

SECTION 5
STORM SEWER

12/08/15



STANDARD CONSTRUCTION SPECIFICATIONS

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5.00 SCOPE OF WORK

The work covered by this division of the specifications consists of furnishing all labor, plant, equipment, appliances, and materials and performing all operations necessary to construct and complete storm and appurtenances in accordance with these specifications, the applicable drawings, and subject to the terms and conditions of the contract.

5.20 STORM SEWER MATERIALS

- A. Reinforced Concrete Pipe** - All reinforced concrete pipe shall meet the requirements and specifications of Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, ASTM C-76, Minimum class shall be Class III, and subsequent revisions, or as otherwise shown in the plans.
- B. Reinforced Concrete Low-Head Pressure Pipe** - All Reinforced Concrete Low-Head Pressure Pipe shall comply with ASTM C-361
- C. Reinforced Concrete Arch Culvert** - All Reinforced Concrete Arch Culvert shall comply with ASTM C-506
- D. Reinforced Concrete Elliptical Culvert** - All Reinforced Concrete Elliptical Culvert shall comply with ASTM C-507
- E. Storm Sewer Inlet Frames and Grates** - The frames and grates shall be of cast iron with tensile strength test not less than Class 25.
- F. Grade Rings** - Lay grade rings in mortar or preformed gasket material with sides plumb and top level. Seal joints with mortar and smooth interior with mortar. Extensions shall be watertight.
- G. Manhole Rings and Cover** - Install frame and cover on top of manhole to positively prevent all infiltration or surfaces or groundwater into manhole. The frame shall be set in a bed of mortar with the mortar carried over the flange of the frame. Set frame so top of cover is flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.
- H. Grout** - Standard premixed mortar conforming to ASTM C-387 or proportion 1 part Portland cement to 2 parts clean, well-graded sand that will pass a 1/8-inch screen. Mortar mixed for longer than 30 minutes shall not be used.
- I. Concrete** - All concrete shall conform to the requirements of Section 12, "Portland Cement Concrete Pavement."
- J. Reinforcing Steel** - All steel shall be thoroughly cleaned of oil, mill scale, rust, and dirt before it is tied in place, and shall be re-cleaned if necessary prior to placement of concrete. All steel shall be accurately positioned and securely tied with

suitable wire, or clips at intersections, and shall be adequately supported by concrete or metal chairs, spacers, hangers, etc., to prevent movement during placement of the concrete.

Bars used shall be parallel to the centerline and surface of the slab or walls. Tolerance of this placement shall be plus or minus ¼ inch both horizontally and vertically.

The Contractor will be required to furnish suitable metal supports of a type and design approved by the City Engineer or his authorized representative for all steel reinforcing bars and for all dowel bars. No direct payment will be made for such work but will be considered as subsidiary work and the cost thereof included in the unit price for the Bid items for which payment is made.

The bars nearest and parallel to the forms shall be placed such that the minimum distance between the face of the bars and the forms shall be 2 inches.

At splices, bars shall be lapped at least 24 diameters or as shown in details and in all cases the lap shall be sufficient to transfer the stress between bars by bond and shear and to develop the full strength of each bar. Supports and ties shall be placed such that they will not be exposed or discolor the finished concrete.

In the event any steel moves or is displaced during placement of concrete, the steel shall be restored to its proper position before it is completely covered.

K. Reinforcing Bars - Reinforcing steel bars shall meet the applicable requirements and conform to ASTM A-615, Grade 40, Deformed Bars.

L. Joint Materials - All reinforced concrete pipe joints used in storm sewer applications shall be sealed with bituminous joint filler or Rubber Gasket Type Joint material in accordance to manufactures specifications.

M. Bituminous Joint Filler - Plastic bituminous compound shall be homogeneous plastic bituminous paste; such as, "Tufflex", "Platico", or an approved equal. Joint material shall not be heated when placed. Sufficient amount of jointing compound shall be spread around bell of pipe to allow complete filling of annular space between pipes when pulled into place. All joints shall be pointed and smoothed from inside pipe.

N. Rubber Gasket Type Joints - When gasket type joints are used, they shall conform to section 720.03 of the Nebraska Department of Roads Standard Specifications, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets and subsequent revisions or shall conform to ASTM D-1056.

O. Lift Hole - Lifting holes in concrete pipe sections, if approved by the City Engineer or his authorized representative, shall be securely plugged using a rubber "Syntex Lift Hole Plug", or equal. Plug to be of long lasting rubber, designed to be pounded into the lift hole without damage to the concrete pipe. Plug to fit snugly inside the hole, and provide a watertight seal. Grouting of lifting holes will only be permitted after review by the City Engineer or his authorized representative of materials, methods and protections of grouted plug as proposed by the Contractor.

5.30 CONSTRUCTION METHODS

A. Protection of Existing Utilities - The accuracy of location of existing underground utilities as shown on the plans is not guaranteed. It shall be the duty of the Contractor to locate these utilities in advance of excavation and to protect them from damage after uncovering. No house service lines are shown on the plans. The Contractor shall contact the owners of the utilities for assistance in locating these service lines. Any expense incurred by reason of damaged or broken lines shall be the responsibility of the Contractor.

B. Structure Subgrade Preparation - Sewer trenches shall be kept free from water by a method approved by the City Engineer or his authorized representative. The Contractor shall not pump waste water into a street or pump to a storm sewer unless approved in writing from the City Engineer. Reinforced concrete pipe shall be placed on a minimum 6" prepared subgrade and in accordance to the manufacturer's installation instructions.

C. Pipe Laying and Jointing - Pipe shall be protected at all times against impact shocks and free fall. Laying of pipe in finished trenches shall be commenced at the lowest point with the spigot ends on bell-and-spigot pipe and tongue ends on tongue-and-groove pipe pointing in the direction of the flow.

Provide drainage pipe of the size, and class indicated and install at the locations and elevations indicated on the contract drawings.

Pipe installation shall be in accordance with the pipe manufacturer's written installation instructions and with the applicable provisions or requirements of the following referenced handbooks and standard specifications:

Reinforced Concrete Pipe: American Concrete Pipe Association "Concrete Pipe Installation Manual".

Corrugated Steel Pipe: "Handbook of Steel Drainage & Highway Construction Products".

Pipe shall be laid on a smoothly-graded, prepared subgrade soil foundation true to alignment and grade as indicated on the contract drawings. Bell holes shall be hand-excavated so that the bottom of the pipe is in continuous contact with the surface of the prepared subgrade material.

Pipe laying shall proceed upstream with the spigot ends pointing in the direction of flow. Pipe shall not be laid in standing water or when trench or weather conditions are deemed unsuitable by the City Engineer or his authorized representative of representative thereof.

Approved backfill material shall be spaded and compacted into the "haunch" area under each side of the pipe so that all void spaces underneath the pipe are filled with compacted backfill material.

Approved backfill material shall be placed in the trench along the side of the pipe and compacted mechanically by hand up to the top of the pipe. Approved backfill material shall be placed and compacted a minimum of 12" above the top of the pipe.

D. Placement of Pipe - Pipe lines or runs intended to be straight shall be so laid. Deflections from a straight line or grade, made necessary by vertical curves or horizontal curves or offsets, shall not exceed the amount of deflection recommended by the pipe manufacturer.

If the specified or required alignment required deflections in excess of those stipulated above, the Contractor shall provide either special bends as approved by the City Engineer or his authorized representative, or pipes in shorter lengths; in such length and number, that the angular deflections at any joint, as represented by the specified maximum deflections, are not exceeded.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced into place with a slow steady pressure without jerky or jolting movements and brought to correct line and grade. The pipe shall be secured into place with approved compacted backfill material. Precautions shall be taken to prevent dirt from entering the joint space.

E. Cutting Pipe - The cutting of pipe for fittings and closure pieces shall be done in a neat and workmanlike manner without damage to the pipe leaving a smooth end at right angles to the horizontal axis of the pipe. The cutting method used shall be approved by the City Engineer or his authorized representative prior to any cuts.

All pipe shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage. Under no circumstances shall pipe materials be dropped or dumped in the trench.

F. Pipe Bedding - The type of bedding used shall be as noted on the drawings or Class C unless specifically modified in the Detailed Specifications and shall conform to the requirements of Section 6, "Excavation, Trenching, Bedding, and Backfilling."

G. Horizontal and Vertical Pipe Separation - Storm sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. Storm sewers crossing water mains shall be laid to provide a minimum vertical distance of 18 inches (460 mm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the storm sewer. The crossing shall be arranged so that the storm sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a storm sewer, adequate structural support shall be provided for the sewer to maintain line and grade.

H. Manholes - Manholes shall be constructed as indicated on the plans. Tops shall be fitted with cast iron rings and covers weighing approximately 450 pounds and satisfactory to the City Engineer. Manholes over three (3) feet in depth shall be equipped with cast iron steps placed on approximately sixteen (16) inch centers.

Drop inlet manholes shall be constructed where indicated on the plans. Manholes of Precast sections conforming to ASTM C-478 specifications may be used. Proper grade rings shall be used to achieve final planned grade. Precast concrete sections for manholes shall be installed with bituminous joint filler.

I. Storm Sewer Inlets - Storm sewer inlets shall be of the type as shown on the plans and constructed as per the detailed drawings. Construction of inlets shall conform to all methods of forming, and concrete placement outlined in these specifications.

J. Excavation Trenching, Bedding and Backfilling - Storm sewer excavation, trenching and backfilling shall conform to the requirements of Section 6, "Excavation, Trenching, Bedding, and Backfilling."

K. Flowable Backfill - All excavations requiring flowable backfill as indicated on the plans shall be backfilled using nonshrinkable flowable backfill. The backfill shall be filled to the sub-grade of the undisturbed sidewalk, curb, gutter, paving, or earth surface. The flowable backfill shall be an approved mixture which flows easily around the utility being covered and develops a 28 day compressive strength of from 30 to 200 psi. Flowable backfill mix designs shall not be used without the approval of the City Engineer or his authorized representative.

L. Exposure of Sanitary Pipe or Manholes - The Contractor shall conduct the work at all times in such a manner as will insure no disruption to the normal function of the sanitary sewer collection system. Particular attention shall be paid to the threat of introduction of storm water or other waters to the piping and manholes of the collection system. The Contractor shall take whatever precautions are necessary, such as, but not limited to, installation of plugs in exposed pipes and manholes when work is not in progress or when leaving the work site. The Contractor will be held responsible for damages which may occur to either the collection system or to private property through introduction of storm water or other waters to exposed piping or manholes relating to the construction work.

5.40 DRAINAGE STRUCTURE CONSTRUCTION

A. Concrete Work - The construction of forms, mixing, placing, finishing, and curing of concrete work, as well as the fabrication, placement, protection, and cleaning of reinforcement, shall conform to the applicable parts of this Section, and Section 12 "Portland Cement Concrete Pavement".

B. Form Work - Form materials when required shall be wood, metal or other suitable material that is straight and free from warp having sufficient strength to resist the pressures generated by the plastic concrete pouring processes without displacement. Trench wall may be used in place of forms, provided the finished wall thickness does not exceed twice the plan thickness. Form work shall be built to conform to the shape, lines, and dimensions of the concrete work and shall be set true to line and grade. Forms shall be braced and tied in a manner that will withstand the pressure created by fresh concrete and will not move, bulge, sag, or leak concrete. Surfaces shall be smooth. Lumber used once in forms shall have nails removed before reusing as formwork. Forms shall be clean and thoroughly oiled with

a non-straining mineral oil before placing concrete. Temporary openings shall be provided at the bottom of the forms to facilitate cleaning and inspection. All exposed concrete edges shall be provided with three fourths of an inch ($\frac{3}{4}$ ") chamfer unless another size of chamfer is shown on the plans. Chamfer strips shall be adequately secured to the forms.

C. Form Removal – Forms shall not be removed until the member supported thereby has acquired sufficient strength to safely support its own weight, and the load imposed on it. Forms must remain in-place for a minimum of 24 hours unless otherwise approved by the City Engineer or his authorized representative. Special care shall be taken to not damage structure while stripping forms. Required backfilling shall begin a minimum of 7 days after concrete placement, after the concrete has sufficient strength.

D. Concrete Placement - The City Engineer or his authorized representative must inspect the depth and character of the foundations, the formwork, and the placing of reinforcing steel and inserts before the concrete is placed. Unacceptable conditions shall be corrected before concrete is placed in the forms.

All water and debris shall be removed from the forms and excavations. Flowing water shall be diverted into side drains or sumps. Concrete shall be placed on clean, damp surfaces and shall not be placed on mud or on dry, porous earth.

Concrete shall be mixed and placed only when the temperature is at least forty degrees Fahrenheit (40°F) and rising.

Concrete shall be carried from the mixer to the forms in bottom dump concrete buckets, concrete buggies, or wheelbarrows, and shall be deposited as close as practical to its final position in the forms. Place in continuous horizontal layers, approximately twelve inches (12") thick, in order that it can be effectively consolidated with a minimum of lateral movement. Place each batch and each layer immediately following the preceding so that there will be no "cold joints" in the work, yet regulated in such a manner that the design pressure of the form work will not be exceeded. Work concrete into corners and around reinforcement and embedded items, with spades, in a manner that will fill all voids and prevent honeycombing and segregation of coarse aggregate.

Concrete shall not be allowed to drop freely more than five feet (5'). When the vertical distance for placement exceeds five feet (5'), the concrete shall be placed with a tremie.

Concrete shall be consolidated with mechanical, internal vibrating equipment supplemented with hand spading and tamping. Vibrators shall not be used for transporting concrete within the forms. Vibrating equipment shall maintain an impulse rate of not less than six thousand (6,000) impulses per minute when submerged in the concrete. At least one (1) spare vibrator, in good operating condition, shall be maintained on the job site as a relief. Vibrators shall be moved continuously from point to point the duration of vibration at any point being limited to that time necessary to consolidate the concrete without causing objectionable segregation. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius

and close enough to forms to vibrate surface effectively but not come in contact with form surfaces. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

Thin section work shall be thoroughly worked with a steel rod. Small diameter holes shall be drilled in form work beneath large wall sleeves and other inserts to prevent entrapment of air beneath the inserts.

Immediately remove any water that accumulates during placement of the concrete.

Top surfaces not covered shall be protected from rain and all other injurious conditions. Formwork and exposed reinforcing steel must not be jarred after concrete has taken its initial set.

Concrete found to be porous plastered, of less strength than specified, or otherwise defective, shall be removed and replaced in whole or in part, or repaired as directed by the City Engineer or his authorized representative, at no additional expense to the City.

E. Finishing - Floor Slabs and Tops of Walls:

- Screed surface to true level planes.
- After initial water has been absorbed, float with wood float and trowel with steel trowel to smooth finish free from trowel marks.
- Do not absorb wet spots with neat cement.

Unexposed Slab Surfaces: Screed to true surface, bull float with wood float, and wood trowel to seal surface.

After removal of the forms, patch all rock pockets, form tie holes and irregularities with a stiff mixture of Portland Cement and sand mixed in accordance with these specifications. Steel trowel all slabs and tops of walls. Finish exposed walls to produce a uniform, flat surface.

F. Construction Joints - Locate as shown or as approved.

G. Protection and Curing - Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain. Protect new surfaces and appurtenances from traffic for minimum of 14 days. Erect and maintain warning signs, lights and watchmen to direct traffic. Concrete shall be cured for at least 3 days after placement to protect it against loss of moisture, rapid temperature change, and mechanical injury.

Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is completed. Cure exposed surfaces within time frame provided by the manufacturer's directions.

Remove and replace concrete damaged by freezing.

H. Waterproofing – Waterproofing materials of the paint and/or membrane types shall be applied to concrete structures at the locations shown on the plans. Waterproofing paint and its application shall be shown on the plans or as specified by the manufacture.

I. Cleaning - Prior to laying pipe, placement of concrete, and installation of structure lids the interior of each pipe section and inlet/manhole structure shall be cleaned of all soil and debris.

After laying and backfilling, all pipe interiors shall be free of all foreign material such as soil, cement mortar, joint compounds, etc. If large amounts of material have accumulated, the City of Kearney may require flushing of the pipe. If flushing is required, any outlets into existing lines will be blocked so that no foreign material can be collected and disposed of in accordance to the National Pollution Discharge Elimination System requirements.

Insure all cleanup work is completed in a condition acceptable under these specifications. In case the cleanup work has not been done within the specified time, the Contractor will not begin any new work until the said delayed cleanup work has been done.

5.70 QUALITY ASSURANCE

A. Testing - Upon completion of sewer, each pipe line and manhole will be tested as specified by the City Engineer or his authorized representative. The Contractor shall furnish such tools, hose, and other equipment necessary for making such tests and shall be present during the inspection to note any deficiencies that may exist. Before final acceptance, all sewers shall be clean, shall comply with the specifications and all contract documents, and shall be acceptable to the City Engineer and municipal authorities.

B. Light Test - A light test shall be performed on all lines as follows. A light held in a pipe at one manhole shall be visible from the next manhole as a full circle of light. Sewer line sections not meeting the above test shall be relaid and the test repeated.

C. Air Test - This test shall be performed according to stated procedures and under the supervision of the Engineer.

Equipment used shall meet the following minimum requirements: (a) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested, (b) pneumatic plugs shall resist internal testing pressure without requiring external bracing or blocking, (c) all air used shall pass through a single control unit, and (d) individual hoses shall be used for the following connections: (1) from control unit to pneumatic plugs for inflation, (2) from control unit to sealed line for introducing the low pressure air, and (3) from sealed line to control unit for continually monitoring the air pressure inside the pipe being tested.

Procedures: All pneumatic lugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be pressurized to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced

into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe.

At least two (2) minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control unit to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter in Inches	Time (Minutes)/100 Feet
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
39	6.6
42	7.3

In areas where ground water is known to exist, the Contractor shall determine the water elevation prior to running the test. The height of water over the invert of the pipe shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. For example, if the height of the water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig and the 3.0 psig to 8.0 psig. The allowable drop of one half pound and the timing remain the same. For safety reasons, do not exceed 9.0 psig.

If the installation fails to meet this requirement, the Contractor shall, at Contractor's expense, determine the source of the leakage. Contractor shall then repair or replace all defective materials and/or workmanship. Air testing shall then be performed on the repaired line to meet the above specifications.

D. Television Inspection - If required in the detailed specifications or if the pipe tests outlined in the previous sections fail, mobile closed circuit television inspection shall be required to determine if any defects such as open joints, breaks, cracks, intrusions, depositions, settling or other misalignment have occurred in the sewer line during the course of construction and prior to final acceptance. Defects in the sewer line or appurtenances shall be repaired or replaced by the Contractor, as directed by the City Engineer or his authorized representative, at no additional cost to the Owner. One copy of the television inspection report and photographs shall be provided to the Owner by the Contractor.

Mobile closed circuit television inspection equipment shall be used to televise sewer lines between manholes. The camera shall be pushed/pulled through the line. Robotic type camera equipment shall be used to televise stubouts.

The television camera used for the inspection shall be a color camera specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. Picture quality and definition shall be satisfactory to the City Engineer or his authorized representative. Inspection operations shall cease if the quality of the image on the screen is unsatisfactory. No payment will be made for unsatisfactory inspections.

A continuous image for viewing shall be produced. The images shall be of first rate quality according to the currently accepted standards for television inspection of sewers. A system, which displays the camera location in feet on the monitor with respect to the starting manhole's centerline, shall be used. This system shall automatically update the camera location display as the camera is pulled forward or backward through the sewer line.

Measurement for location of observations to be recorded shall be made at the ground level by means of a meter device. Measurement meters shall be accurate to one-half (0.5) foot. Measurements shall be referenced from the center of the manhole where the camera is started to the center of the manhole where observations are terminated. The measurements shall be checked at the completion of the observations by measuring the distance between manhole centers at the ground level. The observed measurements made by the meter and the ground level measurements shall correspond to within plus or minus one foot. Surface measurements shall be made by the contractor in the presence of the City Engineer or his authorized representative.

The television camera shall be moved through the line at a uniform slow rate. During the inspection the camera shall be stopped at the points where one or more of the following conditions are observed and distances recorded.

- Service line tees, wyes or taps.
- Infiltration/inflow sources.
- Structural defects, including broken pipe, collapsed pipe, cracks, punctures, settling, etc.
- Abnormal joint conditions, such as horizontal and vertical misalignment, open joints, joints not fully sealed, etc.

E. Unusual conditions - All such conditions shall be photographed as determined by the City Engineer or his authorized representative. Photographs of all questionable conditions shall be taken for subsequent review. The still shots shall be taken from the image on the TV, or other approved methods. Before taking the still shot, the TV camera shall be properly positioned so the optimum view can be obtained.

All still shots shall be identified by location, date taken, and names of the owner's and Contractor's representative. The location of all still shots shall be identified by

recording the distance from each defect or point of interest to the center of the reference manhole. All still shots shall be submitted as specified.

A VHS tape or DVD with a clear and audible voice narrative of the entire TV monitoring shall be furnished. Each tape will be delivered to the Engineer in charge. Each tape shall be titled on the screen with the date, manhole numbers, pipe size, district or project number. The camera shall be set to begin at the center of the manhole and the footage zeroed out.

The title shall change at each manhole and the footage zeroed out again before starting a new pull when more than one section of sewer is televised in succession. Defects in the sewer line shall be repaired or replaced by the Contractor, as directed by the City Engineer or his authorized representative, at no cost to the City.

One bound copy of the final inspection report shall be submitted to the City Engineer or his authorized representative. Included in the report shall be a map showing the work area, a wye location report, a television inspection report, and a VHS tape/DVD and all pictures.

Television inspection shall be measured and paid for on the basis of unit price as set forth in the bid. Such unit price payment shall be full compensation for all reports, photographs, and other work related work to complete the closed circuit television monitoring. If required by the detailed specifications, the unit price named in the Bid for Television Inspection shall be full compensation for continuous television monitoring and permanent photographs of the television image in all defective areas. If required, due to failing test, the cost of television inspection shall be borne by the Contractor.

F. General - Concrete and Reinforcement: Unless otherwise specified. Meet the requirements of ACI 301 and 318/318R

Precast Reinforced Concrete: Unless otherwise specified. Meet the requirements of ASTM C-478.

Formwork: Unless otherwise specified, follow the recommendations of ACI 347.

G. Inspection of Concrete Pipe - Upon arrival at the job site, each section of pipe shall be inspected for compliance with the applicable piping materials product requirements. Any section of pipe found to be defective shall be immediately removed from the job site and shall be replaced.

Immediately prior to laying, each pipe section shall be visually inspected for defects or damage. Any damaged or defective pipe shall not be used.

Pipe roundness shall not vary from a true circle by more than 5% of the pipe's normal diameter and deviation from straight line parallel to pipe length shall not exceed 1/16" per linear foot measured on the concave side. Allowable deviation from vertical grade shown on the drawings shall be no more than 1/2" below or above the true grade line. In addition, vertical sags and crowns in the pipe joint shall be no more than 1/2" across any 16 feet of pipe length. Horizontal alignment between manholes shall be in accordance with the true line as shown on the drawings and shall not vary more than 1/2" across any single joint of pipe. Any sections of pipe found to be

defective, damaged, or in poor alignment shall be taken up and re-laid or replaced at the Contractor's expense.

Storm sewer lines normally need not be tested, but if in the opinion of the City Engineer or his authorized representative, the workmanship and material do not appear to be satisfactory, the City Engineer or his authorized representative may require that the section be tested according ASTM C-828 standards, "Recommended Practice for Low-pressure Air Testing of Installed Sewer Pipe". If the line fails to meet the requirements of the test, the Contractor shall determine the source or sources of leakage and shall make repairs as necessary at no additional cost to the City of Kearney. The pipe installation shall be retested after making repairs to verify that it meets the requirements of the test.

H. Evaluation of Backfill - Trench backfill and compaction testing shall conform to the requirements of Section 6, "Excavation, Trenching, Bedding, and Backfilling."

All failing tests will be paid by the contractor. All testing will be done in accordance with the Excavation, Trenching, and Backfill section of these specifications.

5.71 ACCEPTANCE

A. Acceptance - Upon completion of a job, all debris and surplus materials shall be removed from the job by the Contractor. The City Engineer shall be notified, and shall make an inspection of the work. The City will be notified in writing as to the acceptability of the work.

5.80 SUBMITTALS

A. Submittals:

- Shop Drawings
- Curing compound data
- Complete data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C-94.
- Manufacturer's application instructions for proprietary materials including pipe, joint material, concrete mixes, reinforcing details.
- Ready-mix delivery tickets for each truck in accordance with ASTM C-94.
- Material properties of the Reinforced Concrete Pipe.
- Sieve analysis and density curves for soils encountered.
- Laboratory tests and evaluation reports must also be submitted.
- City Engineer requested information.