

**MATERIAL SPECIFICATIONS**

1. General Conditions
2. Cement
3. Sand
4. Coarse Aggregate
5. Water
6. Concrete
7. Steel for Reinforcement
8. Joint Materials
9. Mortar
10. Brick
11. Brick Masonry
12. Structural Steel
13. Storm Sewers
14. Catch Basin Frames & Covers
15. Water Main Materials
16. Ductile Iron Pipe and Fittings
17. Gate Valves
18. Swing Check Valves
19. Tapping Sleeves
20. Tapping Valves
21. Valve Boxes
22. Fire Hydrants
23. Mechanical Joint Restraint
24. Manhole Ring & Covers
25. Manhole Steps
26. Precast Manholes
27. Small Size Pipe
28. Air Release Valve
29. Steel Encasement Pipe
30. Carrier Pipe in Encasement
31. PVC Gravity Sewer Pipe
32. Sewer Force Mains
33. Aggregate Base Course
34. Asphalt Concrete Binder Course
35. Asphalt Concrete Surface Course
36. Prime Coat
37. Tack Coat
38. Pavement Replacement
39. Stabilization Stone for Pavement Cuts
40. Stabilization Stone for Ditches
41. Concrete Curb & Gutter
42. Rip Rap
43. Guarantee

Note: Shop drawings for water, sewer, & storm drainage related materials are to be submitted to the City for review approval prior to installation. Additional material specifications may be required at times.

1. General Conditions. The following Specifications cover the material under the applicable documents. Unless otherwise specified, all materials used in the work under this contract shall conform to the requirements of the current specifications of the American Society for Testing Materials, and shall be tested in accordance with the current specifications or current methods of testing of ASTM, where specifications and methods of testing have been adopted, revised, or proposed for such materials. No materials shall be used on the work until accepted by the Engineer, and all materials rejected by the Engineer as unsuitable, or not in conformity with the Plans or Specifications, or failing to pass the required tests, shall be removed immediately from the work at no expense to the City. Failure to condemn materials on preliminary inspection shall not be grounds for acceptance if future defects are found. All materials and equipment shall be new and free from all flaws or defects.

2. Cement. All cement used in mortar, or concrete shall conform to Specifications for Portland Cement of ASTM C-150. Brand of cement proposed for use by the Contractor will be subject to the approval of the Engineer. Type II shall be used in all work unless approved by the Engineer.

3. Sand. All sand used in mortar or concrete shall be clean, sharp, practically free from loam, clay or organic matter, and so graded as to ensure workability and water tightness when mixed with other ingredients. Sand will conform to ASTM Specifications C-33 and when made into mortar will have a compressive strength at 7 and 28 days of not less than 100% of mortar made with standard sands.

4. Coarse Aggregate. Coarse aggregate will consist of broken stone, sound, hard and tough, and will conform to the specifications of coarse aggregate given in ASTM Specification C-33. Stone will be broken to the sizes hereinafter specified under "Concrete" for the various classes of concrete, and grading will be well within the limits specified.

5. Water. Water used for mixing concrete and mortar will be clean, and free from deleterious amounts of acids, alkalis, and organic materials.

6. Concrete. All concrete shall be made of Portland cement, water and aggregates as hereinbefore specified, and shall further be in accordance with the following definite requirements for the various classes.

A design of the mix made by an independent laboratory, approved by the Engineer, for each class of concrete, shall be submitted for approval before concreting is started.

During progress of the work, standard compressive strength test specimens shall be made and cured by the Contractor in accordance with ASTM Standard Method, Designation C-31, and tested - by an independent testing laboratory in accordance with ASTM Standard Method, Designation C-39. At least 3 cylinders will be made for each test. Tests results shall be submitted for each thirty- (30) cubic yards, or fraction thereof, for each class of concrete used. Should there be any evidence that concrete is not up to standard, a strength test may be required at any time and the cost paid by the contractor.

If 100 LF of sidewalk is poured, at least one (1) test must be performed with at least 3 cylinders made per test. Test on less than 100 ft. may be done at Engineer's request.

Class A concrete shall have a 28-day compressive strength of not less than 3,000 lbs. per square inch and a slump of from 3 to 5 inches and a maximum water-cement ratio of 0.48.

Coarse aggregate for all classes of concrete shall be commercial 1-inch stone, all of which shall pass a 1-1/2" screen.

All concrete used shall be "ready-mixed" concrete made in accordance with ASTM Standard Method Designation C-94. Cement, aggregate, water and design of mixes shall be as above specified. Elapsed time for placing concrete, between adding the mixing water to the mix and placing the concrete in the forms, shall not exceed that set forth in Table 1000-2.

<b>TABLE 1000-2 ELAPSED TIME FOR PLACING CONCRETE</b>		
<b>Air or Concrete Temperature Whichever is Higher</b>	<b>Maximum Elapsed Time</b>	
	<b>No Retarding Admixture Used</b>	<b>Retarding Admixture Used</b>
90°F or above	30 minutes	1 hour 15 minutes
80°F through 89°F	45 minutes	1 hour 30 minutes
79°F or below <sup>A</sup>	60 minutes	1 hour 45 minutes
70°F through 79°F <sup>B</sup>	60 minutes	1 hour 45 minutes
69°F or below <sup>B</sup>	1 hour 30 minutes	2 hour 15 minutes

<sup>A</sup> Applicable to Class AA, A, and Drilled Pier Concrete

<sup>B</sup> Applicable to Class B Concrete

The concrete temperature at the time of placing in the forms shall not be less than 50°F nor more than 95°F except where other temperatures are required by N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

No concrete shall be placed when the air temperature is below 50°F and is falling. The placing of concrete shall be permitted with permission at air temperature between 40°F and 50°F when said air temperatures are rising.

Deliver concrete to any monolithic unit of a structure at a rate that will permit proper handling, placing, and finishing of the concrete. Regulate the delivery so that the maximum interval between the placing of batches at the work site does not exceed 20 minutes.

All concrete materials and installation shall comply with the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

**7. Steel for Reinforcement.** All reinforcement steel will fulfill the Standard Specifications for Billet Steel Concrete Reinforcement Bars, Designation A615 of ASTM. Intermediate Grade 60 will be used. Deformations shall be in accordance with ASTM Designation A-305.

All steel will be free from rust, scale, or other coatings which would reduce or destroy the bond when placed in forms and the Contractor will provide such protection as is necessary to ensure that the steel will not be injured during the construction period.

**8. Joint Materials.** Joint filler, hot applied joint sealer, low modulus silicone sealant, and bond breaker materials shall comply with Section 1028, Joint Materials of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

All joint filler shall be sealed unless otherwise specified by the engineer.

9. Mortar. Unless otherwise provided, cement mortar will be Type M only. Type M mortar will consist of Portland cement and sand mixed in the proportion of one-part cement to two parts sand with not more than 6-1/2 gallons of water per bag of cement. This mixture may be varied to increase workability only by reducing the amount of sand or blending one or more sands. Mortar in which cement has been placed for more than one hour will not be used.

10. Brick. All brick used on the work will be hard, tough, sound clay or shale brick, of first-class quality, thoroughly vitrified and especially suitable to the class of work for which it is to be used. Brick used in manholes shall conform to ASTM Specifications C-216, grade SW.

11. Brick Masonry. All brick masonry will be constructed using Type M mortar and brick as specified.

12. Structural Steel.

a. General. The American Institute of Steel Construction's "Specifications for the Design, Fabrication and Erection of Structural Steel for Building", latest edition, and the American Institute of Steel Construction's "Code of Standard Practice for Steel Buildings and Bridges", latest edition, are hereby made a part of these Specifications to the same extent as if they were written herein, except that they may be amended or superseded by these Specifications or the Drawings.

b. Materials.

- (1) Structural steel shall conform to "Specifications for Structural Steel", ASTM A-36, latest edition.
- (2) Bolts, nuts, and circular washers - where required - shall conform to the requirements of the latest edition of "Specifications for High-Strength Carbon Steel Bolts for Structural Steel Joints: ASTM A-325 in exposed areas. For buried conditions or when used for sewer components, use 304 Stainless Steel.
- (3) Bolt and nut dimensions shall conform to the current requirements of the American National Standards Institute for heavy hex structural bolts and nuts, ANSI Standard B18.2.1.

13. Storm Sewers. Reinforced concrete pipe (RCP) shall conform to AASHTO Specifications M-170, Table III, Class III. High Density Polyethylene (HDPE) double wall corrugated smooth interior drainage pipe shall conform with NCDOT's current "Standard Specifications for Roads and Structures" and AASHTO M-294 Type S for sizes 15" through 48".

HDPE pipe in public applications shall only be used behind the curb and in areas with no vehicular traffic unless HP Storm or approved equal pipe is used.

Storm drain material and pipe class shall be listed on the pipe chart within the construction plans. Any private storm drain conveying water from the public roadway shall be built to City Standards.

14. Catch Basin Frames and Covers. All catch basin frames and covers shall be of cast iron of superior quality, tough and of even grain, and shall possess a tensile strength of not less than 18,000 psi. Dimensions of the ring and cover shall conform to the Construction Details shown on the attached Drawings. All rings and covers shall be thoroughly cleaned and given two coats of an approved bituminous paint.

15. Water Main Materials. Water main materials shall be certified to meet the NSF/ANSI 61 Standard. All hardware to be stainless steel.

16. Ductile Iron Pipe and Fittings. Ductile Iron Pipe shall be manufactured in accordance with ANSI C151/A21.51 of the AWWA as amended and shall be designed for type 2 laying condition with the wall thickness determined by the depth of cover and a working pressure of 150 psi. Pipe wall thickness shall be calculated in accordance with ANSI C150/A21.50.

Joints for ductile iron pipe shall be manufactured in accordance with ANSI C111 or AWWA A21.11, push-on joint or mechanical joint. Flanges, where required shall be ANSI C110 or AWWA 21.10.

Ductile iron fittings through 12" shall be manufactured in accordance with ANSI Specification 21.10. Joints for fittings shall be mechanical joint conforming to ANSI Specification 21.11. Flanged fittings, where required, shall conform to ANSI Specification B16.1.

Pipe and fittings shall have a cement lining in accordance with ANSI Specification 21.4. All hardware to be stainless steel.

D.I. Pipe shall be a minimum Thickness Class 50, unless pressure or depth requires a higher class of pipe.

17. Gate Valves. Gate valves shall be of the resilient wedge type, iron body, bronze mounted, non-rising stem type designed to work equally well with pressure on either side of the gate. All valves shall conform to the requirements of the latest revision of AWWA Standard C-500 for "Gate Valves for Ordinary Water Works Service". The minimum designed working water pressure shall be 175 psi for valves with diameters of 12" or less.

All buried valves shall be supplied with a 2" square operating nut and shall be opened by turning the operating nut in a counterclockwise direction. Ends shall be mechanical joint.

All inside gate valves shall be hand wheel operated with flanged ends.

All gate valves 12" and smaller shall be supplied with double "O" ring seals in lieu of the conventional stuffing box.

Gate valves shall be manufactured by Mueller, Clow, Darling, or equal. All hardware to be stainless steel.

18. Swing Check Valves. Swing check valves shall have weight and lever. Check valves shall have an iron body with bronze seat and disc rings, and shall be approved by Underwriters Laboratories, Inc. Valves shall have a pressure rating of 175 psi and be American-Darling, Clow, or approved equal. All hardware to be stainless steel.

19. Tapping Sleeves. Tapping sleeves shall be of ductile iron, of the split sleeve type with mechanical joint ends, and with a Class 125 outlet flange. The end gaskets shall be Duck-Tipped Rubber Gaskets and all end and side gaskets shall be totally confined to eliminate cold flow. The tapping sleeves shall be as manufactured by American-Darling Valve Company; Clow or approved equal. All hardware to be stainless steel.

20. Tapping Valves. Tapping valves shall be equal in all respects to the gate valves hereinbefore specified except that they shall come equipped with one end having a Class 125 Flange and the other end having a mechanical joint. All hardware to be stainless steel.

21. Valve Boxes. Valve boxes shall be of cast iron conforming to ASTM Specification A048, Class 35. They shall be of the extension type of a pattern approved by the Engineer. Size of valve box shall be suitable for size valve it is to serve and it's bury. Valve boxes shall be as manufactured by James B. Clow Company, or equal, and shall have the word "WATER/SEWER" cast on the top of the lid.

22. Fire Hydrants. Fire hydrants shall be cast iron bodied, fully bronze mounted, suitable for a working pressure of 150 psi and shall conform to the requirements of the latest revision of AWWA Standard C-502 for "Fire Hydrants for Ordinary Water Works Service". Hydrants shall be constructed to permit withdrawal of internal working parts without disturbing the barrel or casing. Main valves, when closed, shall be reasonably tight when upper portion of the barrel is broken off. For water mains less than 12" in size, main valve opening shall be 4-1/2". For water mains 12" and greater in size fire hydrants shall have main valve opening of 5-1/4". The main valve facing shall be made of rubber. There shall be no chattering under any condition of operation. The hydrants shall be of the compression type, with main valve opening against the pressure and closing with the pressure.

Each hydrant shall be equipped with two (2) 2-1/2" hose connection and one (1) pumper connection. Hose nipples shall be bronze or non-corrosive metal. Threads shall be approved by the City prior to placement of order for the hydrants.

Hydrants shall be American Darling or Clow and painted to city standard color scheme. All hardware to be stainless steel.

23. Mechanical Joint Restraint. Mechanical joint restraint shall be wedge style restraint manufactured of ductile iron conforming to ASTM A536-80 such that the device can be used with standardized mechanical joint pipe and conform to ANSI/AWWA A 21.531 C153 and shall be EBAA Iron, Inc., Megalug or Uni Flange Corporation. Mechanical joint restraints shall be installed on all fittings, valves, bends, plugs, and on all pipe sections on hydrant legs.

24. Manhole Rings and Covers. Manhole rings and covers shall be made of cast iron of superior quality, tough and of even grain, and will possess a tensile strength of not less than 18,000 psi. Rings and covers shall be manufactured in accordance with ASTM A-48 Class 30. Rings will weigh not less than 190 lbs., and covers will weigh not less than 120 lbs. The rings will be a maximum of 7 1/2" high and have a minimum opening of 1'-10". See Detail SS-4 for the wording that shall be cast in the covers. The finished rings and covers shall have the bearings surfaces machined or ground so that there will be no variation that will permit rocking or rattling, and the diameter of the covers shall be such as to fit the rings without wedging. All rings and covers will be thoroughly cleaned and given two coats of an approved bituminous paint. Rings shall have a solid cover on street work and perforated on outfalls.

25. Manholes Steps. Steps shall be constructed of a reinforced molded copolymer polypropylene plastic shell. Reinforcing shall be a single 1/2" steel bar ASTM designation A615 grade 60 and equal in all respects to step PS1-PF as manufactured by M.A. Ind., Inc.

26. Precast Manholes. Precast manholes shall be constructed of reinforced concrete and shall comply with the requirements of ASTM Designation C-478 "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".

Shop drawings shall be submitted for approval prior to manufacture. Manholes shall be constructed with a monolithic base with the side wall extending at least 48" above the base;

appropriate openings left in the side wall to receive the sewer pipe; barrel or riser sections with a 48" maximum length; and a conical top section having a 24" diameter opening offset in such a manner that the edge of the opening is on a vertical line with the edge of the barrel or riser section.

Manhole steps for precast manholes, unless otherwise approved by the Engineer, shall be as hereinbefore specified and shall be set at a spacing of 16" on centers.

Manhole rings and covers for precast manholes shall be as hereinbefore specified. Precast manholes shall be as constructed by N. C. Products Corporation, Raleigh, North Carolina, or approved equal.

Precast manholes shall be parged w/ non-shrink grout at every joint. Block manholes shall be parged from top to bottom.

27. Small Size Pipe. Small size of (2" to 4") pipe will be as follows: 3" or 4" pipe shall be D.I.P., Class 50 minimum. 2" pipe shall be Type "K", soft copper.

28. Air Release Valve. Air release valves shall be as manufactured in accordance with ANSI/AWWA C512 by G.A. Industries, Clow Corporation, or equal, of size, number, and location as shown on the Drawings depending on the type of service. All hardware to be stainless steel.

29. Steel Encasement Pipe. Wherever a line must be encased under a highway or railway, it must be encased in a steel pipe that has been manufactured in conformance with the standards of AWWA C-202. Joints, coatings, and method of installation shall be in conformance with the requirements of the N.C. State Highway Commission. In general, the encasement pipe will be installed by boring with an auger so as not to displace material on the outside of the casing.

Manufactured casing spaces shall be used in sufficient quantity to assure proper alignment of the carrier pipe within the encasement pipe. There shall be 3 spacers per joint of carrier pipe with spacing of these spaces not exceeding 9 feet on center. Spacers shall be stainless steel with stainless steel hardware and polymer skids. Spacers shall be Spider Supports and Spacers as manufactured by Spider Manufacturing Inc. or approved equal.

30. Carrier Pipe in Encasement. Wherever a water line or sewer line must be encased under a highway, it shall be of ductile iron as hereinbefore specified and all joints shall be restrained.

31. PVC Gravity Sewer Pipe. PVC (Poly Vinyl Chloride) Gravity Sewer pipe shall be made of PVC plastic conforming to ASTM D-3034 SDR35. Rubber gaskets shall comply in all respects with the physical requirements specified in ASTM D-3212. The bell shall be an integral part of the pipe and the spigot ends shall be supplied from factory with bevels. The Contractor shall furnish the Owner with an affidavit from the manufacturer that the materials furnished comply with these specifications.

32. Sewer Force Mains. Sewer Force Mains 3" or larger in size shall be of Ductile Iron Pipe, Class 50 as hereinbefore specified. For force mains less than 3" in size, the material shall be IPS Pressure rated PVC, minimum pressure Class 200. All hardware to be stainless steel.

33. Aggregate Base Course. The materials used in the construction of the aggregate base course shall comply with Section 520, Aggregate Base Course, of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

34. Asphalt Concrete Binder Course. The materials used in the construction of the bituminous concrete base course shall comply with Section 610, Asphalt Concrete Binder Course - Type I 19.0, of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

35. Asphalt Concrete Surface Course. The materials used in the construction of the bituminous concrete surface course shall comply with Section 610, Asphalt Concrete Surface Course – Type SF 9.5, of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

36. Prime Coat. The prime coat shall comply with Section 600 of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

37. Tack Coat. The tack coat shall comply with Section 605 of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

38. Pavement Replacement.

a. Wherever asphalt type pavement has been ordered by the Engineer or the Owner to be cut and replaced, it shall be replaced with 6" Type I-190B, and 1" thick asphalt concrete surface course in conformance with N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 (as amended). If existing asphalt is thicker than 7" then additional I19.0B shall be installed. Any tack coat used shall conform to same standards.

b. Wherever concrete type pavement has been ordered by the Engineer or Owner to be cut and replaced, it shall be replaced with Class A concrete poured 8" thick. All concrete shall be doweled into existing concrete using NCDOT approved epoxy coated dowels. If existing concrete is greater than 8" then match existing depth.

39. Stabilization Stone for Pavement Cuts. The stone used in stabilizing pavement cuts shall conform to the Aggregate Base Course as described in the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

40. Stabilization Stone for Ditches. The stone used in stabilizing ditch bottoms, prior to the installation of storm sewer pipe in the said ditch, shall conform to the requirements of Size No. 67 Aggregate as described in the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended.

41. Concrete Curb and Gutter. Concrete used in curb and gutter shall be 3,000 psi concrete as hereinbefore specified.

42. Rip Rap. Rip Rap shall be Class 1 quarry stone as described in Section 1042 of the N.C. State Highway Commission's "Standard Specifications for Roads and Structures", January, 2018 as amended. (Class A & B to be used where specified.)

43. Guarantee. The Contractor shall guarantee that if any materials, equipment or workmanship covered by these Specifications and the accompanying Drawings proves defective within one year after final acceptance, such defects shall be made good by him. The Engineer shall provide a letter to the City indicating the start of the 12-month guarantee period. Provide State required certifications and "As Built" with guarantee letter.