

CITY OF COLUMBUS, OHIO

**SUPPLEMENTAL SPECIFICATION 1100
REVISIONS TO THE 2012 CONSTRUCTION
& MATERIAL SPECIFICATIONS**

DATED August 1, 2014

101.03 Definitions

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101.03 Definitions.

National Holidays. New Years Day, January 1; Martin Luther King's Birthday - the Third Monday in January; Presidents' Day, the Third Monday in February; Memorial Day, the last Monday in May; Independence Day, July 4; Labor Day, the First Monday in September; Columbus Day, the Second Monday in October; Thanksgiving Day, the fourth Thursday in November; Christmas Day, December 25.

101.03 Definitions (New Definition)

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101.03 Definitions.

Registered Architect. An Architect registered with the Ohio Architects Board to practice architecture in the State of Ohio.

101.03 Definitions (New Definition)

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101.03 Definitions.

Allowance. An amount of money established by the City and included in the contract, which is set aside for a specific purpose, when the exact quantity of work for that specific purpose is not known at the time of bid.

101.03 Definitions (New Definition)

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101.03 Definitions.

Business Day. Wherever indicated inside these specifications, business days are defined as: Monday, Tuesday, Wednesday, Thursday, and Friday, excluding National Holidays and, if applicable, the day that a National Holiday is observed.

105.04 Coordination of the Contract Documents

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105.04 Coordination of the Contract Documents. In case of discrepancy, the Engineer will resolve any discrepancies using the following descending order of precedence:

- A. ~~Contract Form Addenda~~
- B. ~~Addenda Proposal and Special Provisions~~
- C. ~~Proposal Plans (Calculated dimensions on the Plans will govern over scaled dimensions.)~~
- D. ~~General Provisions (Section 100) Supplemental Specifications~~
- E. ~~Special Provisions Standard Drawings~~
- F. ~~Plan Notes Standard Specifications~~
- G. ~~Plans (calculated dimensions will govern over scaled dimensions)~~
- H. ~~Supplemental Specifications~~
- I. ~~Standard Drawings~~
- J. ~~Standard Specifications (Sections 200 through 1000)~~

105.11 Inspection of Work

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105.11 Inspection of Work. All materials and each part or detail of the Work shall be subject to inspection by the Engineer, Inspector or duly authorized City representative. The Engineer, Inspector or duly authorized City representative shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection. Notify the Engineer at least twenty four hours prior to all required special inspections and testing as specified in the Contract Documents or as required by the Engineer.

If the Engineer requests it, the Contractor, at any time before acceptance of the Work or any portion thereof, shall remove or uncover such portions of the finished Work as may be directed. After examination, the Contractor shall restore said portions of the Work to the standard required by the Contract Documents. Should the Work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as Extra Work; but should the Work so exposed or examined prove unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed, shall be at the Contractor's expense.

The Contractor shall notify the Engineer at least forty eight hours in advance of any changes in the work schedule. This notification is required to accommodate construction inspection scheduling. The notification shall include the beginning date and time of the work, and the duration of the work. The notification shall be submitted to the Engineer in writing. In the absence of such notification, and if the work is performed without inspection, the Engineer may require the work to be removed and redone.

If the City assigns an inspector(s) to the project and the Contractor does not notify the City of its intent not to work, charges incurred by the City for inspection services will be deducted from monies owed to the Contractor/Developer, unless such charges are waived by the Director.

Any Work done or materials used without supervision or inspection by an authorized City representative may be ordered removed and replaced at the Contractor's expense. Failure to reject any defective Work or materials shall not in any way prevent later rejection when such defects are discovered, or obligate the City to final acceptance of the Work.

When any unit of government or political subdivision or railroad or any corporation is to pay a portion of the cost of the Work covered by this Contract, its respective representatives shall have the right to inspect the Work. Such inspection shall not make any unit of government or political subdivision or railroad or any corporation a party to this Contract, and shall in no way interfere with the rights of the Contractor or City hereunder.

107.01 Laws to be Observed

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107.01 Laws to be Observed. The Contractor shall keep fully informed of all Federal, State and local laws, ordinances, codes and regulations and all orders and decrees of authorities having any jurisdiction or authority, which in any manner affect those engaged or employed on the Work, or which in any way affect the conduct of the Work. The Contractor shall at all times observe and comply with all such laws, ordinances, codes, regulations, orders, and decrees; and shall protect and defend, indemnify and hold harmless the City as provided in 107.24 relating to violation of any such law, ordinance, code, regulation, order, or decree, whether by the Contractor or its employees or agents, or the Contractor's subcontractors or suppliers.

The Contractor agrees that in the hiring of employees for the performance of work under this Contract or any subcontract hereunder, no Contractor or subcontractor, nor any person acting on behalf of such Contractor or subcontractor, shall, by reason of race, sex, ~~creed or~~ sexual orientation, gender identity or expression, color, religion, ancestry, national origin, age, disability, family status, or military status discriminate against any citizen of the United States in the employment of labor or workers, who is qualified and available to perform the work to which the employment relates. ~~That no~~ No Contractor, subcontractor, nor any of their employees or agents shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this Contract on account of race, sex, ~~creed or~~ sexual orientation, gender identity or expression, color, religion, ancestry, national origin, age, disability, family status, or military status.

108.02 Preconstruction Conference

Page 60-61

108.02 Preconstruction Conference. Unless otherwise provided for in the Contract Documents, no Work shall be commenced under this Contract until the Contract is fully executed and a Notice to Proceed has been issued.

The Preconstruction Conference shall not occur until after the Contract is fully executed. In general, fourteen days are required to notify all interested parties of a Preconstruction Conference. The Contractor shall take due note of this requirement and aid in the timely scheduling of the Preconstruction Conference to avoid unnecessary delays in the commencement of the Work.

At or before the Preconstruction Conference, the Contractor shall submit, to the Engineer, the baseline construction schedule prepared according to 108.03. The Contractor shall furnish a list of proposed subcontractors and material suppliers at or before the Preconstruction Conference. If the Contractor fails to provide the required submissions at or before the Preconstruction Conference, the Engineer may order the Preconstruction Conference suspended until they are furnished.

~~Unless otherwise provided for in the Contract Documents, no Work shall be commenced under this Contract until a Preconstruction Conference has been held.~~

~~After the Contract is fully executed, the City will send Preconstruction Conference notices to all parties. In general, fourteen days are required to notify all interested parties of a Preconstruction Conference. The Contractor shall take due note of this requirement and aid in the timely scheduling of the Preconstruction Conference to avoid unnecessary delays in the commencement of the Work.~~

~~At or before the Preconstruction Conference, the Contractor shall submit to the Engineer the baseline construction schedule prepared according to 108.03. Furnish a list of proposed subcontractors and material suppliers at or before the Preconstruction Conference. If the Contractor fails to provide the required submissions at or before the Preconstruction Conference, the Engineer may order the Preconstruction Conference suspended until they are furnished.~~

207.02 Materials

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207.02 Materials. Furnish commercial fertilizer, seed, and mulch materials conforming to Item 659. Furnish stabilized construction entrances, filter fabric ditch checks, rock checks, inlet protection, perimeter filter fabric fence, straw wattles, bale filter dikes, sediment basins and dams, dikes, slope drains, and rock channel protection materials as specified on the standard construction drawings.

207.03.B.1 Construction Requirements

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1. Perimeter Controls. Use perimeter filter fabric fence to protect the project

from sheet flow runoff from off Right-of-Way and off construction limit locations. Use perimeter filter fabric fence to protect the following project items from sheet flow runoff: water bodies, wetlands, or other significant items shown on the plans.

Use dikes to prevent sediment flow from coming on to the project and to non-vegetated barren areas on the project.

Install perimeter filter fabric fence, stabilized construction entrances, and dikes concurrent with clearing and grubbing operations.

207.06 Method of Measurement

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207.06 Method of Measurement. The City will measure fertilizer by the number of tons (metric tons) under 659 Commercial Fertilizer.

The City will measure Construction Seeding and Mulching by the number of square yards (square meters).

The City will measure Slope Drains by the number of feet (meters).

The City will measure Sediment Basins and Dams by the number of cubic yards (cubic meters) of excavation and embankment.

The City will measure Perimeter Filter Fabric Fence, Bale Filter Dike and Construction Fence by the number of feet (meters).

The City will measure Filter Fabric Ditch Check by the number of feet (meters).

The City will measure Inlet Protection by the number of inlets protected (each).

The City will measure Dikes by the number of cubic yards (cubic meters) of excavation and embankment.

The City will measure Construction Ditch Protection and Construction Slope Protection by the number of square yards (square meters).

The City will measure Rock Channel Protection, Type C or D (with or without) filter by the number of cubic yards (cubic meters).

The City will measure Sediment Removal by the cubic yards (cubic meters).

The City will measure Stabilized Construction Entrances by the Cubic Yard (Cubic Meter).

207.07 Basis of Payment

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207.06 Basis of Payment. The City will not pay if temporary erosion and sediment control items are required due to the Contractor's negligence, carelessness, or failure

to install permanent controls as a part of the work as scheduled; install such temporary work at no expense to the City.

The City will not pay for stream crossing work specified in 207.03.B.8.b.

If erosion control items in the Contract are properly placed according to the Contract Documents, the City will pay to maintain or replace erosion control items at the unit bid prices or according to 109.05.

The City will pay for sediment removed from dams, basins, inlet protection, ditch checks, rock checks, perimeter filter fabric fence, bale filter dikes, and all other types of filter fabrics, straw or hay bales, or any other temporary sediment control items under 207 Sediment Removal.

The City will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
207	Square Yard (Square Meter)	Construction Seeding and Mulching
207	Foot (Meter)	Slope Drains
207	Cubic Yard (Cubic Meter)	Sediment Basins and Dams
207	Foot (Meter)	Perimeter Filter Fabric Fence
207	Foot (Meter)	Bale Filter Dike
207	Foot (Meter)	Filter Fabric Ditch Check
207	Each	Inlet Protection
207	Cubic Yard (Cubic Meter)	Dikes
207	Square Yard (Square Meter)	Construction Ditch Protection
207	Square Yard (Square Meter)	Construction Slope Protection
207	Cubic Yard (Cubic Meter)	Rock Channel Protection Type C or D with Filter
207	Cubic Yard (Cubic Meter)	Rock Channel Protection Type C or D without Filter
207	Cubic Yard (Cubic Meter)	Sediment Removal
207	Foot (Meter)	Construction Fence
207	Square Yard (Square Meter)	Geo-textiles
<u>207</u>	<u>Cubic Yard (Cubic Meter)</u>	<u>Stabilized Construction Entrance</u>

259.03 Classification

259.03 Classification. Based upon the Engineer's selection as described in 259.02, furnish one of the following pavement types:

Permanent Pavement Replacement (Standard Drawing No. 1441-Dr. A)

- Type I - Bituminous
- Type III- Brick
- Type V – Concrete

Driveway Pavement Replacement (Standard Drawing No. 2160-Dr. A)

- Type IIIA - Asphalt Driveways
- Type IIIB - Concrete Driveways
- Type IIIC - Gravel Driveways

306.01 Description

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306.01 Description. This work consists of constructing a PCC base on a prepared subgrade or base course. This work shall conform to the requirements of Items 305 and 451 except that:

1. For concrete proportioning, meet the requirements of Item 499, Concrete, Class F.
2. Conform to the opening-to-traffic requirements as specified in 451.16 except that the split tensile strength shall be ~~250~~ 350 pounds per square inch (~~1.7~~ 2.4 MPa), as tested per ASTM C496.

3. Load transfer devices are not required.

401.20 Asphalt Binder Price Adjustment

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401.20 Asphalt Binder Price Adjustment. A Contract Item is eligible for a price adjustment when the Contract's Proposal specifically includes an Asphalt Binder Price Adjustment note ~~and the Contract Item meets the quantity limitations of the ODOT proposal note for Asphalt Binder Price Adjustments for Single Year or Multi-Year, as applicable.~~

423.09 Method of Measurement

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423.09 Method of Measurement. The City will measure Crack Sealing, of the type specified, by the number of pounds (kilograms) of hot applied sealant in place, completed, and accepted.

The City will measure Crack Sealing, of the type specified, by the number of linear feet (meters) of sealant in place, completed and accepted.

423.10 Basis of Payment

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423.10 Basis of Payment. The City will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
423	Pound (Kilogram)/ Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing with Routing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing with Sawing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type II
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type III
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type II or III
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type IV

451.061(2) Depositing and Curing Concrete During Cold Weather

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2. Once placed, cover the entire surface of the top and the sides of the newly placed concrete and protect from freezing for seven days, unless ~~split tensile-beam~~ specimens have attained the required minimum strength specified. Accomplish protection as directed in Item 511.12 with insulated blankets or with a combination of loose straw 12 inches (0.3 m) thick covered with a securely fastened exterior cover of waterproof material.

451.07 Placing Reinforcement

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451.07 Placing Reinforcement. Place pavement mesh of the size and at the locations within the concrete slab shown on ~~the~~ ODOT standard construction drawings BP-1.1.

499.04 Proportioning Options for Portland Cement Concrete

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499.04 Proportioning Options for Portland Cement Concrete. The Contractor may substitute one of the following options for each respective class of concrete given in Table 499.03-2 and Table 499.03-3. Use the same air content specified in Table 499.03-2 and Table 499.03-3. Comply with slump requirements of Table 499.03-1. Submit requests to use any of the following optional mix designs to the **Engineer Laboratory** for approval before use. The SSD weights specified in Table 499.04-1 through Table 499.04-3 were calculated using the specific gravities in 499.03.C. Make adjustments to the mix design when specific gravities differ by more than $\cdot 0.02$. Make other adjustments allowed in 499.03.D and approved by the Engineer.

511.17 Curing and Loading

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511.17-1 (Table).

TABLE 511.17-1			
	Span ^[1]	Age of Concrete in Days	
		No Beam Split Tensile Test	Beam Split Tensile Test ^[2]
Removing Falsework	Over 10 feet (3 m)	14	5
	10 feet (3 m) or less and all pier caps	7	3
Traffic ^[3]	Any	14	7

[1] Span is defined as the horizontal distance between faces of the supporting elements when measured parallel to the primary reinforcement.
 [2] Applicable only when the average ~~Split Tensile psi-modulus-of-rupture~~ for two tests is not less than 400.650 psi (2.76 4.5 MPa).
 [3] When placing Class HP concrete for a superstructure between October 15 and March 15, open the deck to traffic no sooner than 30 days after placement.

603.02 Materials

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603.02 Materials. Furnish materials conforming to:

Soil and granular embankment 203.02.R

Structural backfill, Types 1 and 2 703.11

~~The Engineer will allow Type 3 structural backfill, conforming to 703.11, to be used as bedding below the pipe only when pumping operations do not control severe ground water problems. Place at least 12 inches (300 mm) of Type 1 structural backfill on top of the Type 3 structural backfill to prevent piping.~~

Embankment 203.02.R

603.11 (D) Placement and Compaction Requirements.

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~~(D) — Place Structural Backfill Type 3 in layers not to exceed 12 inches (300 mm) loose depth. Vibrate, tamp, or compact to approximately 85 percent of the original layer thickness.~~

604.06 Precast Concrete Modular Construction.

Page 436

604.06 Precast Concrete Modular Construction. Furnish precast bases on a compacted structural backfill bed having a minimum thickness of 3 inches (75 mm). Ensure that the structural backfill bed is level and uniformly support the entire area of the base.

Catch basins and inlets manufactured with knock-out panels will only be permitted where the construction drawings show a pipe entering the structure that will replace the panel.

~~After placing the pipe, grout all openings between the pipe and structure less than 4 inches (100 mm) with mortar and grout all openings between the pipe and structure greater than 4 inches (100 mm) with nonshrink mortar. Seal all joints between modules with materials specified in Item 603 for Type A, B, C, D, or F conduit.~~

All joints between modules shall be as follows:

Sanitary manholes shall conform to the requirements of ASTM C443 as it pertains to the use of a confined gasket.

Storm sewer applications shall be in conformance with ASTM C443, 706.10 or 706.11.

Pipe entrances to the precast modular sections for sanitary sewers 8 inches (203 mm) to 48 inches (1.2 m) in diameter shall be a flexible watertight joint in accordance with 706.16.

Pipe entrances to the precast modular sections for storm sewers shall be in accordance with 706.16, or neatly grouted in place.

All lift holes and other openings in the structure shall be thoroughly and neatly grouted with cement mortar or other suitable material approved by the Engineer, after all pipes are placed into the structure.

All sanitary manholes shall be watertight structures.

Cure median inlets with the same materials and methods specified in 622.07.

630.02 Materials

Page 513-514

630.02 Materials. The acceptance of materials and products is based on Certified Test Data, furnished in triplicate, or on test results of samples according to 106.02, as required by the Engineer.

Transfer manufacturers' guarantees or warranties on all traffic sign material to the City or other maintaining agency upon completion and acceptance of the project.

Furnish materials conforming to:

Concrete, Class C	499, 511
Steel:	
Structural steel.....	711.01
Reinforcing steel	509.02
U-channel posts.....	730.015
Square posts	730.016
Wooden Box Beam	730.017
<u>Street name sign supports.....</u>	<u>730.017</u>
Tube and pipe.....	730.01
Anchor bolts and nuts	730.02
Poles and arms	730.03
Base and arm plates.....	730.04
Handhole covers.....	730.05
Pole caps	730.06
Arm caps	730.07
Hardware	730.08
Stainless steel	730.09
Stainless steel hardware	730.10
Messenger wire	732.18
Aluminum:	
Sheet and plate	730.11
Extrusions.....	730.12
Tube and pipe.....	730.13
Castings	730.14
Forgings	730.15
Welding rods	730.16
Hardware	730.17
Other materials:	
Decals	725.21
Reflective sheeting, Type F.....	730.18
Reflective sheeting, Type G.....	730.19
Reflective sheeting, Type H....	730.192
Reflective sheeting, Type J	730.193
Nonreflective sheeting	730.20
Silk screen inks	730.22
Transparent electronic cuttable films	730.23
<u>Cantilevered offset brackets.....</u>	<u>730.24</u>

630.04 Sign Fabrication

630.04 Sign Fabrication. Sign types include flat sheet, double faced, extrusheet, and temporary overlay. Flat sheet signs consist of one-piece units made of aluminum. Double faced signs consist of flat sheet aluminum or extruded aluminum blanks with legend on both sides. Extrusheet signs consist of a number of horizontal panels assembled to form a complete sign. Temporary overlay signs consist of an aluminum sheet covering portions or entire surfaces of extrusheet signs.

Prior to reflective sheeting application, clean aluminum sign surfaces either by total immersion in a tank containing an alkaline solution of the manufacturer's specification or by steam cleaning with an alkaline solution of the manufacturer's specification, followed by a thorough rinsing with running water. After cleaning, etch the surface with an acid solution, and dry. Do not allow cleaned and etched surfaces to become contaminated by contact with oil or grease. Drill or punch bolt holes to finish size.

Use sign legends according to the (a) City Sign Design Manual, (b) OMUTCD and (c) the ODOT Sign Design Manual. In case of a conflicting specification statement, the specification document hierarchy shall be in the order listed from (a), highest, to (c) lowest. Use Clearview font for positive contrast legends on freeway and expressway guide signs and on all other guide signs when permitted in the ODOT Sign Design Manual and City Sign Design Manual, respectively. Use capital legends and upper/lower case legends in accordance with the City Sign Design Manual. When either is permitted in the City Sign Design Manual, use upper/lower case legends.

For flat sheet, double faced mile marker, double faced street name and ground mounted extrusheet signs, use Type G, H or J reflective sheeting for background and reflective legends. For overhead extrusheet signs, use Type H reflective sheeting for the background, and use Type H reflective sheeting for reflective legends, shields and symbols (including hazardous cargo plate, airport symbol, arrows and borders). Apply reflective sheeting to the surface according to the manufacturer's recommendations, with no blisters, wrinkles, tears, or blemishes. Do not use reboundable or damage control sheeting for permanent signs.

For reflective legends on flat sheet, double faced street name signs and double faced mile marker signs, use reverse silk screen transparent ink or electronic cuttable film. For nonreflective legends, use direct silk screen black ink or direct applied nonreflective black sheeting copy. For double faced mile marker signs, use flat sheet aluminum and apply reflective sheeting and legend to both sides.

Street Name Sign faces shall be bonded to 0.063 inch (1.6 mm) thick sign blanks according to the sheeting manufacturers' recommendation. There shall be 2 sign faces on each sign blank, 1 on each side, unless otherwise noted. Street name legends shall be printed in heights of 4" on 9" blade, 6" on 12" blade, and 8" on 18" blades (102, 152 and 203 mm) upper and lower case. Standard FHWA Series D 2000 EX lettering shall be used on all signs 9" and 18" blades and FHWA Series C 2000 EX lettering for all 12" sign blades. Prefixes and suffixes shall be printed in heights of 2, 3, and 4 inch (50, 76, and 102 mm) upper and lower case. All letters shall be centered on the vertical dimension and the legend will be centered on the various sign blades horizontally. Street name letter heights will be as follows: 4 inch (102 mm) legend with 2 inch (50

mm) prefix and suffix on a 9 inch (228mm) blade, 6 inch (152 mm) legend and 3 inch (76 mm) prefix and suffix on a 12 inch (305 mm) blade, and an 8 inch (203 mm) legend and 4 inch (102 mm) prefix and suffix on an 18 inch (457 mm) blade. The minimum distance between the edge of the sign and the first or last letter of the street name, prefix, or suffix shall be 4 inch (102 mm). See City of Columbus Standard Drawing(s) for fabrication of street name signs.

Extrusheet panels consist of flat sheet aluminum reinforced with aluminum extrusions attached by spot welding. The Contractor may use panels extruded in a single operation in lieu of extrusheet panels. Do not use extruded panels and extrusheet panels in the same sign. Bolt together the minimum number of full length, sheeted panels to achieve the sign height, using aluminum bolts, washers, lock washers and nuts. For reflective legends, shields and symbols (including hazardous cargo plate, airport symbol, arrows and borders) use direct applied reflective sheeting. Apply all reflective legend on a sign with the same rotation angle orientation. For nonreflective legends, use direct applied nonreflective black sheeting copy.

For temporary overlay signs, use 0.063-inch thick flat sheet aluminum, with a maximum panel size of 8 × 4 feet. Apply sheeting and legend as described above for extrusheet signs. Attach temporary overlays to extrusheet signs in the shop or field using aluminum blind rivets at a maximum spacing of 18 inches on the peripheries of the temporary overlays and 24 inches within the interior. Position rivots so as not to disturb the legend on the underlying sign.

Use fluorescent yellow green reflective sheeting for the following signs: SCHOOL (S4-3), School Crossing (S1-1), yellow portions of school speed limit (S5-H3, S5-H4, S5- H5), SCHOOL ENTRANCE (S3-H3), SCHOOL BUS STOP AHEAD (S3-1), SCHOOL BUS TURN AHEAD (S3-H2), Bicycle Crossing (W11-1), Pedestrian Crossing (W11-2), Handicap Crossing (W11-9), SAFETY ZONE (W11-H15), and Playground (W15-1). Fabricate supplemental signs [such as SHARE THE ROAD (W16-1), Advisory Speed Plate (W13-1), Distance Plates (W16-2, W16-2a, W16-3, W16-3a), Supplemental Arrows (W16- 5p, W16-6p, W16-7p and AHEAD Plate (W16-9p)] from fluorescent yellow green sheeting when used with a sign above.

Use fluorescent yellow reflective sheeting for all yellow signs, yellow portions of multi-colored signs, and yellow sign post reflectors, except for signs and portions of signs required to be fabricated with fluorescent yellow green reflective sheeting.

For lighted signs, cover glare shield and rectangular luminaire support tube with nonreflective sheeting matching the predominant sign color.

Place identification decals of Type G silver white reflective sheeting with silk screened black numerals on signs in accordance with Figure 1. These sign identification decals shall be 6 inches by 3 inches in size and positioned so they can be read horizontally and are clearly visible, not near bolt holes or rivets. Place the decals on the back side of the sign in the lower right-hand corner of rectangular signs, or in an equivalent location of other sign shapes, approximately 3 inches from side and bottom sign edges (for smaller signs, these dimensions may be less).

The Engineer will reject signs delivered at the site without a properly applied decal. At the time of sign installation, indicate the installation data by scratching out the

appropriate month and year. Do not allow the sign installation contractor to erect any such signs, or overlays, that do not have a properly completed and affixed sign decal.

630.06 Sign Supports

Page 517-518

630.06 Sign Supports. Sign supports consist of ground mounted, rigid overhead, span wire, and overpass structure mounted types. Fabricate sign supports according to the applicable requirements of Item 513, and weld according to 513.21. The approval of fabricators according to 501.03 will not apply. Hot-dip galvanize steel structural members according to 711.02. Galvanize steel hardware according to 730.08.

Tighten threaded fasteners, except anchor bolt nuts, by the “turn of the nut” method according to 513.20.

Furnish anchor bolts with a leveling nut, plain washers, lock washer, and anchor nut conforming to 730.02. Use anchor nuts with a plain washer against the base plate upper surface and a lock washer between the plain washer and anchor nut.

Tighten anchor bolt nuts according to 513.20, except that under Table 513.20-3, use the “nut rotation from snug tight condition” from 1/12 to 1/6 turn instead of 1/3 turn.

Apply anaerobic adhesive complying with Federal Standard MIL S 46163, Type II, Grade N to anchor bolts and other threaded connections 1/2-inch (13 mm) diameter or larger, according to the manufacturer’s recommendations. Do not use anaerobic adhesive with torque-limiting nuts.

Submit alternate designs or materials for sign supports for acceptance at least 21 days in advance of a bid opening date. The Director will give notification of the acceptance or rejection of the alternate design to the bidder at least 7 days in advance of a bid opening date.

A. Ground Mounted Supports. Ground mounted supports consist of structural sections of the material and weights required. Drive the ground mounted supports into the earth or embed them in concrete, as specified. Install supports in exposed locations in accordance with the performance requirements of NCHRP 350. The support lengths shown on the plans are approximate. Determine the exact length of supports before fabrication.

1. Post Supports. Mark each driven post with a line of paint 6 inches above the specified driving depth. Drive posts to the specified depth without bending, distortion, or end mutilation. Do not splice posts. Do not place posts in drainage ditches. If unable to install the post at the specified location, relocate the post with the Engineer’s approval at no cost to the City.

Install posts located in paved areas through a hole provided by sleeving or core drilling. After the post is in position, patch the hole with a non-shrink grout; except when the hole is in asphalt, patch with bituminous material.

For groupings of flat sheet signs in multiple arrangements mounted on posts, provide sign backing assemblies.

For temporary sign supports and their placement, conform to the OMUTCD.

2. Structural Beam Supports. Furnish ground mounted structural beam supports from rolled steel sections. The alternate design shown on ODOT Standard Drawing TC-41.10 is not acceptable in the City of Columbus. Furnish slip base connections when specified. Bolt the pieces of each beam together, and preload the assembly bolts before delivery to the project. Carefully handle assembled breakaway beams during transportation and erection. Upon erection, perform the final specified torquing on all threaded fasteners.

At least 4 weeks after erecting signs on breakaway beams, inspect the breakaway feature for evidence of shifting or loose fasteners. Re-torque all loose fasteners to specified values. Loosen and re-torque slip base plate fasteners even if no shifting or looseness is detected. However, if the base plate connection was made with torque limiting nuts, re-torque only if looseness is detected. Apply anaerobic adhesive to the re-torqued conventional nuts, or, as an alternate, use new torque limiting nuts with the proper range.

3. Pipe Supports. Furnish ground mounted pipe supports from structural steel pipe and tubing. Furnish bolt down anchor installations in existing concrete. Furnish triangular slip base connection when specified.

~~**4. Wooden Box Beam Supports.** Furnish wooden box beam supports from laminated veneers pressure treated with wood preservative. Install breakaway feature after installation when specified.~~

~~**4. Street Name Sign Supports.** Supports for double-faced street name signs shall be either 2.5 inch (63.5 mm) nominal post size (NPS) (2.875 O.D. x 0.203 inch wall) (73 mm O.D. x 5 mm) x 14 foot (4.3 m) long post, or 4 inch (102 mm) NPS (4.0 O.D. x 0.226 inch wall) (102 mm x 5.7 mm) x 21 foot (6.4 m) long post fabricated from new, hot dipped galvanized steel pipe in accordance with Section 711.02. All supports shall be embedded in concrete in accordance with 499 Class C, according to 511. The 2.5" (63.5mm) NPS supports shall be concreted in a hole with a minimum depth of 3 feet (0.91 m), and a diameter of 10 inches (254 mm). The post shall have a minimum of 11 feet (3.3 m) above ground level. 4.0 inches (102 mm) NPS supports shall be concreted in a hole with a minimum depth of 4 feet (1.2 m), and a diameter of 10 inches (254 mm). The post shall have a minimum of 14 feet (5.2 m) above ground level. All spoils from installation shall be removed from the worksite. The maximum allowable sign area for a 2 sign installation is 10 square feet (0.95 square meters). If the total street name sign area is greater than 10 square feet (0.9 m²), 1 sign support per sign shall be used. For street name sign support installation and locations see City of Columbus Standard Drawing(s).~~

630.14 Method of Measurement

Page 521-523

630.14 Method of Measurement. The City will measure Ground Mounted Post Support by the number of feet, and will include driving, hardware for anchor base installation, and furnishing and placing of patching materials for excavations in paved areas.

The City will measure Foundations for ground mounted pipe supports, ground mounted structural beam supports, rigid overhead sign supports and span wire sign supports by the number of each for one pipe, structural beam, pole, end frame or strain pole, and will include excavation, reinforcing steel, concrete, backfilling, and when required the 10 foot foundation section of concrete barrier, and the disposal of surplus excavation.

The City will measure Ground Mounted Structural Beam Support by the number of feet measured from the bottom of the foundation to the top of the sign, and will include furnishing and placing of patching materials for excavations in paved areas.

The City will measure Ground Mounted Pipe Support by the number of feet measured from the bottom of the foundation to the top of the sign and will include u-bracket, tubing, posts and hardware for sign attachment, bolt-down anchor and furnishing and placing of patching materials for excavations in paved areas.

~~The City will measure Ground Mounted Wooden Box Beam Support by the number of feet, and will include excavation, backfilling, disposal of surplus material, and installation of breakaway feature.~~

The City will measure Street Name Sign Support as the size and number of pipe supports, including excavation and concrete embedment.

The City will measure Street Name Sign as square footage (square meters) of sign blank, including brackets assemblies, mounting fittings and hardware.

The City will measure One Way Support ~~and Street Name Sign Support~~ by the number of feet, and will include driving and furnishing and placing of patching materials for excavations in paved areas.

630.15 Basis of Payment

Page 523-524

630.15 Basis of Payment. The City will not pay for relocating posts from their planned location without prior approval by the Engineer.

The City will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
630	Each	Ground Mounted Structural Beam Support Foundation
630	Each	Ground Mounted Pipe Support Foundation
630	Each	Rigid Overhead Sign Support Foundation
630	Each	Span Wire Sign Support Foundation
630	Foot	Ground Mounted Support, ___ Post
630	Foot	Ground Mounted Structural Beam Support, ___ Beam
630	Foot	Ground Mounted Support, Pipe
630	Foot	Ground Mounted Wooden Box Beam Support, _____ Beam
630	Foot	One-Way Support, ___ Post

630	Foot	Street Name Sign Support, ___ Post
630	Each	2.5 inch (63.5mm) Street Name Sign Support
630	Each	4.0 inch (102mm) Street Name Sign Support
630	Square Foot	Street Name Sign
630	Foot	Temporary Sign Support, ___ Post or Each
630	Each	Breakaway Structural Beam Connection
630	Each	Triangular Slip Base Connection
630	Each	Overhead Sign Support, Type TC-___, Design___
630	Each	Combination Overhead Sign Support, Type TC-___, Design___
630	Each	Sign Attachment Assembly
630	Each	Luminaire Support Assembly
630	Each	Span Wire Sign Support, Type TC-17.10, Design ___
630	Each	Overpass Structure Mounted Sign Support, Type TC-___, Design___
630	Each	Sign Hanger Assembly, (Span Wire, Mast Arm)
630	Each	Sign Support Assembly, (Pole or Bridge Mounted)
630	Square Foot	Sign, (Flat Sheet, Ground Mounted Extrusheet, Overhead Extrusheet, Temporary Overlay)
630	Each	Sign, Double-Faced, (Mile Marker)
630	Square Foot	Sign Erected, (Flat Sheet, Extrusheet, Temporary Overlay)
630	Each	Sign Backing Assembly
630	Each	Sign Post Reflector
630	Square Foot	Covering of Sign
630	Each	Removal of Ground Mounted(Major) Sign and (Storage, Reerection, or Disposal)
630	Each	Removal of Ground Mounted(Structural Beam, Post, Pipe, Wooden Box Beam) Support and (Storage or Disposal)
630	Each	Removal of Overhead Mounted Sign and (Storage, Reerection, or Disposal)
630	Each	Removal of Overhead Sign Support and (Storage, Reerection, or Disposal), Type TC-___
630	Each	Removal of Overlay Sign

632.02 Contractor Personnel Requirements

Page 530

632.02 Contractor Personnel Requirements. ~~Conform to the requirements of City Supplement 1063 for the installation or testing of traffic signal equipment. Assign a full-time employee of the Contractor to act as the project supervisor. Do not change the project supervisor without giving the Engineer written notice. Provide International Municipal Signal Association (IMSA) certified documentation for Contractor employees if requested by the City.~~

~~An IMSA level two certified technician shall perform all of the following controller work:~~

- ~~1. Back panel wiring terminations~~
- ~~2. Programming~~
- ~~3. Testing or turn on~~
- ~~4. Troubleshooting~~

~~Assign a foreman to each crew performing work for the project. A foreman shall be present at all times when work is performed by the crew. Each foreman shall be an IMSA level one certified technician. Provide prior verbal notice to the Engineer in order to replace a crew foreman.~~

~~In addition, any trade person performing the following work shall be an IMSA level one certified technician:~~

- ~~1. Cable splices~~
- ~~2. Signal head installation~~
- ~~3. Cable and wire installation~~
- ~~4. Power service installation~~
- ~~5. Ground rod testing~~
- ~~6. Cable insulation testing~~
- ~~7. Field wiring terminations~~

632.14 Foundations

Page 537 - 538

632.14 Foundations. Locate support foundations, and stake with the proper elevation. If underground or overhead obstacles are encountered during stakeout, or to correct slope and subsurface difficulties, change foundation location and orientation with the approval of the Engineer. Ensure that the approved location provides a safe clearance from overhead power lines for construction operations, in compliance with the National Electrical Safety Code. The Contractor is responsible for the correct location, elevation, and orientation for all poles and pedestals installed on the foundations.

Orient one side of the anchor base pole foundation cap parallel to the sidewalk, back of-curb or edge-of-pavement, edge of the curb ramp, as shown on the signal plans. Make the top of the foundation flush with any adjacent sidewalk or concrete area, except where the ground rises steeply behind the sidewalk or concrete area. In this case, match the back side of the foundation to the ground slope and set the street side of the foundation above the sidewalk or concrete area and completely out of the sidewalk or

concrete area. Edge the pole foundation top using a 1/2-inch sidewalk edger and do not chamfer.

Install anchor bolts in the angular position shown in the plans. Install a minimum of two 2-inch conduit ells, used or unused, in each pole foundation.

Excavate for foundations using an earth auger to specified dimensions according to 503.04. Exercise caution when excavating in areas of underground installations to avoid their disturbance or damage. When a cave-in occurs or at the direction of the Engineer, excavate using casing, sleeving, or other methods, with the Engineer's approval according to 732.10. If subsurface obstructions are encountered, remove the obstructions, or replace the excavated material and relocate the foundation, with the Engineer's approval. If bedrock is encountered, the Contractor may reduce that portion of the specified foundation depth within the bedrock up to 50 percent. Perform all necessary dewatering of the excavation.

Perform foundation concrete work according to Item 511, except that the loading restrictions in 511.17 are modified by this subsection. Place the concrete against undisturbed soil or compacted embankment. Form the top of the foundations to a nominal depth of 6 inches below the groundline. Place the concrete foundation, including formed top, in one continuous concrete pour.

For foundations for anchor base type supports, provide the required reinforcing rods, and have anchor bolts and conduit ells accurately held by a template.

Remove forms and templates once the concrete has hardened sufficiently so as not to be susceptible to damage. After 14 days, erect and load supports on anchor base foundations. The Contractor may erect and load supports after 7 days if the tests of two ~~split tensile beam~~ specimens of concrete yield an average ~~modulus of rupture~~ of not less than ~~400~~ 650 pounds per square inch.

632.23 Cable and Wire

Page 540

Replace unreadable table 632.23-1 with the following:

TABLE 632.23-1 FIELD WIRING HOOKUP

PED UNIT FIELD WIRING HOOKUP

PED UNIT LOCATION	CROSSWALK DISPLAY	WIRE COLOR
SOUTH CROSSWALK	WALK	BLACK
	DONT WALK	ORANGE
WEST CROSSWALK	WALK	GREEN
	DONT WALK	RED
NORTH CROSSWALK	WALK	BLUE
	DONT WALK	WHITE W/BLACK TRACER
EAST CROSSWALK	WALK	GREEN W/BLACK TRACER
	DONT WALK	RED W/BLACK TRACER

SIGNAL HEAD & CABINET FIELD WIRING HOOKUP

SIGNAL DISPLAY	WIRE COLOR PER APPROACH
THRU R	RED
THRU Y	ORANGE
THRU G	GREEN
L/T R	BLACK (FUTURE USE ONLY)
L/T ↗	WHITE W/BLACK TRACER
L/T ↖	BLUE
R/T R	NOT USED BY CITY
R/T ↗	RED W/BLACK TRACER
R/T ↖	GREEN W/BLACK TRACER

WHITE SHALL BE USED FOR THE COMMON. SPLICE ALL WIRES IN THE SIGNAL HEAD OR PED UNIT. USE A #14 AWG 2 WIRE SPADE TERMINAL FOR EVERY 2 WIRES PER CONNECTION AND A #14 AWG 1 WIRE SPADE TERMINAL FOR EACH SINGLE WIRE CONNECTION TO CONNECT ALL WIRES TO ALL FIELD TERMINALS. USE BUTT SPLICES ON ALL THROUGH WIRES. ALL UNUSED WIRES SHALL BE SPLICED THROUGH AND SHALL HAVE A DEAD-END TERMINAL AT THE END OF THE WIRE.

632.28 (H) Cabinet Assembly Testing By the City of Columbus

Page 544

H. Cabinet Assembly Testing. ~~By the City of Columbus. Perform all cabinet assembly and signal testing and installation following the requirements of Supplemental Specification 1611. The Division of Planning and Operations Electronic Systems Shop will bench test the intersection controller and its complete cabinet assembly prior to the equipment being installed in the field. Testing will not begin unless complete and correct cabinet assembly wiring schematics, loop detector units, and if specified, the intersection tranceiver unit are submitted with the cabinet. The test procedures will consist of operating the equipment for a minimum of forty eight (48) hours. Deliver the controller and complete cabinet assembly for testing to the Division of Planning and Operations Traffic Maintenance Shop at 1820 East 17th Avenue, Columbus, Ohio 43219. Load and unload all equipment and obtain a receipt from shop personnel that lists all delivered materials by manufacturer, model number, and serial number. The Division will complete testing on the controller and cabinet assembly within ten (10) City working days. Upon completion of the testing the Division will notify the Contractor that the equipment can~~

~~be picked up. Replace, repair or correct as necessary all devices found to be unsatisfactory and resubmit for testing. The Division will schedule testing of this returned equipment as quickly as possible but will only provide a forty five (45) day guarantee for the turn around time period. The Contractor shall be solely responsible for any delay caused by this testing. Do not install control equipment, which has not passed testing or which has not been tested by the Division, in the field to control traffic. The Contractor may have a representative in attendance during the testing process. There are no costs associated with the testing. Any cost associated with the delivery and pick up shall be incidental to the cost of the equipment. Contact the Division of Planning and Operations Electronic Systems Coordinator for equipment status.~~

703.08 Aggregate for Pipe Bedding and Initial Backfill (New Section)

Page 632

703.08 Aggregate for Pipe Bedding and Initial Backfill.

1. Provide No. 57 coarse aggregate, as specified in 703.01, consisting of washed gravel, or CCS.

Do not use RPCC for any bedding or initial backfill materials.

Do not use reclaimed asphalt concrete for any bedding or initial backfill materials.

703.11 Structural Backfill for 603 Bedding and Backfill.

Page 632 - 633

703.11 Structural Backfill ~~for 603 Bedding and Backfill.~~ Furnish structural backfill ~~for 603 bedding and backfill~~ consisting of CCS, gravel, natural sand, sand manufactured from stone, ~~or~~ foundry sand, ~~or RPCC (Type I only).~~

Do not use RPCC for any bedding or initial backfill materials.

Do not use RPCC as backfill material for any metallic pipe.

Do not use reclaimed asphalt concrete for any bedding or backfill materials.

Use foundry sand if the material meets these requirements and meets the requirements of the Ohio EPA, Division of Surface Water, Policy 400.007 "Beneficial use of Non-Toxic Bottom Ash, Fly Ash and Spent Foundry Sand and Other Exempt Waste," and all other regulations. Ten days before using foundry sand on the project, from the Ohio EPA, the Contractor may elect to have an independent consultant pre-qualified by ODOT in remedial design environmental site assessment review the proposed usage. The consultant will provide all documentation utilized to usage according to all Ohio EPA regulations. Ensure that the consultant coordinates all EPA required meetings, documentation, and testing requirements. Ensure that the consultant certifies this to the City.

A. Structural Backfill Type 1.

1. Furnish Type 1 structural backfill that meets the gradations of Item 304, except 0 to 20 percent may pass the No. 200 sieve.

2. Physical properties.

Percent of wear, Los Angeles test, maximum (CCS or washed gravel)	50 %
Loss, sodium, sulfate soundness test, maximum	15 %
Percent by weight of fractured pieces (one or more faces), minimum (Type 3 only)	90 %

Do not exceed the following percentages of deleterious substances:

Material Type	Percent by weight
Shale and shaly material	5.0
Chert, that disintegrates in 5 cycles of the soundness test	5.0

Ensure that the portion of the material passing through the No. 40 (425 µm) sieve has a maximum liquid limit of 25 and a maximum plasticity index of 6.

When using RPCC, ensure that the maximum percentage passing the #200 sieve is 10%.

B. Structural Backfill Type 2.

1. Furnish Type 2 structural backfill that meets the gradation below:

Sieve Size	Total Percent Passing
2 1/2 inch (63 mm)	100
1 inch (25.0 mm)	70 to 100
3/4 inch (19.0 mm)	–
3/8 inch (9.5 mm)	–
No. 4 (4.75 mm)	25 to 100
No. 8 (2.36 mm)	–
No. 40 (425 µm)	10 to 50
No. 50 (300 µm)	–
No. 200 (75 µm)	5 to 15

2. Physical properties:

Percent of wear, Los Angeles test, maximum (CCS or gravel)	50 %
Loss, sodium sulfate soundness test, maximum	15 %

Ensure that the portion of the material passing through the No. 40 (425 mm) sieve has a maximum liquid limit of 25 and a maximum plastic index of 6.

703.13 Coarse Aggregate for Items 305, 451 and 452.

Page 633

703.13 Coarse Aggregate for Items 305, 306, 451 and 452.

703.15 Suitable Materials for Embankment Construction.

Page 636

~~703.15~~ 703.16 Suitable Materials for Embankment Construction.

703.16 Aggregate Materials for 304.

Page 638

~~703.16~~ 703.17 Aggregate Materials for 304.

703.17 Materials for Items 410, 411, and 617.

Page 639

~~703.17~~ 703.18 Materials for Items 410, 411, and 617

703.18 Rock and Aggregate Materials for Item 601.

Page 640

~~703.18~~ 703.19 Rock and Aggregate Materials for Item 601.

706.05 Precast Reinforced Concrete Box Sections.

Page 661

706.05 Precast Reinforced Concrete Box Sections. Provide precast reinforced concrete box section conforming to ASTM C 1577, with the following modifications:

Use precast concrete member manufacturers certified by the Laboratory according to City Supplement 1073.

Submit shop drawings according to 501.04 (A).

6.2.1 Provide cement according to 701, except 701.07.

6.2.2 Provide fly ash according to 701.

6.3 Provide aggregates conforming to the quality requirements of 703.02.

6.5 Provide reinforcement according to 709.10 or 709.12. Provide longitudinal distribution reinforcement according to 709.01, 709.10 or 709.12.

7.1 Use only the following box sizes with a span by rise of 8 x 4, 5, 6, 7; 10 x 5, 6, 7, 8, 9; and 12 x 4, 6, 8, 10 feet.

9.1 Provide hardened concrete that contains a minimum of 4 percent entrained air for wet-cast sections with spans less than 14 feet and for all sections with spans 14 feet and greater.

9.4 Do not use lift holes. Use handling devices that do not require a hole through the box.

10.1 Verify concrete strength using cylinders. Do not ship items before the concrete reaches its design strength.

11.5 Ensure a minimum cover of 1/2 inch over both circumferential and longitudinal reinforcement at the mating surfaces of joints.

15 In addition, mark the identification of the plant on each box section. For box sections 14 feet or greater, mark the reinforcing steel areas for the section on each box section. Place the manufacturers' name and required product information on the inside of the box section within the top one-half of the culvert.

706.051 Precast Reinforced Concrete Three-Sided Flat Topped Culverts

Page 662

706.051 Precast Reinforced Concrete Three-Sided Flat Topped Culverts. Provide precast concrete three-sided flat topped culverts according to ASTM C 1504, with the following modifications:

Provide flat deck culvert structures with a minimum clear span (measured normal to the structure at the bottom of the haunch) of 14 feet and a minimum opening rise (measured from bottom of leg to bottom of deck at the centerline of the structure) of 4 feet; and a maximum clear span of 34 feet and maximum opening rising of 10 feet. Ensure minimum wall and deck thicknesses of 10 inches and 12 inches respectively, measured under the haunch normal to the structure and at the centerline of the span measured perpendicular to the structure.

Use precast concrete member manufacturers certified according to City Supplement 1073.

Ensure that the manufacturer submits design calculations, a structural load rating and shop drawings ~~according to 501.04 (A) for review and approval by the City~~. Do not produce any units until ~~approved drawings have been submitted to the City receiving approval. Submit a minimum of five copies of the drawings. Allow a minimum of four weeks for approval.~~ Ensure that the shop drawings include the following:

1. Load rate the structure according to the requirements of Section 900 of ODOT's Bridge Design Manual.
2. All material specifications.
3. All plan view.
4. All elevation view.

5. All headwall and wingwall attachment requirements.
6. All dimensions.
7. All maintenance of traffic phases.
8. All section sizes.
9. All design handling strength.

The manufacturer may modify an approved shop drawing and resubmit according to 501.04 (A) for approval to the City.

706.052 Precast Reinforced Concrete Arch Sections

Page 666

706.052 Precast Reinforced Concrete Arch Sections. Provide precast reinforced concrete arch sections according to ASTM C 1504, with the following modifications:

This item shall consist of manufacturing precast reinforced concrete arch sections for culverts.

Use precast concrete member manufacturers certified according to City Supplement 1073.

~~5~~ Ensure the manufacturer submits design calculations, a structural load rating and shop drawings according to 501.04 (A) for review and approval by the City. Do not produce any units until approved drawings have been submitted to the City receiving approval. Submit a minimum of five copies of the drawings. Allow a minimum of 4 weeks for approval. Ensure the shop drawings include the following:

1. Load rate the structure according to the requirements of Section 900 of ODOT's Bridge Design Manual.
2. All material specifications.
3. All plan view.
4. All elevation view.
5. All headwall and wingwall attachment requirements.
6. All dimensions.
7. All maintenance of traffic phases.
8. All section sizes.
9. All design handling strength.

The Contractor may modify an approved shop drawing and resubmit according to 501.04 (A) for approval to the City.

706.053 Precast Reinforced Concrete Round Sections

Page 670

706.053 Precast Reinforced Concrete Round Sections. Provide precast reinforced concrete elliptical and circular arch sections according to ASTM C 1504, with the following modifications:

This item consists of manufacturing precast reinforced concrete elliptical and circular arch sections for culverts.

Use precast concrete member manufacturers ~~of~~ certified according to City Supplement 1073.

~~5-~~ Ensure the manufacturer submits design calculations, a structural load rating and shop drawings according to 501.04 (A) for review and approval by the City. Do not produce any units until approved drawings have been submitted to the City, receiving approval. Submit a minimum of five copies of the drawings. Allow a minimum of 4 weeks for approval. Ensure the shop drawings include the following:

1. Load rate the structure according to the requirements of section 900 of ODOT's Bridge Design Manual.
2. All material specifications.
3. Plan view.
4. Elevation views.
5. Headwall and wingwall attachment requirements.
6. Dimensions.
7. All maintenance of traffic phases.
8. Section sizes.
9. Design handling strength.

The City will allow the Contractor to modify an approved shop drawing and resubmit according to 501.04 (A) for approval to the City.

706.13 Precast Reinforced Concrete Manhole Riser Sections, Catch Basins Inlet Tops, and Portable Barriers

Page 676

706.13 Precast Reinforced Concrete Manhole Riser Sections, Catch Basins Inlet Tops, and Portable Barriers. All manhole and barrier structures will conform to ASTM C478. All catch basins, inlets, and inlet tops will conform to ASTM C913.

706.16 Resilient Connectors Between Precast Manhole Riser Sections, Catch Basins, Inlets, and Pipes. (New Section)

Page 676

706.16 Resilient Connectors Between Precast Manhole Riser Sections, Catch Basins, Inlets, and Pipes. Material and performance requirements shall meet the standards of ASTM C923, and be approved by the Engineer. The actual joint may be one of the following designs:

- (a) Rubber sleeve with stainless steel band
- (b) Rubber gasket compression
- (c) Rubber gasket expansion

711.12 Gray Iron Castings

Page 699

711.12 Gray Iron Castings. Provide gray iron casting in accordance with ASTM A 48, Class ~~35B30B~~, with the following modifications:

730.017 Street Name Sign Supports (New Section)

Page 736

730.017 Street Name Sign Supports. Provide street name sign posts fabricated from new hot-dipped galvanized steel pipe as in 711.02 and in accordance with ASTM Specification Number A53 with a minimum yield strength of 30,000 psi and a minimum tensile strength of 48,000 psi. Evidence of prior rusting or pitting shall be cause for rejection of the posts. The street name sign post shall have a tubular section of uniform diameter and wall thickness. The diameter and wall thickness shall be for the standard weight (Schedule 40) nominal pipe size (NPS) as specified for each bid item. The finished post shall be straight, have a smooth finish and be free from defects affecting their strength, durability or appearance. All cut ends shall be free from burrs. Each piece shall be continuous with no butt welds.

Provide materials in accordance with the City's QPL.

730.24 Cantilever Offset Bracket (New Section)

Page 739

730.24 Cantilever Offset Bracket. Finished street name sign blanks shall be riveted to 2 cantilevered offset bracket assemblies with universal saddle clamps and a double tee section in accordance with 711.01. For signs greater than 48 inch (1.2m) in length, a special assembly is required. This assembly shall consist of 2 cantilevered offset brackets placed back to back and placed on top and bottom of sign assembly and riveted to the appropriate double tee section. The signs shall be attached to the sign supports using a stainless steel buckle-strap combination. For fabrication see City of Columbus Standard drawing(s).

733.02 Controller Units

Page 757

733.02 Controller Units.

B. C. Type TS-2/A2. Provide a controller unit meeting NEMA TS-2...

801.03 Ductile Iron Pipe

Page 784

801.03 Ductile Iron Pipe.

Polyethylene Encasement: Wrap all ductile iron pipe with tube style 8-mil linear low density polyethylene (LLDPE) film made from virgin material (no recycle material) in accordance with AWWA C 105/A21.5 ~~for all open cut installations~~. Provide black film with nominal 2% carbon black UV inhibitor and printed per the C105 Standard. Adhere to the following Physical Properties:

801.03 Ductile Iron Pipe

Page 785

801.03 Ductile Iron Pipe.

Installation: Deliver film to the jobsite contained in a sound sacrificial sleeve of UV Protected Polyethylene to protect contents during storage prior to installation.

Install the polyethylene encasement per Method A of ANSI/AWWA C105/A21.5. Remove all lumps of clay, mud, cinders, etc. from the pipe surface before encasing the pipe. Keep soil, or bedding material, from becoming trapped between the pipe and the polyethylene sleeve. When lifting polyethylene-encased pipe use a fabric type sling or padded cable to protect the polyethylene. Overlap joints (double coverage) and tape. Fold excess slack over the top of the pipe and tape in place every three feet. Carefully backfill the pipe according to Item 801.11 and 801.12. To avoid damage during backfilling allow adequate slack in the film tube at joints. Use backfill material free of cinders, rocks, boulders, nails, sticks or other material that could damage the polyethylene sleeve.

801.10 Excavation and Pipe Laying

Page 794

801.10 Excavation and Pipe Laying. Pipe Haunching (for 20 inch ~~inch~~ diameter and greater): Provide Crushed Carbonate Stone (CCS) Size No. 57 as specified in 703 – Aggregate. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. Extend the depth of haunching ~~extend~~ from the trench bottom up to 1/2 times the pipe diameter. If the pipe requires adjustment after placement, remove and re-lay as new pipe. Prevent damage to coating when placing backfill. Place haunching material manually around pipe and spade full depth of lift to prevent bridging and provide uniform bearing and side support.

801.11 Backfill Within The Influence of Pavement

Page 796

801.11 Backfill Within The Influence of Pavement. This section discusses backfilling above the initial backfill up to ground surface or beneath pavement subgrade within the influence of pavement as defined by Standard Drawing L-6309E.

Unless otherwise shown, specified, or ordered, provide granular backfill material meeting the requirements of ~~Section 304.02 or Section~~ Item 703.11. The City will allow use of ~~f~~Flowable Control Density Fill, Type II complying with the requirements of Item 613 as an alternate to compacted granular material. Do not use RPCC for any bedding or backfill material.

Ensure that the moisture content does not exceed less than minus 4 percent of optimum moisture prior to spreading. Shovel in-place and compact material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Do not exceed 8 inches for a single layer of compacted thickness. See ~~Section~~ Item 801.12 for compaction requirements. Extend the compacted backfill to the top of the pavement subgrade for trenches within traveled areas, and to within 6 inches of the existing ground in all other areas.

801.12 Backfill Outside The Influence of Pavement

801.12 Backfill Outside The Influence of Pavement. Backfill in conformance with the requirements of Section 801.11 above, outside the influence of pavement, as defined by Standard Detail L-6309E, except as herein modified..

Provide suitable backfill material native to the project, or granular backfill material conforming to the requirements of ~~Section 304.02 or Section Item~~ 703.11. Do not use RPCC for any bedding or backfill material. Dispose of excavated material unsuitable for backfill compacting at no additional cost to the City. Provide granular backfill material from somewhere else. Spread material in successive layers not exceeding a depth of 8 inches. Compact from above the initial backfill to within 6 inches of the existing ground. The following requirements apply to granular material conforming to Section 304.02, Section 703.11, and to native material:

Max. Lab. Dry Wt. Lbs./cu. Ft.	Min. Compaction Requirements % Lab. Max.
90-104.9	102%
105-119.9	100%
120 and more	98%

Backfill the remaining 6 inches of excavation with approved material without mounding of fill. Maintain trenches in good and safe condition up to the time of acceptance of the work.

Backfill traveled areas in accordance with Section 801.11.

801.14 Hydrostatic Tests

801.14 Hydrostatic Tests. Apply a hydrostatic test to the mains and fire hydrant leads as required in Section 5 of the Standard AWWA Specification C600 for Ductile Iron Pipe, Section 4 of AWWA Specification C604 and M11 for Steel Pipe or AWWA M9 for Concrete Pipe. Test all new services to the curb stop. Test each valved section of water main independently of one another unless otherwise approved by the Engineer. Conduct pressure test with all watch valves open and hydrant foot valves closed. Maintain 150 psi of pressure in any tested section for a minimum of two hours. ~~Maintain 150 psi of pressure in any tested section.. Test for at least two hours, except when the test indicates zero leakage after the first hour. The City may approve termination of the pressure test after one hour with zero leakage.,~~ Furnish all materials, make all taps required and furnish a pump, metering equipment, piping, other equipment and all necessary assistance for conducting the tests.

801.16 Main Shuts

801.16 Main Shuts. Prior to the start of proposed water main improvement, submit a plan and an accompanying schedule identifying the location and estimated dates for water main shuts to the Division of Power and Water for approval.

Only Division of Power and Water personnel will operate valves. Operation of existing valves by the Contractor or their representative may result in penalties as identified in Chapter 1113 of the City Code.

Notify Division of Power and Water personnel at least 72 hours in advance to the actual water main shut. Notify and coordinate water main shuts with all affected customers. City personnel will work with the Contractor in identifying affected customers and will provide a sample notification letter. The City will approve the final notification letter. The Division of Power and Water personnel may re-schedule the main shut at its discretion if the Contractor appears unprepared to perform the work scheduled during the shut.. The City will not pay for costs associated with lost time due to lack of preparation by the Contractor. At a minimum, notify critical users (large 801.17 businesses, hospitals, medical centers, industries, etc.) of non-shuts due to rescheduling or delays in the work.

To minimize impacts to customers, the City may require the Contractor to make shuts at night. Include costs incurred to perform contract work after regularly scheduled hours due to main shuts and all cost associated with coordinating shuts with the City in Item 801.

No shuts are permitted to occur on or one (1) business day before a National Holiday or National Holiday weekend, unless otherwise approved by the Engineer.

809.02 Description of Fire Hydrants

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809.02 Description of Fire Hydrants.

7. **Paint.** Provide hydrants with two good coats in a gloss enamel of one color for the entire hydrant. The color shall be Safety Orange. After installation of the fire hydrants, the contractor is responsible to apply touch-up paint to any damage to the factory-applied hydrant paint. Hydrants will not be accepted until any paint damage from shipping or installation has been repaired. Use hydrant touch-up paint in accordance with the approved material list.

~~7. **Paint.** Provide hydrants with two good coats of special yellow hydrant enamel, with the top 4 inches (102 mm) of the hydrant from operating nut down painted flat black.~~

809.03 Installation

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809.03 Installation. Furnish and install hydrants at the locations shown on the plans. Locate hydrants 2 feet behind the back of the curb line or 8 feet from the edge of paved area on non-curbed roadways unless otherwise shown on the plans or directed by the Engineer. Provide hydrants of the proper length to suit the depth of cover over the water lines at the locations shown on the plans and furnish the necessary extensions to

obtain the proper length. Locate fire hydrants a minimum of 6 feet clear of all driveway openings and curb returns. Install and restrain a second watch valve within 2 feet of the hydrant if the hydrant lead exceeds 15 feet in length.

Excavate the pit or trench for the fire hydrant so when installed, the hydrant base rests on a concrete slab on undisturbed soil. Set the hydrant plumb with nozzle outlet approximately 18 inches from ground line. Set hydrants set in accordance with grade line or approximately 2 inches below bottom of break connection on the hydrant standpipe.

Install fire hydrants with hardwood backing against Class "C" concrete backing poured against undisturbed earth, as approved by the Engineer.

Any fire hydrant used between the dates of September 15th and April 15th shall be pumped dry to the foot valve of the hydrant barrel or a minimum of five (5) feet below the surface of the existing ground, by the contractor, immediately after each time the hydrant is operated or after initial installation.

901.02 Materials and Material Handling

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901.02 Materials and Material Handling. Provide pipe of the size and kind specified in the proposal and shown on the plans and meeting the requirements of the relevant parts of Section 706, Section 720 or Section 801. If the proposal or plans do not specifically itemize the type of pipe, the Contractor may use pipe from its list of approved manufacturers. The City will maintain a list of current Approved Manufacturers, Product Types and Sizes, and Authorization Letters on file at the Laboratory.

Provide specific materials as follows unless otherwise specified in the Contract Documents:

1. Concrete for encasement, cradle, backing
and backfill Class A 499, 905
2. Concrete for blocking - Class C 499
3. Stone or gravel bedding - No. 57 703
4. Compacted granular material 912.02
5. Cement for mortar 701
6. Sand for mortar 703.03
7. Lime for mortar 712.04
8. Gaskets for Concrete Pipe Joints 901.15
9. Gaskets for Vitrified Clay Pipe Joints 901.15
10. Gaskets for PVC Pipe Joints..... 901.15
11. Gaskets for Ductile Iron Pipe Joints 901.15
12. Non-Reinforced Concrete Pipe 706.01
13. Reinforced Concrete Pipe 706.02
14. Reinforced Elliptical Concrete Pipe 706.04
15. Vitrified Clay Pipe, Extra Strength 706.08

16.Polyvinyl Chloride (PVC) Sewer Pipe	720
17.Ductile Iron Pipe	801.03
18.Precast Reinforced Concrete Box Sections	706.05
19.High Density Polyethylene Pipe (HDPE)	720
<u>20.High Density Polypropylene Pipe (HDPP)</u>	<u>720</u>

Exercise care in material handling to prevent field and installation damage that could impair the function and durability of the installation. In particular, carefully handle thermoplastic conduits during cold weather.

901.11 Bedding and Embedment

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901.11 Bedding and Embedment. Place cutoff trench dams of native clay or impervious soil across and along the trench at 150 foot (45.7 m) intervals. Place at least 1 trench dam between adjacent manholes regardless of spacing. Compact the trench dams 6 feet (1.8 m) in length, as measured along the sewer centerline and bench into the undisturbed trench sides from the subgrade or top of cradle, to within 5 feet (1.5 m) of the existing surface. If constructing trench dams in rock or hardpan, extend to the top thereof whichever is greater. Where pipe cover is less than 5 feet (1.5 m) ~~the~~ extend the dam to within 1 foot (0.3 m) of the existing surface. Provide the trench dam installation with a minimum of 3 feet (0.9 m) of compacted material above the crown of the pipe.

Type I.

1. For flexible sanitary and storm sewers 6 inches (152 mm) in diameter up to and including 60 inches (1524 mm) in diameter, provide a bedding of No. 57 stone, conforming to Item 703.08, or compacted granular material in accordance with Section 912.02 extending from a point 4 inches (101 mm) below the bottom of the pipe to a point ~~12-6~~ inches (~~305-152~~ mm) above the outside top of pipe as shown on the standard drawings.
2. For rigid sanitary and storm sewers 6 inches (152 mm) in diameter up to and including 27 inches (685 mm) in diameter, provide a bedding of No. 57 stone, conforming to Item 703.08, or compacted granular material in accordance with Section 912.02 extending from a point 4 inches (102 mm) below the bottom of the pipe to spring line of the pipe as shown on the standard drawings.
3. For rigid sanitary and storm sewers 30 inches (762 mm) in diameter up to and including 108 inches (2743 mm) in diameter, provide a bedding of No. 57 stone, conforming to Item 703.08, or compacted granular material in accordance with 912.02 extending from a point 6 inches (152 mm) below the bottom of the pipe to the spring line of the pipe as shown on the standard drawings.

If using Type I bedding, include the cost of all bedding as described above in the price bid for the various pipe items. ~~If compacted granular material fails to meet the compaction required under Section 912.03, under pipe haunches and around the pipe, the Engineer will direct the use of stone bedding, No. 57, in lieu of compacted granular material at no additional cost to the City.~~

Provide embedment for thermoplastic pipe used in areas where lateral soil support is negligible or questionable in accordance with the recommendations of ASTM D2321 Appendix XI Commentary.

901.12 Laying Pipe

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901.12 Laying Pipe. Examine each pipe for defects and damage. Do not use defective or damaged pipe. Lay pipelines to the grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Do not, under any circumstances lay pipe in water or when trench conditions or weather prove unsuitable for such work. Provide for the diversion of drainage or dewatering of trenches during construction as necessary. Inspect all pipe in place before backfilling, and remove and replace those pipes damaged during placement.

Lay pipes in finished trenches starting at the lowest point so that the spigot ends point in the direction of flow. Lay all pipes with ends abutting and true to line and grade.

Where necessary with bell end pipe, excavate suitable bell-holes in the bedding material for the bell of each pipe so that the bells will not support the weight of the pipe. Fit and match the pipes so that when placed, they will form a conduit with a smooth and uniform invert. Use all possible care when shoving the pipes together to minimize the joints and carefully clean the pipe ends before placing the pipes. Install gaskets in accordance with the manufacturer's recommendations.

Use Class A concrete encasement, in accordance with ~~to~~ the applicable dimensional standard drawing, within the limits of existing or proposed paved areas inside right-of-way, where minimum cover during construction or proposed cover over the outside top of the pipe to top of finished grade is 48 36 inches (~~762 914~~ mm) or less.

Make all connections with existing structures after cleaning the structures in a thorough, first class, neat and workmanlike manner acceptable to the Engineer. Include the cost of this work in the price bid for the various pipe items.

901.15 Pipe Joints

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901.15 Pipe Joints.

Sanitary Sewers

Concrete. Provide pipe joints conforming to the requirements of ASTM C 443 and as specified herein. Use solid gaskets of circular cross section confined in an annular space formed by the shoulder on the bell and spigot or in the groove in the spigot of the pipe so that movement of the pipe or hydrostatic and hydrodynamic pressure cannot displace the gasket. When the joint is assembled, compress the gasket to form a watertight seal.

Provide all elliptical reinforced concrete pipe for sanitary sewers with Type B - mortar joints and ASTM C 877 rubber and mastic sealing band.

Vitrified Clay. Provide pipe joints conforming to the requirements of ASTM C 425 Compression Joints for Vitrified Clay Bell and Spigot Pipe.

Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe. Provide pipe joints conforming to the requirements of ASTM D 3212.

Ductile Iron. Use mechanical or push on joints meeting AWWA C111 or restrained joints meeting AWWA C110 or C153.

Polypropylene Sewer Pipe. Provide pipe joints conforming to the requirements of **ASTM D 3212.**

Storm Sewers

Concrete. Use pipe joints conforming to one of the following:

Type A Rubber Gasket. Meet the requirements of ASTM C 443.

Type B Mortar. On sewers 30 inches (762 mm) in diameter and larger, lay the groove end of the pipe to line and grade and wash with a wet brush and butter the bottom half of the groove with 1 to 2 Portland Cement mortar. Clean the tongue of the next section of pipe with a wet brush and apply a layer of 1 to 2 Portland Cement mortar to the top half of it. Then fit the tongue end of the second pipe into the groove end of the first pipe until the mortar is squeezed out onto the inner and outer surfaces. Point the inner surface of the pipe at the joint and smooth with a long handled brush. Point the outside with a bead of mortar. If the joint opening on the bottom half of the pipe exceeds 1/2 inch (13 mm), fill with 1 to 2 Portland Cement mortar.

Type C Bituminous pipe joint filler. Meet the requirements of Section 706.10.

Type D Preformed butyl rubber material. Meet the requirements of 706.14. For concrete pipe 78 inch (2.0 m) diameter and over, prime the annular mating surfaces.

Vitrified Clay. Construct pipe joints conforming to one of the following:

Type A Compression. Meet the requirements for vitrified clay pipe joints used in sanitary sewers as specified herein.

Type C Bituminous filler. Meet the requirements of 706.10.

Type D Preformed butyl rubber material. Meeting the requirements of 706.14.

High Density Polyethylene/Polypropylene. Construct pipe joints conforming to one of the following:

Type A pipe joints. Meet the requirements of ASTM D 3212.

Type B pipe joints. Meet the requirements of AASHTO M-252, M-294, and Section 23 of the Standard Specification for Highway Bridges, Division II. Construct joints "silt tight" with bell and spigot connection. Provide bells either integrally joined to the pipe, or with separate sleeves (double-belled) designed to join the pipe in the field. The Contractor may use split couplings or separate sleeves to make field repairs.

For all elliptical reinforced concrete pipe for storm sewers, use Type B – mortar or, Type C Bituminous pipe joint filler. Where conditions dictate the use of other types of joints, the City will note such on the plans.

The Contractor may use preformed rubber coupling rings, Fernco 5000 series or approved equal, if approved by the Engineer, when performing field repairs on both rigid and flexible pipes for both sanitary and storm sewer applications. Ensure the rubber sleeve and steel bands make a tight seal capable of meeting the leakage requirements as specified in Item 901.20. Use preformed rubber coupling rings, Fernco 5000 series, only to join pipe of similar material. Perform all installations of the Columbus standard drawings.

When connecting pipes of dissimilar materials, use the type of coupler specifically manufactured for making the connection between said materials (i.e. concrete to clay, clay to plastic, etc.). Complete the repair by removing the existing pipe to the nearest structurally sound joint and install the new pipe in accordance with all applicable sections of Item 901. Sawcut existing pipe in a neat workmanlike manner, making the cut perpendicular to the longitudinal axis of the pipe. Include the cost of this work in the price bid for the various pipe items, unless directed otherwise by the Engineer.

901.20 Leakage Tests

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901.20 Leakage Tests. Acceptance testing of all sanitary sewers shall require a 30 day waiting period from the date of final backfilling. This shall include all laterals installed as part of mainline construction. Do not exceed the allowable limits of leakage for all completed and installed sanitary and storm sewer pipe as follows:

912.02 Materials

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912.02 Materials. Use the following materials:

Unless otherwise shown, specified, or ordered, provide granular material meeting the requirements of Section 703.11, incorporated in an 8 inch (203 mm) layer. Granular material consisting of natural or synthetic mineral aggregate such as broken or crushed rock, gravel, slag, sand or cinders incorporated in an 8 inch (203 mm) layer, and conforming to the gradation specified in Section 703.11, Type 1.

The Contractor may use controlled density fill mixes as an alternate to compacted granular material, conforming to the requirements of Item 613.

Do not use RPCC as bedding, initial backfill, or final backfill material for any metal sewer pipe installation.

912.03 Compaction Requirements

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912.03 Compaction Requirements. Apply the following compaction requirements to granular materials and to native backfill materials if such materials require compaction in accordance with Item 911.

Max. Lab. Dry Wt. Lbs./cu. Ft. (kg/m³)	Min. Comp. Requirements % Lab. Max.
90-104.9 (1442-1680)	102%
105-119.9 (1682-1920)	100%
120 and more (1922)	98%

Consider materials having a maximum laboratory dry weight of less than 90 lbs./cu. ft. (1442 kg/m³) unsuitable for **backfill compaction**. Spread soil, granular material, or other approved material in successive level layers of a depth to allow compaction to the specified density and of not more than 8 inches (203 mm) in thickness (loose measurement), unless otherwise specified and/or authorized in writing by the Engineer.

Cooperate to the fullest extent to accommodate compaction tests. The City will not pay for delay or time lost due to verification of compaction required.

REVISED ON A QUARTERLY BASIS, OR AS NEEDED.

SUPPLEMENTAL SPECIFICATION 1100
Revision Summary
August 1, 2014

101.03 Definitions (New Definition)

Page 3

101.03 Definitions.

Allowance. An amount of money established by the City and included in the contract, which is set aside for a specific purpose, when the exact quantity of work for that specific purpose is not known at the time of bid.

101.03 Definitions (New Definition)

Page 4

101.03 Definitions.

Business Day. Wherever indicated inside these specifications, business days are defined as: Monday, Tuesday, Wednesday, Thursday, and Friday, excluding National Holidays and, if applicable, the day that a National Holiday is observed.

306.01 Description

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306.01 Description. This work consists of constructing a PCC base on a prepared subgrade or base course. This work shall conform to the requirements of Items 305 and 451 except that:

1. For concrete proportioning, meet the requirements of Item 499, Concrete, Class F.
2. Conform to the opening-to-traffic requirements as specified in 451.16 except that the split tensile strength shall be ~~250~~ 350 pounds per square inch (~~1.7~~ 2.4 MPa), as tested per ASTM C496.

423.09 Method of Measurement

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423.09 Method of Measurement. The City will measure Crack Sealing, of the type specified, by the number of pounds (kilograms) of hot applied sealant in place, completed, and accepted.

The City will measure Crack Sealing, of the type specified, by the number of linear feet (meters) of sealant in place, completed and accepted.

SUPPLEMENTAL SPECIFICATION 1100
Revision Summary
August 1, 2014

(Continued)

423.10 Basis of Payment

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423.10 Basis of Payment. The City will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
423	Pound (Kilogram)/ Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing with Routing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing with Sawing, Type I
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type II
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type III
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type II or III
423	Pound (Kilogram) Square Yard (Square Meter) <u>or Foot (Meter)</u>	Crack Sealing, Type IV

733.02 Controller Units

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733.02 Controller Units.

B. C. Type TS-2/A2. Provide a controller unit meeting NEMA TS-2...