

ARTICLE IV

SUPPLEMENTAL SPECIFICATIONS

for

PAVING CONSTRUCTION

INDEX

IV.1 General

IV.2 Earth Work

IV.3 Mix Design

IV.4 Forms, Removing, Placing, and Finishing of Concrete

IV.5 Joints

IV.6 Protection and Opening to Traffic

IV.7 Tests

IV.8 Storm Sewer and Drainage Structures

IV.9 Sidewalks

IV.10 Miscellaneous

ARTICLE IV

SUPPLEMENTAL SPECIFICATIONS

for

PAVING CONSTRUCTION

IV.1 GENERAL

- A. The work covered by this Article IV of the specifications consists in furnishing all labor, equipment, supplies and materials, and in performing all operations in connection with the preparation of subgrade as required and in performing all operations in the connection with the construction of air-entrained Portland cement concrete pavement. The following recognized standards State of Nebraska, Department of Transportation 2017 Standard Specifications for Highway Construction (NDOT), the American Water Works Association Standards (AWWA), American Standards for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), etc. or the latest revisions thereof shall apply except as hereinafter provided. All Supplemental Specifications included in this Article IV will pertain. Precedence shall be in the following order; Special Provisions, Plan Notes, Supplemental Specifications, Standard Specifications, and Standard Plans. Calculated dimensions shall take precedence over scaled dimensions.

IV.2 EARTH WORK

- A. All borrow material shall be approved by the Engineer before being placed.
- B. Excavation of every description and of whatever substances encountered within the limits of the project shall be performed to the lines and grades indicated on the drawings. Except as otherwise permitted by the Engineer, all excavated areas shall be excavated in such a manner as will afford adequate drainage. All suitable material removed from the excavations shall be used, insofar as practicable, in the formation of embankments, backfilling, and for such other purposes as directed by the Engineer. Where material encountered within the limits of the work is considered unsuitable by the Engineer, such materials shall be excavated below the grade shown on the drawings or as directed by the Engineer, and replaced with suitable material. All excavated materials which are considered unsuitable and any surplus of excavated material which is not required for embankments shall be disposed of by the Contractor as directed by the Engineer.
- C. Fill work shall consist of the construction of embankments by depositing, placing and compacting materials of acceptable quality above the natural ground or other surface in accordance with the lines, grades and cross sections shown on the plans, and as required by the Engineer.

Revised 01/2022

- D. Before any fill is placed all clearing, tree removal, sod and top soil removal over the entire area shall be performed as directed by the Engineer, and the entire area shall then be rolled at least twice with a sheepsfoot roller.
- E. Clearing shall consist of the removal and disposal of all obstructions such as foundations, walls, fences, buildings, rubbish, etc., to a depth of at least 12 inches below subgrade elevation. Sod within the area shall be removed to a depth of 6 inches.
- F. Trees, except those designated to be saved and all stumps, shall be removed to a depth of at least 18 inches below the subgrade elevation. All trees designated to be saved shall be protected by fencing the circumference at the drip line during clearing and subsequent construction operations.
- G. Topsoil shall be excavated and stockpiled as directed by the Engineer.
- H. Material used as fill shall be free of debris, roots, organic matter, and frozen matter. Fill shall not contain stone greater than 4 inches and the top 12 inches of shall not contain stone greater than 2 inches in diameter. Each layer of the fill material not to exceed 8 inches in loose depth shall be disced sufficiently to break down oversized clods, to form a homogeneous mixture of the different materials, to secure a uniform moisture content, and to insure uniform density and proper compaction. Each layer shall be thoroughly compacted by roller or vibratory equipment suitable for the type of embankment material.
- I. In the event sufficient suitable fill material is not obtained within the limits of this contract to provide all the embankment required, the Contractor shall furnish such additional fill material borrow to complete the designated embankment. The cost of furnishing this material shall be borne by the Contractor unless otherwise noted on the plans or proposal form. Borrow material shall meet the same requirements as on-site fill material and shall be approved by the Engineer.
- J. Subgrade shall conform to the lines, grade and cross sections shown on the plans.
- K. All soft and yielding material and other portions of the subgrade which will not compact readily when rolled or tamped, shall be removed as directed and replaced with suitable material placed and compacted as specified herein.
- L. All fill shall be compacted to a minimum of 96 percent of the maximum dry density as determined by (AASHTO T99, ASTM D698) Standard Proctor. In embankments with less than 12 inches of fill, the contractor shall scarify the width of the subgrade to a depth required to provide 12 inches of densified subgrade. The top 12 inches of the subgrade in areas that do not require any fill (cut sections) shall be compacted to a

minimum of 96 percent of the maximum dry density as determined by (AASHTO T99, ASTM D698) Standard Proctor.

- M. The Contractor shall bring all the fill material and the subgrade's moisture content to not more than 4% above or 2% below the optimum content as determined by (AASHTO T99, ASTM D698) Standard Proctor. If needed moisture shall be added, the cost of which shall be subsidiary to other work performed.
- N. City shall hire an independent soil laboratory to establish the optimum moisture content, range, and maximum dry density before beginning any tests for completion. City shall hire a soil laboratory to perform all in-place compaction tests. All costs associated with soil tests shall be the responsibility of the City. Any costs for retesting due to non-passing results shall be the responsibility of the contractor.
- O. When in-place density tests are performed, the tests shall be performed in accordance with the procedures set forth in the following ASTM or latest version thereof:
 - ASTM D 2167 (Rubber Balloon Method)
 - ASTM D 1556 (Sand Cone Method)
 - ASTM D 6938 (Nuclear Method)
- P. If the tests show non-compliance with the plans and specifications, the backfill shall be removed, replaced, and retested by the Contractor without extra compensation and at no extra cost to the Owner.
- Q. The finished subgrade and foundation course shall be maintained in a smooth and compacted condition until the concrete has been placed. The mixer, ready-mix trucks, or other equipment shall not operate between the forms unless permitted by the Engineer. If the Contractor is permitted to operate trucks between the forms resulting in rutting or displacement of the subgrade material the Contractor shall re-roll the subgrade to correct any ruts or other objectionable irregularities which may have been caused by the trucking of materials.
- R. The subgrade shall be finished in an acceptable condition for at least one half days (1/2) progress in advance of pavement construction at all times.
- S. All excess concrete and debris shall be removed from the excavation behind the curb line before backfilling. The backfill will be placed as indicated on the plans or graded to form a uniform slope. The Contractor shall remove all dirt and debris from the paving following backfill operations.

IV.3 MIX DESIGN

- A. Mix Design. The Contractor shall, at his expense, have an approved independent testing laboratory prepare the mix design using aggregated sampled from the

Contractor's source for this project. The laboratory shall check the water reducing admixture for compliance with ASTM-C-494, Type A regarding water reduction.

- B. Preliminary Review. Reports covering the source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Engineer for review before any concrete is placed.

Alkali-Silica Reactivity Testing. Concrete shall be tested for alkali-silica reactivity for each concrete mix utilized for the project. Alkali-silica reactivity for concrete mixes shall be determined in accordance with ASTM C1567. The ASTM 1567 results will be considered current if the results are no more than 9 months old at the time of submittal and will be no more than 12 months old when the last of the concrete is placed.

Testing and reports for alkali-silica reactivity required for preliminary review shall be made by an independent testing laboratory at the expense of the Contractor.

- C. Cement: All concrete for the project shall use Type 1P or 1S cement in accordance with the NDOT standard specifications. This includes concrete used for retaining walls, storm sewer structures, sanitary sewer structures, and all concrete surfacing.

D. Concrete shall be proportioned according to the following table:

Concrete Mixes (Cubic Yard Batch)

Class of Concrete	Base Cement Type *			Total Cementitious Materials (Min. lb/cy)	Total Agg. (Min. lb/cy)	Total Agg. (Max. lb/cy)	Course Agg. (%) (2)	Type of Coarse Agg.	Air Content (% Min. – Max.) (1)	Water/Cement Ratio Max. (3)	Required Strength 28 days (Min. psi)
47B (SLIP)	1P, <u>1S</u>			564	2850	3150	30+/- 3	Limestone	6.5 – 9.0	0.45	3500
47B (HAND)	1P, <u>1S</u>			564	2850	3150	30+/- 3	Limestone	6.0 – 8.5	0.45	3500

(1) As determined by ASTM C 138 or ASTM C 231.

(2) Coarse aggregate shall be limestone unless otherwise specified.

(3) The Contractor is responsible to adjust the water/cement ratio so that the concrete supplied achieves the required compressive strength without exceeding the maximum water/cement ratio. The minimum water/cement ratio for any slip form concrete pavement is 0.38.

(*) Cementitious Material Requirement for Portland Cement Concrete

Interground/Blended Cement for Portland Cement Concrete (PCC)

Blended hydraulic cements Type 1P or 1S, shall conform with Type GU cementitious requirements in accordance with ASTM C595 Standard Specification for Blended Hydraulic Cements. Fly Ash used for blending shall conform with Type “F” requirements in accordance with ASTM C618 Standard Specification for Coal Fly Ash for Use in Concrete. The maximum fly ash replacement shall be 25% (± 2%). Slag used for blending shall be in accordance with C989 Standard Specification for Slag Cement. The maximum slag cement replacement shall be 38% (± 2%). Cement intergrinding/blending of cements shall only be performed at the cement manufacturing facility. Interground/blended cements shall be on the Nebraska Department of Transportation Qualified Material Vendor List (NQMVL).

High Early Strength Concrete Pavement: The Contractor shall provide High Early Strength Portland Cement Concrete for use at roadways and drives as indicated in the plans or as directed by the Engineer. The Contractor shall submit to the Engineer for approval, a proposed High Early Strength Concrete mix design, which will provide a minimum concrete strength of 3,000 psi at 72 hours. Mix designs, which utilize accelerators or admixtures containing calcium chloride, will not be considered. The approved mix design shall be used at locations as directed and approved by the Engineer to facilitate local traffic movement and access to businesses.

The Contractor, at his option, may elect to use the High Early Strength Concrete mix at other locations to facilitate his operations, subject to approval of the Engineer. Additional payment will not be made over and above the unit price bid for Concrete Pavement for use of High Early Strength Concrete under these circumstances. Payment for High Early Strength Portland Cement Concrete Pavement which is authorized by the Engineer will be made in accordance with the unit price bid for the appropriate pay items shown on the plans and bid proposal.

- E. The minimum cement content shall and the maximum water content shall meet the requirements of Article IV.3.D. All water must be added to the batch at the batch plant. No water shall be added from the transit mixer tank unless permission is obtained from the Engineer.
- F. A water reducing agent shall be used for all concrete furnished on this project. A set retarding mixture shall be used only upon approval of the Engineer if weather conditions warrant. All admixtures used shall be in liquid form, introduced into the mix with an approved dispenser, and these admixture shall meet the appropriate ASTM Spec. for Type A and D Admixtures.
- G. The maximum allowable slump shall be 3 inches for formed paving. Concrete that is rejected because of excessive slump shall be removed completely from the project. Unloaded concrete that is rejected shall not be retempered.
- H. Compression test specimens shall be made in the field as required by the Engineer, and in accordance with ASTM Designation C-31-49 when tested in accordance with ASTM C-39 assumed minimum compressive strength shall be 7 day, 2,400 psi; 28 day, 3,500 psi.

IV.4 FORMS, REMOVING, PLACING, AND FINISHING OF CONCRETE

- A. All forms used on this project shall meet the NDOT Specifications, and the placing of concrete shall be done according to the NDOT Specifications, except as hereinafter provided.

- B. All concrete indicated to be removed adjacent to concrete to remain shall be sawcut through its entire depth prior to removal.
- C. The Engineer shall be given a minimum of 48 hours notice prior to the placement of any concrete.
- D. Concrete shall not be placed upon a soft, spongy or frozen subgrade or other subgrade, the stability of which is, in the opinion of the Engineer, unsuitable for the placement of concrete. The subgrade shall be in a moist condition at the time the concrete is placed. It shall be thoroughly wetted a sufficient time in advance of the placing of the concrete to insure that there will be no puddles or pockets of mud when the concrete is placed, but shall not be allowed to dry out before the concrete is placed.
- E. All consolidating and finishing of concrete, including the method of curing it, shall be done according to the NDOT Specifications, except as hereinafter provided.
- F. The surface of the concrete pavement shall receive a wet burlap drag in order to give it a finished texture. If approved by the Engineer, the driving lanes (only) may be finished with a carpet drag, but the gutter line (2 feet in width) and curb face will still require a wet burlap finish.
- G. Integral curbs shall be required along the edges of all street pavement as indicated on the plans, except at such locations as the Engineer may direct. Drop curbs shall be provided at all driveway entrances, and at such other locations as designated by the Engineer.
- H. The finished surface of the curb and gutter shall be checked by the use of the 10 foot straight edge, and corrected if necessary. While the concrete is still plastic the drainage at the gutter should be checked by pouring water at the gutter summit, and observing its flow to the inlet. In order to prevent damage to the concrete surface, the water should be poured onto a piece of burlap or curing paper.
- I. All manholes, catch basins, or structures of a permanent nature encountered in the areas to be paved shall be raised or lowered as the case may be, to the surface of the new pavement.
- J. A separate load ticket shall be made for each load of concrete showing truck number and amounts of each of the separate materials. These tickets shall be furnished to the inspector or Engineer on the job.

IV.5 JOINTS

- A. When transverse contraction joints are to be formed by sawing, care must be taken to saw the grooves soon after placing to prevent the formation of random cracks due to contraction of any slab. All transverse joints shall be sawed at least 1/3 of the slab depth. Any procedure for sawing joints that results in premature and uncontrolled cracking shall be revised immediately by adjusting the time interval between the placing of the concrete and the cutting of the joints.
- B. Transverse dummy groove joints shall be formed by a groove or cleft in the top of the slab of the dimensions shown on the plans. The groove made in the plastic concrete by a suitable tooling device, shall extend vertically downward 1/3 of the slab depth from the surface and shall be true to line.
- C. Longitudinal construction joints (i.e., joints between construction lanes) shall be of the dimensions shown on the plans. The keyway shall be constructed by placing a deformed metal plate against the form when the first lane adjacent to the joint is placed.
- D. This metal plate shall be removed with the form. When placing the second slab, care must be taken that no concrete is left to overhang the lip formed in the first slab by the edging tool.
- C. A thickened edge may be called for at the longitudinal construction joints. Such construction shall conform to details shown on the plans.
- D. All required joints shall be sealed with a joint sealer conforming to Section 1019 of the NDOT Specifications. Immediately prior to sealing of any joint, the joint shall be sand blasted and blown to give the sealer a clean dry surface to bond to. The sealing may be performed without the need for sand blasting if approved by the Engineer, the joints are sealed the same day they are sawn, and the sawing is done without the use of water.
- E. Tiebars or tiebolts when shown on the plans shall be of deformed steel and of the dimensions and at the spacing specified. Tiebars and tiebolts shall be epoxy coated and shall be firmly supported by chairs. When drilling tiebars into existing concrete, the Contractor shall use epoxy from the NDOT approved products list to secure the tiebars into the existing pavement.

IV.6 PROTECTION AND OPENING TO TRAFFIC

- A. Concrete shall be protected according to the NDOT Specifications, except as hereinafter provided.

- B. The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Owner. Contractors forces shall be excluded from the pavement by erecting and maintaining barricades and signs until the concrete has attained a strength of 3000 psi or is at least 14 days old, or for a longer period if so directed by the Engineer. Opening to traffic shall require a compressive strength of 3500 psi.
- C. When work is in progress on or adjacent to streets and highways the Contractor shall erect warning signs according to the Manual on Uniform Traffic Control Devices 2009 Edition and the Nebraska Supplement to the MUTCD..
- D. The contractor shall provide the City of Norfolk a detailed traffic control plan prior to the start of construction.

IV.7 TESTS

- A. Compliance with the Specifications as to pavement thickness and compressive strength shall be determined based on the pour sequence and on long pours on a block basis. A block means the distance between two intersecting streets provided that distance is not over 600 feet. Where the distance is over 600 feet, the length shall be divided into parts not less than 250 feet, nor more than 600 feet.
- B. Compliance with the Specifications for thickness shall be based upon 4" diameter concrete cores. If requested by the engineer core specimens shall be removed by the Contractor in accordance with the procedures set forth in ASTM C-42 at no cost to the Owner.
- C. Exact core locations shall be located based on a random number table and generally be located as follows: Longitudinally they should be located at distances approximately equal to 1/5, 1/2, and 4/5 of the distance from the end of the block. Transversely they should not be located within 2 feet of the back of curb. For lengths of pavement less than 40 feet, only one core is required for analysis. Lengths between 40 and 100 feet shall be accepted on the basis of two cores. Other locations may be selected by the Engineer at his discretion.
- D. Cores taken within a block shall be averaged to determine the thickness for that block. Cores that exceed specified thickness, (T) plus 1/2 inch, shall be counted only as specified thickness plus 1/2 inch. Cores that are less than specified thickness, (T) minus 1/2 inch, shall indicate pavement that is unacceptable. If the core is deficient by more than 1/2 inch, additional cores shall be taken to determine the extent of the deficiency. These cores shall be taken at 10 foot intervals longitudinally on either side of the deficient core. When cores indicate an acceptable thickness (T" to T"-1/2"), the thickness of the pavement in the block shall be determined, omitting those cores which define unacceptable pavement. If the average of the cores taken in a block are not less than specified thickness minus 1/4 inch, the pavement shall be considered to be of the specified thickness. Pavement which is between 1/4 to 1/2

inch deficient in thickness as determined by the average method, shall be accepted only by the reduction in pay according to the following table:

Payment for Pavement

T - .25"	= 100% of Bid Price
T - .30"	= 85% of Bid Price
T - .35"	= 80% of Bid Price
T - .40"	= 75% of Bid Price
T - .45"	= 70% of Bid Price
T - .50"	= 65% of Bid Price
Less than T - .50"	= 0%

- E. The City will contract for materials testing services. Sampling and testing shall be performed by an independent certified testing laboratory and shall be the responsibility of the Contractor to coordinate. Number and type of tests to be determined by Engineer with a minimum of one (1) air test, one (1) slump test, and one (1) set of test cylinders per days run or perblock (300' of pavement) or 150 cubic yards for patch work; which ever is the lessor quantity of work completed. .

Samples for strength tests of each class of concrete shall be taken not less than once for each days run nor less than once for each 150 cubic yards of concrete or for each 5,000 sq. feet of surface area placed. The samples for strength tests shall be taken in accordance with "Method of Sampling Fresh Concrete" (ASTM C 172). Cylinders for acceptance tests shall be molded and laboratory-cured in accordance with "Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field" (ASTM C 31) and tested in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39). Each strength test result shall be the average of two cylinders from the same sample tested at 28 days. One sample shall be taken and tested at 7 days one at 14 days and the final test at 28 days.

When the frequency of testing provides less than five tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five are used. When the total quantity of a given class of concrete is less than 50 cu. yards, the strength tests may be waived by the Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.

The strength level of the concrete will be considered satisfactory if the averages of all sets of two consecutive strength test results equal or exceed the required strength and no individual strength test result falls below the required strength by more than 500 psi, and complies with the requirements of ACI 318.

Strength tests of specimens cured under field conditions in accordance with Section 9 (c) of "Method of Making and Curing Concrete Compressive and Flexural Strength

Test Specimens in the Field” (ASTM C 31) may be required to check the adequacy of curing and protection of the concrete in the structure. Such specimens shall be molded at the same time and from the same samples as the laboratory-cured acceptance test specimens. Procedures for protecting and curing the concrete shall be improved when the strength of field-cured cylinders at the test age designated for measuring strength is less than 85 percent of that of the companion laboratory-cured cylinders. When the laboratory-cured cylinder strengths are appreciably higher than strength, the field-cured cylinder strengths need not exceed strength by more than 500 psi even though the 85 percent criterion is not met.

If individual tests of laboratory-cured specimens produce strengths more than 500 psi below strength or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate that the load carrying capacity may have been significantly reduced, tests of cores drilled from the area in question shall be required in accordance with “Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete” (ASTM C 42). Three cores shall be taken for each case of a cylinder test more than 500 psi below strength. If the concrete in the structure will be dry under service conditions, the cores shall be air dried temperature 60 to 80 F, relative humidity less than 60 percent, for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.

Concrete in the area represented by the core tests will be considered structurally adequate if the average of the three cores is equal to at least 85 percent of strength and if no single core is less than 75 percent of strength.

To check testing accuracy, locations represented by erratic core strengths may be retested. If these strength acceptance criteria are not met by the core tests, and if structural adequacy remains in doubt, the Contractor shall provide load tests as outlined in Chapter 20 (ACI 318) for the questionable portion of the structure, or take other action appropriate to the circumstances. For any other concrete tests refer to section IV.3.

- F. Pavement which does not meet the minimum specifications for thickness or strength shall be removed and replaced. Such replaced concrete shall be subject to acceptance under the same plan as the entire block.
- G. Ponding Water Testing and Correction: The Contractor is responsible for ensuring that all pavement is constructed with positive drainage. Shallow areas of ponding water are not permitted and the Contractor shall promptly repair any area found to pond water.

The Contractor shall flood the constructed street surfaces with water as directed by the Engineer to demonstrate that the streets have positive drainage and no areas of ponded water.

Any areas of water ponding that are discovered shall be corrected by performing the necessary grinding of the concrete surface to provide positive drainage and eliminate any ponded water. Grinding work shall gradually transition to existing pavement surfaces and shall be complete to the satisfaction of the City and the Engineer.

Grinding over one-half inch in depth shall not be permitted. Any ponding area requiring grinding in excess of one-half inch in depth to correct shall be corrected by removal and replacement of the area of concrete pavement necessary to correct the drainage. Concrete removal and replacement shall be to the nearest joint and to the satisfaction of the Engineer.

IV.8 STORM SEWER AND DRAINAGE STRUCTURES

- A. This section of the specification covers the installation of storm sewer pipe, drainage structures, necessary excavation and backfilling and all other incidentals necessary for proper construction of a drainage system. Recognized Standards (NDOT, ASTM, AASHTO, etc.) as referred to herein, shall be construed to mean the latest adopted standard, and shall form an integral part of this specification.
- B. All materials used unless otherwise indicated on the plans, in the Special Provisions, or on the Proposal shall conform to the applicable portion(s) of the following requirements:
 - a. All reinforced concrete pipe (RCP) shall conform to the Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM Designation, C-76, Class III tongue and groove pipe unless specified otherwise in the plans.
 - b. Corrugated metal pipe, culverts and flared end sections shall be of 16 gauge thickness, unless otherwise specified, and shall conform to the requirements of AASTHO Standard Specification M 36. End sections shall include suitable connections for fastening to pipes.
 - c. Grey Iron Casting shall conform to ASTM A-48, Class No. 35, shall be marked “No Dumping, Drains to River”, and shall be of the type and quality or an approved equal as follows:
 - i. Manhole Ring and Cover not under traffic (Type A Inlets or Junction Boxes) Deeter 2001.

- ii. Manhole Ring and Cover under traffic (Junction Box) Deeter 1030.
 - iii. Manhole Ring and Cover Under traffic (Manhole) Deeter 1030.
 - iv. Frame and Grate under traffic (Type A or Type B Inlets) Deeter 2106.
- C. All lifting holes in RCP shall be filled with concrete grout. Wire mesh shall be used to prevent the grout from falling through the holes.
- D. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings, and in accordance with the lines and grades for the work to be given by the Engineer on such locations, at such times, and only so far in advance of the work as may be required. All grading in the vicinity of the trench shall be controlled to prevent surface ground water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.
- E. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
- F. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of existing underground structures, the Contractor shall make explorations and excavations for such purposes.
- G. The bottom of the trench shall be accurately graded and shaped to provide uniform bearing and support on undisturbed soil along its entire length. Bell holes, where required, shall be excavated so that only the barrel of the pipe receives bearing pressure from the trench bottom. This operation shall be done by hand by men skilled in this type of work.
- H. The materials excavated shall be laid compactly on the sides of the trench and kept trimmed up so as to be of as little inconvenience as possible to public travel or the adjoining tenants.
- I. Pipe bedding consisting of washed river sand, or other material approved by the Engineer, shall be provided for all storm sewer pipe, the price to be included in the bid price for the pipe. Sand bedding shall extend the full width of the trench, and shall extend upward from 3" below the bottom of the pipe to the centerline of the pipe barrel. Backfill above centerline of pipe barrel shall be compacted earth.
- J. Each pipe shall be inspected immediately before it is laid, and all defective or damaged pipe shall be rejected. The Contractor shall assume full responsibility for

installing defective pipe, and will remove such pipe at his own expense when directed to do so, and replace same with suitable material.

- K. Pipe laying shall proceed up grade with the tongue ends of tongue-and-groove pipe pointing in the direction of flow. The tongue ends of pipe shall be fully entered into adjacent sections of pipe. Corrugated metal pipe shall be laid with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides.
- L. RCP joints shall be made with cold applied asphalt joint compound in accordance with manufacturer's recommendation. Prior to placing joint sealing material, the pipe ends shall be thoroughly cleaned to provide direct contact between pipe and sealer. The joint shall be completely filled and then pointed and smoothed from the inside. This joint material shall be "Kalkite 340", "Plastice" or approved equal.
- M. The Contractor shall backfill from the bottom of the trench to the center line of the pipe barrel with sand, and the balance of the trench shall be backfilled using suitable material from the excavation of the trench. Material suitable for use as backfill shall be free of debris, roots, organic matter, frozen matter, and stone having dimensions greater than 2" in the top 12" of backfill or greater than 4" elsewhere. All backfill must be compacted to a minimum of 94 percent of the maximum dry density as determined by (AASHTO T99, ASTM D698) Standard Proctor. The top 12 inches of backfill in locations under existing or future pavement shall be compacted to a minimum of 96 percent of the maximum density as determined by (AASHTO T99, ASTM D698) Standard Proctor.
- N. Under existing or future pavements the Engineer may require that the backfill shall be placed and compacted in lifts of eight (8") inches maximum loose thickness.
- O. The Contractor shall bring all backfill material to not more than 4% above or 2% below the optimum moisture content before backfilling as determined by (AASHTO T99, ASTM D698) Standard Proctor.
- P. The Contractor shall construct new sewer inlets, and manholes of the types, and in the locations shown on the plans or where directed by the Engineer. Inlets and junction boxes shall be constructed of 8" poured in place concrete. The floor of a manhole or inlet shall be smooth and slope towards the channel at 1 1/2 inches per foot plus or minus 1/2 inch per foot. The invert of the channels shall be smooth and semi-circular in shape and changes in direction of flow shall be made in a smooth long radius curve.
- Q. All concrete shall be worked into place and consolidated by internal or external vibrators, or types acceptable to the Engineer. External vibrators of approved type may also be used in addition to internal vibrators. Before placing any concrete, all surfaces upon which or against which the concrete is to be placed shall be cleaned of

all mud and debris. Concrete shall be NDOT Class 47-B unless stated otherwise on plan or special provision.

- R. An approved plastic bituminous compound may be used in making the joints in precast manhole rings in locations where ground water is not a problem. This material shall be "Tufflex", "Plastice", or other approved equal.
- S. Connection to existing storm sewer will be made as shown on the drawings. All concrete work, cutting, and shaping will be done in a workmanlike manner to the satisfaction of the Engineer.
- T. Concrete for headwall construction shall consist of form construction and the handling, placing, curing, and finishing of concrete for headwalls in accordance with these specifications and in conformity with the lines, grades, dimensions, and designs shown in the plans, and/or as directed by the Engineer.

IV.9 SIDEWALKS

- A. Sidewalks shall be constructed according to the most current ADA standards.
- B. Unless called out specifically on the plans, no running/longitudinal slope shall exceed 5.0% without approval of the Engineer, with the exception of curb ramps.
- C. All areas at the top of curb ramps or wherever the 5.0% running slope is exceeded, shall have a flat area as required per current ADA standards. Flat is defined as a slope that is less than 2.0% in any direction. Positive drainage is required at all sidewalks, including flat areas.
- D. All sidewalk cross slopes shall be less than 2.0% including across driveways.
- E. Forms shall be set at 0.5% below maximum allowable slopes to allow for variances during construction operations.
- F. Sand and gravel mixture may be substituted for Type 47B aggregate for sidewalks only. 47B shall still be utilized where sidewalks cross driveways or other drivable surfaces.
- G. The Contractor shall space contraction joints in sidewalks equal to the width of the sidewalk.
- H. Detectable warning panels shall be preformed cast iron and embedded into the concrete sidewalk. They shall be from the NDOT approved products list.

IV.10 MISCELLANEOUS

- A. The Engineer's office shall be given 48 hours notice before any construction begins, and 3 working days notice for any work requiring staking by the Owner.
- B. All sites to be used for proportioning plants, mixing plants, or storage of materials or equipment, shall be only those having the approval of the Building Inspector if the site is within the City's two-mile zoning jurisdiction.