DIVISION 500. STRUCTURES

BRIDGES

SECTION 501. REMOVAL OF EXISTING STRUCTURES

501.01 Description. This work shall consist of the removal of existing traffic and drainage structures or portions thereof.

CONSTRUCTION REQUIREMENTS

501.02 General. Materials that are to be salvaged under the contract and which the Engineer deems fit for reuse shall be carefully removed in transportable sections and stockpiled near the site at a location designated by the Engineer. If the material for reuse is unfit, through no fault of the Contractor, the material shall be disposed of according to Article 202.03. When the Contractor damages or destroys such material, the Contractor shall repair or replace the material in a manner satisfactory to the Engineer. Materials that are not to be salvaged shall be removed and disposed of according to Article 202.03.

When a superstructure is specified to be salvaged for reerection, all members and loose parts shall be properly matchmarked, all machined steel surfaces treated with an approved anti-rust compound, and all loose parts wired to adjacent members or packed in marked boxes.

501.03 Protective Shield System. When required, a protective shield system shall be erected and maintained to protect pedestrian, vehicular, or railroad traffic from falling objects. The system shall protect the area shown on the plans. The protective shield system shall be designed and constructed to sustain loads of 200 lb/sq ft (9.5 kPa) in addition to its own weight. Protective shield systems comprised of wood members shall be designed for a minimum loading duration of seven days. The system may be either fixed or mobile. The existing vertical clearances above roadways and/or railroad tracks shall be maintained. The Contractor shall coordinate the installation with municipalities and/or utilities to insure protection of their facilities during the removal process.

The Contractor shall submit working drawings and calculations prepared and sealed by an Illinois Licensed Structural Engineer to the Engineer for the protective shield system. The drawings shall provide full details, dimensions, and types of materials proposed for use. The protective shield system shall not be installed until authorization to proceed is given by the Engineer.

Concrete removal shall not commence until the protective shield system is in place and in conformity with the sealed working drawings.

Upon completion of the work or when directed by the Engineer, the protective shield system shall be removed.

CONSTRUCTION REQUIREMENTS

550.04 Excavation and Foundation. Trenches shall be excavated to an elevation 4 in. (100 mm) below the bottom of the pipe and to the following widths.

Trench Depth/Protection	Required Trench Width On Each Side of the Pipe
5 ft (1.5 m) and less, without protection	9 in. (225 mm)
5 ft (1.5 m) and less, with protection	18 in. (450 mm)
Greater than 5 ft (1.5 m)	18 in. (450 mm)

The trench shall be excavated so that vertical faces are maintained at least to the elevation of the top of pipe. For trench depths greater than 5 ft (1.5 m), trench protection shall be utilized according to the applicable standards for work place safety. The Contractor shall provide to the Engineer, in writing, his/her procedures for fulfilling the safety requirements for trench protection.

If a water main is encountered during storm sewer construction, the requirements of the IEPA shall govern the horizontal and vertical separation of the water main from the storm sewer.

Well compacted aggregate, at least 4 in. (100 mm) in depth below the pipe, shall be placed for the entire width of the trench and length of the pipe; except when the storm sewer outlets from an embankment or natural ground, the last 3 ft (1 m) of the pipe shall be bedded in impervious material. The aggregate and impervious material shall be compacted by mechanical means to the satisfaction of the Engineer.

When pipe having bells or hubs is used, cross trenches not more than 2 in. (50 mm) wider than the bell or hub shall be excavated to provide uniform bearing along the length of the pipe.

If the excavation has been made deeper than necessary, the foundation shall be brought to the proper grade by the addition of well compacted bedding material.

Where a firm foundation is not encountered at the grade established due to soft, spongy, or otherwise unsuitable soil, unless other special construction methods are called for in the contract, all such unsuitable soil under the pipe and for the width of the trench shall be removed and replaced with well-compacted bedding material.

Where rock, in either ledge or boulder formation, is encountered, it shall be removed to an elevation at least 8 in. (200 mm) below the bottom of the pipe and replaced with a cushion of well compacted bedding material.

All excavated material not needed on the work shall be disposed of according to Article 202.03.

550.05 Plugging Existing Sewers and Drains. Abandoned sewers and drains, as designated by the Engineer, shall be plugged with Class SI concrete, or brick and suitable mortar, to the satisfaction of the Engineer.

This work will not be paid for separately, but shall be considered as included in the contract unit price bid for the storm sewer items or in the absence of such items for earth excavation.

550.06 Laying Sewer Pipe. The trench shall be kept free from water while the sewer is being placed and until the joint has been sealed. The laying of pipes shall be started at the outlet end with the spigot ends pointing in the direction of flow, and shall proceed toward the inlet end with pipes abutting and true to line and grade. The flow line at the outlet end of the pipe shall be at least 6 in. (150 mm) above the flow line of the open ditch.

When an end treatment, pipe tee, or elbow is required, it will be specified on the plans. End treatments shall be according to Article 542.07. Pipe tees and elbows shall be according to Article 542.08.

The ends of pipes shall be carefully cleaned before the pipes are lowered into the trenches, and the pipes shall be lowered so as to avoid unnecessary handling in the trench.

As each length of pipe is laid, the mouth of the pipe shall be properly protected to prevent the entrance of earth or the bedding material. The pipes shall be fitted and matched so that when laid in the work they will form a sewer with a smooth, uniform invert. If reinforced concrete pipe is used, the word "Top" or "Bottom" may be stenciled on the inside of the pipe sections. All concrete pipe so marked shall be placed as indicated by these marks. Each section of pipe shall be pushed or pulled to the section in place to ensure tight joints. Pipe having a diameter greater than 42 in. (1050 mm) shall be set or "brought home" with a winch, come-a-long, or other positive means.

All joints in concrete sewer pipe shall be sealed with rubber gaskets, preformed flexible joint sealants, mastic joint sealer, or external sealing bands. When mastic joint sealer is used, it shall be applied according to the manufacturer's recommendations and the material shall completely fill the joint after the pipes have been brought together. After each joint is sealed, it shall be wiped clean on the inside. Lifting holes shall be filled with a precast concrete plug sealed and covered with mastic or mortar.

PVC pipes shall be joined according to ASTM D 3034.

550.07 Backfilling. As soon as the condition of the pipe will permit, the entire width of the trench shall be backfilled with aggregate to a height of at least the center of the pipe; except when the storm sewer outlets from an embankment or natural ground, the last 3 ft (1 m) of the pipe shall be backfilled with impervious material. The backfill material shall be placed longitudinally along the pipe. The elevation of the backfill material on each side of the pipe shall be the same. The space under the pipe shall be completely filled. The backfill material shall be placed in 8 in. (200 mm) lifts, loose measurement, and compacted by mechanical means to the satisfaction of the Engineer.

When using flexible pipe, as listed in the first table of Article 550.03, the aggregate shall be continued to a height of at least 1 ft (300 mm) above the top of the

pipe and compacted to a minimum of 85 percent of standard lab density by mechanical means.

The installed pipe and its embedment shall not be disturbed when using movable trench boxes and shields, sheet pile, or other trench protection.

The remainder of the trench shall be backfilled to the natural line or finished surface as rapidly as the condition of the sewer will permit. The backfill material shall consist of suitable excavated material from the trench or trench backfill as herein specified. All backfill material shall be deposited in such a manner as not to damage the sewer. The filling of the trench shall be carried on simultaneously on both sides of the pipe.

The backfill material for trenches made in the subgrade of the proposed improvement, and trenches where the inner edge of the trench is within 2 ft (600 mm) of the proposed edge of pavement, curb, gutter, curb and gutter, stabilized shoulder or sidewalk, shall be trench backfill

All backfill material shall be deposited and compacted as specified in Method 1, 2, or 3 below. The method used shall be the choice of the Contractor. If the method used does not produce results satisfactory to the Engineer, the Contractor will be required to alter or change the method being used.

When trench backfill is used with Method 1, the lifts shall not exceed 8 in. (200 mm) in depth, loose measurement, and each lift shall be compacted to 85 percent of standard lab density by mechanical means. When trench backfill is used with Method 2 or 3, gradations CA 6 and CA 10 will not be allowed.

(a) Method 1. The material shall be deposited in uniform lifts not exceeding 12 in. (300 mm) in depth, loose measurement, and each lift shall be compacted by mechanical means to the satisfaction of the Engineer.

(b) Method 2. The material shall be deposited in uniform lifts not exceeding 12 in. (300 mm) thick, loose measurement, and each lift shall be either inundated or deposited in water.

(c) Method 3. The trench shall be backfilled with loose material, and settlement secured by introducing water through holes jetted into the backfill to a point approximately 2 ft (600 mm) above the top of the pipe. The holes shall be spaced as directed by the Engineer but shall be no farther than 6 ft (2 m) apart.

The water shall be injected at a pressure just sufficient to sink the holes at a moderate rate of speed. The pressure shall be such that the water will not cut cavities in the backfill material nor overflow the surface. If water does overflow the surface, it shall be drained into the jetted holes by means of shallow trenches.

Water shall be injected as long as it will be absorbed by the backfill material and until samples taken from test holes in the trench show a satisfactory moisture content. The Contractor shall bore the test holes not more than 50 ft (15 m) apart and at such other locations in the trench designated by the

Engineer. As soon as the water soaking has been completed, all holes shall be filled with soil and compacted by ramming with a tool approved by the Engineer.

Backfill material which has been water soaked shall be allowed to settle and dry for at least ten days before any surface course or pavement is constructed on it. At the end of the settling and drying period, the crusted top of the backfill material shall be scarified and, if necessary, sufficient backfill material added, as specified in Method 1, to complete the backfilling operations.

In lieu of suitable excavated material or trench backfill, the Contractor may, at no additional cost to the Department, backfill the entire trench with controlled low-strength material according to Section 593.

When sheeting and bracing have been used, sufficient bracing shall be left across the trench as the backfilling progresses to hold the sides firmly in place without caving or settlement. This bracing shall be removed as soon as practicable. Any depressions which may develop within the area involved in the construction operation due to settlement of the backfilling material shall be filled in a manner meeting the approval of the Engineer.

When the Contractor constructs the trench with sloped or benched sides according to Article 550.04, backfilling for the full width of the excavation shall be as herein before specified, except no additional compensation will be allowed for trench backfill material required outside the vertical limits of the specified trench width.

Whenever excavation is made for installing sewer pipe across earth shoulders or private property, the topsoil disturbed by excavation operations shall be replaced as nearly as possible in its original position, and the whole area involved in the construction operations shall be left in a neat and presentable condition.

550.08 Deflection Testing for Storm Sewers. All PVC storm sewers shall be tested for deflection not less than 30 days after the pipe is installed and the backfill compacted.

For PVC storm sewers with diameters 24 in. (600 mm) or smaller, a mandrel drag shall be used for deflection testing. For PVC storm sewers with diameters over 24 in. (600 mm), deflection measurements other than by a mandrel drag shall be used.

Where the mandrel is used, the mandrel shall be furnished by the Contractor and pulled by hand through the pipeline with a suitable rope or cable connected to each end. Winching or other means of forcing the deflection gauge through the pipeline will not be allowed.

The mandrel shall be of a shape similar to that of a true circle enabling the gauge to pass through a satisfactory pipeline with little or no resistance. The mandrel shall be of a design to prevent it from tipping from side to side and to prevent debris build-up from occurring between the channels of the adjacent fins or legs during operation. Each end of the core of the mandrel shall have fasteners to which the pulling cables can be attached. The mandrel shall have nine, various sized fins or legs of appropriate dimension for various diameter pipes. Each fin or leg shall have a

permanent marking that states its designated pipe size and percent of deflection allowable.

The outside diameter of the mandrel shall be 95 percent of the base inside diameter, where the base inside diameter is:

For all PVC pipe: as defined using ASTM D 3034 methodology.

If the pipe is found to have a deflection greater than that specified, that pipe section shall be removed, replaced, and retested.

550.09 Method of Measurement. Storm sewers will be measured for payment in place in feet (meters). When the storm sewer enters a manhole, inlet, or catch basin, the measurement will end at the inside wall of the manhole, inlet or catch basin. Allowance will be made for the length of pipe necessary to permit the pipe to meet the sides of the manhole. No payment for storm sewer will be made through an inlet or manhole where the inlet or manhole is paid for as a separate item. However, when the storm sewer is continuous and the inlet is constructed on top of the storm sewer, the measurement will be from end to end of storm sewer with a deduction made for the tee section which is paid for separately.

Trench backfill will be measured for payment according to Article 208.03.

Excavation in rock will be measured for payment according to Article 502.12.

550.10 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for STORM SEWERS, of the class, type, and diameter specified, and of the kind of material when specified.

Trench backfill will be paid for according to Article 208.04.

Excavation in rock will be paid for according to Article 502.13.

Removal and replacement of unsuitable material below plan bedding grade will be paid for according to Article 109.04.

End treatments, pipe tees, and elbows will be paid for according to Article 542.11.

SECTION 551. STORM SEWER REMOVAL AND INSTALLATION

551.01 Description. This work shall consist of the removal and/or installation of storm sewers, including laterals.

551.02 Materials. New materials shall be according to Articles 550.02 and 550.03.

CONSTRUCTION REQUIREMENTS

551.03 Removal. Existing storm sewers shall be removed so that all pipe considered suitable by the Engineer for future use shall be salvaged. The location and manner of storage of salvaged material shall be as directed by the Engineer.

Any of the material having salvage value which has been damaged by the Contractor shall be replaced with new pipe of the same kind and size. Material not suitable for salvage shall be disposed according to Article 202.03.

Excavation of trenches shall be performed according to the applicable requirements of Article 550.04. Backfill of trenches shall be performed according to the applicable requirements of Article 550.07.

551.04 Installation. Suitable pipe salvaged from storm sewer removal shall be used when available. When salvaged pipe is available for use, any new material required shall be of the same kind as the salvaged pipe.

Storm sewer installation shall be performed according to the applicable requirements of Section 550.

551.05 Method of Measurement. This work will be measured for payment according to Article 550.09.

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill for storm sewer removal will be measured for payment according to Article 208.03, except an addition will be made for one-half of the volume of the pipe removed.

Trench backfill for storm sewer installation will be measured for payment according to Article 208.03.

551.06 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for STORM SEWER REMOVAL or STORM SEWER INSTALLATION, of the diameter specified.

The furnishing of new pipe, except for replacement of pipe damaged by the Contractor, will be paid for according to Article 109.04.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to Article 208.04.

Removal and replacement of unsuitable material below plan bedding grade will be paid for according to Article 109.04.

SECTION 552. STORM SEWERS JACKED IN PLACE

552.01 Description. This work shall consist of furnishing and installing, by jacking, storm sewers of the required inside diameter at locations shown on the plans.

552.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Note 1)	1042
(b) Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe (Note 1)	1042

Note 1. Tongue and Groove Type Joint. Not less than a Class IV Pipe.

552.03 Traffic Control. The road shall be kept open to traffic according to Article 701.17(d)(3).

CONSTRUCTION REQUIREMENTS

552.04 General. Storm sewers, of the type and size specified, shall be jacked in a continuous operation. The construction may be accomplished by jacking the storm sewer, or if the Contractor elects, a metal liner of sufficient strength and size first, then the storm sewer installed inside the liner. If the liner is used, it shall remain in place to support the embankment, and the voids between the liner and the sewer pipe shall be completely filled with sand or grout mixture as approved by the Engineer. The diameter of the metal liner, if used, shall not exceed the outside diameter of the storm sewer by more than 6 in. (150 mm).

The Contractor may shorten the length of storm sewer to be jacked by open cutting and sheeting, shoring or bracing the excavation outside the roadway limits. No open cutting shall be permitted inside the shoulder lines. If continuous jacking operation cannot be maintained, the Contractor shall take the necessary precautions for not allowing the jacked pipe to freeze in place.

All sheeting, bracing, shoring, jacking frame, guide rails, backstop, shields, sleeves, and other materials necessary for the complete installation of the storm

sewer shall be of sufficient strength to support the loads that are to be imposed on them.

The types, sizes, and number of jacks, jacking pit, and other equipment used shall be such as to exert sufficient force to overcome the greatest resistance to be encountered, considering both weight of the pipe or liner and the friction on its exterior surface. Lubricants, if required, may be used to decrease the frictional resistance on the exterior surface of the pipe being jacked. Suitable lubricants may be applied directly to the surface or through 1/2 in. (13 mm) nipples through holes drilled in the cutting shield at the lead pipe.

Care shall be taken in arranging the jacking equipment and struts to ensure that thrust is applied parallel with the centerline of the pipe or liner or as approved by the Engineer. A jacking head or collar shall be used to apply pressure from the jack to the pipe or liner. Pressure applied with the metal of the jack in direct contact with concrete pipe will not be permitted.

A cutting edge at least 1/2 in. (13 mm) greater in diameter than the pipe or liner being jacked shall be provided for the leading pipe or liner. The upper half of the cutting edge shall project beyond the pipe or liner end to support the embankment. Excavation within the jacked pipe or liner shall be performed in such a manner as to not increase the excavated diameter larger than the pipe or liner being jacked. Excavation shall not be carried beyond the end of the cutting edge of the pipe or liner. Any holes provided in the lead pipe to attach the cutting edge shall be properly filled with plug and mastic as approved by the Engineer after completion of the jacking operation and removal of cutting edge.

552.05 Joints. As each succeeding pipe section is placed against the previously jacked pipe, a 1/2 in. (13 mm) manila rope or other suitable material shall be inserted throughout the entire groove of the joint and set in place with asphalt mastic. The opening on the inside of the pipe shall be mortared with a mixture composed of one part cement to three parts sand, by volume, based on dry materials, after the complete sewer has been jacked in place. Any other method of jointing must be approved by the Engineer prior to the start of construction.

552.06 Accuracy of Placement. The alignment and elevation of the forward end of the pipe shall be checked at regular intervals as work proceeds and appropriate measures immediately taken to correct any observed deviation. When the Contractor elects to jack a metal liner prior to installing the storm sewer, all earth and other foreign material shall be removed from inside the liner. The storm sewer sections shall be installed by jacking the sections through the liner.

552.07 Method of Measurement. This work will be measured for payment in place in feet (meters).

Excavation in rock will be measured for payment according to Article 502.12.

552.08 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for STORM SEWERS JACKED IN PLACE, of the diameter specified.

Excavation in rock will be paid for according to Article 502.13.

UTILITIES

SECTION 560. CAST IRON SOIL PIPE

560.01 Description. This work shall consist of constructing a cast iron soil pipe.

560.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Cast Iron Soil Pipe	1006.20

CONSTRUCTION REQUIREMENTS

560.03 General. Construction requirements shall be according to Section 550 with the following exceptions.

The pipe shall be laid with its spigot end lacking 1/4 in. (6 mm) of being driven full into the bell. Gaskets of clean, sound hemp yarn braided or twisted and tightly driven shall be used to pack the joints, followed by caulking with pure soft lead of the best quality for the purpose, so as to make a tight and permanent joint. All pipes shall be carefully cleaned before laying, and shall be left clean and in working order. The pipe shall have a solid bearing throughout its entire length. If it becomes necessary to cut the pipe, it shall be cut in such a manner that the ends will be square with the axis of the pipe.

560.04 Method of Measurement. This work will be measured for payment in place in feet (meters).

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill will be measured for payment according to Article 208.03.

560.05 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for CAST IRON SOIL PIPE, of the diameter specified.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to Article 208.04.

SECTION 561. WATER MAIN

561.01 Description. This work shall consist of constructing a water main.

561.02 Materials. Materials shall be as shown in the contract.

CONSTRUCTION REQUIREMENTS

561.03 General. The construction of water mains, including protection from sewers, pressure testing, and disinfection, shall be according to the "Standard Specifications for Water & Sewer Main Construction in Illinois", except as follows.

(a) Excavation and Foundation. This work shall be according to the applicable requirements of Article 550.04.

(b) Backfilling. This work shall be according to Article 550.07, except backfilling shall not be done in freezing weather nor made with frozen material.

Backfilling around joints shall not be performed until the pressure testing has been completed.

561.04 Method of Measurement. This work will be measured for payment in place in feet (meters). The length measured will include stops, fittings, and valves.

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill will be measured for payment according to Article 208.03.

561.05 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for WATER MAIN, of the diameter specified.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to in Article 208.04.

SECTION 562. WATER SERVICE LINE

562.01 Description. This work shall consist of constructing a water service line.

562.02 Materials. Materials shall be as shown in the contract.

CONSTRUCTION REQUIREMENTS

562.03 General. Work shall be performed according to the Illinois Plumbing Code or local codes where applicable, except as follows.

Any excavation required shall be only sufficient to install the water service line. Surplus material shall be disposed of according to Article 202.03.

The applicable requirements of Article 550.07 shall govern the backfilling, except that backfilling shall not be done in freezing weather nor made with frozen material.

562.04 Method of Measurement. This work will be measured for payment in place in feet (meters). The length measured will include stops, fittings, and valves.

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill will be measured for payment according to Article 208.03.

562.05 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for WATER SERVICE LINE, of the internal diameter specified.

Excavation in rock will be paid for according to Article 502.13.

Trench backfill will be paid for according to Article 208.04.

SECTION 563. ADJUSTING SANITARY SEWERS AND WATER SERVICE LINES

563.01 Description. This work shall consist of adjusting sanitary sewers and water service lines.

563.02 Materials. Materials shall be as shown in the contract. Materials for replacement shall be new and of the same kind as, or equal to, the material being replaced.

CONSTRUCTION REQUIREMENTS

563.03 General. When a Sanitary District, Municipality, or Water District has jurisdiction of a sanitary sewer or water service line, the work shall be performed as prescribed by the Sanitary District, Municipality, or Water District and shall meet the approval of its Engineer.

Materials suitable for reuse in the opinion of the Engineer shall be carefully removed to prevent damage. Such materials damaged by the Contractor shall be replaced. All material removed and not reused shall become the property of the Contractor.

Surplus material shall be disposed of according to Article 202.03.

563.04 Adjusting Sanitary Sewers. Adjustment of sanitary sewers shall be according to the "Standard Specifications for Water and Sewer Main Construction in Illinois". The applicable requirements of Article 550.07 shall govern the backfilling, except that backfilling shall not be done in freezing weather nor made with frozen material.

563.05 Adjusting Water Service Lines. The work necessary to adjust water service lines shall be performed according to Article 562.03.

Any water service line, other than copper, which is or will be under a base or surface course and which requires adjustment, shall be replaced with copper pipe according to the requirements of Article 1006.33.

563.06 Method of Measurement. This work will be measured for payment in place in feet (meters). The length measured will include stops, fittings, and valves.

Excavation in rock will be measured for payment according to Article 502.12.

Trench backfill will be measured for payment according to Article 208.03.

563.07 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for ADJUSTING SANITARY SEWERS, (8 IN. (200 MM) DIAMETER OR LESS); ADJUSTING SANITARY SEWERS, (OVER 8 IN. (200 MM) DIAMETER); and ADJUSTING WATER SERVICE LINES.

Excavation in rock will be paid for according to Article 502.13.

Trench Backfill will be paid for according to Article 208.04.

The furnishing of materials, except for replacement of materials damaged by the Contractor, will be paid for according to Article 109.04.

SECTION 564. MOVING FIRE HYDRANTS

564.01 Description. This work shall consist of moving and adjusting existing fire hydrants, with auxiliary valves when applicable, which interfere with the construction of the proposed improvement.

564.02 Materials. Materials shall be as shown in the contract. Materials for replacement shall be new and of the same kind as, or equal to, the material being replaced.

CONSTRUCTION REQUIREMENTS

564.03 General. The work shall be performed in a manner approved by the Engineer of the Municipality or the Water District.

Fire Hydrants shall be set on a firm foundation and shall be thrust blocked. Thrust blocking shall consist of Class SI concrete cast against the fittings and the undisturbed earth on the side where the thrust is expected to occur. A minimum of 1/4 cu yd (0.2 cu m) of concrete shall be used for the thrust block. The dimensions of the thrust block shall be determined by the Engineer. Blocking shall be placed such that the pipe, fittings and joints shall be accessible for future repair.

Upon completion of relocating or adjusting the fire hydrant, it shall be tested and disinfected according to Article 561.03.

The hole formed by the removal of a fire hydrant and the remaining excavated area around the relocated fire hydrant shall be backfilled with fine aggregate.

Surplus material shall be disposed of according to Article 202.03.

Any fire hydrant damaged by the Contractor shall be repaired.

564.04 Basis of Payment. This work will be paid for at the contract unit price per each for FIRE HYDRANTS TO BE MOVED.

SECTION 565. MOVING DOMESTIC METER VAULTS AND WATER SERVICE BOXES

565.01 Description. This work shall consist of moving domestic meter vaults and water service boxes.

565.02 Materials. Materials shall be as shown in the contract. Materials for replacement shall be new and of the same kind as, or equal to, the material being replaced.

CONSTRUCTION REQUIREMENTS

565.03 General. The work shall be performed in a manner approved by the Engineer of the Municipality or the Water District.

The hole formed by the removal of the domestic meter vault or water service box shall be backfilled with fine aggregate.

Surplus material shall be disposed of according to Article 202.03.

Any domestic meter vault or water service box, including the stop cocks, which are damaged by the Contractor, shall be repaired.

565.04 Basis of Payment. This work will be paid for at the contract unit price per each for DOMESTIC METER VAULTS TO BE MOVED or DOMESTIC WATER SERVICE BOXES TO BE MOVED.

MISCELLANEOUS

SECTION 580. MEMBRANE WATERPROOFING FOR RAILWAY STRUCTURES

580.01 Description. This work shall consist of furnishing, transporting and placing all materials required to construct a membrane waterproofing system on railway structures.

The membrane waterproofing shall be of the bituminous or butyl rubber type as specified on the plans.

580.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Waterproofing Materials (Note 1)	1060
(b)	Fine Aggregate	1003.05

Note 1. The bitumen used shall be asphalt. The bitumen for mopping and for the protective cover shall be the same type as that with which the fabric is treated.

CONSTRUCTION REQUIREMENTS

580.03 General. Surfaces to be waterproofed shall be smooth and free from projections which might damage the waterproofing membrane and there shall be no depressions in horizontal surfaces of the finished waterproofing. Projections or depressions on the surface on which the membrane is to be applied that may cause damage to the membrane shall be removed or filled as directed by the Engineer. The surface shall be cleaned of dust, dirt, grease, and loose particles, and shall be dry before the waterproofing is applied. Concrete surfaces shall not be waterproofed until

a period of at least seven days has elapsed after the placing of the concrete, unless otherwise approved by the Engineer.

There shall be no depressions or pockets in horizontal surfaces of the finished waterproofing. The membrane shall be carefully turned into drainage fittings. Special care shall be taken to make the waterproofing effective along the sides and ends of girders and at stiffeners, gussets, and all other plates where the membrane terminates.

Bituminous membrane waterproofing shall not be applied when the atmospheric temperature is below 50 ºF (10 ºC) and butyl rubber membrane shall not be applied when the atmospheric temperature is below 10 ºF (-12 ºC), without written permission of the Engineer.

Surfaces of concrete or steel that are to be waterproofed shall be given one coat of Asphalt Primer (RC-70) before the first mopping of Asphalt (AWP), except that at construction and expansion joints where insulation is to be used, the surfaces shall not be coated with primer. The primer shall be applied to the surface in a uniform coating and may be applied without heating. A minimum of 1 gal (4 L) of primer per 100 sq ft (10 sq m) of surface shall be used. The priming coat shall be applied at least 24 hours before applying the waterproofing membrane and it shall be dry before the first mopping of bitumen is applied.

The primer shall be omitted for a width of 9 in. (225 mm) on each side of construction and expansion joints and a strip of insulating paper 18 in. (450 mm) wide shall be laid thereon before the waterproofing is applied. Insulating paper shall be a waterproof paper weighing not less than 10 lb/100 sq ft (0.5 kg/sq m).

Expansion joints and grooves shall be dry and clean; and shall be filled with plastic cement. Expansion joints and grooves filled with plastic cement shall be overfilled to allow for shrinkage.

580.04 Membrane Application. Bituminous and butyl rubber membranes shall be applied as specified.

(a) Bituminous Membrane. On surfaces that are vertical, or nearly so, the strips of fabric shall be laid vertically or with the slope; on other surfaces the strips shall be laid horizontally, beginning at the lowest part of the surface to be waterproofed. Sufficient fabric shall be allowed for anchorage at the upper edge of the surface to be waterproofed.

Surfaces to be waterproofed shall be mopped in sections. While the first mopping of bitumen is still hot, a strip of fabric shall be laid on the mopping and pressed into place. Each mopping thereafter shall be applied so that it will completely cover and seal the fabric. The amount of bitumen used for each mopping shall be not less than 4 1/2 gal/100 sq ft (1.8 L/sq m) of surface. The bitumen for mopping shall be heated to a temperature which will permit uniform application. Asphalt shall not be heated above a temperature of 350 ºF (175 ºC).

Asphalt (AWP) shall be used for mopping asphalt saturated cotton fabric.

Application of bituminous membrane shall be started by mopping a section of the surface 2 in. (50 mm) wider than 1/3 of the width of fabric. On this hot mopping, a 1/3 width of fabric shall be laid. The top surface of this fabric and an adjacent section of the surface 2 in. (50 mm) wider than 1/3 width of fabric shall then be mopped. On this hot mopping, a 2/3 width of fabric shall be laid completely covering the first strip. The top surface of this fabric and an adjacent section of the surface 2 in. (50 mm) wider than 1/3 width of fabric shall then be mopped. On this hot mopping shall be laid a full width of fabric completely covering the first and second strips. The top surface of this fabric and adjacent section, the width of 1/3 width of the fabric, shall then be mopped. On this hot mopping, the second full strip of fabric shall be laid lapping the first 1/3 width of the fabric at least 2 in. (50 mm). Thereafter, full widths of fabric shall be laid in hot moppings of bitumen and in such manner that each strip will lap the third preceding strip at least 2 in. (50 mm). Side laps shall be not less than 2 in. (50 mm) and end laps not less than 12 in. (300 mm).

The bituminous membrane shall be free from punctures, pockets or folds, and patching shall not be done without the permission of the Engineer. Where patching is permitted for defective waterproofing, the first ply shall extend at least 12 in. (300 mm) beyond the defective portion. The second and each succeeding ply of the patch shall extend at least 3 in. (75 mm) beyond the preceding ply.

The work shall be regulated so that at the end of the day all fabric that has been laid shall have received the final coat of bitumen, except that the fabric for making the lap shall not be mopped with bitumen until the joint is to be completed. With the approval of the Engineer, spraying will be permitted in lieu of mopping.

(b) Butyl Rubber Membrane. Butyl rubber membrane sheets shall be laid and secured in a hot mopping of bitumen applied over the primed surfaces. When the surface has been primed using RC-70, the mopping shall be with asphalt (AWP). An adhesive, compatible to the membrane and other materials, may be used in lieu of the hot mopping of bitumen, at the option of the Contractor. If adhesive is used, it shall be applied to the areas to be waterproofed in a thin layer with a squeegee at a rate of 1 gal/100 sq ft (0.4 L/sq m).

Membrane sheets shall first be positioned and drawn tight without stretching. Half of the membrane sheet shall then be uniformly rolled up in a direction away from the starting edge or subsequent splice. The bitumen or adhesive shall now be applied to the exposed area. If adhesive is used, it shall be allowed to dry so as not to stick to a dry finger touch. The membrane shall then be unrolled and pressed firmly and uniformly in place, using care to avoid trapping air. The same procedure shall be used for the remaining half of the membrane sheet. Wrinkles and buckles shall be avoided. Each succeeding sheet shall be positioned to fit the previously installed sheet and spliced.

Splices shall be of tongue-and-groove or lap type. All seam, lap, and splice areas shall be cleaned with heptane, hexane, toluene, trichlorethlene, or

white gasoline, using a clean cloth, mop, or similar synthetic cleaning device. Rubber cement shall be spread continuously on seam, lap, and splice areas at a uniform rate of not less than 2 gal/100 sq ft (0.8 L/sq m). After the rubber cement is allowed to dry until it will not stick to a dry finger touch, butyl gum tape shall be applied to the cemented area of membrane. The tape shall be extended at least 1/8 in. (3 mm) beyond edges of splice and lap areas. The tape shall be rolled or pressed firmly into place so full contact is obtained. Bridging and wrinkles shall be avoided. Corner splices shall be reinforced with two continuous layers of rubber membrane over one layer of butyl tape.

All projecting pipe, conduits, and sleeves passing through butyl rubber membrane waterproofing shall be flashed with prefabricated or field-fabricated boots or fitted coverings, as necessary to provide watertight construction. Butyl gum tape shall be used between layers of rubber membrane.

Any holes in the membrane sheeting shall be patched with a minimum overlap of 4 in. (100 mm) and according to the manufacturer's instructions. During construction, care shall be exercised to prevent damage to the membrane by workers or equipment.

580.05 Protective Cover. The protective cover shall be placed over the membrane as soon as practicable after the membrane has been laid. Dirt and other foreign material shall be removed from the surface of the membrane before the protective cover is placed.

At expansion joints of decks protected with butyl rubber membrane, a strip of anti-bonding paper 18 in. (450 mm) wide shall be laid above and below the membrane before the protective cover is applied.

One of the following methods of protection shall be used.

(a) A layer of asphalt plank not less than 1 1/4 in. (30 mm) thick laid in a mopping of asphalt with all joints filled with asphalt.

(b) A layer or layers of asphaltic panels not less than 3/4 in. (20 mm) in total thickness.

For bituminous membrane, the asphalt plank protection shall be laid in hot asphalt (AWP). The asphalt shall be applied at the rate of not less than 5 gal/100 sq ft (2 L/sq m) of surface. As successive planks are laid, the edges and ends of adjacent planks already laid shall be coated heavily with hot asphalt. The planks shall be laid tight against those previously laid so that the asphalt will completely fill the joints and be squeezed out at the top. After all planks are laid, any joints not completely filled shall be filled with hot asphalt. The ends of adjacent planks shall be staggered.

For butyl rubber membrane, the asphalt plank shall be laid in a coating of bonding adhesive. The bonding adhesive shall be the same as that used for securing the membrane to the deck. The adhesive shall be applied at a rate of not less than

1 gal/100 sq ft (0.4 L/sq m). Voids between the joints shall be filled with a compatible material.

Asphaltic panels are available in various thicknesses. To obtain the thickness of 3/4 in. (20 mm) required, the recommended application is in two layers with the joints staggered. The panels shall be laid tight jointed with an approved adhesive. For bituminous membrane, the asphaltic panels shall be laid in hot asphalt (AWP) and for butyl rubber membrane, the panels shall be laid in a coating of bonding adhesive. The application rate shall be the same as previously specified for asphalt planks. Any voids between the panels shall be filled with a material compatible to both the membrane and the panel.

When asphaltic panels are used as a protective cover, a 2 in. (50 mm) layer of fine aggregate shall be placed over the panels as a cushion prior to placement of ballast. The cost of this cushion shall be included in the bid price for membrane waterproofing.

580.06 Method of Measurement. This work will be measured for payment as follows.

(a) Contract Quantities. The requirements for the use of Contract Quantities shall conform to Article 202.07(a).

(b) Measured Quantities. The membrane waterproofing will be measured for payment in place, and the area computed in square feet (square meters). The area for measurement will include only the surface of the membrane waterproofing covered with a protective cover.

580.07 Basis of Payment. This work will be paid for at the contract unit price per square foot (square meter) for MEMBRANE WATERPROOFING.

SECTION 581. WATERPROOFING MEMBRANE SYSTEM

581.01 Description. This work shall consist of furnishing and placing a waterproofing membrane system over a properly prepared concrete bridge deck prior to placing of the hot-mix asphalt (HMA) surface course.

581.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Water	1002
(b)	Waterproofing Membrane System (Note 1)	1061

Note 1. The waterproofing membrane system shall consist of a penetrating primer, a built-up coal tar pitch emulsion membrane with two plies of coated glass fabric, and a 1/2 in. (13 mm) thick asphalt sand seal protection layer.

CONSTRUCTION REQUIREMENTS

581.03 General. All methods employed in performing the work and all equipment, tools, and machinery used for handling materials and executing any part of the work shall be subject to approval of the Engineer before the work is started, and whenever found unsatisfactory, shall be changed or improved as required. All equipment, tools, machinery, and containers used shall be kept clean and maintained in a satisfactory condition.

581.04 Preparation of Concrete Deck. All surfaces which are to be covered shall be thoroughly cleaned by the use of air jets, water jets, mechanical sweeper, hand brooms, or other approved methods, or as required by the Engineer until the surface is free of all sand, clay, dust, salt deposits, and all loose or foreign matter. Any accumulations of oil or grease shall be scraped off the surface of the roadway after which those areas shall be cleaned with a strong caustic solution, the residue of which shall be thoroughly flushed away with clean water before application of the primer.

All cleaned areas shall be primed without delay as soon as they are dry. All dust and dirt shall be blown off with air jets immediately preceding application of primer. Any unusually sharp concrete edges on the deck surface which could puncture the membrane shall be corrected in a manner satisfactory to the Engineer prior to application of the primer. Exposed aggregate or rough spots shall be smoothed.

A 1/2 to 3/4 in. (13 to 20 mm) fillet of concrete or epoxy grout shall be placed in the cove area between curb, parapet, median and expansion dam faces, and the deck surface to prevent a void area where the membrane turns up the vertical face.

Concrete surfaces, structural steel, railing, passing vehicles, etc. shall be protected to prevent their being defaced by primer or other materials being used. Should defacement occur, the Contractor shall clean surfaces on the structure to the satisfaction of the Engineer and be solely responsible and liable for damage to passing vehicles. From the time the bridge deck is cleaned and prepared for the prime coat until the HMA is spread and compacted, the only traffic permitted on the area being treated shall be the necessary men and equipment to perform the work required.

581.05 Weather and Moisture Limitations. Work shall not be done during wet weather conditions, or when the deck and ambient air temperatures are below 45 ºF (7 ºC). The deck shall be surface-dry at the time of the application of the primer. The membrane shall not be placed until at least 28 days after deck-concrete placement on new structures unless otherwise directed. On existing structures where the normal traffic flow is interrupted by the project work, as much drying time after the curing period shall be allowed as is feasible before membrane placement.

581.06 Application of Membrane System. Pressure distributors used for the application of the tar emulsion shall be self-propelled, equipped with pneumatic tires, and capable of applying 0.08 to 0.10 gal/sq yd (0.4 to 0.5 L/sq m) of tar emulsion over the required width of application. Distributors shall be equipped with removable manhole covers, tachometers, pressure gauges, and volume measuring devices.

Mixing and agitating equipment furnished shall be either a portable power mixer or a tank-type power mixer. A portable mixer for use in drums shall have sufficient power and propeller blades shaped to thoroughly mix and pull the material upward from the bottom of the drum. Mixing in tanks may be done in round bottom tanks equipped with a power driven mixer of sufficient capacity to maintain the emulsion in suspension.

The primer and full membrane shall extend up the curb faces and other vertical barriers to at least the elevation of the top of the surfacing. The lips of drain openings and edges of open joints, deck slab, and other openings at deck level shall be completely sealed by extending the full waterproofing course over the lip or edge.

The penetrating primer shall be applied by spraying, preferably with high pressure hydraulic equipment using hand-held spray bars that permit close control of the quantity applied. Applied at the rate of approximately 0.01 gal/sq yd (0.05 L/sq m), the quantity shall be controlled to produce a "brown coat" filling all pores and depressions but devoid of lakes or pools showing a solid film when dried out. The purpose of the primer is to neutralize the concrete surface and not to produce a membrane film by itself.

Primer shall not be diluted unless ordered by the Engineer. A distributor truck shall not be used to apply the primer unless its performance has been demonstrated and its use approved by the Engineer. Surfaces shall be dry when primer is applied, and the weather and atmospheric conditions favorable for a drying period of at least four hours. Care shall be taken that the primer does not flow onto nor is applied over bituminous or mastic materials.

Coal tar pitch emulsion shall not be applied until the primer has cured for 24 hours or until all solvents that may cause bleeding of the emulsion have evaporated. The coal tar pitch emulsion coatings shall not be applied when the weather is foggy or when rain threatens, or when the atmospheric or pavement temperature is below 45 ºF (7 ºC).

Due to the settling that may take place in transit, the emulsion shall be thoroughly agitated by power mixers so that a homogeneous consistency is assured for proper and uniform application.

A total of four applications of emulsion shall be applied to the deck, the fourth coat being in the form of a slurry. The slurry shall be applied at the rate of 0.30 gal/sq yd (1.4 L/sq m) in order to obtain 0.13 to 0.15 gal (0.5 to 0.6 L) of undiluted coal tar emulsion per square yard (square meter). The first three coats of undiluted coal tar emulsion shall be applied at the rate of 0.08 to 0.10 gal/sq yd (0.4 to 0.5 L/sq m). Two layers of fiberglass fabric shall be placed parallel to the length of the bridge. The necessary time shall be allowed between coats for proper setting. After the roadway surface has been properly primed and approved by the Engineer, the coal tar pitch emulsion shall be applied according to one of the two following methods.

(a) Hand Method. The emulsion shall be applied in four coats in the amounts per square yard (square meter) as required. The undiluted material shall be poured in strips on the pavement and spread with a squeegee or brush, smoothing out with a brush. This procedure shall be continued until the

entire area is covered. Application can also be made by means of a heavy spray gun when approved by the Engineer. The first coat shall be allowed to dry or cure sufficiently to prevent pickup before the second coat is applied. When spreading the second coat, it shall be spread crosswise to the placing of the first coat when practicable.

(b) Distributor or Applicator. When applied by distributor or approved type of applicator, the emulsion shall be applied uniformly to the surface of the pavement at the prescribed pressures and in the amount per square yard (square meter) as stated. The emulsion shall be thoroughly mixed before use. When necessary to dilute the emulsion in order to aid proper application, the emulsion may be diluted with a maximum of ten percent by volume of clean fresh water as directed by the Engineer.

In all cases, the waterproofing shall begin at the low point of the surface to be waterproofed so that water will run over and not against the laps.

One width of the fiberglass fabric shall be laid loosely into the second coat of emulsion while the film is still wet. The fabric shall be brushed into the emulsion thereby eliminating all wrinkles and blisters, but without stretching the fabric tight. The adjoining widths of fabric shall be installed in the same fashion, side lapping the former by 3 in. (75 mm). All end laps shall be at least 12 in. (300 mm). The upper layer of fabric shall be applied in the same manner, but the laps shall extend over the lower laps by at least 6 in. (150 mm).

The fourth coat shall be a slurry top coat. The emulsion and aggregate shall be blended and premixed to produce a slurry top coat. The coal tar emulsion may be diluted up to a ratio by volume of 0.1 parts water to one part coal tar pitch, emulsion to facilitate the mixing and spreading of the slurry. The slurry shall contain a nominal 4 lb (0.5 kg) of fine aggregate per gallon (liter) of coal tar pitch emulsion.

Before application, the materials shall be proportioned accurately and mixed by suitable mixing equipment. Mixing machines for preparing the slurry may be mortar mixers, concrete mixers, or any type approved by the Engineer capable of producing a uniform mixture of emulsion and aggregate. The emulsion and the water shall be first charged into the mixer and blended into the desired consistency. Then the aggregate shall be added at a slow and uniform rate while the mixing is continued until the batch aggregate is incorporated. After all the components are in the mixer, the mixing shall continue for minimum of five minutes or as long as may be necessary to produce a smooth, free flowing, homogeneous mixture of a uniform consistency. Mixing shall be continuous from the time the bitumen is placed into the mixer until the slurry is poured into the spreading equipment.

During the entire mixing process, there shall be no breaking, segregating or hardening of the emulsion, nor balling, lumping, or swelling of the aggregate. After the required mixing period, the slurry shall be spread over the designated area while the slurry is of the proper consistency. The slurry shall be applied at the rate of 0.28 to 0.30 gal/sq yd (1.3 to 1.4 L/sq m) in order to obtain 0.13 to 0.15 gal (0.5 to 0.6 L) of undiluted coal tar emulsion per square yard (square meter).

The application of the slurry shall be either by hand methods using rubber squeegees for spreading or by any other suitable mechanical method approved by the Engineer. The slurry shall be applied at a uniform rate as specified.

A suitable spray type applicator or distributor approved by the Engineer may be used for applying the slurry. Such equipment shall be equipped with an agitator to keep the slurry uniformly mixed before and during application and so designed to uniformly spread the slurry on the roadway at the specified rate of application.

At all times, particular care shall be taken to protect the membrane from damage. Any damage which may occur shall be repaired by patching in a manner satisfactory to the Engineer. The complete membrane shall be allowed to cure for at least 24 hours before placement of the protection layer.

581.07 Protection Layer. The fine aggregate and asphalt binder shall be combined in such proportions that the composition by weight of the finished mixture shall be as directed by the Engineer but within the following range limits.

Fine Aggregate	90.0 to 93.0 %
Asphalt Binder	7.0 to 10.0 %

The hot-mix asphalt (HMA) plant used for the manufacture of the protection course material shall be capable of producing completely coated uniform mixtures within the tolerances set forth and at a uniform workable temperature as specified by the Engineer, but not to exceed 350 ºF (175 ºC) for the mixture when leaving the plant.

The exact proportions, within the limits specified, shall be regulated so as to produce a satisfactory mixture with all particles coated with asphalt binder. The fine aggregate shall be mixed dry for not less than 15 seconds. The asphalt binder shall then be added in an evenly spread sheet over the full length of the mixer box. The mixing shall be continued for a period of not less than 30 seconds and at least until the aggregate is completely coated with asphalt binder.

The asphalt sand seal protection layer shall be placed and compacted according to the requirements of Section 406, except that the material shall not be mixed or placed when the atmospheric temperature is below 50 ºF (10 ºC). The temperature of the mix shall not be less than 290 ºF (144 ºC) at time of placement. The mix shall be placed and compacted so as to provide a protection layer of approximately 1/2 in. (13 mm) in thickness.

581.08 Sequence of Construction Operations. The sequence of construction operations for the waterproofing membrane systems shall be as follows.

(a) Penetrating Primer 0.01 gal/sq yd (0.05 L/sq m) [Cure 24 Hrs.]

(b) Coal Tar Emulsion 0.08 to 0.10 gal/sq yd (0.4 to 0.5 L/sq m) [Cure 4 Hrs.]

(c) Coal Tar Emulsion 0.08 to 0.10 gal/sq yd (0.4 to 0.5 L/sq m) & Fiberglass Fabric 1.65 oz/sq yd (55 g/sq m) [Cure 4 Hrs.]

(d) Coal Tar Emulsion 0.08 to 0.10 gal/sq yd (0.4 to 0.5 L/sq m) & Fiberglass Fabric 1.65 oz/sq yd (55 g/sq m) [Cure 4 Hrs.]

(e) Coal Tar Emulsion Slurry 0.3 gal/sq yd (1.4 L/sq m) [Cure 24 Hrs.]

(f) Asphalt Sand Seal Protection Layer 1/2 in. (13 mm) thick

581.09 Method of Measurement. This work will be measured for payment as follows.

(a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a).

(b) Measured Quantities. This work will be measured for payment and the area computed in square yards (square meters) of bridge deck surface covered. No measurement or allowance will be made for laps, material used for extending up curb faces or other vertical barriers, material used for extensions over lips or edges, or for repairs.

581.10 Basis of Payment. This work will be paid for at the contract unit price per square yard (square meter) for WATERPROOFING MEMBRANE SYSTEM.

SECTION 582. HOT-MIX ASPHALT SURFACING ON BRIDGE DECKS

582.01 Description. This work shall consist of constructing a hot-mix asphalt (HMA) surface course on a prepared bridge deck.

582.02 Materials. Materials shall be according to Article 406.02.

582.03 Equipment. Equipment shall be according to Article 406.03, except vibratory rollers will not be permitted on bridge decks.

CONSTRUCTION REQUIREMENTS

582.04 General. Work shall be according to Section 406, except as specified herein.

Only a tandem roller, meeting the requirements of Table 1 of Article 406.07(a), will be permitted for breakdown rolling.

582.05 Target Density. A target density will be established from tests conducted on a calibration strip consisting of 100 ft (30 m) of HMA surface course placed on the bridge deck.

A target count rate which represents the maximum compactive effort will be determined with nuclear testing equipment within the calibration strip.

Compaction of the calibration strip with the breakdown roller shall commence immediately after the surface course is placed and shall be continuous and uniform over the entire area. All rolling operations must be completed before the temperature

of the mixture drops below 190 ºF (90 ºC). At a minimum of two random locations within the calibration strip, a growth curve consisting of a plot of counts per minute vs. number of passes with a breakdown roller will be developed.

The growth curve at each random location will be established by using a nuclear gauge using a fast count or with a nuclear gauge using a 30-second timing cycle in the backscatter position. Tests will be made after each pass until the lowest count either raises or remains the same. At this time, mineral filler will be spread and a 4 minute (calibration) count will be taken in the backscatter position to establish the relative target density.

The established average target density shall apply throughout the project unless there are changes in mix materials or an appreciable change in the job mix formula. The Engineer may require a new average target density to be established if there is reason to believe that the mixture being placed is not the same as the mixture used to determine the target density.

582.06 Acceptance Tests. Acceptance tests will be performed once the average target density has been established. At least one acceptance test will be taken for each 200 ft (60 m) or portion thereof of bridge deck per paver pass. Acceptance tests on material placed in a single day shall average 98 percent of the established average target density with no one test being below 95 nor more than 103 percent of the established target density. If the above requirements for average or individual density tests cannot be obtained, placement of additional material will be discontinued until the cause of the failure is investigated and corrected.

Acceptance tests will be performed with the same nuclear equipment used to establish the average target density. Acceptance tests will be for one-minute duration and the area to be tested shall be prepared with mineral filler prior to testing.

582.07 Method of Measurement. This work will be measured for payment according to Article 406.13.

582.08 Basis of Payment. This work will be paid for according to Article 406.14.

SECTION 583. PORTLAND CEMENT MORTAR FAIRING COURSE

583.01 Description. This work shall consist of placing portland cement mortar along precast, prestressed concrete bridge deck beams as required for fairing out any unevenness between adjacent deck beams prior to placing of waterproofing membrane and surfacing.

583.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Portland Cement	1001
(b)	Fine Aggregate	1003.02
(c)	Water	1002

CONSTRUCTION REQUIREMENTS

583.03 General. This work shall only be performed when the air temperature is 45 ºF (7 ºC) and rising. The mixture for portland cement mortar shall consist of three parts sand to one part portland cement by volume. The amount of water shall be no more than that necessary to produce a workable, plastic mortar.

Prior to placement of the mortar fairing course, all areas where unevenness occurs between the deck beams shall be prepared according to Article 503.09(b).

The mortar shall be placed to the thickness necessary to eliminate unevenness between the beams. It shall be placed to form a smooth even surface from the higher beam edges to the lower surface. The mortar finished surface shall slope not less than 1:3 (V:H) and shall be feathered smoothly into the deck beam surfaces. The finish shall be free of depressions or sharp edges.

The mortar shall be cured for a period of not less than three days by the wetted burlap method according to Article 1020.13(a)(3). Curing shall commence as soon as practicable after mortar placement.

583.04 Method of Measurement. This work will be measured for payment in feet (meters) along the beam edges.

583.05 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for PORTLAND CEMENT MORTAR FAIRING COURSE.

SECTION 584. EPOXY GROUTING OF ANCHOR RODS AND BARS

584.01 Description. This work shall consist of drilling and epoxy grouting anchor rods and bars into hardened concrete.

584.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Chemical Adhesive Resin System	1027

CONSTRUCTION REQUIREMENTS

584.03 General. Holes shall be drilled in the concrete to 1/4 in. (6 mm) larger in diameter than the diameter of the anchor rods or bars and to the depth shown on the plans. A template or other approved method shall be used to assure accurate location of the drilled holes. All holes shall be blown free of concrete dust and chips and shall be absolutely dry prior to placing the epoxy grout.

Prior to inserting the anchor rod or bar into the hole, the hole shall be filled approximately 1/3 full of the mixed epoxy grout. The anchor rod or bar shall be inserted into the partially filled hole and moved up and down several times to insure total contact of the grout with concrete as well as the rod or bar. Additional grout shall be extruded to proper concrete level and finished as necessary. The anchor rod

or bar shall be aligned to maintain a perpendicular plane. No load shall be applied to the anchors until the grout has cured for at least 24 hours.

584.04 Basis of Payment. This work will not be measured or paid for separately, but shall be considered as included in the unit price bid for the item of construction involved.

SECTION 585. RESERVED

SECTION 586. SAND BACKFILL FOR VAULTED ABUTMENTS

586.01 Description. This work shall consist of furnishing, transporting and placing sand backfill behind vaulted abutments to serve as a form for the placement of the concrete approach slab.

586.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Fine Aggregate (Note 1)	1003.01

Note 1. The material for backfilling shall be bank-run or stockpiled sand.

CONSTRUCTION REQUIREMENTS

586.03 General. The wedge behind the abutments shall be backfilled with the sand material to the required elevation of the bottom of the approach span slabs. The backfill shall be placed in convenient lifts for the full width between the abutment sidewall. Mechanical compaction will not be required. Backfilling shall not be started until test specimens show that the concrete in the abutment has attained a flexural strength of 650 psi (4,500 kPa) but in no case until at least seven days have elapsed after the placing of the concrete. In the absence of tests to determine the flexural strength, the sand backfill shall not be placed until at least 14 days have elapsed after the placing of the concrete, exclusive of days on which the temperature of the air surrounding the concrete falls below 45 ºF (7 ºC).

The sand backfill shall be brought to the finished grade of the bottom of the abutment approach slab to serve as a base for placement of the slab. The Contractor, subject to approval of the Engineer, may prepare the top surface of the fill to receive the concrete as he/she deems necessary for satisfactory placement at no additional cost to the Department.

586.04 Method of Measurement. This work will be measured for payment as follows.

(a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a).

(b) Measured Quantities. This work will be measured for payment in place and the volume computed in cubic yards (cubic meters). The volume will be

determined by measuring the wedge areas above the embankment slope, behind the abutment mainwalls, and for the full width between sidewalls.

586.05 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for SAND BACKFILL.

SECTION 587. CONCRETE SEALER

587.01 Description. This work shall consist of furnishing and applying a sealer to concrete structures as shown on the plans.

587.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Concrete Sealer	1026

CONSTRUCTION REQUIREMENTS

587.03 General. Before the sealer is applied, the concrete surface shall have a minimum 48 hour drying period, and shall be cleaned with oil-free compressed air or wire brushes to remove all oil, grime, and loose particles. Surfaces that will not respond to cleaning by compressed air or wire brushes shall be cleaned by sandblasting.

Care shall be taken to prevent the sealer from flowing over the edges and onto any concrete that is not to be sealed.

The sealer shall be applied according to the manufacturer's instructions, and information provided in the approved list of Concrete Sealers.

587.04 Method of Measurement. This work will be measured for payment in place and the area computed in square feet (square meters).

587.05 Basis of Payment. This work will be paid for at the contract unit price per square foot (square meter) for CONCRETE SEALER.

SECTION 588. CONCRETE JOINT SEALER

588.01 Description. This work shall consist of sealing the horizontal joint in the bridge roadway slab.

588.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Concrete Joint Sealer	1058

CONSTRUCTION REQUIREMENTS

588.03 General. The faces of all joints to be sealed shall be free of all foreign matter, curing compound, oils, grease, dirt, free water, and laitance. Concrete joints to be sealed shall be free of cracked or spalled areas. Any cracked areas shall be chipped back to sound concrete before placing joint sealer.

The concrete joint sealant shall be applied only when the ambient temperature is 68 ºF (20 ºC) and rising.

A continuous length of backer rod of the size designated on the plans, shall be placed in the joint opening at the depth below the finished surface of the joint shown on the plans. The surface of the rod shall be wiped clean with solvent (toluene or xylol) before installation.

All sealing compound shall be placed with an applicator recommended by the manufacturer, and the mixing and placing instructions of the manufacturer shall be adhered to. A copy of these directions and the specifications for the applicator to be used shall be filed with the Bureau of Materials and Physical Research.

No sealing compound shall be placed in a joint on any material (joint filler or expansion board) containing any bituminous material until a separating barrier of foil or other suitable material has been placed on top of bituminous material in such a manner so that the sealing compound cannot contact the bituminous material. No material that will allow bitumen to soak through may be used. When it is deemed necessary to prevent bonding of the sealing compound to a joint surface, the Engineer may require the Contractor to place, at no extra cost, paper, plastic, or foil barriers over the joint surface before applying the sealing compound.

The joint must be covered with a masking tape before the application of the protective coat on the bridge deck to prevent the spray from filming the vertical faces.

All bridge joints shall be filled to 1/4 in. (6 mm) below the finished surface of the joint. This is to be interpreted to mean that the surface of the sealant shall be level and the point of its contact with the sidewalls of the joint shall be 1/4 in. (6 mm) below the finished surface of the joint.

Any sealing compound that is not bonded to the joint wall or face 24 hours after placing shall be removed and the joint shall be cleaned and resealed.

588.04 Basis of Payment. This work will not be paid for as a separate item, but shall be considered as included in the unit price bid for the major item of construction involved.

SECTION 589. ELASTIC JOINT SEALER

589.01 Description. This work shall consist of furnishing and placing an elastic sealer in joints of hot-mix asphalt (HMA) surface course on bridge decks.

589.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Hot-Poured Joint Sealer	1050.02

CONSTRUCTION REQUIREMENTS

589.03 General. Prior to sealing, the joint shall be sawed to form a reservoir for the sealing material. The sawed joint shall be 1/4 in. (6 mm) wide and 3/4 in. (20 mm) deep. Immediately prior to pouring the elastic sealer, the joint shall be cleaned with compressed air and shall be free of foreign and loose material and in a dry condition. The joint shall not be poured when the temperature is below 40 ºF (4 ºC) or when the weather is foggy or rainy.

The equipment required for this work shall be approved by the Engineer before the work will be permitted to start. The heating apparatus and equipment for applying the sealing material shall meet the recommendations of the manufacturer supplying the sealing material, and shall be such that the joint will be completely filled from bottom to top to the satisfaction of the Engineer.

Sufficient compound shall be placed in the joints so that the top of the seal is flush with the top surface of the wearing course.

589.04 Basis of Payment. This work will not be paid for as a separate item, but shall be considered as included in the unit price bid for the item of HMA surface course involved.

SECTION 590. EPOXY CRACK INJECTION

590.01 Description. This work shall consist of injecting cracks in structural concrete with an epoxy bonding compound, or as designated in the contract.

590.02 Materials. Materials shall be according to the following.

Item	Article/Section
(a) Epoxy Bonding Compound	1025.01

CONSTRUCTION REQUIREMENTS

590.03 General. Only cracks or portions thereof that are 0.007 in. (0.2 mm) or wider shall be injected.

The areas for epoxy crack injection shall be prepared by removing all dust, debris, or disintegrated material from the crack by the use of oil-free compressed air and/or vacuuming. Any cracks holding oil or grease shall be chipped out to clean concrete.

Horizontal and vertical cracks shall have suitable one-way injection ports installed every 6 to 18 in. (150 to 450 mm) or as required, depending on the width of crack, the horizontal or vertical location, and the dimensions of the member. The surface of cracks between the injection ports shall be sealed with a suitable sealing compound recommended by the supplier of the epoxy bonding compound. When the sealing compound is cured, mechanical pressure equipment shall be used to inject the epoxy bonding compound into the cracks.

Injection shall begin at the bottom and progress upward when applicable. The injection pressure and epoxy bonding compound flow characteristic shall result in 90 percent penetration of the epoxy bonding compound. Injection shall continue until refusal, and without damage to the structural concrete. Pressure injection shall not exceed 500 psi (3450 kPa). When the epoxy bonding compound is cured, the injection ports and sealing compound shall be removed and the surface smoothed by stoning or grinding.

590.04 Method of Measurement. This work will be measured for payment in place in feet (meters).

590.05 Basis of Payment. This work will be paid for at the contract unit price per foot (meter) for EPOXY CRACK INJECTION.

SECTION 591. GEOCOMPOSITE WALL DRAIN

591.01 Description. This work shall consist of furnishing and installing geocomposite wall drain on the soil side of abutment walls, wing walls, retaining walls, and culvert sidewalls.

591.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Geocomposite Wall Drain	1040.07

CONSTRUCTION REQUIREMENTS

591.03 General. Geocomposite wall drain shall be constructed in horizontal courses with the first course resting on the top of the footing. The geocomposite shall be in direct contact with the wall and secured with concrete nails not less than 2 in. (50 mm) long with approved washers not less than 9 sq in. (5800 sq mm) in area. The spacing of the concrete nails shall be as directed by the Engineer but shall not be more than 3 ft (1 m) apart, both horizontally and vertically. There shall be at least one horizontal row of nails in each course.

Horizontal seams shall be formed by a 4 in. (100 mm) flap of geotextile extending from the upper course and lapping over the top of the lower course or by a 12 in.

(300 mm) wide continuous strip of geotextile centered over the seam and securely fastened to the upper course with continuous 3 in. (75 mm) wide plastic tape. The overlapping flap or strip shall be fastened to the lower course intermittently as directed by the Engineer, but the spacing shall not exceed 2 ft (600 mm). Vertical splices shall be formed by a 4 in. (100 mm) flap of geotextile extending from one or the other abutting pieces or by a 12 in. (300 mm) wide continuous strip of geotextile centered over the splice. Vertical splice flaps or strips shall be continuously fastened to the geocomposite with continuous applications of contact adhesive or 3 in. (75 mm) wide plastic tape.

The bottom, side, and top edges of the geocomposite shall be covered with a suitable cap formed by folding a 6 in. (150 mm) flap or a 12 in. (300 mm) wide strip of geotextile over the edge and securing it in place with a continuous application of contact adhesive or 3 in. (75 mm) wide plastic tape. All seams, splices, bottom caps, top caps, and end caps shall be constructed so that backfill material cannot enter the geocomposite during or after construction.

Connection to pipe outlet systems shall be as shown on the plans. Outlet fittings shall be fastened to the wall drains as directed by the manufacturer and so that backfill materials cannot enter the system during or after construction. If necessary, to facilitate the rapid and complete flow of water from the wall drain into the pipe outlet, a portion of the wall drain core equal to the cross section at the outlet shall be removed. Weep holes shall be accommodated by cutting a matching hole through the wall drain. An approved weep hole cover extending at least 4 in. (100 mm) from the edge(s) of the hole shall be securely fastened to the soil side of the wall drain by 3 in. (75 mm) wide plastic tape or contact adhesive applied continuously around its periphery.

591.04 Method of Measurement. This work will be measured for payment in place and the area computed in square yards (square meters).

591.05 Basis of Payment. This work will be paid for at the contract unit price per square yard (square meter) for GEOCOMPOSITE WALL DRAIN.

SECTION 592. BRIDGE WASHING

592.01 Description. This work shall consist of washing the entire bridge, including bridge deck, sidewalk, curbs, pier and abutment caps, all superstructure members, trusses, interior of truss members, flanges and webs of beams or girders, expansion joints, and drains to prevent deterioration of the structure.

592.02 Materials. Water shall be according to Section 1002.

592.03 Equipment. Washing equipment shall consist of power brooms, air compressors, water tanks, water pumps with associated delivery hardware, and hand tools, to properly flush, clean, and remove all foreign material from the bridge structure. Other types of washing equipment may be used, subject to approval of the Engineer. Water pressure shall be sufficient to remove the accumulated material without damaging paint coverage of the structural steel.

Other equipment may be necessary to gain access to areas designated for washing. It will be the Contractor's responsibility to determine and utilize whatever method and equipment best suits his/her operation to successfully wash the structure. This equipment shall be available to the inspector until final acceptance of the work.

CONSTRUCTION REQUIREMENTS

592.04 General. All accumulated foreign material shall be removed from the bridge. Special care shall be taken on connected parts, members below open joints and difficult to reach areas to remove all foreign material.

All deck drains shall be flushed with water under pressure. Blockages in the deck drains shall be removed so that they will drain properly. The drain system may have to be taken apart to remove large blockages. Should they be taken apart, they shall be returned to their original configuration immediately after washing. Foreign material in the scuppers at the drains shall be either removed externally or flushed down the drain system. The area beneath all expansion devices shall be thoroughly flushed and washed with water under pressure. These areas include drain troughs beneath the expansion device and pier tops immediately adjacent to the expansion device. All abutment and bridge seats shall have foreign material removed by compressed air, water under pressure, or hand sweeping. All structural steel and bearings shall be washed with water under pressure. All foreign debris shall be removed from truss members. All foreign material accumulated in the interior of members shall be removed. Areas which have been washed shall be free of all accumulate sand, gravel, dirt, bird nests and excrete, and other foreign materials. Free standing water shall be removed upon completion of washing.

The Contractor shall provide adequate protection against worker inhalation of dust from his/her washing operations.

The Contractor shall exercise due caution while washing those portions of the structures that are adjacent to or above parking lots, buildings, sidewalks, roadways, and railroad tracks. Dirt and debris deposited on adjacent property or redeposited on the bridge shall be removed to the satisfaction of the Engineer.

The Contractor shall obtain his/her own source of water.

592.05 Traffic Control. The road shall be kept open to traffic according to Article 701.17(d)(4).

592.06 Method of Measurement. This work will be measured for payment in units of each, at the locations specified.

592.07 Basis of Payment. This work will be paid for at the contract unit price per each for BRIDGE WASHING at the location specified.

SECTION 593. CONTROLLED LOW-STRENGTH MATERIAL, BACKFILL

593.01 Description. This work shall consist of furnishing and placing controlled low-strength material (CLSM) as backfill for pipe culverts, storm sewers, structure excavation, or other excavations as specified.

593.02 Materials. Materials shall be according to the following.

	Item	Article/Section
(a)	Controlled Low-Strength Material (CLSM)	1019

CONSTRUCTION REQUIREMENTS

593.03 General. The mix shall not be placed on frozen ground, in standing water, or during wet weather conditions. Mixing and placing shall begin only when the air temperature is at least 35 ºF (2 ºC) and rising. At the time of placement, the material temperature shall be at least 40 ºF (5 ºC). Mixing and placing shall stop when the air temperature is 40 ºF (5 ºC) and falling.

The mix shall not be exposed to freezing temperatures or wet weather conditions during the first 24 hours after placement.

The mix may be subjected to loading upon approval by the Engineer or when a penetration of 1.5 in./blow (38 mm/blow) or less has been obtained with the Dynamic Cone Penetration (DCP) test.

593.04 Placement. The mix shall be placed directly from the chute into the space to be filled. Other placement methods may be approved by the Engineer if the mix design is appropriate.

(a) Structures. When backfilling against structures, the mix shall be placed in lifts to prevent damage by lateral pressures. Side slopes shall be stepped or serrated to prevent wedging action of the backfill against the structure. Each lift shall be allowed to harden prior to placing the next lift.

(b) Pipes. When backfilling pipe culverts or storm sewers, the mix shall be distributed evenly on each side of the pipe and placed in lifts. The first lift shall be placed up to one-fourth the height of the pipe and allowed to settle. After settlement of the first lift, as determined by the Engineer, the second lift shall be placed up to one-half the height of the pipe and allowed to settle. After settlement of the second lift, as determined by the Engineer, the remainder of the trench shall be filled.

When backfilling concrete pipes, the mix may be placed in a single lift.

593.05 Method of Measurement. This work will be measured for payment as follows.

(a) Contract Quantities. The requirements for the use of contract quantities shall be according to Article 202.07(a).

(b) Measured Quantities. This work, when specified, will be measured for payment in place and the volume computed in cubic yards (cubic meters).

(1) Structures. When CLSM is specified for backfilling structures, the computed volume will not exceed the volume computed for the excavation according to Article 502.12(b) with a deduction for the volume of the structure.

(2) Pipe Culverts and Storm Sewers. When CLSM is specified for backfilling pipe culverts or storm sewers, the computed volume will not exceed the volume of the trench as computed by using the trench width specified in Sections 542 and 550 and the actual depth of the completed backfill above the top of the bedding materials, with a deduction for the volume of the pipe.

593.06 Basis of Payment. This work will be paid for at the contract unit price per cubic yard (cubic meter) for CONTROLLED LOW-STRENGTH MATERIAL.