CITY OF SPRINGFIELD CONSTRUCTION AND MATERIAL SPECIFICATIONS

December 2021
Revision June 2023

Construction (Methods and Materials) shall be performed in accordance with the latest edition of City of Springfield Construction and Material Specifications and Standard Drawings. If no City Specification is available, the latest edition of the Ohio Department of Transportation "Construction and Material Specifications" shall apply.

200 EARTHWORK

ITEM 202 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Item 202 of the current State of Ohio Department of Transportation Construction and Materials Specifications shall govern the requirements for this item, with the following exceptions:

202.04 Pipe Removed. The work under this section shall include excavating all material necessary to permit removing the pipe; disposing of excavated material, including broken pipe; sealing openings left in manholes, catch basins or existing pipes that are to remain in place. All work shall be done as directed by the Engineer.

202.05 Pavement, Drives, Walks, Curbs etc. Removed. Concrete Pavements, Drives, Walks, Curbs, etc. shall be removed at existing joints only, unless otherwise shown on the plans or directed by the Engineer. Where the removal limit is not at an existing joint, a saw cut shall be made to produce a neat joint. After removal, the existing joint and adjacent concrete shall be left in a straight, clean and undamaged condition. Adjacent concrete damaged by the Contractor shall be replaced at his expense.

202.10 Manhole, Catch Basin, and Inlet Removed. Existing drainage structures of these types designated for removal shall be removed under this item.

ITEM 261 PAVEMENT RESTORATION

261.01 Description. This work shall consist of the restoration of street pavement, by constructing new pavement using the specified materials in reasonably close conformity with the lines, grades, and dimensions shown on the plans or established by the Engineer.

261.02 Materials. Materials shall be:

Concrete……...…ODOT Class QC 1
Asphalt concrete……...…….... 441
Aggregate base……..……304
Tack coat.……..……407
Prime coat……..…….. 408

261.03 Composition. The composition of each type of pavement restoration as shown on the plans or directed by the Engineer shall be as follows (*Item 408, Prime Coat shall be used on restoration widths of over 8 feet only):

Type	Pavement Composition
A	2” Item 441, Asphalt Concrete Surface Course, Type 1 (448) on 8” Item 304, Aggregate Base with Item 408, Prime Coat applied at 0.4 gal. per sq. yd.*
B	1” Item 441, Asphalt Concrete Surface Course, Type 1 (448) on[A1] 2” Item 441, Asphalt Concrete Intermediate Course, Type 1 (448) on 9” Item 304, Aggregate Base with Item 408, Prime Coat applied at 0.4 gal. per sq. yd.*
C	2” Item 441, Asphalt Concrete Surface Course, Type 1 (448) on 4” Item 301, Bituminous Aggregate Base
C-Mod	Item 441, Asphalt Concrete Surface Course, Type 1 (448) – match existing Item 301, Asphalt Concrete Base equivalent to existing base with Item 407, Tack Coat applied at 0.06 gal. per sq. yd.
D	2” Item 441, Asphalt Concrete Surface Course, Type 1 (448) on 4” Item 441, Asphalt Concrete Intermediate Course, Type 1 (448) on 7” Item 305, Portland Cement Concrete Base with Item 407, Tack Coat applied at 0.08 gal per sq. yd.
D-Mod	Item 441, Asphalt Concrete Surface Course, Type 1 (match existing) 7” Item 305, Portland Cement Concrete Base with Item 407, Tack Coat applied at 0.08 gal. per sq. yd.
E	Pavement composition shall be as shown on the plans or as directed by the Engineer.

261.04 Construction. The existing edge of pavement along the trench shall be trimmed to neat lines prior to placing new asphalt. Provide a 6 inch shoulder of undisturbed earth on both sides of the trench, unless otherwise directed by the Engineer. All joints between new and old asphalt pavement shall be painted on the edges with RS-2 asphalt emulsion[A2] or approved equal prior to placement of asphalt restoration. All joints shall be sealed with RS-2 asphalt emulsion or approved equal a minimum of 3 inches wide. Loose sand cover shall be applied in areas directed by the Engineer.

All asphalt courses shall be applied in layers not to exceed 2 inches in depth.

Asphalt course depth for restoration types D and D-Modified shall be estimated by the Engineer for bidding purposes, but in shall no case be less than the existing asphalt cover.

Concrete base shall cure a minimum of 48 hours before the placement of any asphalt courses. Suitable barricades shall be furnished and placed to protect the areas until the concrete has cured or until the asphalt course has cooled.

Pavements shall be restored no later than one week after the work for which the pavement was removed has been completed and accepted. Required testing of any utility work under the pavement must be performed and the line accepted before the restoration of the pavement is done.

261.05 Method of Measurement. When the square yard is specified as the unit of measure for this Item, the quantity shall be the number of square yards of pavement restored to the limits designated by the Engineer and to the depth required for each type of restoration. The restoration shall be for the allowable trench width or the actual restored width, whichever is less. No deductions for manholes, valves, etc. will be made.

When the linear foot is specified as the unit of measure for this Item, the quantity shall be the number of linear feet of pavement restored to the limits designated by the Engineer and to the depth required for each type of restoration. Measurements shall be from center to center of manholes, valves, intersecting pipe, ends of pipe, etc.

261.06 Basis of Payment. Payment will be made at the contract price for:

Item	**Unit**	**Description**
261	Square yard	Pavement restoration, Type ___
261	Linear feet	Pavement restoration, Type ___

ITEM 262 BITUMINOUS BASE PULVERIZING AND SHAPING WITH CALCIMENT

262.01 Description. This work shall consist of scarifying, pulverizing and crushing the existing bituminous pavement to a depth of ten inches, removing surplus or unsuitable material, adding new material if required, and shaping, rolling and compacting the crushed base to the proper elevation and slope.

262.02 Equipment. The scarifying, pulverizing, and crushing shall be accomplished with a single piece of equipment. A pneumatic-tired or sheepsfoot roller shall be required for the initial rolling and a vibratory roller, minimum 10 ton, for the finished rolling.

262.03 Scarifying And Pulverizing. The material shall be scarified and uniformly pulverized to a maximum of two inches, except that five percent of the material may be oversized, provided that the oversize material is not so large as to adversely affect the stability and structural integrity of the base, nor hamper the shaping operations. Any excess or unsuitable material such as lumps, excess clay or other foreign substances hall be disposed of by the Contractor at the contractor's expense as directed by the Engineer. The material shall be scarified and uniformly pulverized, in one or more passes.

The outside lanes of the street shall be pulverized first. The inside lanes shall then be pulverized and the material stored on top of the previously pulverized material in the outside lanes. Unsuitable material, as determined by the Engineer, shall not be stored for re-use. After pulverization and storage, material from the inside lanes shall be excavated and disposed of. A sufficient amount of material shall be removed in order to obtain a finished surface cross slope of 3/16 inch per foot. The cost for excavation and disposal of material shall be included in the unit priced bid for Item 262.

After sufficient material has been removed from the inside lanes, the stored material shall be placed and spread evenly throughout the excavated area.

262.04 High-crowned Streets. On abnormally high-crowned streets, additional excavation from the inside lanes will be required in order to obtain the desired finished cross slope. The Engineer will determine and identify streets that require additional excavation. Estimated quantities for additional excavation on high-crowned streets will be determined by the Engineer and paid for separately under Item 203.

262.05 Addition of Calciment [A3]**(or an approved equal).** Calciment or an approved equal shall be applied to the pulverized material at a minimum rate of 6 lb/in of depth/sy using a vane type spreader. The calciment will be blended with the pulverized material to the desired depth and brought to the optimum moisture content for the soil classification for shaping, compacting and curing. The calciment shall not be added until all excess material which is not to be incorporated into the work has been removed.

Any proposed changes to the job mix formula must be submitted in writing and are to pre-approved by the City Engineer before the work commences. Samples and/or testing may be required by the City Engineer. Contractor will identify the source of materials.

262.06 Grading, Shaping, Rolling, And Compacting. The scarified and pulverized material shall be spread to the existing street width. The intent of this grading operation is to balance the pulverized material in such a manner so that the slope and profile will be approximately parallel to the existing street profile.

The laboratory density shall be determined in accordance with ASTM D1557, Method D. The pulverized material shall be compacted to not less than 98 percent of the unit weight obtained by the ASTM D1556, D2167 or D2922 test method.

If the amount of pulverized material is not sufficient to provide adequate grade, No. 304 aggregate shall be added to the material as directed by the Engineer.

262.07 Finishing And Compacting. After spreading, the pulverized material shall be thoroughly compacted by rolling. The rolling shall progress gradually from the sides to the center of the lanes under construction, or from one side toward previously placed material by lapping uniformly each preceding rear-wheel track by one-half the width of such track. Rolling shall continue until the entire area of the course has been rolled by the rear wheels. The rolling shall continue until the stone is thoroughly set, the voids of the material reduced to a minimum, and until creeping of the stone ahead of the roller is no longer visible. Rolling shall continue until the base material has been compacted to not less than 98% density, as obtained by the ASTM D1556, D2167, or D2922 test method. Blading and rolling shall be done alternately, as required or directed, to obtain a smooth, even, and uniformly compacted base.

The pulverized material shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the base course. In areas inaccessible to rollers, the pulverized material shall be tamped thoroughly with mechanical tampers. Any water added, if necessary, to the material during rolling shall be in the amount and by equipment approved by the Engineer.

The cross-slope of pulverized material surface shall conform to the specified cross-slope as determined in the field plus or minus 3/4 inch in 10 feet.

Work on the pulverized material shall not be accomplished during freezing temperatures nor when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.

If, in the opinion of the Engineer, the base has not been compacted to the desired density, and it's structural integrity is not suitable for placement of the asphalt courses, the Contractor shall repair, to the satisfaction of the Engineer, any defective areas at no additional cost to the City.

262.08 Method Of Measurement. The work involved in this item, including all labor, equipment, materials, and supplies for the base pulverizing and shaping will be measured by the number of square yards complete and accepted. Base pulverizing will be calculated for bid purposes using a nominal depth of ten inches. No. 304 aggregate will be measured by the cubic yard and paid for under the pertinent 304 item.

262.09 Basis of Payment. The work included in this item shall be paid for at the contract price, complete in place. The cost of pulverizing to depths is excess of ten inches will be paid for by supplemental agreement.

Item	Unit	Description
262	Square yard	Bituminous base pulverizing and shaping with calciment.

500 STRUCTURES

ITEM 503 ROCK EXCAVATION[A4]

503.01 Description. This work shall consist of the excavation of rock where encountered to the line, grade and cross section as shown on the plans, or in the case of trench excavation, as described herein.

503.02 Construction. Trenches shall be excavated to a width sufficient to allow for proper jointing of the conduit and thorough compaction of the granular bedding as well as proper backfill around the conduit. The width of trench for sewer pipe shall be restricted in accordance with Item 803. Trench widths for water mains shall be in accordance with Item 838. Backfill and bedding for those areas of rock excavation shall be placed in accordance with and paid for under Item 803 and Item 838 for sewer pipe and water main respectively.

The Contractor shall provide and operate any equipment necessary for the removal of all water entering the excavation. The Contractor shall also be responsible for any damage incurred by such water.

Blasting shall be subject to approval by the Engineer and acquisition of a blasting permit from the Fire Chief.

Adequate precautions shall be taken and insurance carried to cover damage arising from blasting, or use of mechanical equipment for excavating or drilling. Special conditions shall be as indicated on the construction drawings.

Disposal sites for rock excavation shall be subject to approval by the Engineer.

503.03 Method of Measurement. The quantities of rock excavation to be paid for shall be the actual number of cubic yards of material in the original position, acceptably excavated. Rock excavation outside plan lines or in the case of trench excavation beyond maximum allowable trench widths and depths, shall not be included in measurement for payment.

503.04 Basis of Payment. The accepted quantities, including the furnishing of all labor, equipment, and material necessary to excavate the rock shall be paid for at the contract price for:

Item	Unit	Description
503	Cubic yards	Rock Excavation

600 INCIDENTALS

ITEM 608 DRIVES, WALKS, CURB RAMPS AND STEPS

608.01 Description. This work shall consist of constructing drives, walks, 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.

608.02 Materials. Materials shall be:

Concrete (Class QC 1)..……..ODOT CMS Item 499
Subgrade Material. …….……..…ODOT Item 304
Crushed Stone or
Approved Equal
Expansion Joint Material ……...…….……...AASHTO M 153
or AASHTO M 213
Or Foam Joint Filler – "Foamtech" or approved equal
Curing Material…….. ……ASTM C 309

608.03 Concrete Walks and Drives.

(a) Excavation shall be made to the required depth and to a width that will permit the installation and bracing of forms. The removal of existing walks or drives shall be as per 202. Any fill necessary to bring the subgrade to the proper grade shall be made using Item 304, crushed stone or other material approved by the Engineer. The cost of any fill required to bring the subgrade to grade shall not be paid for separately, but shall be included in the price bid for this item. The subgrade shall be shaped and uniformly compacted to a surface conforming to the plans or as ordered using mechanical vibratory compacting equipment. All tree roots shall be trimmed to a point at least 2 inches clear of any concrete placed.

(b) Forming. Forms shall be metal or sound 2 inch, nominal size, wood plank and extend for the full depth of the concrete, and be of sufficient strength to resist the pressure of the concrete without springing. Forms for circular sections may be metal or plywood. Forms shall be straight, true, clean and coated with a suitable oil immediately before the concrete is placed. Forms must be approved by the Engineer prior to placing concrete.

Before placing concrete, any water or gas valve boxes shall be adjusted to final grade.

(c) Placing and Finishing. The subgrade shall be moistened thoroughly immediately prior to placing concrete. The concrete shall be deposited in a single layer and carefully place so as not to disturb the alignment of the forms, and thoroughly spaded or puddled to eliminate honeycomb. Honeycomb remaining after the forms have been removed shall be filled with a mortar of sand and cement. After placing concrete, the use of additional water on the surface to aid in finishing is not permitted. It shall be struck off with a template and smoothed with a float to obtain a sandy texture. The final surface shall be broom finished. No plastering will be permitted. All outside edges and joints shall be edged with a ¼ inch radius tool. The surface of walks shall be divided into equally spaced blocks at 5 foot intervals to form rectangular blocks. Transverse joints shall be formed to a depth of ½ inch if tooled, and 1/3 the depth of the slab if sawed, and shall be approximately 1/8 inch wide. Expansion joint filler (1/2 inch) extending the full depth of the concrete shall be installed between the new concrete and any fixed structure, including curbs, poles, valve boxes, and

at every 50 linear feet of new walk and on each side of a drive. No concrete shall be placed before 7:30 a.m. or after 4:00 p.m. except with the permission of the Engineer.

(d) Curing. Immediately after the final finishing and after the free water has disappeared, all exposed surfaces shall be sealed by spraying thereon, a uniform application of white curing membrane in such a manner as to provide a continuous uniform film without marring the surface of the concrete. Clear curing material may be used in place of white before May 15 and after September 15. The material shall be applied with an approved mechanical sprayer. Wind protection to the fog spray shall be provided by an adequate shield. A minimum of 1 gallon of material shall be used for each 200 square feet of surface treated. Curing material shall be thoroughly agitated immediately prior to use.

Adequate precautions shall be taken to protect the membrane from damage. If the film is broken or damaged at any time during the specified curing period, the area or areas affected shall be given a complete duplicate treatment of the curing material applied at the same rate as the first treatment. Any concrete showing injury or damage due to inadequate curing shall be repaired or replaced by the Contractor at no additional cost.

(e) Weather Limitations. When the temperature is below 36°F, or predicted to go below 36° F. in the next 72 hours, no concrete shall be placed without permission of the Engineer. Permission so granted shall be for the day and location in question only and must again be requested for subsequent days when the temperatures are as above. When such permission is granted, the following conditions must be met: adequate covering materials such as plastic and straw or paper and straw is on the site, and a sufficient number of workmen are present to place, finish and cover the concrete as soon as practicable; all forms must be cleaned of frost; concrete shall not be placed on frozen or frost-covered ground. A maximum of 2% calcium chloride admixture or other accelerator, approved by the Engineer, may be used.

(f) Protection. Adequate methods and devices, including barricades, guards and lighting shall be provided to protect the work, and pedestrian and vehicular traffic. Walks shall be protected from pedestrian traffic for not less than 24 hours. Drives shall be protected from vehicular traffic for not less than 72 hours.

608.04 Concrete Steps.

(a) The construction of concrete steps shall conform to the above specifications and to ODOT's Standard Drawing.

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

608.05 Curb Ramps. The construction of curb ramps shall conform to the above specifications. The final surface texture shall be rougher than adjacent walk and shall be obtained by coarse brooming or other method approved by the Engineer to obtain striations transverse to the ramp slopes and adhere to ODOT's STD BP-7.1, current edition

608.06 Method of Measurement. Walks and drives 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.

Curb ramps in new 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 new walk, which is measured through the curb ramp area. [A5]

608.07 Basis of Payment. The accepted quantities of specific items will be paid for at the contract prices designated for each of the pay items listed. Excavation, backfill, subgrade material, expansion joint material, hand railing and other miscellaneous items will not be paid for separately, but the cost thereof shall be included in the cost of the walks, drives, curb ramps and steps of which they are a part.

Payment will be made under:

Item	**Unit**	**Description**
608	Square foot	Concrete walk
608	Square foot	Concrete drive
608	Each	Curb ramps
608	Linear foot	Concrete Steps

ITEM 609 CURBING

Item 609 of the current State of Ohio Department of Transportation Construction and Materials Specifications shall govern the requirements for this item, with the following exceptions and additions:

609.02 Materials. Reinforcing steel is not permitted.

609.04 Cast in Place. Curb forms shall be either metal or sound two inch wood plank, and they shall be straight, true and clean. Forms for circular sections may be metal or plywood. All forms shall be the full depth of the back of curb and full depth for face of curb and gutter. Any fill necessary to bring the subgrade to the proper grade shall be made using Item 304, crushed stone or other material approved by the Engineer. The cost of any fill required to bring the subgrade to grade shall not be paid for separately, but shall be included in the price bid for this item. The subgrade shall be shaped and uniformly compacted to a surface conforming to the plans or as ordered using mechanical vibratory compacting equipment. All tree roots shall be trimmed to a point at least 2 inches clear of any concrete placed. The subgrade shall be moistened thoroughly immediately prior to placing concrete.

All curb and combination curb and gutter not constructed integral with the base or pavement shall have ¼ inch wide contraction joints constructed at 5 foot intervals. The contraction joints shall be ½ inch deep if tooled, and 1/3 the depth of the concrete if sawed.

Expansion joints shall be placed where new curbing abuts existing curbing, at driveways, at the ends of all circular sections, every 50 lineal feet and on either side of driveways and at 18 inches on each side of catch basins[A6]. Expansion joints shall be the full depth of concrete.

After removal of the forms, the void at the back of the curb shall be backfilled with earth tamped to solid compaction. The void remaining between the outside gutter edge and the street pavement shall be backfilled with Item 304 compacted to street grade, the cost of which shall be included in the unit price bid for the pertinent 609 item.

The completed curbing may be used for traffic when 3 days has elapsed.

609.08 Basis of Payment. Curbing having a radius of 50 feet or less shall be paid for separately.

Payment will be made under:

Item	Unit	Description
609	linear foot	Curb, Type ___
609	linear foot	Combination Curb and Gutter, Type ___

614 MAINTENANCE OF TRAFFIC

Item 614 of the current State of Ohio Department of Transportation Construction and Materials Specifications shall govern the requirements for this item, with the following additions or exceptions:

General. On projects where the road is open to through or local traffic, the Contractor shall provide access for basic services such as mail and parcel delivery and refuse removal.

The City will provide, install, and maintain signs prohibiting turns, regulating speed, prohibiting parking, and establishing detours unless specified otherwise in the plan notes. For City installed signing the contractor must notify the Engineer two full working days in advance of such need.

When specified, on projects where the road is open to local traffic, the Contractor shall supply, erect and maintain signs at the terminus points of the project, providing notification that the roadway is open to the business(es) within the construction zone.

On projects where the road is open to through traffic, the Contractor shall maintain a minimum 10 feet of lane width (this does not include the space needed for channelizing and other traffic control devices) for each movement of traffic maintained.

Driveway Access. The contractor shall maintain access to all commercial and residential driveways within the work area.

All residents or occupants served by the driveway shall be notified prior to any driveway work. When access to any driveway must be disrupted for more than 4 hours, the contractor shall notify the occupant of said property a minimum of 12 hours in advance of the closing. For closings of less than four hours, same day notification is permitted.

Commercial properties with multiple driveways shall be served by a minimum of one (1) open driveway at all times. Driveways within excavated areas of the roadway shall have access maintained using granular crushed material to provide a drivable surface. Temporary driveway ramps shall be bid under Item 410, Traffic Compacted Surface.

Residential and commercial driveways having enough width for access on half, shall be constructed one half at a time to permit uninterrupted access. Those driveways which are too narrow for this process shall be completely removed and replaced within 3 working days.

Any interruption of access over a weekend or other non-working period shall be approved in advance by the Engineer.

Removal of Existing Traffic Control Signs. Contractor shall contact the City Service Department at (937) 525-5800 to arrange for removal or relocation of any regulatory signs in conflict within the project limits

To maintain the safety of vehicular traffic during construction, existing signs shall not be blocked or removed by the contractor until a suitable substitute has been installed by City Traffic Control Personnel.

Other types of traffic control signing (i.e. guide, warning, or parking regulations) may be removed by the contractor during the project. The contractor shall call the City Service Department for pickup of any removed signs and care shall be taken to preserve the signs

and supports in a reusable condition. All signs removed under this paragraph shall be reinstalled by City Forces prior to reopening the roadway to vehicular traffic.

The contractor shall install a penetrable sleeve (e.g., metallic can, fiberboard cylinder, etc.) when a sign will need to be replaced in a new concrete surface.

Material and Equipment Storage. The contractor shall protect all materials, equipment, and excavated areas through the placement of barricading devices and construction fence as specified in the OMUTCD and additionally, when specified by the Engineer.

ITEM 630 TRAFFIC SIGNS AND SIGN SUPPORTS

Item 630 of the State of Ohio Department of Transportation Construction and Material Specifications shall govern the requirements of this item, with the following exceptions or additions:

630.04 Sign Fabrication. Street Name Signs supplied under this item shall be 9 inch single faced flat sheet signs with 6 inch white letters on a green background with no border, (see Standard Drawing SN-1). The material for street name signs shall be 3M Company, Scotchlite, Diamond Grade Translucent VIP, or approved equal, hereinafter referred to as Type J sheeting.

Signs shall be identified through the application of a decal to the back of the blank. The decal shall contain the name of the owner, "City of Springfield", month and year of fabrication and month and year of installation. The data shall be silk screened on the decal.

630.06 Sign Attachments. Mast arm Sign Hanger Assemblies furnished under this item shall be of the open gusseted tube type comparable to PELCO Products Inc., Astro-Sign-Brac, No. 144, or an equal item approved by the Engineer. The bracket shall be sized for the specific sign to be mounted.

The street name sign supports supplied under this item shall be painted black with all necessary components and hardware to provide a ready-to-use unit.

ITEM 632 TRAFFIC SIGNAL EQUIPMENT

Item 632 of the State of Ohio Department of Transportation Construction and Material Specifications shall govern the requirements of this item, with the following exceptions or additions:

632.08 Pedestrian Signal Heads. Pedestrian Signal Heads furnished under this item shall be constructed of polycarbonate, including doors, lens holders, and visors. Signals shall be equipped with lenses which shall be fabricated with ultra-violet and impact resistant plastic and meet all provisions of the latest revision of ITE specifications. All pedestrian signals shall be LED in lieu of incandescent bulbs and shall display the hand and man outline symbol on a single 12" lens with a Z-Crate visor.

Pipe spacers and fittings shall be aluminum and painted black. Pedestrian signal bracket arms shall be bolted not banded to the poles.

632.09 Pedestrian Pushbutton. All Pedestrian Pushbuttons furnished shall have a round housing with the 2" Bull Dog type to meet ADA requirements as manufactured by Polara, or approved equal. The button shall have a stainless steel button cap with latching style LED indicator.

632.10 Loop Detector Unit. Loop detector units furnished shall be self tuning and operational within one (1) second after application of power. The unit shall have unlimited Environment tracking throughout the tuning range and operate between 95-35 VAC 60 Hz. at 4.0 watts. The unit shall be capable of accepting a loop inductance from 30 to 1,000 microhenries with a Q Factor of 5 or greater.

The Loop input shall be transformer isolated.

The unit shall have accessible from the front panel three (3) selectable frequency ranges, three (3) selectable sensitivity settings, and three (3) selectable mode settings as follows:

1. Long Presence Mode - shall provide continuous loop tracking with 8-15 minutes maximum hold time.
2. Medium Presence Mode - shall provide continuous loop tracking with 4 -10 minutes maximum hold time.
3. Pulse Mode - Shall be capable of tuning out a vehicle after a two (2) second period, so as to detect any other vehicle occupying the remainder of the loop. The Loop Zone shall be at full sensitivity within 100 milliseconds.

The unit shall be able to tolerate, without damage, 1,000 volts discharged directly across the loop input terminals from a ten (10) microfarad capacitor. The Output Circuit shall be a relay output operation.

If the loop lead-in network exceeds inductance tolerance range limits, or if a total loop failure occurs, a continuous output in all modes shall be generated which cannot be removed unless power is removed. All digital logic with exception of the clock generated circuit shall be contained in a single integrated circuit.

The indicator on the front panel shall be a high intensity light emitting diode (LED).

The Loop Detector Unit shall be provided with one (1) set of wiring diagrams and operational manuals and a parts list, which details all proprietary components and other components, identifying generic equivalents if available. This shall be a rack mounted multiple channel unit.

632.15 Signal Support. Signal Supports shall be painted black, (Federal Spec. No. 595-14090) in lieu of galvanizing. Combination signal supports shall be fabricated without pole plates and shall be drilled for clamp-on luminaire brackets as shown on the individual plan. All signal supports shall be furnished with anchor bolts, bolt covers, and reinforcing cage for foundation.

632.19 Pedestal. Pedestals shall have a black powder coat finish in lieu of galvanizing. Pedestals shall be furnished with a transformer base and an access opening with door and bolt supplied.

632.24 Power Service. Electrical Service shall be obtained from the Ohio Edison Company. Power lines shall be run from Ohio Edison lines to a commercial meter socket equipped with a bypass, which shall be mounted on the signal support or strain pole adjacent to the controller cabinet. The power service shall include a four (4) terminal type meter base for a connected 120-volt, single-phase service. (Please note: the meter base is not furnished by the power company and must be furnished as part of this bid item and must be tagged 120V-2W. Contact Ohio Edison for tag.) A separate disconnect switch or disconnect enclosure is required.

Inspection and approval of the power service shall be obtained from the City Electrical Inspector. Once approved, power connections may be arranged by contacting Ohio Edison, Springfield Division.

ITEM 633 TRAFFIC SIGNAL CONTROLLERS

Item 633 of the current State of Ohio Department of Transportation Construction and Material Specifications shall govern the requirements of this item with the following exceptions or additions:

633.07 Controllers. Equipment furnished shall be in conformance with NEMA Standards TS-2-2. Controller Units shall be manufactured so that all integrated circuits shall be mounted in sockets to allow for replacement without soldering or de-soldering. The controller shall be equipped with an internal time base coordinator and preemption circuitry, loop detector units, furnished with any additional panels, circuit boards, modules and/ or connectors to allow the controller to operate these components. Each controller shall be furnished with a parts list which shows both the manufacturer's part number and the generic equivalent part or reference number and description to allow for purchase at a local electronic supply house.

633.071 Conflict Monitor (Malfunction management Unit). Equipment shall be in conformance with NEMA Standards TS-2-1. Units shall be capable of extended monitoring

functions. The unit shall perform all functions as specified in NEMA publication TS-1-1983, Part 6. The unit shall detect faulty sequencing of signals on a per channel basis, monitor AC+ line voltage for brown-out and power interruption, and permit +24 V monitoring and CVM fault latching via a front panel switch. The unit shall detect absence of a logic input transition from the controller, and provide for a "Walk Disable" Option for Red Monitoring via a front panel switch. The unit shall detect the absence of a program card and constant reset input.

The unit shall be equipped with Internal Diagnostics and all programming functions shall be from front panel mounted switches. The unit shall display Red, Yellow, Green and Walk Input for each channel monitored and fault conditions including: Conflict, Red, Fail, Clearance, Dual Indication, CVM/WE, +24 V – 1 and +24 V – 2.

The unit shall be furnished with a "Real Time" Clock to flag and register date and time that the monitor is triggered by a fault condition.

The unit shall contain non-volatile memory for review by font panel display of a log of previously recorded faults.

The unit shall be supplied with two (2) sets of wiring diagrams and operational manuals.

Each unit shall be furnished with a parts list, which shows both the manufacturer's part number and the generic equivalent part or reference number and description to allow for purchase at a local electronic supply house.

633.072 Preemption, Emergency Vehicle. Preemption shall provide City of Springfield emergency response vehicles with the capability to control a traffic signal by advancing the controller to a pre-selected phase. This item shall include detectors, cable, control units and all incidental items to provide a "ready for use" system. Preemption shall be measured and paid for on an each basis for a complete system furnished and installed for each intersection.

The emergency vehicle preemption system furnished shall be the Opticom Priority Control System, Series 700, Manufactured by the 3M Company, Safety and Security Division.

633.08 Cabinets. The cabinet shall be a Type P, 77"H x 44" W x 27 ½" D, base mounted unit, with anchor bolts and associated hardware for mounting on a concrete foundation with work pad or if specified a Type M pole mounted unit with appropriate clamping devices for mounting on a signal support or strain pole. The cabinet shall be painted yellow outside and white inside.

Detector test switches shall be provided for each vehicular and pedestrian phase. The switches shall be capable of placing manual calls into the controller during activated operation. The switches shall be in parallel with the vehicular detector relay closure and pedestrian push button circuits. All loop detector circuits shall have a wiring harness and connector installed to accept and operate a loop detector unit.

All load switches shall be supplied with input and output LED indicators mounted on the front panel.

Lightning Protection and Surge Protection shall be provided as follows:

a. All pedestrian circuits shall be optically isolated from the street side.

b. The main power line shall be protected by an EDCO ACP 340 with indicator lights.

c. Each Loop Detector Circuit shall be protected with an EDCO SRA-6LCA Type protector.

d. Each power supply circuit for each piece of electronic equipment within the cabinet shall be protected by a TII-317(A) Type 3 Electrode Gas Tube Arrestor.

e. The pedestrian circuit isolation circuitry and the preemption circuitry shall be rack mounted on the top shelf of the controller cabinet.

The contractor shall provide a cabinet plan showing component placement for approval prior to installation.

633.12 Flasher Controller. Equipment shall be in conformance with NEMA Standards TS-2-1. The flasher controller shall consist of the following components:

1. 365 day programmable time clock, solid state digital, with capacitor backup.
2. Heavy Duty Plug-in flasher, NEMA solid state, two (2) 10 amp circuits.
3. 20 amp circuit breaker.
4. Surge Arrestor, TII 317.
5. EDCO ACP 340 with indicator lights.
6. Isolation Relay between the time clock and flasher
7. On-Off Power Switch

The cabinet shall be a pole mounted type, furnished with mounting hardware for attachment to a steel pole. The cabinet shall be manufactured of weather proofed sheet or cast aluminum, the exterior shall be painted yellow and the interior painted white per ODOT 514.03. The cabinet shall be fitted with screened vents and a gasketed door with a standard traffic lock.

Each flasher controller shall be supplied with two (2) sets of wiring diagrams and operational manuals for the controller and time clock. Additionally, flasher controllers shall be supplied with parts list of all proprietary component and other component identification numbers and listing generic equivalents for those components if available.

650 ROADSIDES

ITEM 659 SEEDING AND MULCHING

659.01 Description. This item shall consist of furnishing and placing all seed, commercial fertilizer and mulching material.

The areas to be seeded and paid for under this item shall include all areas designated or described on the plans by the Engineer. All areas outside of specified limits where the vegetative growth has been disturbed or destroyed by the Contractor shall be restored and seeded in accordance with these specifications by the Contractor at no additional cost to the City.

A second application of commercial fertilizer shall be applied to selected grass areas when and as ordered by the Engineer.

659.02 Materials. Materials shall be as follows:

Commercial Fertilizer. Commercial Fertilizer may be dry or liquid in analysis specified or in the same ratio as specified.

Seeds. All seeds specified shall meet the current specification on file with the Ohio Department of Transportation as to percentage purity, weed seed and germination. All seeds proposed to be used under this item shall be on an approved list, and shall meet the requirements of these specifications.

Mulching Material. Materials used for mulching shall be straw, hay or wood fiber. The material shall reasonably free of weed seed and such foreign materials as may detract from their effectiveness as a mulch or injurious to desired plant growth.

659.03 General. The standard application of fertilizer (10-20-20) shall be at the rate of 10 pounds per 1,000 square feet. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area, then thoroughly disked, harrowed, or raked into the soil to a depth of not less than one (1) inch.

If the seed bed becomes compacted prior to seeding, it shall be re-disked or loosened to a friable condition before seeding. If the fertilizer has been washed or otherwise lost from the seed bed, the areas so depleted shall be retreated as directed by the Engineer at no cost to the project.

All areas to be seeded shall be free of rock and other foreign material three (3) inches or greater in any dimension and shall be satisfactorily shaped and finished as provided in Item R-203. Areas in front of residences, between curb and sidewalks, and other areas indicated on the plans, shall be free of all stones one (1) inch or greater in any dimension and shall have a smooth surface. In such areas, hand raking will be required if inaccessible to machines, and may be required if machines do not provide results equivalent to hand raking. Payment for the work necessary for proper preparation of the seed bed shall be included in the unit price for Item 203.

The seed shall be thoroughly mixed and then evenly sown over the prepared areas at the rate of three (3) pounds per thousand (1,000) square feet. Seed shall be sown dry or hydraulically.

All areas shall be seeded with the following mixture: (Percentages are by weight)

60 percent Kentucky Blue Grass (Poa Pratensis)

20 percent Penlawn Red Fescue (Festuca Rubra Pennlawn)

20 percent Annual Rye Grass (Lolium Multiflorum)

Immediately after sowing, the area shall be raked, dragged or otherwise treated so as to cover the seed to a depth of approximately ¼ inch.

The operation of seed sowing shall not be performed when the ground is frozen or muddy, or when soil or weather conditions would prevent the proper soil preparation and subsequent operations as specified.

Within forty-eight (48) hours after any given area is seeded, vegetative mulching material shall be evenly placed over all seeded areas at the rate of approximately two 2 tons per acre for straw, or 3 tons per acre for hay, when seeding is performed between the dates of March 15th and October 15th, and at the approximate rate of 3 tons per acre for straw, or 4 ½ tons per acre for hay, when seeding is performed between the dates of October 15th and March 15th of the succeeding year. Mulching materials shall be kept in place with asphalt emulsion applied at a minimum rate of sixty (60) gallons per ton of mulch or by methods as are approved or may be otherwise required to prevent displacement of material. Emulsion shall be nontoxic to plants and shall be so prepared that it will not change in transportation or storage. Mulching which is displaced shall be replaced at once but only after the seeding or other work which preceded the mulching and which work was damaged as a result of displacement of mulching material has been acceptably repaired.

The Contractor shall maintain all seeded and mulched areas until final inspection by the City, or until a three (3) inch minimum growth of grass has been attained, which ever is later. Maintenance shall also include providing protection for traffic by approved warning signs or barricades, and repairing any areas damaged following the seeding and mulching operation due to wind, water fire or other causes. Such damaged areas shall be repaired to re-establish the condition and grade of the area prior to seeding and shall then be refertilized, reseeded and remulched as directed by the Engineer.

When damage or erosion of these areas occurs as a result of the fault or negligence of the Contractor, the areas shall be repaired and re-fertilized, re-seeded, and mulched at no additional cost to the City.

659.04 Method of Measurement. Commercial fertilizer to be paid for shall be the number of tons furnished, spread and incorporated. Seeding and mulching to be paid for shall be the number of square yards of the area seeded and mulched in accordance with these specifications.

659.05 Basis of Payment. Payment for accepted quantities will be paid for at the contract price for:

Item	Unit	Description
659	Square yard	Seeding and mulching
659	Ton	Commercial fertilizer

800 UTILITIES

ITEM 803 SANITARY AND STORM SEWERS

803.01 Description. This work consists of the construction of sanitary and storm sewers and pipe culverts. Combined sewers shall be constructed in the same manner as, and hereinafter referred to as sanitary sewers. The work shall be in accordance with these specifications and in close conformity with the lines and grades shown on the plans or established by the Engineer. This work shall include: excavating for pipe and foundations for same, including clearing and grubbing and the removal of all materials necessary for placing the pipe except removals listed and paid for separately; furnishing and placing granular or concrete bedding and granular backfill as required; constructing and subsequently removing all necessary cofferdams, cribs and sheeting unless otherwise specified; pumping and de-watering; sealing or banding all pipe joints; furnishing and installing all necessary pipe bends and branches of a type at least equal to the conduit of which they become a part; joining to existing and proposed appurtenances as required; performing deflection and leakage tests as required; and restoration of disturbed facilities and surfaces except as provided for in the plans or these specifications.

803.02 Materials. Pipe shall be the size and kind specified in the proposal and shown on the plans. When the kind of pipe is not specifically itemized, any of the kinds listed herein under the specified sewer type may be used. Higher strength pipe of the same material may be furnished where lower strength pipe is specified. In no case will a lower strength pipe than specified be substituted. Pipe material must be the same between manholes.

Materials shall be as follows:

Concrete for bedding, collars and encasement (Class QC 1C)…...ODOT CMS Item 499
Reinforcing Steel (bedding, collars, encasement)..…….ODOT CMS 509.02
Granular material for bedding…….….. AASHTO M 43
Backfill……..611
Sanitary sewer T and Y branches…..……..Type PSM Polyvinyl Chloride Sewer Pipe, ASTM D 3034 SDR 26
Sanitary sewer connections……...Inserta Tee ASTM C 923 or approved equal
Pipe and Joint Materials…….……See Tables

The kinds of pipe and joint material permitted, and testing required for each type of sewer (sanitary, combined and storm) are as shown in the conduit tables:

Type A conduits shall be used for sanitary and combined sewers.

Type B conduits shall be used for storm sewers.

TYPE A CONDUITS - FOR USE ON SANITARY AND COMBINED SEWERS

Permissible Pipe and Joint Materials	Test(s) Required
Type PSM Polyvinyl Chloride Sewer Pipe, ASTM D 3034 SDR 26 with flexible elastometric seal joints conforming to ASTM D 3212	Deflection & Leakage
Thermoplastic Closed Profile Double Wall Sewer Pipe with joints per ASTM D 3212 (18" through 60" size)	Deflection & Leakage
Force Main Only: ASTM D 1784 and AWWA C-900 and C-905 with joints conforming to ASTM D 3139 & gaskets per ASTM F 477	Deflection & Leakage

TYPE B CONDUITS - FOR USE ON STORM SEWERS

Permissible Pipe and Joint Materials	Test(s) Required
Type PSM Polyvinyl Chloride Sewer Pipe, ASTM D 3034 SDR 26 with Flexible Elastometric Seal Joints conforming to ASTM D 3212	Deflection
Reinforced Concrete Pipe, ODOT CMS 706.02, ASTM C655 C-76, Wall B, Class III with joints conforming to ODOT CMS 706.10	None
Reinforced Concrete Elliptical Pipe, ODOT CMS 704.04, ASTM C507 with joints conforming to ODOT CMS 706.10	None[A7]
Corrugated Polyethylene Smooth Lined Pipe ODOT CMS 707.33 with Flexible Gasket Joints conforming to ASTM F 477	Deflection

ODOTCMS = Ohio Department of Transportation Construction and Materials Specifications

The bell portions of Corrugated Polyethylene Smooth Lined Pipe shall be integrally formed with the pipe. Hand welding of the bells to the pipe will not be permitted.

Lift holes in Type A conduit will not be permitted. Lift holes in Type B conduit are permitted provided they are permanently sealed after installation.

803.03 Storage and Handling. All pipe shall have smooth interior and exterior surfaces, be free from cracks, blisters and other imperfections and be true to theoretical shapes and forms throughout each length. PVC pipe in excess of one year from date of manufacture or that appears to have UV damage shall not be used. Proof of date of manufacture shall be marked on the pipe or submitted from the manufacturer.

Care shall be taken during the transporting of the pipe to insure that the binding and tie down methods do not damage or deflect the pipe in any manner. Pipe which is bent, deflected, discolored or otherwise damaged during shipping will be rejected.

Pipe shall be stored in a way that does not damage the joints. Pipe shall be either palletized or placed on wood strips of sufficient thickness to raise the spigot end of the pipe off of the ground. Wood blocks shall be used to prevent pipe from rolling. Pipe shall not

be stored on end. Palletized units of PVC pipe shall not be stacked more than 60 inches high. Stored PVC pipe shall be covered with canvas or other opaque material to protect it from the sun's rays. Air circulation shall be provided under the covering. PVC pipe shall not be removed from the pallet and/or laid out along the ditch until the bedding material is in place and ready to receive the pipe.

803.04 Excavation. Trenches shall be excavated to a width sufficient to allow for proper joining of the conduit and thorough compaction of the granular bedding around the conduit and proper backfill material. The minimum trench width shall be one and twenty - five one - hundredths (1.25) times the outside diameter plus twelve inches (12"). The width of the trench at the top of the conduit shall not exceed 12 inches on each side of the conduit for pipe diameters or spans of 24 inches or less, and 18 inches for pipe diameters or spans of over 24 inches.

The foundation for the conduit bed shall be firm for its full length. Where unstable material is encountered below the foundation it shall be removed to the depth directed by the Engineer under the conduit and replaced with granular material. Rock or boulders encountered at the conduit bed shall be removed at least six (6) inches below the bottom of the conduit and replaced with granular material.

If it becomes necessary to remove unsuitable material at the direction of the Engineer in an amount not to exceed one (1) foot below the bottom of the proposed trench, the same shall be done at the contract bid price. When it becomes necessary to remove more than 1 foot of unsuitable material below the bottom of the trench, compensation will be provided therefor in a supplemental agreement or as provided for under Item 203, Excavation.

Where a conduit is to be placed within an embankment or the top of the conduit is above the existing ground, the embankment shall be constructed at least to the spring line of the conduit before trenching for the conduit. The trench shall then be excavated to the minimum width necessary for the proper placing and backfilling of the conduit as described in this specification. Jacking or tunneling may be permitted provided written permission of the Engineer is obtained. The contractor shall provide and operate any equipment necessary for the removal of all water entering the excavation. He shall also be[A8] responsible for any damage incurred by such water and shall replace the damaged work at his cost.

803.05 Bedding. Type B pipe bedding, as shown on Standard Drawing PB-1, shall be utilized for all conduits unless otherwise specified by the manufacturer. The bedding shall have a thickness of at least 4 inches below the bottom of the pipe and extend up and over the pipe to a point not less than 12 inches above the top of the pipe. The layer of bedding material shall be shaped to fit the conduit for at least 10 percent of the outside diameter of the conduit and shall have recesses shaped to receive the bell of bell-and-spigot pipe.

803.06 Laying Pipe. All pipe shall be laid in strict conformity to the line and grade as given by the Engineer. Laying shall begin at the low end and the pipe shall be laid with the bell end upgrade. The first length of pipe must be anchored sufficiently to prevent movement. The use of blocks or shims of any kind to bring the pipe to grade is prohibited.

The contractor shall conduct his operations so as to maintain sewer flows through existing facilities until new facilities are completed and placed in use, or as per plan or at the direction of the Engineer

803.07 Joining Conduit. The joining of the conduit will be performed in accordance with the instructions of the manufacturer. All pipe shall be free of all dirt and debris before joining. When joining new pipe to existing pipe a sewer flex coupling meeting ASTM[A9] C 1173 shall be used.

Conduit shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and re-laid or replaced at the Contractor's expense

803.08 Sanitary Sewer Service Connections. This work consists of connecting sanitary services to main line sewers. Service connections shall be installed at the locations shown on the plans, or as directed by the Engineer by one of the following methods:

1. For newly constructed sewers, T or Y fittings shall be installed on the main line with the branch inclined to a point where the top of the branch is level with the top of the main line pipe.

2. For existing sewers, taps shall be made by use of special fittings such as "Inserta-T" by Inserta Fittings Co.or approved equal.

After the connection is made at the main sewer, the stub shall be connected to the existing service line with approved materials. If the connection to a service line is not required, the stub shall be extended to the right of way line or easement line[A10] with a cleanout and shall be plugged with a manufactured fitting. The cost to extend the sanitary service shall be included in the unit price bid for the pertinent 803 conduit item.

803.09 Backfilling. The Contractor shall begin the backfilling and compaction operations only after authorization from the Engineer. The backfill material and compaction shall meet the requirements of Item 611.

When the top of a conduit is above the top of the trench, proper embankment (transitioning to existing grade at a maximum 4:1 slope) material shall be placed and compacted for a width on each side of the conduit equal to at least twice the diameter of the conduit or 12 feet, whichever is less, and for a minimum depth of two feet over the top of the conduit. One diameter or four feet on each side of the conduit, whichever is less, shall be granular material and shall be compacted in layers not to exceed 6 inches in thickness with mechanical tampers. The remainder of the embankment material shall meet the requirements of Item 203.

803.10 Leakage Testing. Sanitary sewers shall be subject to thorough inspection and testing, as described below, the right being reserved by the Engineer to waive such tests as considered necessary. The Contractor shall furnish all labor and materials necessary for the tests. The cost of testing shall be included in the price bid for the pipe.

For PVC pipe, the Contractor shall follow the procedures as outlined in ASTM F 1417, "Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air."

For concrete pipe, the Contractor shall perform an infiltration/exfiltration test following the procedures as outlined in ASTM C 969.

803.11 Deflection Testing. Prior to final acceptance of completed plastic sewer lines, the Contractor shall, at his expense, perform a pipe deflection test. The test will occur no earlier than sixty (60) days after the completion of backfill operations, providing, in the judgment of the Engineer, sufficient settlement has occurred. The maximum limit of vertical deflection shall not exceed 5% of the base inside diameter of the pipe. In any area where deflections exceed 5%, the trench shall be re-excavated, and the pipe, backfill and bedding shall be removed and replaced in accordance with the original plans and specifications. If, in the opinion of the Engineer, the pipe has been damaged, it shall be replaced with new pipe at the Contractor's expense and installed per the plans and specifications.

The test shall be conducted by manually pulling a nine (9) arm mandrel having a diameter equal to 95% of the base inside diameter of the pipe. The Contractor shall be responsible for supplying all material and labor, including mandrel, necessary to complete the test. The mandrel used shall be approved by the Engineer prior to any testing.

Any pipe reinstalled because of excessive deflection shall be retested after the sixty (60) day period described above.

803.12 Method of Measurement. The length of conduit to be paid for will be the actual number of linear feet measured from center to center of appurtenant small structures or between open ends inclusive of lengths of pipe bends, branches, catch basins or manholes. Sanitary service connections will be measured by the unit for each size of connection made.

803.13 Basis of Payment. The accepted quantities of conduit of the sizes and types specified will be paid for at the contract unit prices per linear foot, complete in place. Service connections will be paid for per unit for each size. Work, includes the furnishing of all labor, material and equipment for pavement removal, excavation, cofferdamming, removal of water, laying pipe, testing, maintenance of existing sewer flows, backfilling, cost of repair of any damaged utility services and cleanup of the work site.

Payment will be made under:

Item	**Unit**	**Description**
803	Linear foot	___" Conduit, Type ___
803	Each	___" x ___" Sanitary service connection

ITEM 804 MANHOLES AND CATCH BASINS

804.01 Description. This work shall consist of the construction or reconstruction of manholes and catch basins of the type and size specified; or the adjustment of existing castings to grade, as specified. The work shall include: excavation, including clearing and grubbing, and the removal of all materials necessary for placing the structure, except removals listed and paid for separately; furnishing and placing granular bedding and backfill as required; constructing and subsequently removing all necessary cofferdams, cribs and sheeting; pumping and dewatering; performing leakage test as specified; and restoration of disturbed facilities and surfaces unless paid for separately.

804.02 Materials. Materials shall be:

Concrete…….ODOT CMS Item 499, Class QC 1
Masonry units……..ASTM C 139
Granular Material ……AASHTO M 43
Precast reinforced concrete manhole and catch basin sections……..…..……ASTM C-478
Flexible gasket joints……..…….ASTM C-443
Rubber boots…….…….. ASTM C-923
Manhole sealer…….Kop-Coat, Bitumastic No. 300-M
Glidden, Glid-Guard Coal Tar Epoxy
Finish No. 5270 / 5271
M.A.B. Ply-Tile Epoxy Tar Coating
or approved equal
Chimney seals……Cretex Specialty Products or approved equal
Cast frames, grates and covers……..…….as specified in manhole table

804.03 Construction Methods, General. The construction for the item specified shall conform to the standard construction drawings and be placed at the locations and elevations shown on the plans or ordered by the Engineer.

Connections for sewers will be considered a part of all manholes, catch basins and inlets. Connections of sewers into all structures[A11] shall be cored using a rubber boot conforming to ASTM C 923. Saw cutting or chiseling will not be permitted. All structures shall be free of visible leakage.

Iron frames, tops and covers of the type specified shall be set in a mortar bed and adjusted to final grade using solid concrete precast risers. Concrete risers only pertains to manholes. Concrete bricks can be used as risers for catch basins.

For manholes the total height of risers shall be a minimum of 8 inches and maximum of 18 inches installed.

Earth or debris entering into the structure or connecting pipes resulting from construction operations shall be removed by the Contractor.

When reconstruction is specified, the work shall consist of the careful removal and cleaning of existing castings; the removal of existing walls as necessary; and reconstruction of the units to the new grades, conforming as nearly as practicable to the existing dimensions and type of construction, using the salvaged castings. Reconstruction of manholes and catch basins shall be designated when the total difference in elevation

between the top of the existing and proposed structure exceeds plus 12 inches or minus 6 inches.

When adjustment to grade is specified the work shall be accomplished by carefully removing and cleaning the existing casting, adjusting the height of supporting walls as necessary; and resetting the existing casting in a bed of mortar or concrete. Metal or plastic adjusting rings will not be permitted for adjustments of castings to grade.

On construction such as asphalt overlays, the pavement shall be neatly removed to expose the structure. The structure shall then be adjusted to the finished grade by the above methods. After adjustment, concrete shall be placed around the structure to three (3) inches below finished grade. The concrete shall be allowed to cure for a minimum of 72 hours (24 hours with 5,000 psi concrete). Item 448 shall then be placed and thoroughly compacted to the finished grade of the leveling course prior to the placement of the surface course.

On full depth pavement construction the casting shall be removed and stored, and the opening of the structure covered before any paving operations begin. After the asphalt base courses and leveling course have been constructed, adjustment shall be as described above.

When specified on the plans or directed by the Engineer, the Contractor shall furnish new, replacement castings for reconstructed or adjusted structures.

804.04 Excavation and Backfill. The excavation shall be of such dimensions in all cases as will give ample room for construction, but with a minimal amount of pavement removal. This shall include clearing and grubbing and the removal of all materials necessary for placing the item, except removals listed separately.

If the material found at grade is not suitable for foundation, a further depth shall be excavated and filled with suitable material as per 803.

Backfilling shall follow the completion of the work as closely as possible, and shall conform to the requirements of Item 611. Special care must be taken not to disturb the work. In paved areas, the pavement shall be replaced as shown on the plans or as directed by the Engineer.

All surplus from excavation shall be disposed of by the Contractor at his expense.

804.05 Precast Modular Concrete Construction. All manholes and catch basins shall be constructed by this method. Precast bases shall be placed on a sand or gravel bed having a minimum thickness of six inches. This bedding shall be compacted and provide uniform support for the entire area of the base.

Flexible gaskets shall be used for sealing joints between manhole modules.

Solid wall catch basins shall be used in new construction (subdivisions, etc.) or when there are no potential obstructions (utility lines, etc.) for the catch basin leads. Cored holes in solid wall construction shall not be moved or enlarged without the approval of the Engineer. Knock-out panels for other situations may only be used with the approval of the Engineer.

804.06 Exterior Coating. All **s**anitary and combined manholes shall have an exterior coating conforming to these specifications.

Factory coat exterior of manhole from concrete bench to top of section with two (2) coats of coal tar epoxy paint with a total minimum dry film thickness of 16 mills. All surfaces shall cure a minimum of 30 days prior to coating, unless certification from the

manufacturer is provided stating that coating may be done after 7 days cure time. Prior to coating, the surfaces of manholes shall be prepared by removing all efflorescence, chalk, dust, dirt, grease, oils, soaps and other foreign matter. All measurable protrusions and spills of excess concrete from mortar shall be ground smooth. Application of coating material shall be in accordance with the material manufacturer's recommendations. A primer and finish coat shall be applied. Each coat shall be applied at a rate of 8 to 10 dry mills, 11 to 14 wet mills.

The Contractor shall provide the Engineer a statement from the manhole manufacturer certifying that the coating material conforms to these specifications and that the coating material has been applied in accordance with the requirements of the coating material manufacturer.

The Contractor shall field apply touch-up coats after installation as directed by the Engineer.

804.07 Chimney Seal. A manhole frame chimney seal shall be installed on all sanitary and combined manholes. A rubber seal extension, to cover any additional height of chimney not covered by the seal itself, shall be used. The sleeve and extensions shall have a minimum thickness of 3/16 inches and shall be extruded or molded from a high grade rubber compound conforming to the applicable requirements of ASTM C923, with a minimum 1,500 psi tensile strength, maximum 18% compression set and a hardness (durometer) of 48±5. The bands used for compressing the sleeve and extension against the manhole shall be fabricated from 16 gauge stainless steel conforming to ASTM A240 Type 304. Any screws, nuts or bolts used on this band shall be stainless steel conforming to ASTM F593 and ASTM F594 Type 304. The internal seal shall have a double or triple pleat with a minimum unexpanded height of 8 inches for the double pleat and 10 inches for the triple pleat and be capable of vertical movement of not less than 2 inches when installed.

804.08 Testing. Sanitary and combined manholes (Types A-1 and A-2) shall be vacuum tested from the top of the cone down in accordance with ASTM C1244, "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (vacuum) Test." All leaks shall be repaired in a manner approved by the Engineer. Testing and any repair of leaks shall be at the Contractors expense.

Manholes and catch basins shall be constructed in accordance with the standard drawings corresponding to the structure number.

The requirements for manholes, by type, shall be according to the manhole table below.

Sanitary and combined sewers shall be constructed using Type A manholes.

Storm sewers shall be constructed using Type B manholes.

MANHOLE TABLE

R = component or test required for each manhole type

	Sanitary and combined sewers		Storm Sewers	
MANHOLE TYPE……	**A-1**	**A-2**	**B-1**	**B-2**
Standard frame and cover *			R	
Standard frame with gasket cover **	R			
Frame with watertight cover ***		R		R
Exterior Coating	R	R		
Chimney Seal	R	R		
Vacuum Test	R	R		

* Neenah R-1657-1 with Type A (solid) lid, or East Jordan 1600Z1 with solid cover.
** Neenah R-1657-1 with self-sealing cover, or East Jordan 1600Z1 with gasket seal cover.
*** East Jordan 1600Z1PT with "watertite" assembly, or Neenah R-1916-D - only to be used if specified or directed by the Engineer.

Low profile casting East Jordan 1118 shall be used when specified in the plans or directed by the Engineer.

804.09 Method of Measurement. The complete and accepted manholes, and catch basins, whether new, or adjusted to grade, will be measured by the unit for each type of structure and class of work itemized. Reconstructed manholes or catch basins will be measured by the vertical foot of difference in elevation. Manhole depth in excess of 10 feet will be measured by the vertical foot. The total depth of the manhole will be measured from the invert of the manhole to the top of the cover. Replacement castings shall be the number of each type furnished.

804.10 Basis of Payment. The work included in this item, including excavation and backfill, shall be paid for at the contract price, complete in place.

Item	**Unit**	**Description**
804	Each	Manhole, No. ___, Type ___
804	Vert. ft.	Manhole depth in excess of 10 feet
804	Each	Catch basin, No. ___
804	Vert. ft.	Manhole, catch basin reconstructed to grade
804	Each	Manhole, catch basin adjusted to grade
804	Each	Manhole, catch basin casting furnished

ITEM 838 WATER MAINS

838.01 Description. This item consists of specifications for installation and testing of ductile iron water main. This item includes the excavating of the trench, furnishing, laying, joining the ductile iron pipe, T's, elbows, bends, fittings, installation of tracer wire system and other necessary appurtenances at locations shown on the plans; testing, backfilling of the trench and disinfecting as noted in the specifications or as directed by the Engineer.

838.02 Materials. Pipe shall be the size shown on the plans. All joints shall be push-on type.

Material shall be as follows:

Pipe…….….	ANS A21.51 (AWWA C151) Wall thickness Class 50 unless otherwise noted on plans or in specifications
Fittings……..	Ductile Iron, ANS A21.10 except shorter laying lengths will be acceptable
18 inch and under…….	350 PSI pressure rating
20 inch and over……..	250 PSI pressure rating
Mechanical Joints……	ANS A21.11
Push-on Joints…….	ANS A21.11, except gaskets, shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
Mechanical Joint Reducer……..……..	AWWA C110
Mechanical Joint Tees…….…….	AWWA C110 Mechanical Joint Cross AWWA C110
Shop Coating and Lining	
Cement Lining…….	ANS 21.4
Bituminous Coating…….	Manufacturer's standard
Rust Preventative Compound……	Dearborn Chemical "No-OX-ID 2W", Houghton "Rust Veto 344", or Rustoleum "R-9" Non lead based.
Field Coating…….	Heavy coal tar paint, MIL-C-18480, Koppers "50 Bitumastic", USS "Tarmastic 101" or approved equal
Polyethylene Encasement……..	ANSI/AWWA C105/A21.5-82

All material shall be current year production unless specifically approved by Engineer.

838.03 Shop Coating and Lining. The interior surfaces of all pipe regardless of length or type of joint, and the interior surfaces of all fourteen (14) inch or larger fittings shall be cement lined. Flange faces shall be shop coated with a rust preventive compound. All other surfaces of pipe and fittings shall be shop coated with a bituminous coating.

838.04 Handling. Pipe, fittings, and accessories shall be handled in a manner that will insure installation in sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling and laying pipe and fittings shall be such that the pipe and fittings are not damaged. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces.

Pipe and fittings in which the cement lining has been broken or loosened shall be replaced by and at the expense of the Contractor. Where the damaged areas are small and readily accessible, the Contractor may be permitted to repair the lining if approved by the Engineer. Pipe coating which has been damaged shall be repaired by the Contractor prior to installing the pipe.

838.05 Cutting Pipe. Cutting shall be done in a neat manner, without damage to the pipe or to the cement lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. All pipe cutting shall be done with mechanical pipe cutters except where the use of mechanical cutters would be difficult or impractical.

838.06 Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before being installed and shall be kept clean until the work has been accepted. Before joining, all joint contact surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until joining is completed.

Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug to prevent trench water from entering the pipe.

838.07 Inspection. Pipe and fittings shall be carefully examined by the Engineer for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective pipe and fittings shall be removed from the site of the work.

838.08 Alignment of Bell and Spigot Pipe. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the quantities stipulated in these specifications. If alignment of pipe requires deflections greater than those specified, shorter pipe sections, beveled joints or special bends shall be installed.

For permissible pipe joint deflections see table on next page.

Maximum Deflection
Full Length Pipe - Push-On Joint

Pipe Diameter (inches)	Deflection Angle (Degree)	Maximum Deflection (inches)		Approximate Radius of Curve Produced by Succession of Joints (feet)	
-	-	18’ Length	20’ Length	18’ Length	20’ Length
3	5	19	21	205	230
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3	11	12	340	380
16	3	11	12	340	380
18	3	11	12	340	380
20	3	11	12	340	380
24	3	11	12	340	380
30	3	11	12	340	380
36	3	11	12	340	380
42	2	7 ½	8	510	570
48	2	7 ½	8	510	570
54	1 ½	5 ½	6	680	760

838.09 Laying Pipe. Pipe shall be protected from lateral displacement by means of pipe embedment material installed as specified in Standard Drawing PB-1. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions.

Pipe shall be laid with the bell ends facing the direction of laying except when reverse laying is specifically authorized by the Engineer. Tracer wire shall be installed with all new buried water main installation, including all connectors, test stations and grounding anodes as specified in Item 842.

838.10 Mechanical Joints. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over-tightening of bolts to compensate for poor installation practice will not be permitted.

838.11 Push-On Joints. All instructions and recommendations of the pipe manufacturer, relative to gasket installation and other joining operations, shall be followed by the Contractor. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water (NSF 61 approved), shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

838.12 Connections With Existing Pipelines. Where connections are made between new work and existing piping, such connections shall be made using the fittings indicated on the plans or approved by the Engineer. The Contractor shall be responsible for furnishing and installing the correct size fitting. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, as authorized by the Engineer and coordinated with the City Service Department. Facilities shall be provided for proper dewatering and disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing pipe. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with or dipped in a chlorine solution having a chlorine content of 200 milligrams per liter.

838.13 Reaction Anchorage and Blocking. All tees, plugs, bends and similar fittings as indicated by the drawings or as determined by field inspections shall be provided with cast-in-place concrete reaction blocking or restrained joint pipe and fittings to prevent movement of the pipe caused by internal pressure, or both, as approved by the Engineer. Lengths of restrained joint pipe shall be determined using tables published by the Ductile Iron Pipe Research Association.

Cast-in-place concrete reaction blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. All pipe, joints and hardware within the reaction blocking area shall be wrapped with two layers of visqueen prior to placing the concrete. The bearing area of blocking shall be as shown in the standard drawing WB-1 or as determined by the Engineer. If adequate support against undisturbed ground cannot be obtained, restrained joint pipe shall be installed to provide support, or adequate anchorage facilities shall be installed to provide the necessary support, as approved by the Engineer.

All steel clamps, rods, bolts and other metal accessories used in reaction anchorage or joint harness subject to submergence or contact with earth or other fill material shall be protected from corrosion by two coats of coal tar paint applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be primed and then coated with two coats (in addition to a prime coat) of a paint acceptable to the Engineer.

838.14 Excavating and Trenching. Excavation work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards. Excavation shall provide adequate working space and clearance for the work to be performed therein. In no case shall excavation faces be undercut. The contractor shall comply with all applicable OSHAA safely requirements.

No backfill, fill or embankment materials shall be installed on frozen surfaces, nor shall backfill contain any frozen materials, snow or ice.

Excavation and trenching work shall include the removal and disposal of all materials excavated or removed in performance of the contract work, regardless of the type, character, composition or condition of the materials. No blasting or the use of explosives for excavation will be permitted without the written permission of the Fire Chief and Engineer.

Except where otherwise authorized, shown, or specified, all material excavated below the bottom of the walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with 3,000 psi concrete or a material determined by the Engineer to be suitable.

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches or other part of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built or structure to be installed, therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed. Subgrades for structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of forty-eight (48) inches. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to original ground or pavement surface elevation. Where greater pipe depths are necessary, depths up to one foot (1') deeper shall be included in the cost of installed pipe, depths greater than one foot (1') shall be paid in a supplemental agreement or as provided for under Item 203, Excavation.

Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. However, the limiting trench widths below an elevation six (6) inches above the top of the installed pipe, and minimum permissible clearances between the installed pipe and each trench wall, expressed in inches, shall be as shown in the table below.

Pipe Size (inches)	Minimum Trench Width (inches)	Minimum Clearance (inches)	Maximum Trench Width (inches)
6	17	5	30
8	24	6	34
12	30	6	40
16	36	6	44
24	48	8	48
30	54	10	60

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back to slopes which shall not extend lower than one (1) foot above the top of the pipe.

Any concrete surface or curb damaged in the performance of this work shall be replaced from the nearest construction joint to the damaged area to the nearest construction joint past the damaged surface or curb.

Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as shown in the standard drawings, to provide for the installation of granular fill pipe foundation material. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with trench bottom, trench walls, or granular fill when the pipe is joined.

If it becomes necessary to remove unsuitable material below the bottom of the trench at the direction of the Engineer in an amount not to exceed one (1) foot, the same shall be done at the contract bid price. When it becomes necessary to remove more than one (1) foot of unsuitable material below the bottom of the trench, compensation will be provided therefore in a supplemental agreement or as provided for under Item 203 Excavation.

Jacking or tunneling may be permitted provided written permission of the Engineer is obtained.

All granular fill material beneath the pipe shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by the withdrawal of pipe slings or other lifting tackle.

Embedment materials both below and above the bottom of the pipe, classes of embedment to be used, and placement and compaction of embedment materials shall conform to the requirements shown on the standard drawings and to the following supplementary requirements:

Class A Arch Encasement Class A arch encasement is not required unless improper trenching or unexpected trench conditions require its use as determined by the Engineer.

Class B Bedding Class B bedding shall be used for all pre-stressed concrete and ductile iron pipe water lines, unless otherwise shown on the plans or directed by the Engineer.

Backfill shall be in conformance with Item 611.

All excess excavated materials together with all debris, junk, stones, logs, stumps, roots, and other materials shall be removed from the site and disposed of by, and at the expense of, the Contractor. It shall be the responsibility of the Contractor to secure the permission of the owner of the site to dispose of excavated materials. It shall also be the responsibility of the Contractor to verify that the dump site is in compliance with all local, state and federal regulations as they pertain to dump sites. Any damages or claims caused by the disposal of these excavated materials shall be resolved by the Contractor at no cost to the City. All fire, OSHAA and other safety regulations shall be observed.

838.15 Testing. All joints in piping shall be watertight and free from visible leaks during the prescribed tests. Any leak which may be discovered at any time prior to the expiration of the guarantee period, as set forth in the General Provisions shall be located and repaired by and at the expense of the Contractor.

The pipelines shall be tested in sections between shutoff valves or, at option of the Contractor, between a shutoff valve and a test plug, or between test plugs. All valves shall be tested in a closed position with minimum pressure differential of the difference between the test pressure and static City line pressure. If intermediate test plugs are so used, they shall be furnished and installed by the Contractor at his own expense, together with all anchors, braces, and other devices as may be required to withstand the hydrostatic pressure on such plug or plugs without imposing any hydraulic thrust on the pipeline or any part thereof; the Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from the failure of test plugs furnished by him or supports therefor, in any case.

Testing Equipment and Facilities: The Contractor shall provide, at his own expense, all necessary piping connections between the pipeline to be tested and the source of potable water supply, together with test pumping equipment, water meter, pressure gauge, and other equipment, materials and facilities required for the tests.

Test pressures shall be applied by means of a force pump of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test.

The water meter and the pressure gauge shall be a maximum of 300 PSI, accurately calibrated and acceptable to the Engineer.

Pressure Test: All pipelines constructed hereunder shall be tested for defective materials and workmanship by being subjected to a hydrostatic test pressure. For new domestic and combination lines (water service lines that provide service for both domestic and fire demand) the test pressure, as measured at the low point on the line, shall be 150 psi. No pressure drop shall be permitted.

The specified test pressure shall be applied and maintained for a period of not less than 30 minutes for pipes up to and including 8" diameter and not less than 60 minutes for pipes larger than 8" diameter and for whatever longer period as may be necessary for the Engineer to complete the inspection of the line under test and to locate any and all defective joints and pipeline materials. If repairs are needed, such repairs shall be made, the line refilled, and the test pressure applied as before; this operation shall be repeated until the line and all parts thereof withstand the test pressure in a satisfactory manner.

All dedicated fire service lines shall be tested at a pressure, as measured at the low point on the line, of 200 psi. The test pressure shall be applied and maintained for a period of not less than two (2) hours. No pressure drop shall be permitted during the test. If repairs are needed, the line shall be retested as described above.

Leaks in mechanical joints shall be repaired by dismantling, cleaning, realigning gland and gasket and rebolting. Under no circumstances shall gland bolts be tightened beyond the specified and allowable torque limits in an attempt to reduce or stop leakage from a defective joint or for any other purpose. Bell joint clamps may be used to repair joint leaks with the approval of the Engineer.

838.16 Disinfection and Verification. All water lines and connecting piping installed under the contract shall be disinfected by means of chlorine solutions by and as a subsidiary obligation of the contractor. The entire cost thereof shall be included in the unit prices named in the contractor's bid (and in the contract unit prices) for each type of water pipe installation.

All disinfection work and disposal of chlorinated water performed hereunder, including procedure and methods used therein, shall be performed in accordance with ANSI/AWWA C651-14 (or the current revision), Disinfecting Water Mains.

Verification of disinfection shall be performed with bacteriological tests completed in accordance with Section 5.1.1.1 Option A of said AWWA Standard Samples shall be taken from a tap located and installed in such a manner that outside contamination is prevented. Laboratory testing will done by the City with forty-eight hours prior notice. First test samples shall only be taken on Monday, Tuesday or Wednesday of the week.

838.17 Flushing of Pipe. All water mains shall be flushed thoroughly in order to remove foreign materials that might have entered the main during the course of the installation. The minimum rate of flow shall not be less than the water demand rate of the system and the flushing operations shall be continued for a sufficient time to ensure thorough cleaning. A bag test shall be conducted to ensure that the line has been thoroughly flushed. The test shall be conducted by attaching a hose to the two and one half inch (2 ½") outlet of all fire hydrants and allowing the flow from the end of the hose to go through a burlap bag, or other bag approved by the Engineer. After fifteen (15) minutes of full flow, the bag shall be checked for debris. If debris is present, the test shall be repeated in fifteen (15) minute intervals until the bag is clear. On dual use lines into buildings, the line shall be bag tested through use of a plug and a minimum two inch valve at the terminus of the line.

The bag test shall be performed before any purity tests on the new line.

838.18 Method of Measurement. The completed and accepted water main shall be paid for as the actual number of linear feet measured from the connection with the existing main to the end of the new main, inclusive of pipe bends, tees or other appurtenances. This also includes installation of a complete tracer wire system for new water main installations per Item 842.

838.19 Basis of Payment. The accepted quantities of conduit of the sizes and type specified will be paid for at the contract unit prices per linear foot, complete in place. Work includes the furnishing of excavation (including all labor, material and equipment for pavement removal), cofferdamming, dewatering / removal of all surface and ground water, laying pipe, installation and testing of tracer wire, bedding, backfilling, disinfecting, testing and repair of any damaged utility services and cleanup of the work site.

Payment will be made under:

Item	Unit	Description
838	Linear Foot	___" Water main

ITEM 839 VALVES

839.01 Description. This item consists of furnishing and installing water valves and valve boxes of the specified size and type, or the adjustment of existing valve boxes at the locations shown on the plans or directed by the Engineer.

839.02 General. All ferrous surfaces of valves and accessories, both interior and exterior, shall be shop painted for corrosion protection. The valve manufacturer's standard paint will be acceptable, provided it is compatible with the field painting. Valves shall be set in such a manner as to provide a firm bearing on the trench bottom or compacted fill if required, and shall be set plumb.

Excavation, backfill and dewatering shall be in accordance with 838.14.

Tracer Wire installation for valves on new water main shall be in accordance with 842

839.03 Resilient Seat Wedge Valves. Valves of this type shall be Kennedy Ken-Seal, Clow R/W, or equal resilient seat wedge valve conforming to AWWA C515, clockwise open with an operating nut, and non-rising stems with O-ring stem seals. Valves must have a fully encapsulated disc, with bubble tight two hundred (200) psi differential sealing ability. When open, they shall have a smooth unobstructed waterway. Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open. NOTE: Post indicator valves shall operate in a counter-clockwise direction.

839.04 Butterfly Valve. Valves of this type shall be Clow, Mueller, Kennedy, or approved equal conforming to AWWA C504, rubber seated tight closing type with Class 150B valve shaft diameter and underground-service-operator torque rating throughout entire travel. Butterfly valves shall also meet the following requirements:

1. The Body shall be High Strength Cast Iron conforming to ASTM A126, Class B or ASTM A48, Class 40, or Ductile Iron conforming to ASTM A536, Grade 65-45-12.
2. The Disc shall be the off-set design providing a 360 degree seating surface uninterrupted by shaft holes, and shall be High Strength Cast Iron conforming to ASTM A126, Class B or ASTM A48, Class 40, or Ductile Iron conforming to ASTM A536, Grade 65-45-12.
3. The Seat shall be natural or synthetic rubber with a stainless steel, type 304 mating seat surface; must be mechanically restrained either incorporated into the valve body or on the disc edge; and must be capable of replacement in the field without chipping, grinding or burning.
4. The Seal shall be O-ring contained in a corrosion resistant cartridge, capable of replacement without removal of the valve shaft.
5. The Operator shall have a 2 inch AWWA operating nut, traveling nut type, sealed, gasketed and lubricated for underground service.

Where the shaft projects through the body for the operator connection, a shaft seal shall be provided. Valve body ends shall be flanged with facing and drilling in accordance with ANSI B16.1 Class 125 lb., mechanical joint in accordance with AWWA specification C-111 or wafer style suitable for mounting between ANSI B16.1, Class 125 lb. flanges. Any

adapter fittings required to connect the butterfly valve to the standard pipe lengths shall be included in the unit price bid for Item 838, Water Main.

839.05 Tapping Sleeve and Valve. The tapping sleeve shall be JCM432, Ford Fast, Power Seal 3490 or 3490 MJ, or equal, all stainless steel [LM12]with the ability to fit ductile iron, cast iron or sand cast pipe. The tapping sleeve furnished shall have full circumferential sealing gaskets around the pipe to be tapped.

The valve shall conform to 839.03 and must accept a full size tapping cutter. Tapping valves shall be supported with solid concrete blocks.

The tapping sleeve and valve assembly shall be furnished and installed complete with gaskets as required and with all bolts for the sleeve and flanged connection between the sleeve and valve, according to the manufacturer of the tapping sleeve and valve.

Tapping sleeves shall be installed a minimum of two feet from bells and spigots.

The Contractor making taps into City water mains must receive prior approval from the City Service Department.

Taps for water mains 12 inches and smaller can be made by the City Service Department personnel for a fee, provided two full working days notice is given. The Contractor must provide an excavated area of sufficient size to accommodate the workers making the tap. The excavation must be within OSHAA safety standards.

Taps larger than twelve inches must be made by the Contractor.

Test tapping sleeve and valve at 150 psi or two times the working pressure of the main line, whichever is greater for 15 minutes.

839.06 Valve Boxes. Valve boxes shall be provided for all buried valves and shall be suitable for the depth of cover required. Valve boxes shall be Tyler 6860 Series with No. 6 Base, or approved equal. Covers shall have the word WATER cast on it. All parts of valve boxes, bases and covers shall be coated by dipping in bituminous varnish.

Valve boxes shall be set plumb and placed directly over the valve it serves. Set the top of the box flush with the final subgrade elevation. After placement and compaction of the base courses and intermediate asphalt course for the street, excavate around the valve box to permit the box to be raised to the finished pavement elevation by use of an approved extension section. ODOT CMS Item 499, Class QC 1 concrete shall then be placed around the box and brought to three (3) inches below the finished pavement grade. After the concrete has cured, place and compact an intermediate layer of asphalt flush with the adjoining intermediate course.

Setting valve boxes which are part of a newly installed valve to final grade will not be paid for separately, but shall be included in the unit price bid for the valve and box.

839.07 Valve Boxes Adjusted to Grade. This work shall consist of raising or lowering existing valve boxes to the grades shown on the plans or directed by the Engineer. When specified on the plans or directed by the Engineer, the Contractor shall furnish and install new replacement valve boxes.

The Contractor shall remove the minimum amount of material necessary to provide adequate space to adjust the valve box. The existing valve box and cover shall be removed and thoroughly cleaned. The valve box shall be adjusted by the use of an approved adjusting ring or other method approved by the Engineer.

When existing valve boxes are adjusted in full depth pavement construction areas, the method outlined in 839.06 shall be used to set the top to final grade.

839.08 Method of Measurement. Valves of the type specified and valve boxes shall be counted as one item and measured on an each basis.

Valve boxes adjusted to grade will be measured on an each basis, and shall include any extension sections of valve boxes required.

New valve boxes, when specified, shall be paid for separately and shall be measured on an each basis.

839.09 Basis of Payment. Payment for accepted quantities of each item specified will be made at the contract unit price. Payment will be full compensation for labor, material, tools, equipment and incidentals necessary for each item; furnished, installed in place, tracer wire installation, joined, hydrostatically tested, disinfected and accepted.

Item	Unit	Description
839	Each	___" Resilient seat wedge valve and valve box
839	Each	___" Butterfly valve and valve box
839	Each	___" x ___" Tapping sleeve, valve & valve box
839	Each	Valve box adjusted to grade
839	Each	New valve box furnished

ITEM 840 FIRE HYDRANT

840.01 Description This item shall consist of furnishing all material, labor and equipment necessary for the installation of fire hydrants. This item includes the excavation necessary, furnishing and installing the fire hydrant at the locations shown on the plans; testing, disinfecting, installation of tracer wire system and backfilling around the hydrant as noted in the specifications or as directed by the Engineer.

840.02 Material Fire hydrants shall conform to AWWA C502, as modified herein. Manufacturer shall be Kennedy K-81-A, Darling B-84B, Mueller Centurion or Clow Medallion. The information required by Section 2 is as follows:

Affidavit of Compliance	Not required
Catalog and maintenance date	Review before manufacture
Type of shutoff	Compression with 5 1/4" min. main valve opening
Size of hydrant	six (6) inches
Inlet Connection	six (6) inch, mechanical joint
Harnessing lugs	Required
Bury length	As required to provide not less than forty-eight (48) inches of cover over the top of the connection pipe
Barrel requirements	six (6) inch ID minimum, designed so that nozzles may be placed in any given direction
Outlet nozzles	two (2) - two and one half (2 ½) inch hoses and one (1) - four (4) inch pumper threaded and pinned
Outlet nozzle diameters	two and one half (2 ½) inch nozzles: ID two and one half (2 ½) inch, OD three and twenty-five one hundreds (3.25) inch. Four (4) inch nozzle: ID four (4) inch, OD four and eight hundred seventy five thousandths (4.875) inch.
Outlet nozzle treads	Springfield, Ohio, standard threads: six (6) threads per inch, Higbee cut, sharp vee, pitch eleven - sixty fourths (11/64) inch.
Direction to open	counterclockwise
Stem seals	"O" ring
Color of finish paint above ground line	yellow
Outlet nozzle cap chain	not permitted

Drain outlet and valve……	required
Operating and outlet nozzle cap nuts…….	pentagonal, fifteen sixteenths N(15/16) inch to thirty-one thirty-secondths (31/32) inch, point to flat one and one-half (1½) inches
Type……..	traffic model break away type

Repair parts and component parts shall be readily available and regularly carried in stock by the hydrant manufacturer.

840.03 Construction The hydrant shall be set so that at least the minimum pipe cover is provided for and branch supply line and the nozzles are at least eighteen (18) inches but not more than twenty-four (24) inches above finished grade. The hydrant shall be set on a concrete block foundation, 2 inch x 8 inch x 16 inch and blocked with concrete as per Standard Drawing WB-1, or suitably anchored by use of restrained joint pipe.

Hydrant drainage shall be provided by installing around the hydrant, and below the top of the hydrant supply pipe, at least seven (7) cubic feet of gravel or crushed stone.

The hydrant shall stand plumb, with hose nozzles parallel with, and the pumper nozzle perpendicular to, the curb line. The face of nozzle shall be 2 feet behind the face of curb.

The Contractor shall furnish and install a six (6) inch resilient seat wedge valve and valve box between the water main and the fire hydrant, when specified on the plans or as directed by the Engineer. The valve shall be restrained to the main line by use of a swivel tee.

Hydrant branches, valves and valve boxes shall each be paid for separately.

Tracer Wire, connectors and access point shall be installed per Item 842 and FH-1.

840.05 Fire Hydrant Relocated. Where existing hydrants are indicated for relocation, the hydrant shall be adequately supported before being disconnected and reset in the new location. The existing branch line shall be capped and adequate reaction blocking to brace the cap shall be installed. The reset hydrant shall be installed at the new location in accordance with 840.03. Hydrant branches, valves and valve boxes for the reset hydrant shall each be paid for separately.

840.06 Fire Hydrant Removed. This work shall consist of removing of fire hydrants designated for removal. The existing branch line shall be capped and adequate reaction blocking to brace the cap shall be installed. The removed hydrant shall be salvaged for pick-up by the City Service Department.

840.04 Method of Measurement The installed and accepted fire hydrant, whether new or relocated, shall be measured by the unit specified. Fire hydrants removed shall be measured on an each basis.

840.05 Basis of Payment Work includes all labor, equipment and materials necessary for the installation of the new hydrant, tracer wire, tracer wire access point, ground rod including excavating and backfill as specified above.

The cost for any ductile iron pipe or gate valves (if required) shall be paid for separately, and included in the price bid for those pertinent items.

Item	Unit	Description
840	Each	Fire hydrant
840	Each	Fire hydrant relocated
840	Each	Fire hydrant removed

ITEM 841 PROPERTY SERVICE

841.01 Description. This item shall consist of tapping water mains, installing corporation stop (valve), boring the property service under the pavement (when specified), laying property service, installing curb stop and curb box, reconnection to existing service lines, and installing meter box (unless otherwise specified) and tracer wire system per Item 842. The service shall be laid with a minimum cover of forty-eight (48) inches. This item includes the furnishing of all materials for the above work.

841.02 Materials. The service line shall be type "K" copper tubing[A13] and shall be connected to the water main by use of an approved type corporation stop with AWWA C.C. taper thread inlet and flared copper outlet. The service line shall be one piece with no fittings between the flare nuts for corporation stop and curb stop. Refer to standard drawing WM-1 for materials. A Ford F202 tapping saddle, or equal, shall only be used with the approval of the Engineer. On all watermains 16" and larger a Ford F202 tapping saddle, or equal, must be used. All materials shall be made in the U.S.A.

In addition to copper tubing, the City will accept plastic water service tubing. The plastic water service tubing. The plastic water service tubing shall be manufactured from high density CTS Polyethylene (PE3408 C-3 SDR-9) in accordance with ASTM D-2739 or the latest revisions thereof (REV. Jan. 1998). Tubing shall be marked with the manufacturer's brand name, pipe size, working pressure, material designation, National Sanitation Foundation approval, ASTM specification, and production code. Pipe shall be manufactured to Type K copper OD., and the dimensions and tolerances shall correspond with the values listed in U.S. Department of Commerce CS-255-63 for flexible plastic pipe. Pipe shall have a working pressure of 200 psi at 73°F and the pipe shall be capable of maintaining pressures of 300 psi at 73ºF for 1,000 hours. All joints using plastic tubing shall be made by flaring the plastic tubing or the Mueller "Instar-tite" connection. A 14 AWG standard copper tracing wire is to be placed adjacent to the tubing.

841.03 Construction. Procedures outlined in ANSI/AWWA C810-17 (or current edition) shall be followed for the replacement and flushing of lead service lines.

No tunneling or pushing of service lines under curbs, sidewalks, or other obstructions shall be permitted unless directed by the Engineer.

Curb stops shall be installed at the end of the service line at the location designated by the Engineer. All curb stops shall be ball type with built-in stop for 90° turn only, without drain. Curb stops shall be flared copper inlet and flared copper outlet connection.

The connection to the existing corporation stop and/or existing house service line will be made with approved type fittings only. When replacement services are specified, the existing corporation stop shall be extracted and the new stop inserted in it's place.

A solid concrete block shall be placed under each curb stop and curb box.

Curb boxes shall be made in the U.S.A., cast iron "Buffalo" type screw adjustment with 2 ½" shaft and shall have a cover with "WATER" clearly imprinted on the surface of the cover in raised letter.

The meter box shall be the dimensions shown on standard drawing WM-1.

Tracer Wire system shall be installed per standard drawing WM-1

Backfill shall be as per Item 304, crushed stone or other material approved by the Engineer.

The Contractor, with approval of the City Service Department, will tap the water line or pay the City Service Department to tap said waterline and install the corporation stop. All taps shall be a minimum of 10 inches apart and a minimum of two feet from a bell or spigot. When replacing an existing service, the Contractor shall remove and dispose of the existing curb box.

When boring a service under the pavement, the Contractor shall be responsible for repairing any damage, at the Contractor's expense, caused to the street pavement, street base, or underground utilities encountered during the boring operation.

It will be the responsibility of the Contractor to assure that the service line is bored at a minimum depth of forty-eight (48) inches. If, for any reason, any portion of the completed bore has a cover of less the forty-eight (48) inches, the Contractor shall abandon the bore and make a new bore at the specified depth.

All taps made by the City Service Department will be billed to the Contractor.

841.04 Curb Stop and Meter Box Relocated. This work shall consist of relocating existing curb stops and meter boxes to the locations shown on the plans or directed by the Engineer. The Contractor shall remove the existing meter, meter box, curb stop and reconnect the existing meter, meter box curb stop to the existing service line.

If the existing curb box is not salvageable, replacements may be obtained, at no cost to the Contractor, from City Service Department upon approval of the Engineer. All service line extensions shall use ¾" type "K" copper tubing (unless 1" service) and shall be furnished by the Contractor.

Meter boxes shall conform to 841.03. Meter boxes shall not be reused unless approved by the Engineer.

841.05 Method of Measurement. Property services will be measured as the actual number of services for each type and class of work, and shall include excavation, backfill, pipe or tubing and fittings, tapping saddles if necessary, corporation stops, curb stops and curb boxes, tracer wire system, hydrostatic testing, disinfecting, backfilling, restoration of surfaces (unless paid for separately) and disposal of surplus material.

Curb stops and meter boxes relocated will be measured as a unit on an each basis.

841.06 Basis of Payment. Payment for accepted quantities of property services, and curb stops and meter boxes relocated, will be made at the contract unit price. Payment will be full compensation for labor, materials, tools, equipment, and incidentals necessary for each item; furnished, installed in place, jointing made, tracer wire system, hydrostatically tested, disinfected and accepted.

Item	Unit	Description
841	Each	___" Property service
841	Each	___" Property service with meter box
841	Each	___" Property service, Bored
841	Each	___" Property service with meter box, Bored
841	Each	Curb stop and meter box relocated

ITEM 842 TRACER WIRE

842.01 Description. This item shall consist of providing all labor, materials, equipment and incidentals as shown, specified and required to install and test all tracer wire, connections, and grounding anodes. The Work includes, but is not limited to installation of tracer wire with all buried piping for water mains, valves, fire hydrants and property services. This item shall also include the installation of all connectors, test stations and grounding anodes as required to provide a complete tracing system.

Installation procedures can be reviewed under other items and coordinated with work that is related to each pertinent item.

842.02 Materials. All tracer wire and associated products shall be domestically manufactured in the U.S.A. Trace wire shall have HDPE insulation intended for direct bury, color coded per APWA standard for the specific utility being marked. Tracer wire shall have a permanent legible marking on insulating jacket to repeat at minimum interval of every two linear feet. Markings shall include manufacturer, wire size, insulation thickness and type, and electrical rating.

A. Trace Wire:
    1. Open Trench-Material Description
        a. Trace Wire shall be #12 AWG Solid Copper. Average 450 lbs. break load and minimum tensile strength of 67,000 psi, with minimum 30-mil HDPE insulation thickness.
        b. Steel: High Strength with 0.54 carbon or greater. Verified to meet required mechanical properties.
        c. Copper: UNS-C10200; OF Copper according to ASTM B-170 (latest edition). High conductivity, oxygen free copper to achieve optimal signal performance.
        d. Surface Condition: Wire surface shall be free of any defects, including flakes, grooves, pits, and voids. Wire surface shall be smooth, bright and shiny, and free of excessive copper dust and residual drawing lubricants.
        e. Manufacturer: Copperhead Industries, LLC, Solo Shot Xtreme or approved equal

    2. Directional Drilling/Boring-Material Description
        a. Trace Wire shall be #12 AWG Solid Copper, extra high strength wire. Average 1150 lbs. break load and minimum tensile strength of 200,000 psi, with minimum 45-mil HDPE insulation thickness.
        b. Manufacturer: Copperhead Industries, LLC, Solo Shot Xtreme or approved equal

B. Connectors:
    1. Direct bury wire connectors – shall be specifically manufactured for use in underground installation.

a. Connectors shall be filled with non- hardening, dielectric silicon to seal out moisture and prevent corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
b. Connectors must be lockable / latching to contain the dielectric silicon within the connector for protection of uninsulated wire and connector components and prevent opening during backfilling.
c. Manufacturer: Copperhead Industries LLC, SnakeBite Connectors

C. Termination/Access:
1. Fire hydrant tracer wire access box applications: Install above ground test station with jumpers.
a. Test stations shall be color coded to per APWA standard for the specific utility being marked.
b. Test Stations shall be made from polypropylene and all hardware including jumpers shall be stainless steel.
c. Test Stations shall be mounted to fire hydrant grade flange by use of stainless steel mounting bracket.
d. Manufacturer: Copperhead Industries, LLC, Cobra T3 Test Station, or approved equal.

2. Lawn Area Access
a. Utilize a lite duty adjustable access box with lid color coded to APWA standard for the specific utility being marked.
b. Lid shall allow connection to tracer wire without lid removal.
c. Manufacturer: Copperhead Industries, LLC, Bingham & Taylor, or approved equal.

3. Roadway Area Access
a. Utilize traffic duty rated adjustable access box with lid color coded to APWA standard for the specific utility being marked.
b. Lid shall allow connection to tracer wire without lid removal.
c. Manufacturer: Copperhead Industries, LLC, Bingham & Taylor, or approved equal.

D. Grounding:
a. Utilize 1.5 pound Magnesium anode stake capable of being driven into soil.
b. Anode shall include an HDPE cap and 20’ of factory installed 12 AWG solid copper tracer wire meeting requirements of Table 1 and red 30 mil high- density high molecular weight polyethylene (HDPE) insulation meeting requirements of Table 2.

c. Manufacturer: Copperhead Industries, LLC, or approved equal.

842.03 Quality Assurance. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

A. Reference Standards:
   1. ASTM B-170 (latest revision), Oxygen-Free Electrolytic Copper
   2. ASTM D 257, DC Resistance or Conductance of Insulating Materials
   3. ASTM D 638, Tensile Properties of Plastics
   4. ASTM D 746, Brittleness Temperature of Plastics and Elastomers
   5. ASTM D 790/1, Reinforced Plastics and Electrical Insulating Materials
   6. ASTM D 792, Density and Specific Gravity (Relative Density) of Plastics
   7. ASTM D 1238/E, Melt Flow Rates of Thermoplastics by Extrusion
   8. ASTM D 1525, Vicat Softening Temperature of Plastics
   9. ASTM D 1531, Relative Permittivity (Dielectric Constant) and Dissipation Factor
   10. ASTM D 1693/B, Environmental stress-cracking
   11. ASTM D 1895, Apparent Density, Bulk Factor, and Pourability of Plastic Materials
   12. ASTM D 2240, Rubber Property—Durometer Hardness
   13. ASTM D 2951, Resistance of Polyethylene Plastics to Thermal Stress-Cracking
   14. ASTM D 3417, Enthalpies of Fusion and Crystallization of Polymers
   15. ASTM D 3755, Dielectric Breakdown Voltage and Strength of Solid Electrical Insulating Materials Under Direct-Voltage Stress
   16. ASTM D 3895, Oxidative-Induction Time of Polyolefins

842.04 Submittals. Submit the following for approval:

A. Shop Drawings.
   1. Tracer Wire
   2. Connectors, grounding anodes, and test stations

842.05 Product Delivery, Storage, Handling, and Inspection. Deliver materials to the site to ensure uninterrupted progress of the Work. Materials received from factory shall be in new, undamaged condition. The Engineer or Engineer's Representative shall inspect all components of the tracer wire system prior to installation. Materials cracked, gouged, chipped, dented or otherwise damaged will not be acceptable and shall be removed from the site immediately. Damaged or defective materials will be rejected whether previously incorporated into the work or not. The CONTRACTOR shall pay all expenses of repairing or removing and replacing such defective materials. All materials shall be stored in a protective environment in accordance with manufacturers' recommendations.

842.06 Construction.

A. General
   1. Tracer wire installation shall be performed in such a manner that

allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

2. Tracer wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
3. Lay mainline tracer wire continuously, by-passing around the outside of valves and fittings on the North or East side.
4. Any damage occurring during installation of the tracer wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
5. Tracer wire shall be installed on top of the pipe and secured (taped/tied) at 5' intervals.
6. All conductive and non-conductive water service lines shall include tracer wire.
7. Tracer wire must be properly grounded as specified.
8. All service lateral tracer wires shall be properly connected to the mainline tracer wire, to ensure full tracing/locating capabilities from a single connection point.
9. At all mainline dead-ends; tracer wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the tracer wire. (See Grounding)
10. Mainline tracer wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the tracer wire.
11. All service lateral tracer wires shall be a single wire, connected to the mainline tracer wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline tracer wire.
12. In occurrences where an existing tracer wire is encountered on an existing utility that is being extended or tied into, the new tracer wire and existing tracer wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

B. Connections

1. All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
2. Non locking friction fit, twist on or taped connectors are prohibited.

C. Termination/Access

1. Primary access for water main tracer wire will be at fire hydrants. Trace wire must terminate at an approved above-ground tracer wire access box, properly affixed to the hydrant grade flange with a stainless steel bracket, (affixing with tape or plastic ties shall not be acceptable). Minimum of 24 in of PVC conduit shall extend below grade from bottom of access box to protect wire.
2. Above-ground tracer wire access boxes will be installed on all fire hydrants.
3. Tracer wire on all water service laterals must terminate at an approved tracer wire access box color coded blue and located directly above the service lateral at the edge of road right of way.
4. All tracer wire termination points must utilize an approved tracer wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
5. All grade level/in-ground access boxes shall be appropriately identified with "sewer" or "water" cast into the cap and color coded.
6. A minimum of 2 ft. of excess/slack wire is required in all tracer wire access boxes after meeting final elevation.
7. Tracer wire for service laterals with outside meters of 3' or larger, must terminate at an approved grade level/in- ground tracer wire access box, located at the entry point to meter pit.
8. Tracer wire for service laterals with outside meters 5/8" to 2", extend tracer wire into meter pit with sufficient slack to extend 2 feet above grade and be wrapped around meter bar without making an electrical connection.
9. Tracer wire for service laterals for inside meters must terminate at an approved above- ground tracer wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground tracer wire access box, located within 2 linear feet of the building being served by the utility.
10. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the grounding anode wire connection.
11. Where long-runs, in excess of 500 linear feet without service laterals or hydrants are constructed, tracer wire access must be provided utilizing an approved grade level/in- ground tracer wire access box. Grade box shall be located at the edge of the road right-of- way, and out of the roadway. The grade level/in-ground tracer wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

D. Grounding

1. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

2. Tracer wire must be properly grounded at all dead ends/stubs.
3. Grounding of tracer wire shall be achieved by use of drive-in magnesium grounding.

842.06 Basis of Payment. The installed, complete and accepted tracer wire system shall be included in each pertinent item as specified in Item 838, 840 and 841 and Standard Construction Drawings WM-1 and FH-1.

1000 MISCELLANEOUS

ITEM 1001 PREMIUM FOR OWNER'S PROTECTIVE INSURANCE

1001.01 Description. This item shall include payment for the premium for the required amount of Owner's Protective Insurance to be obtained in accordance with 103.42.

1001.02 Basis of Payment. The Contractor shall submit certification as to the actual amount of the premium for the Owner's Protective Insurance with the first estimate. Payment will be made under:

Item	Unit	Description
1001	Lump sum	Premium for owner's protective insurance

ITEM 1002 PREMIUM FOR CONTRACT PERFORMANCE AND PAYMENT BOND

1002.01 Description. This item shall include payment for the premium for the required amount of Performance and Payment Bonds to be obtained in accordance with Section 101.04 of the Information and Instructions to Bidders of this Contract

1002.02 Basis of Payment. The Contractor shall submit certification as to the actual amount of the premium for the performance and payment bond with the first estimate. Payment will be made under:

Item	Unit	Description
1002	Lump sum	Contract performance and payment bond