elevations shown on the plans. After the

461.04

concrete base is cured the cushion material shall be spread and leveled at the same thickness as the adjoining material.

The bricks shall be laid in straight courses to form a "running bond" pattern, or as directed by the Engineer, hand tight, with a smooth finished surface. All objectionable bricks shall be removed and replaced with acceptable bricks. The bricks shall be brought to firm bearing and finished grade by means of a rubber mallet and wood blocks. Driving or ramming of the bricks shall not be permitted. A maximum of 1/8 inch shall be permitted for whole or cut brick joints. Concrete sand shall be swept over the bricks to fill all joints and the area saturated by fine spraying with water. The brick surface shall not vary more than 1/8 inch in ten feet.

Unused whole bricks shall be returned by the Contractor to the stockpile at 1420 Triplett Boulevard. Broken bricks, unused brick pieces, sand, and other debris shall be removed from the site.

461.04 Method of Measurement. The quantity to be paid shall be the number of square yards of brick pavement installed and accepted, as determined from the Engineer's final measurements.

461.05 Basis of Payment. Payment for completed work will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
461	Square Yard	Brick Pavement (Salvaged Bricks)
461	Square Yard	Brick Pavement (New Bricks)
461	Square Yard	Brick Pavement Reconstructed (Salvaged Bricks)
461	Square Yard	Brick Pavement Reconstructed (New Bricks)

This price shall include compensation for all labor, materials, equipment, tools and incidentals required to complete the work as specified herein, including all excavation, concrete base, cushion material, paving bricks and joint filler.

ITEM 464 HORIZONTAL SAWING OF CURB

464.01 Description

464.02 Method

464.03 Method of Measurement

464.04 Basis of Payment

464.01 Description. This item shall consist of sawcutting existing curb horizontally to conform to lines and/or dimensions of proposed driveway aprons and curb ramps. Removed material shall be disposed of and the area cleaned of all debris.

464.02 Method. Work shall be performed using an industrial duty wet masonry saw designed to cut horizontally, inclined and sloped.

The finish of the horizontal sawed curb shall be an even plane surface slightly sloped toward the pavement, as directed by the Engineer. At the ends of the horizontal saw cut, an inclined saw cut shall be made to match the incline of the curb ramp or apron. The intersection of the saw cuts shall be mechanically ground to a smooth radius.

464.03 Method of Measurement. The quantity measured will be the actual number of linear feet of curb cut in place, measured along the front face of the curb, whether straight or curved.

464.04 Basis of Payment. Payment for accepted quantities will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
464	Linear Feet	Horizontal sawing of curb

The above price shall constitute full compensation for furnishing all labor, materials, equipment, tools and incidentals required to complete this work as specified.

ITEM 499 CONCRETE - GENERAL

- 499.01 Description**
- 499.02 Materials**
- 499.03 Proportioning**
- 499.04 Equipment**
- 499.05 Handling, Measuring and Batching Materials**
- 499.06 Mixing and Delivering**
- 499.07 Sampling and Testing**
- 499.08 Concrete Which Fails to Meet Specifications**

499.01 Description. This item shall consist of proportioning, mixing and transporting concrete.

499.02 Materials. Materials shall be:

Fine aggregate	703.02
Coarse aggregate	703.02
Portland cement.....	701.01, 701.04 and 701.05
Air entraining admixture	705.10
Chemical admixture for concrete	705.12

499.03

The brands or kinds of all concrete materials for any one item may be changed only by permission of the Engineer.

Water used in concrete shall be free from sewage, oil, acid, strong alkalis or vegetable matter and also shall be free from clay and loam. Water which is potable is satisfactory for use in concrete.

499.03 Proportioning. Proportioning shall be based on predetermined cement content. Except as otherwise provided herein, each cubic yard of concrete shall contain the specified weight of cement as determined by the yield test. The water-cement ratio shall not exceed the maximum specified. Below this limit the quantity of water shall be adjusted to meet the slump requirements.

Concrete shall contain 6, plus or minus 2, percent of entrained air.

Slump shall be maintained within the range shown as nominal slump in the following table. No concrete shall be used in the work that has a slump greater than that shown as maximum in the table. When the slump is found to exceed the limit of nominal slump but is within the maximum limit, occasional loads of concrete may be used, provided an immediate adjustment is made in the mixture to reduce the slump of succeeding loads to within the nominal range shown.

<u>Type of Work</u>	<u>Nom. Slump Inches</u>	<u>Max. Slump Inches</u>
Concrete Pavement (305, 451, 452, 453, 615)	1-3	4
Structural concrete (511, 610, 622 excluding superstructure concrete)	1-4	4
Superstructure Concrete 511	2-4	4
Non-reinforced concrete (454, 455, 456, 457, 458, 551, 562, 563, 601, 602)	1-3	4

The contractor may, with the prior approval of the Engineer, add an approved type F or type G high-range, water-reducing admixture provided the following criteria are met.

- (a) The Engineer must be present and approve the addition of the admixture on a load-by-load basis. Failure to obtain approval of the Engineer will result in the rejection of the load.
- (b) The admixture shall be supplied by the ready-mix supplier providing concrete for the project.

- (c) The slump of the concrete prior to the addition of the admixture is three inches or less and does not exceed six inches after the addition of the admixture.
- (d) The addition of the admixture shall take place before a third of the load has been discharged. At no time shall admixture be added to a load containing less than four cubic yards.
- (e) The air content of the concrete mixture shall be maintained within the acceptable range after the addition of the admixture.
- (f) The yield of the concrete mixture shall be maintained at 27 ± 0.5 C.F./C.Y.

Failure to maintain acceptable mixture properties as determined by the Materials Testing Laboratory may result in the suspension of the use of these admixtures.

Tests on the plastic concrete for pavement shall be made at the paving site or at a location designated by the Engineer. Tests for structure concrete shall be made at the site of the work at the time the concrete is being placed.

The weights of fine and coarse aggregate shall be determined by the Engineer from the weights given in the Concrete Table, not exceeding the maximum water-cement ratio shown and the range in slump stated. If high-early strength concrete is specified, the Contractor may use high-early strength cement (per 701.05), additional cement, approved chemical admixture or a combination of these materials to achieve a modulus of rupture of 600 pounds per square inch in three days or less. If high-early-strength concrete is not specified, but is desirable to expedite the work, the Contractor may use, at his own expense, high-early-strength cements, additional cement, approved chemical admixtures, or a combination of these materials with the approval of the Engineer. Do not waive concrete curing periods specified for the item of work in which concrete is used.

The weights specified in the Concrete Table were calculated for aggregates of the following bulk specific gravities: natural sand and gravel 2.62, limestone sand 2.68, limestone 2.65, slag 2.30. For aggregates of specific gravities differing more than plus or minus 0.02 from these, the weights in the table shall be corrected as indicated in paragraph (c) of this section.

CONCRETE TABLE
Quantities Per Cubic Yard
Dry Aggregates

Type Of Course Aggregate	Fine Aggregate (lb.)	Coarse Aggregate (lb.)	Total (lb.)	Cement Content (lb.)	Water Cement Ratio Maximum
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CLASS C (Using No. 57 Size)

(min. 28 days compressive strength, 4000 psi)

Limestone	1285	1630	2915	600	0.50
Slag	1350	1360	2710	600	0.50

CLASS F (Using No. 57 Size)

(min. 28 days compressive strength, 3000 psi)

Limestone	1345	1730	3075	500	0.50
Slag	1380	1470	2850	500	0.50

CLASS S (Using No. 57 Size)

(min. 28 days compressive strength, 4500 psi)

Limestone	1260	1530	2790	715	0.44
Slag	1280	1370	2650	715	0.44

CLASS C (Using No. 7, 78, or 8 Size)

Provide concrete with an air content of 8%±2%

(min. 28 days compressive strength, 4000 psi)

Limestone	1380	1410	2790	600	0.50
Gravel	1320	1460	2780	600	0.50

Calcium Chloride (CaCl₂) as an admixture will not be permitted. The Contractor may, with prior approval of the Engineer, add an approved Type C or Type E non-chloride set accelerating admixture provided the requirements of 499.03 paragraph four, items (a) through (f) are met. All initial water, called for in the design, must be added at the plant. The addition of the admixture is not construed as substitute for cold weather protection, but as an addition to it.

At any time during the construction period, the relative weights of fine and coarse aggregate as determined from the above table may be varied by the Engineer in order to insure a workable mix within the slump range and to control the yield. However, the total weight of aggregate per cubic yard shall not be changed except as provided in the preceding paragraph or for the following conditions or both.

(a) For batch weights, the weights determined as described above shall be corrected to compensate for moisture contained in the aggregates at the time of use.

(b) If it is found impossible to prepare concrete of the proper consistency without exceeding the maximum water-cement ratio specified, a water reducing admixture conforming to requirements of 705.12 shall be used or the cement content shall be increased. However, the Contractor shall not be compensated for the admixture or additional cement which may be required by reason of such adjustment.

(c) If, during the progress of the work, the specific gravity of one or both of the aggregates changes, the batch weight shall be adjusted to conform to the new specific gravity.

(d) Unit weight determinations shall be made and the yield shall be calculated in accordance with the method on file with the Engineer. Based on these determinations, the batch weights will be adjusted when necessary. However, the specified cement content shall be maintained and the maximum water-cement ratio shall not be exceeded.

(e) The amount of mixing water shall be adjusted for the moisture contained in the aggregate and for the moisture which they will absorb, in order to determine the amount of water to be added at the mixer.

(f) When the temperature of concrete, at the time of placement, is expected to exceed 75°F, an approved water reducing admixture meeting the requirements of 705.12, Type A or Type D, shall be added at the plant and mixed in accordance with the manufacturer's recommendations. The admixture shall be compatible with the air entraining admixture used. The specified cement content shall be maintained. The cost of the admixture shall be included in the unit price of the item requiring the concrete. Proposed admixture shall be submitted to the Engineer for approval prior to start of construction.

Concrete Class MS. This mixture is a moderate-setting portland cement concrete for accelerated strength development. The rigid replacement may be opened to traffic after 24 hours provided test beams have attained a modulus of rupture of 400 psi. The minimum cement content shall be 800 pounds per cubic yard and the maximum water-cement ratio shall be 0.43.

The proportioning of the concrete materials to meet the requirements of each class of rigid replacement concrete specified shall be the responsibility of the contractor. The entrained air content shall be $6 \pm$ two percent. Slump shall meet the requirements of 499.03. No water shall be added on site, the slump may be adjusted with the approval of the engineer by the addition of an approved type F or type G high-range water reducer (superplasticizer). Failure to obtain the engineer's approval will result in the rejection of the load.

If high-early strength concrete is specified, the Contractor may use high-early strength cement, additional cement, approved chemical admixture or a combination

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of these materials to achieve a modulus of rupture of 600 pounds per square inch in three days or less.

499.04 Equipment. Equipment shall be as follows:

(a) Batching plants. Each plant shall be constructed and operated so that no intermingling of materials occurs prior to batching. The plant shall have weighing mechanisms which provide either a visible means of checking weights or a printed record. Dispensing mechanisms for water and admixtures shall have a visible means of checking quantities or shall produce a printed record.

Weighing mechanisms used for cement and aggregates shall weigh to an accuracy such that the weight indicated on the scale or printed ticket is within plus or minus 0.5 percent of the correct weight. Devices for weighing or metering water shall measure to an accuracy of plus or minus 1.0 percent throughout the range used.

All weighing and metering devices shall have been checked and their accuracy attested to within the 12 month period immediately prior to their use. This service may be performed by the Division of Weights and Measures or a scale servicing company.

Ten 50-pound standard test weights shall be readily available for testing and weighing devices at the batch plant. These weights and all others used in testing the weighing devices shall be sealed every 3 years by the Ohio Department of Agriculture.

Weighing and dispensing devices shall be tested as often as the Engineer may deem necessary to assure their continued accuracy.

(b) Mixers. Mixers may be stationary mixers (central-mix) or truck mixers (transit mix). Agitators may be truck mixers or agitators. Each mixer shall have attached in a prominent place the manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Central-mix plants shall be approved types capable of producing thoroughly mixed and uniform concrete within the specified mixing period, and of discharging the mixture without segregation. The mixer shall be equipped with an approved timing device which automatically prevents the discharge of the batch before it has been mixed the specified minimum amount of time.

Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central-mix concrete, shall conform to paragraphs 8.1, 8.2, 8.3, 9.2, 9.4 and 9.5 of AASHTO M 157.

Truck mixers shall be equipped with mechanically or electrically actuated counters by which the number of revolutions of the drum or blades may readily be verified.

When a truck mixer is used for complete mixing, each batch of concrete shall be mixed for not less than seventy revolutions of the drum or blades at the rate of rotation designated on the metal plate on the mixer as mixing speed.

Mixers and agitators shall be examined or weighed routinely as frequently as necessary to detect changes in condition due to accumulation of hardened concrete or mortar and examined to detect wear of blades. When such changes are extensive enough to affect the mixer performance, the mixer or agitators shall not be used unless the condition is corrected.

499.05 Handling, Measuring and Batching Materials. Aggregates from different sources and of different gradings shall not be stockpiled together. Aggregates that have become segregated or mixed with earth or foreign material shall be reworked or cleaned as directed by the Engineer, or rejected. Coarse aggregate shall be maintained with a uniform moisture content.

The fine aggregate and each size of coarse aggregate shall be separately weighed in the respective amounts set by the Engineer as outlined in 499.03. Separate weighing devices shall be used for weighing the cement.

Batching shall be so conducted as to result in the weights of each material required within a tolerance of plus or minus 1.0 percent for cement and plus or minus 2.0 percent for aggregates. Water shall be measured by weight or volume to within a tolerance of plus or minus 1.0 percent. Admixtures shall be dispensed to within plus or minus 3.0 percent of the desired amount.

Methods and equipment for adding air-entraining agents or other admixtures into the batch, when required, shall be approved by the Engineer.

499.06 Mixing and Delivering. The concrete may be mixed in a central mix plant or in truck mixers. The mixer shall be of an approved type.

Concrete that is mixed completely in a central mix plant and transported to the point of delivery either in a truck agitator or in a truck mixer operating at agitating speed shall conform to the following: The mixing time shall be counted from the time all of the solid materials are in the drum. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates and all water shall be in the drum by the end of the first one-fourth of the specified mixing time. The acceptable mixing time for mixers having capacities of 1 yd³ (0.76 m³) or less shall be not less than 1 minute. For mixers of greater capacity, this minimum shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity.

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Concrete shall be mixed and delivered in accordance with 499.04 (b). The Contractor shall furnish to the City with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped or written information concerning said concrete as follows:

- name of ready-mix batch plant
- serial number of ticket
- date
- truck number
- name of purchaser
- name and location of job
- specific class or designation of concrete
- amount of concrete in cubic yards
- type, brand and amount of cement
- batch weight of fine aggregate
- batch weight and size of coarse aggregate
- total mixing water added by producer
- water added by receiver of concrete and initialed
- type and brand and amount of admixtures
- time of loading or first mixing of cement and aggregates,
imprinted by an automatic time clock

The concrete shall be delivered to the site of the work and discharge shall be completed within one hour after the combining of the water and the cement. If an approved set-retarding or a water-reducing and set-retarding admixture is used at the Contractor's expense, discharge shall be completed within 90 minutes after the combining of the water and the cement. This time extension shall not apply to 511 superstructure concrete.

Mixers shall be operated at a drum speed as shown on the manufacturer's name plate on the approved mixer. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity, as shown on the manufacturer's standard rating plate on the mixer.

Retempering concrete by adding water will not be permitted. When concrete is delivered in transit mixers or agitators, additional water within the limits specified may, with the approval of the Engineer, be added and a minimum of 30 revolutions of the drum at mixing speed performed to adjust the slump and to regenerate the specified air content throughout the batch, provided all of the following criteria are met.

(a) The Engineer must be present and approve the addition of the water on a load-by-load basis. Failure to obtain approval of the Engineer will result in the rejection of the load and removal, at no cost to the City, of all concrete placed from the rejected load.

(b) The slump of the concrete prior to the addition of water is three inches or less and does not exceed the requirements of 499.03 after the addition of water.

(c) The addition of water shall take place before no more than one cubic yard of the load has been discharged.

Admixtures for accelerating the set will be permitted only when provided for in the contract, or with the written permission of the Engineer.

After discharged into the work, ensure that the temperature of all concrete does not exceed 90° F.

499.07 Sampling and Testing. The Contractor shall afford the Engineer all reasonable access, without charge, for the procurement of samples of fresh concrete to determine conformance of it to these specifications.

Slump and air-content tests shall be made at the time of placement as often as is deemed necessary by the Engineer and always when strength specimens are made. If the slump or air-content falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed the requirements of the specifications.

Fresh unit weight and yield tests may be made at the time of placement as is deemed necessary by the Engineer.

For a strength test 3 or more standard test specimens (6" x 12" cylinders) shall be made.

Strength tests as well as slump, air content, fresh unit weight and yield tests shall be generally made with a frequency of not less than one test for each 150 C.Y. per class of concrete placed or one test per day per class of concrete if less than 150 C.Y. is delivered.

Methods of sampling and testing concrete shall be in accordance with the following ASTM methods.

Sampling Fresh Concrete - Method C 172

Slump - Test Method C 143

Air Content - Test Methods C 138, C 173 or C 231

Yield, Weight per Cubic Foot - Test Method C 138

Compression Test Specimens - Method C 31

Compression Tests - Test Method C 39

Flexural Strength of Concrete - Test Method C 78

The testing laboratory performing tests of concrete shall meet the requirements of ASTM Recommended Practice E 329.

499.08 Concrete Which Fails To Meet Specifications. Concrete which fails to meet the specified slump or air content requirements shall be rejected and removed from the job site at no cost to the City. Concrete which fails to meet the specified strength requirement shall be removed and replaced at no cost to the City, or at the option of the Engineer, may be left in place and paid for at reduced unit prices determined as follows:

- A. For pavement (Items 451,452, and 453), curbing (Item 455) sidewalks, driveways and steps (Item 456) and patching concrete structures (Item 519), the unit price paid for all concrete represented by the failed sample shall be the bid price for the respective item of work times the square of the ratio of the average 28 day compressive strength achieved to the specified minimum 28 day compressive strength.
- B. For items of work such as piling, pile caps for sewers, and concrete for structures, a reduction shall be imposed as follows:

For each cubic yard of concrete represented by the failed sample, a reduction of \$200 times the quantity one minus the square of the ratio of the average 28 day compressive strength achieved to the specified minimum 28 day compressive strength.