

**POTTAWATOMIE COUNTY
DESIGN STANDARDS
FOR
ROADWAY DESIGN**
Adopted April 19, 1999

INTRODUCTION

To advise and aid owners and developers of platted additions and other unplatted areas who are required by the Pottawatomie County Zoning Regulations or other regulations to construct road, street and drainage improvements in compliance with the Pottawatomie County Public Works Department, the following standards have been established to create an overall uniform policy and program of minimum standards for the construction and improvement of subdivision streets and roads.

- (1) Streets and roads along with their related drainage improvements shall be constructed at the expense of the owners or developers of such areas.
- (2) Construction shall be per plans prepared by a licensed engineer in the State of Kansas and as approved by the Pottawatomie County Public Works Director.
- (3) Notification shall be given to the Pottawatomie County Public Works Department at least two days prior to commencement of construction. At this time there shall be the necessary staking to begin construction, which shall include right-of-way hubs, alignment control points, slope stakes and benchmarks.
- (4) During the course of construction, other staking may be requested at the discretion of the Pottawatomie County Public Works Department (i.e. Blue tops, pavement grade and offsets, etc.)

SECTION 1 - STREET STANDARDS

General

Internal gravel residential streets shall have a minimum graded base width of 27 feet within a minimum 60-foot right-of-way. Internal paved residential streets shall have a minimum graded base width of 27 feet within the 60-foot right-of-way. Curbing and sidewalks are not generally a requirement in rural developments but in some instances curbing may be required in (1) poor drainage sites, (2) when the development lies within an area of potential annexation by an incorporated city, (3) under some conditions of topography and soils.

1. The County shall consider either full depth curbs or laid back curbs and will determine which type shall be accepted on a case by case basis.
2. New half or partial streets will not be permitted.
3. Cul-de-sacs should only be used when a through road is determined to be unacceptable due to topography, drainage constraints or economic reasons.
4. Cul-de-sacs shall have at the closed end, a turnaround with a right-of-way having a minimum outside radius of not less than sixty (60) feet and shall be surfaced to a radius of not less than

- forty-eight (48) feet.
5. Drainage of a cul-de-sac shall preferably be toward the open end.
 6. The owner of such lots shall maintain drainage improvements and easements between or through tracts or outside the right-of-way.
 7. Residential entrances and driveways shall be maintained a minimum of 250 feet from all public road intersections whenever possible.
 8. Driveway entrances shall have a minimum sight triangle distance based on roadway design speed.
 9. The Public Works Department reserves the right to vary the engineering design standards when unusual circumstances so warrant.
 10. The County shall become the owner and maintain said roadway and appurtenances thereto following construction inspection and approval and upon acceptance thereof by the County.

Street Alignment

1. Whenever street lines are deflected in excess of 5 degrees, connection shall be made by horizontal curves.
2. Residential streets should approach major streets at an angle of not less than eighty (80) degrees or more than one hundred (100) degrees.
3. To insure proper street layout, safety and site design, the Pottawatomie Public Works Department recommends the following standards be employed:
 - (a) To ensure adequate sight distance, minimum centerline radii for horizontal curves should be 275 feet for through streets and 150 feet for residential streets.
 - (b) A long radius curve is preferred in all cases to a series of curves and tangents.
 - (c) Approaches to an intersection should follow a straight course for a minimum of 50 feet.
 - (d) Any applicant who encroaches within the legal right-of-way of a State highway should note that prior permission is required from the Kansas Department of Transportation.

Street Standards

Minimum Street Geometric Standards

The following are recommendations where topography and soil conditions permit and are subject to review by the Public Works Department:

1. Alignment in residential areas should fit closely to the existing topography to minimize the need for cuts or fills without sacrificing safety. Caution should be taken that the safety of the facility is not reduced and also in the design of both the vertical and horizontal alignment.
2. Centerline grades should not be less than 1 percent.
3. The maximum grades for residential streets shall be no greater than 8 percent.
4. Vertical curves should be used in changes of grade to assure a minimum stopping sight distance in the range of 200 to 475 feet based on design speed.
5. All crossroad pipes shall be a minimum of 18" in diameter or its pipe-arch equivalent and be a minimum of 16 gauge galvanized corrugated steel. Minimum gauges for pipe larger than 18" diameter shall correspond to current Kansas Department of Transportation

Specifications. Metal end sections shall be used. Pipe shall be of sufficient length to maintain 3:1 shoulder slope and 24' gravel road top or 24' paved road top. Pipe sizes shall be reviewed by the Public Works Director, to correspond to the area and hydrology of the drainage.

6. All entrance pipes shall be a minimum of 12" in diameter and be a minimum of 16 gauge galvanized corrugated steel. Entrance pipes should be of sufficient length to maintain a 20' wide entrance top and 3:1 side slopes. A minimum 6-inch depth of cover, including surfacing, shall be maintained over all entrance culverts. Metal end sections shall be used, but the Public Works Director, due to topography, hydrology and other site factors may grant variances. All pipe sizes shall be reviewed by the Public Works Director, to correspond to the area and hydrology of the drainage.

NOTE: Steel and plastic pipe may be used only with prior permission from the Pottawatomie County Public Works Dept.

- a. Steel Pipe – New or used steel pipe may be used, if the wall thickness is ¼” or greater and the pipe is free of pinholes and scaled rust. In the event steel pipe is joined together, it must be continuously welded around the seam. End sections shall not be required when new or used steel pipe is allowed, however end treatments may be utilized. NOTE: New or used steel pipe will not be allowed on drainage’s which require a pipe diameter in excess of 18”.
- b. Plastic Pipe – New polyethylene corrugated pipe with an integrally formed smooth waterway and end section. Pipe manufactured for this specification shall comply with the requirements for test methods, dimension, and markings found in AASHTO Classification “Type D” (smooth waterway) and AASHTO Designations M252 and M294. Pipe corrugations may be either annular or spiral. Used polyethylene corrugated pipe will not be allowed.

General Minimum Design Standards for All Roads

- (a) Ditch Depth - 1.5 feet
- (b) Ditch Width - 4.0 feet
- (c) Shoulder Slope - 3:1
- (d) Back Slope - 2:1, 4:1 is recommended in subdivisions. Slopes may be steeper in areas of solid rock
- (e) Bridge Loading - H-20
- (f) Minimum Design Speeds - 30 mph
- (g) Ditch lining required for all slopes greater than 4-1/2% in highly erodable soils
- (h) Ditch lining required for all slopes greater than 6% in all other soils
- (i) Other circumstances may dictate the need for ditch lining or slope protection

Minimum Design Standards for Graveled Roads

- (a) Base Width - 27 feet
- (b) Surfaced Width - 24 feet
- (c) Minimum depth of 5" of Crushed Rock to be applied in layers of three inches of 2” rock and two inches of 1-1/2” or AB-3 crushed rock. (Type to be approved by the Engineer)
- (d) Crushed Rock Shall be Placed in Two Lifts

- (e) Crown – 4%
- (f) Type B, MR-90 (KDOT Standards 210.04 and 210.03 - Compaction and Moisture Standards) required on the Subgrade Material

Minimum Design Standards for Paved Roads

- (a) Surfacing – minimum depth 6" Reinforced Concrete (See Section 3 for specifications) or 8 1/2" Asphalt (See Section 4 for Specifications)
- (b) Minimum depth of 8" of subgrade stabilization (fly ash, calcium chloride or lime, depending on soil composition). Soil testing may be required to determine the optimum ash/calcium chloride/lime content and moisture content and shall be the responsibility of the developer.
- (c) Base Width - 27 feet (without curb and gutter)
- (e) Surfaced Width - 24 feet (Without curb and gutter)
- (f) Shoulder – 18" minimum (Without curb and gutter)
- (g) Base Width – 33 feet (with curb and gutter)
- (h) Surfaced Width with Curb and Gutter - 31 feet back to back of curbs in subdivisions
- (i) Storm drains and inlets shall be provided as necessary.
- (j) Crown - 3/16" per foot

Residential Street and Road Intersections

1. Streets shall be laid out to intersect as nearly as possible at right angles but no street shall intersect another at an angle less than 80 degrees or more than 100 degrees.
2. Multiple street intersections involving junction of more than two streets shall be avoided. Where this proves impossible, such intersection shall be designed with extreme care for both pedestrian and vehicular safety.
3. Clear sight triangles based on design speed measured along the street right-of-way lines from their points of junction shall be provided at all intersections, and no obstruction shall be higher than 2 feet above the center line within the sight triangle.

Street & Road Plans

1. All applicants for subdivision plats shall submit a set of road plans, to the Pottawatomie County Public Works Department for approval. Upon approval, two additional copies of such plans shall be submitted. Plans shall be developed by a Professional Engineer and bear the stamp of that Engineer.
2. The plans shall include the following elements:
 - (a) Either a registered land surveyor or a registered engineer shall prepare topographic map of the area being developed. Scale to be not less than one inch to 100 feet. Contour intervals not to exceed 5 feet.
 - (b) Plans, profiles and cross-sections, including approximate excavation quantities. Ditch profiles, with grade percentages, shall be shown when varying from a standard ditch. Scale for plan and profiles to be not less than one inch to 100 feet and scale for cross sections to be not less than one inch per 10 feet.
 - (c) Show Drainage areas.
 - (d) Show location, type, sizes and lengths of all drainage structures with hydrologic and

hydraulic data to be shown for each crossroad structure (drainage area, coefficient of runoff, design intensity, design runoff, design headwater depth, and flowline elevations).

- (e) Denote Entrance culvert size and length to each lot being subdivided.
 - (f) Sizes and map locations of all easements on or bordering the property to be subdivided; this shall include all travel easements and temporary construction easements.
 - (g) Road surfacing material quantities or rates shall be shown in tons or yards.
 - (h) The type and content of the surface soil.
 - (i) Seeding Proposal showing types and quantities of seed, fertilizer and mulch to be used. (See Section 6 – Seeding)
 - (j) Plan showing erosion control measures during construction.
3. All plans must be submitted and approved prior to the start of any construction. All plans must contain a signature space for approval by the Pottawatomie County Public Works Director.

Testing & Inspection

- 1. It shall be the responsibility of the Developer to provide for and pay all costs associated with the testing of materials and job site inspections (Project Inspector).
 - a) Materials, which are incorporated in the job, shall be tested according to current KDOT standards.
 - b) All material certifications, which are required by KDOT standards, must be submitted before being incorporated in the work.
- 2. The Project Inspector must be qualified to perform inspections under KDOT guidelines. All Project Inspectors must be approved by the Pottawatomie County Public Works Dept. before work commences.
 - a) The Project Inspector shall be present on the job site during, but is not limited to, the following operations:
 - 1) During placement of all concrete
 - 2) When excavation operations are being performed
 - 3) When drainage structures are being placed
 - 4) During pile driving operations
 - 5) During all surfacing operations
 - 6) During the trenching, placement and backfill of all water or sewer lines
 - 7) During backfilling operations
 - 8) During subgrade modification operations
 - a) Frequency and documentation of on-site testing and inspection shall be performed according to KDOT guidelines.

SECTION 2 - EXCAVATION AND COMPACTION OF EARTHWORK

General

The work under this section covers the furnishing of all labor, materials and equipment to perform all

work associated with excavation, compaction, trenching and backfilling of earthwork as shown on the plans.

Excavation

1. "Excavation" shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof. No classification of excavated materials will be made unless shown on the plans or proposal.
2. The Contractor shall strip all vegetation and other objectionable matter from all areas or original ground or fill on which any new construction is to be placed. The stripping shall be deposited at locations designated by the Developer and shall not be used for fill under new construction.
3. The Contractor shall perform all excavation to the dimensions, elevations and sections indicated on the drawings and as shown on the plans. Where rock or shale are encountered, excavation shall be made at least one (1) foot below base course elevations and backfilled as hereinafter prescribed. Soft or other objectionable materials shall be excavated to depths as directed by the Project Inspector on site and restored to grade with backfill as hereinafter prescribed. Excess excavated material shall be deposited in locations indicated by the plans.

Compaction

1. The Developer shall make any necessary excavation to allow the Engineer to take compaction tests at sites selected by the Project Inspector. The compaction test shall dictate the quality of the compaction and the Contractor shall remove and recompact any areas that do not pass the compaction test, at the Contractor's expense. All embankments required to fill sections of roadbeds and fill required under and around structures shall be compacted by rolling with a sheepfoot roller or by mechanical tamping. No frozen or organic material shall be placed in any embankments.
2. The sheepfoot roller, when fully loaded, shall have a load on each tamper foot not less than 200 pounds per square inch of cross-sectional area. Enough moisture shall be present in the soil to obtain proper density before placing the next lift. Each lift shall consist of level 8-inch loose lifts or less prior to compaction.

Site Grading

Upon completion of other work, the entire site of construction shall be graded to uniform slopes, conforming to existing adjacent contours, properly drained without ponding, and presenting a neat appearance.

Subgrade Preparation (For Gravel Roads)

The subgrade shall be excavated or filled to conform to the typical sections and profiles as shown on the drawings. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material having the proper moisture content and compacted as specified above. The entire surface shall be bladed, moistened, fine graded and rolled until the surface is uniformly smooth, conforming to the required subgrade elevation.

Subgrade Stabilization (For Paved Roads)

The work to be done under this section consists of furnishing of all materials, equipment and labor for fly ash stabilized base course. This method shall consist of full depth reclamation of the top-8-inches of the entire base (including shoulders) area to be occupied by pavement. The stabilized base shall be produced by the in place pulverization and blending of the existing materials with Class C fly ash or other approved materials and spreading and compacting the recycled material in accordance with these specifications.

Materials

- (1) The additive shall be ASTM C618 Class C Fly Ash and shall meet the requirements specified in the appropriate sections of the State Standard Specifications or Special Provisions.
- (2) Water for pulverization and mixing: (a) all sources of water shall be subject to approval by the owner, (b) water shall be reasonably clear and free from excessive quantities of oil or vegetable matter.

Equipment

- (1) The equipment necessary for proper execution of the work shall be on the project and approved by the Engineer.
- (2) Blending of the fly ash shall be accomplished with a self-propelled recycling machine. The machine shall have a visible depth gauge to allow for the easy determination of the depth of cutting and mixing. This equipment shall have a liquid additive system consisting of a positive displacement pump, flow meter, feet per minute meter and a spray bar and nozzles. The spray bar nozzles shall be kept clean and free flowing to maintain a uniform rate of application.
- (3) Compaction equipment shall be of the following type and shall have watering systems to keep drums and tires wetted as required to prevent pick-up.
 - a) Vibratory, single drum, padfoot roller, minimum operating weight of 24,000 pounds, with a minimum centrifugal force of 24,000 pounds and a minimum drum width of 66 inches and
 - b) Self-propelled pneumatic tire roller, having a minimum operating weight of 24,000 pounds.
- (4) A spreading device shall be required for distribution of the fly ash on the pavement surface in front of the recycling operation. This device shall be capable of uniformly distributing the fly ash. (A motor grader may be used if uniform distribution can be achieved.)
- (5) Other equipment shall include a motor grader for additional mixing, if required, and for shaping and finishing of the stabilized base. A water tanker shall be available to add moisture at the mixing drum and for sprinkling compacted sections.

Preparation of Shoulder - Small berms shall be required along the shoulders to maintain the fly ash at the proper depth on the roadway and prevent waste of the material.

Application and Mixing of Additive

- (1) Application of Fly Ash. The amount of fly ash shall be determined by prior soil tests. The Developer shall absorb all costs associated with testing. The additive amount may be varied

if the recycled mixture properties indicate a change is needed.

- (2) Uniform Distribution. A spreading device shall be required for distribution of the fly ash on the roadway surface in front of the recycling operation to ensure uniform coverage.
- (3) Mixing. Blending of the fly ash may be accomplished in one pass if the moisture content can be shown to be uniform throughout the base material. Otherwise, two passes will be required. Water will be added through the mixing machine. All materials shall be well mixed and blended with the appropriate moisture content. The water content shall be eight (8) to fourteen (14) percent by weight of subgrade materials and fly ash, unless it is determined by the engineer to adversely affect the compatibility of the recycled material (content to be adjusted as required).

NOTE: Pavement coring and sampling and laboratory testing of the subgrade materials will be conducted by the Developer to determine the percent of fly ash and water to be utilized.

Compaction and Density

- (1) The initial rolling shall begin immediately behind the shaping and mixing operation and all rolling shall be completed within 30 minutes from the time the fly ash is mixed with the subgrade materials.
- (2) The initial rolling shall be with a vibratory padfoot roller that meets the requirements of Section 2 - Equipment. Compaction with this roller shall continue until no further consolidation of the stabilized base is evident.
- (3) At the completion of the initial rolling, the stabilized base shall be shaped and sprinkled with water as necessary. A pneumatic tired roller, meeting the requirements of Section 2 - Equipment, shall be used to compact the remaining loose material.
- (4) Density of the stabilized base shall be such that after tamping or rolling, the roller will walk-out of the material and ride the top portion of the lift.

Finish Grading

The stabilized base will require blue top stakes at a maximum of 100' intervals along the centerline and both shoulders of the roadbed. The completed surface shall have no deviations in excess of 3/8 inch in 10 feet when determined with a 10-foot straight edge.

Curing of Stabilized Base

After compaction or final shaping of the stabilized base has been completed, no traffic shall be permitted on the stabilized material for at least 24 hours.

Weather Limitations

Full depth reclamation with fly ash shall be completed only when the ambient air temperature is above 40 degrees Fahrenheit and be performed in the absence of rain.

SECTION 3 - CONCRETE STREETS

General

1. The work to be done under this section consists of furnishing all materials, equipment and labor for the construction of concrete pavement and curb. The work shall be performed in

accordance with these specifications and in such a manner that completed items will conform to lines, grades and elevations as shown on the plans.

2. Concreting operations shall be stopped when descending air temperature away from artificial heat reaches 40 degrees Fahrenheit. Concreting operations may resume when ascending air temperature away from artificial heat reaches 35 degrees Fahrenheit. Concrete shall not be mixed or placed at temperatures of 35 degrees Fahrenheit and below without expressed permission of the Engineer, and then only with adequate frost protection. Aggregate, water, or both, shall be heated as required to permit placing of the mixture at concrete temperatures ranging from 50 to 100 degrees Fahrenheit. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials or materials containing snow or ice shall be used.

Materials

1. Upon the request of the Engineer, the Contractor shall provide three (3) copies of certified test reports indicating the material conforms to the specifications as outlined in the following sections. The manufacturer shall perform all tests in conformance with applicable standards. Testing may be witnessed by the Project Inspector or approved independent testing laboratory.
2. All materials shall be stored so as to prevent deterioration or intrusion of foreign matter. No deteriorated or damaged material shall be used.
3. Cement shall be Type I Portland Cement, and shall conform to ASTM C150. Only one brand of cement shall be used throughout any job.
4. Concrete aggregates shall conform to ASTM C33. Aggregate shall be free from injurious amounts of alkali, organic matter or deleterious substances. When tested for soundness under ASTM C88, the aggregate shall pass five (5) cycles without showing evidence of disintegration or a total loss greater than 12% for the coarse particles, and 10% for the fine portions.
5. Water used in mixing concrete should be potable; however, non-potable water may be used if mortar cubes made with the water in question have 7 and 28-day strengths equal to, or greater than, companion specimens in which potable water was used. Water shall be clean and free from injurious amounts of sewage, oil, acids, strong alkalis and vegetable matter.
6. Admixtures, when used, shall conform to appropriate ASTM Standards. The Engineer, prior to construction, shall approve the use of admixtures not specifically listed in these specifications, including but not limited to, fly ash, calcium chloride, other accelerators and retardants.
7. (a) Dow Corning 888 or approved equivalent shall be used in joints filled with a rubberized joint sealer. The sealer shall be placed according to the manufacturer's directions. A backer rod shall be used to be compatible with the Dow 888 Silicone. Carter-Waters Cera Rod or approved equivalent backer rod shall be used. The face and bottom of all joints to be sealed shall be thoroughly cleaned by sandblasting. After cleaning, sand and dust shall be removed from the joints using compressed air (oil-free), sweeping, brooming, resawing and additional methods as required by the Engineer to insure absolutely clean joints for sealing. The use of water to clean joints is prohibited, and all joints shall be dry before sealing. After the joint has been

properly cleaned, backer rod shall be placed in the joint sealer reservoir to provide the proper dimensions for the joint sealer. The finished surface of the joint sealer shall be smooth, and shall be 1/4 inch below the surface of the concrete. Any material spilled adjacent to the joint shall be removed immediately.

- (b) Wire mesh for concrete reinforcement shall conform to cold drawn steel wire for concrete reinforcement and conform to ASTM A-82. The wire shall be 6 gauge with 6" x 6" openings.
8. Aggregate used in concrete shall be composed of limestone and sand, or limestone, sand and gravel. The Contractor shall be required to initially certify the aggregate quality, and total gradation of their mix, when it is obtained from a ready-mix company. Prior to operation, all batch plant concrete shall require the same aggregate certification from the Contractor as previously stated.

Classification and Proportioning

1. Concrete strength of the mix design shall be for 4000 psi concrete at twenty-eight (28) days.
2. A minimum of 550 pounds of cement shall be used per cubic yard of concrete. Fly Ash may be substituted for cement in a 1:1 basis up to a maximum of 100 lbs. per cu. yd. of concrete.
3. The water/cement ratio shall be less than .55 and shall be as low as possible while still maintaining adequate workability.
4. Concrete shall be air-entrained according to ASTM C260. Air content shall be seven (7) percent, plus or minus one (1) percent.
5. The slump of concrete at the time of placement shall not exceed three (3) inches as tested according to ASTM C143. This shall not apply in special circumstances where a plasticizer has been approved for use.

Concrete Construction

1. All forms shall be sufficiently strong to support the loads resulting from construction without deflection in any direction. Furthermore, forms shall be set true to line and grade with all curves being smooth. Joints in the forms shall be locked rigidly in true alignment so as to prevent play or movement of the joint in any direction. Forms shall be cleaned and thoroughly oiled prior to placing concrete. Slip-form paving machines are acceptable.
2. Ready mixed concrete shall be mixed and delivered in accordance with ASTM C94, and shall be in compliance with all other requirements outlined herein. The Inspector shall be allowed to have free access to the mixing plant.
3. Care shall be taken to finish the curb section true to line and grade. The curb shall conform to straightedge inspection procedures, as does the surface of the finished pavement. The curb shall be straight on top, on the face, and into the gutter section when checked longitudinally. Any deviation from the straightedge of over 1/8-inch shall not be allowed. At the Project Inspector's option, poorly constructed or finished curb, which does not conform, shall be removed and replaced at the developer's expense.
4. Concrete shall be conveyed from the mixer to the final position in the forms as rapidly as practicable. Methods of conveying shall be used which insure prevention or segregation or loss of ingredients.
5. The concrete shall be placed before the initial set occurs. In no event shall concrete be

placed more than one (1) hour after the initial addition of water at the batching facility. Concrete shall be placed on a properly prepared subgrade. No concrete shall be placed on mud, dry porous earth, or frozen surfaces. The concrete shall be worked into all corners and angles of the forms and around reinforcement and embedded areas in such a manner as to avoid segregation.

6. When most of the water glaze or sheen has disappeared and just before the concrete becomes non-plastic, the surface shall be finished by brooming or burlap drag. In either case, the finish shall not have disfiguring marks.
7. All edges shall be finished with a three-eighths (3/8)-inch radius edge.
8. All joints shall be constructed to the dimensions and at the locations shown on the drawings or as required by the Engineer. Care shall be taken to insure compliance with straightedge requirements through the joint section. All joints shall be perpendicular to the surface of the pavement. Edges of all joints, except sawed contraction joints, shall be finished with a three-eighths (3/8)-inch radius edge unless otherwise approved by the Engineer. No joints shall exceed 15' unless otherwise approved by the Engineer.
9. The faces and bottom of all joints to be sealed shall be thoroughly cleaned by sandblasting, or by using a power wire brush. After cleaning, sand and dust shall be removed from the joints using oil-free compressed air, sweeping, brooming, resawing, and additional methods, to insure absolutely clean joints for sealing. The use of water to clean joints is prohibited, and all joints shall be dry before sealing. After the joint has been properly cleaned, backer rod shall be placed in the joint sealer reservoir to provide the proper dimensions for the joint sealer. The finished surface of the joint sealant shall be smooth, and shall be one-quarter (1/4) inch below the surface of the concrete. The Contractor shall exercise caution to prevent pouring any material on the exposed surfaces of the pavement adjacent to the joint. Any such material shall be removed immediately.
10. Transparent membrane curing compound shall be applied on all projects, regardless of season, to all concrete surfaces that are exposed to the air. The membrane shall be applied to the green concrete surface at the rate recommended by the manufacturer, immediately following the disappearance of water sheen. The surface shall be back-spotted to obtain uniform distribution. Immediately after the forms are removed, the entire area of the sides of the slabs shall be coated with curing compound at the rate specified for pavement.
11. When the ambient air temperature is at or below 40 degrees Fahrenheit, the Contractor shall protect the concrete from freezing using auxiliary covering. The concrete shall be protected until a strength of 3000 psi is achieved, or a maximum of seven days. Concrete damaged by improper curing shall be removed and replaced as directed by the Engineer. This shall be done at the developer's expense.

Sampling and Testing Concrete

1. As work progresses, concrete shall be sampled in accordance with Method of Sampling Fresh Concrete; ASTM C172. The Contractor shall correct job conditions if a determination is made by the Engineer that a change is necessary.
2. The slump of concrete shall be tested by the Project Inspector according to ASTM C143; Method of Test for Slump of Portland Cement Concrete. The slump of the concrete at the time of placement shall not exceed three (3) inches.

3. The Project Inspector according to ASTM C173 shall test air content of concrete. Air content shall be uniformly maintained, and shall not exceed seven (7) percent plus or minus one (1) percent.

Reinforcement

1. The Contractor shall furnish and install all reinforcement, including rods, fabric and structural shapes, as indicated on the plans or otherwise required. All reinforcement bars for concrete shall conform to the requirements of A.S.T.M., designation A 15. Unless otherwise indicated, all bars shall be deformed, intermediate grade. All welded wire fabric reinforcement shall conform to A.S.T.M. designation 185-37. All reinforcement shall be, when surrounding concrete is placed, entirely free from rust, scale, grease, or other coating which might destroy or reduce its bond with concrete. The Contractor shall furnish Shop drawings lists, and bonding details when required.
2. The clear distance between parallel rods shall not be less than 1 1/2 times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized shall in no case be less than one (1) inch.
3. All reinforcement shall be accurately placed, with clear spacing between main reinforcement and concrete surfaces as shown on the plans or as may be directed by the Engineer.
4. Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bonds, as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered.
5. All reinforcement shall be secured in place, true to the lines and grades indicated, by the use of metal or concrete supports, spacers or ties. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation, and shall be used in such manner that they will not be exposed on the face of, nor in any way discolor or be noticeable in the surface of the finished concrete.

SECTION 4 - ASPHALT STREETS

General

1. This section shall consist of the specifications regarding the materials and equipment for the construction of combined curb and gutter and asphaltic concrete pavement. The work shall be performed in accordance with these specifications and in such a manner that completed items will conform to the lines, grades and elevations as shown on the plans.
2. All combined curb and gutter shall be constructed of concrete. No asphaltic curb and gutter will be accepted. All materials, methods of construction and curing for combined curb and gutter shall conform to the specifications outlined in the Concrete Street section of these specifications. Combined curb and gutter shall be subject to the same test as concrete streets.

Materials

All materials shall conform to the standard specifications for the State Road and Bridge Construction of the Kansas Department of Transportation. The asphaltic cement for these mixtures shall be AC-

10, and shall be mixed with the aggregate at the rate of 5.25 percent, plus or minus 2 percent, by dry weight of aggregate. The tack material shall be SS-1h, emulsified asphalt, and shall be applied at the approximate rate of 0.05 gallons per square yard of surface.

Construction

Asphaltic Concrete Pavement shall be constructed as specified by the Standard Specifications for State Road and Bridge Construction of the Kansas Department of Transportation. The base course shall be BM-2C or BM-2, and the surface course shall be BM-2.

1. Subgrade Preparation. The subgrade shall be graded to the lines and elevations shown on the plans. Soil shall be stabilized, if required, and compacted in accordance with the Excavation and Compaction of Earthwork Section of these specifications. The subgrade shall be free of debris, standing water or ice prior to placing asphalt.
2. Tack Requirements. Emulsified asphalt shall be applied to the subgrade for a tack coat unless the subgrade is free of loose fines. In that case, a water tack shall be used. A tack coat shall also be applied between lifts if there has been sufficient time delay between the placing of lifts to cause surface oxidation, or there is sufficient accumulation of surface dirt to inhibit bonding between lifts.
A tack coat shall be applied to the vertical face of the toe of the gutter immediately prior to placing asphalt next to concrete curb and gutter. This is to insure a good bond between the concrete and the asphalt.
A prime coat of *MC-30* cutback asphalt shall be applied to the granular sub-base prior to the application of asphaltic concrete pavement at the rate of approximately 0.20 of a gallon per square yard, depending on the amount of penetration, which can be achieved.
3. Thickness of Lifts. The standard asphalt street thickness shall be a minimum of eight and one-half inches (8 1/2"). The BM-2 base course shall be laid in two equal lifts, which total seven inches (7"). The BM-2 surface course shall be placed in one lift of one and one-half inches (1 1/2"). For projects requiring thicker pavement, the base course shall be adjusted accordingly, but at no time will lift thickness' greater than four inches (4") be allowed.

Inspection and Testing

Prior to asphalt work, the Contractor shall submit to the Engineer asphalt test reports for each asphalt mix to be used on the project. This report shall include sieve analysis in accordance with Kansas Testing Method KT-1-80 and DT-2-80 and Marshall Test of Bituminous Mixtures in accordance with Kansas Testing Method KT-14-80. During production, the Developer shall provide at least one sieve analysis and one Marshall Test for every 400 tons of material produced, but no less than one for each production day.

For each Marshall Test performed during production, the Contractor shall also test the in-place density of the asphalt mixture utilizing either core-drilled specimens or nuclear testing apparatus. In-place densities shall be tested in accordance with Kansas Test Method KT-15-80, and shall be 95 percent of the field mold density.

SECTION 5 - DRAINAGE STRUCTURES

All Drainage Structures

1. All drainage structures shall have adequate waterway opening to be determined by accepted civil engineering practices and shall be reviewed by the Public Works Department. Drainage structures shall be designed on a 10-year frequency, unless the Pottawatomie County Public Works Department approves a lesser design.
2. The Developer will apply for structures requiring a permit from the Kansas Division of Water Resources (DWR). Sufficient drainage, road profile and waterway opening data shall be provided for submittal to DWR along with any significant channel changes or stream bank and vegetation changes.
3. All disturbed areas shall have vegetation re-established as per seeding guidelines.

Box Culvert Standards

1. All reinforced concrete box (RCB) structures shall conform to current Kansas Department of Transportation (KDOT) standards.
2. All RCB's shall be designed for an HS-20 loading.
3. All RCB's shall have a minimum roadway width of 26 feet.
4. All RCB's shall have a minimum clear zone of 10' or guardrail may be required.

Bridge Standards

1. Bridges shall be classified as a structure having a total span length greater than 20 feet.
2. Bridges shall conform to current Kansas Department of Transportation (KDOT) standards.
3. Bridges may be composed of structural steel superstructure and metal deck, with either gravel or concrete deck surface or reinforced concrete haunch slab or other acceptable designs, as approved by the Public Works Department.
 - (a) Gravel surfacing on metal decking may only be used where the road surface approach is gravel or earth. Gravel depths shall be determined by the specifications of the metal deck manufacturer. Concrete bridge deck surfaces may be used on gravel or earth roadways.
 - (b) Concrete surfacing on metal decking or a reinforced concrete haunch slab shall be used where the road surface approach is or has been planned to be hard surfaced.
4. All bridges shall be designed for an HS-20 loading.
5. All bridges shall have a minimum roadway width of 26 feet.
6. The type of bridge replacement design shall be determined by analyzing the physical characteristics of the site, and preparing a cost analysis of the different types of bridges, including labor and materials.
7. All bridges shall have the appropriate handrails and guardrails installed according to current KDOT standards.

SECTION 6 - SEEDING

- 1) After receiving preliminary approval from the Pottawatomie County Public Works Department, of the roadway, ditch, drainage structure and drainage improvements construction, the owners or developer's shall seed, fertilize, and mulch all areas exposed by

such construction, as per the following:

Seed combination in paved subdivisions:

- a) Smooth brome grass 20 lbs./acre
- b) Fescue K-31 (or equal) 60 lbs./acre

OR

Seed on gravel roads:

- a) Smooth brome 80 lbs./acre

Fertilizer:

- a) 10-20-10 or 30% Nitrogen 350 lbs./acre

Mulch

- a) Prairie hay mulch 15 bales /acre at 50 bales/bale

NOTE: All slopes greater than 3:1 shall be covered with an erosion control mat after seeding and mulching operations, and placed according to the manufacturer's specifications.

SECTION 7 - WATER LINES

General

This section covers the excavation and embankment work required for water main excavation and trenching including excavation, trenching, backfilling, all necessary sheeting, shoring and protection work, pumping and dewatering as necessary or required, materials, and methods for water main construction and other subsidiary or appurtenant work.

Trench Excavation

1. Trenches in soil for water mains and service lines shall provide a minimum depth of cover of 42 inches above the top of the pipe.
2. Greater depth trenching may be required at road crossings, railroad crossings, creek crossings, pipeline crossings and telephone cable crossings or at other locations as may be called for on the plans.
3. The trench shall not be open longer than is necessary to expedite the work.
4. The trench bottom shall be uniformly graded and cleaned in such a manner that the pipe will be in continuous and uniform contact with the trench bottom for its entire length.
5. The bottom of the trench shall be free of rocks, clods or other sharp edged objects.
6. The trench width shall be a minimum of three (3) times the nominal pipe diameter except in areas where rock is encountered.

Pipe Clearance in Rock

- a. Ledge rock, shale, boulders and large stones shall be removed to provide a minimum of four inches below the pipe and four inches at either side.
- b. Minimum clearance requirements are not minimum average but are minimum clear distances which will be permitted between the pipe being laid and any projection or point of such rock, shale, stone or boulder.

- c. All material so removed shall be replaced with sand or select material as required in trench backfill.

Replacement of Unstable Pipe Foundations

In locations where an otherwise stable soil becomes soft or mucky in the bottom of the trench and the presence of ground or surface water is in such a condition that the trench bottom cannot be properly shaped and graded and also where it is difficult and impractical to obtain a uniform bearing for the pipe at all points because of the hardness of the soil, such unsuitable material shall be removed to a depth of not less than four inches below the elevation of the pipe subgrade over the entire width of the trench and replaced with suitable, finely divided material of acceptable quality and sufficiently damp for proper compaction.

Blasting

1. Blasting, when required, including necessary and proper safety precautions shall be performed in compliance with all laws, ordinances and applicable safety code requirements and regulations relative to the handling, storage and use of explosives and the protection of life and property. The developer shall be responsible for all damages to life and property caused by his blasting operations.
2. The Developer shall be responsible for removing all rocks, which may be brought to the ground surface by blasting, or other means of excavation. Insofar as possible, the ground surface shall be returned to its original condition.

Removal of Water

Proper and adequate dewatering equipment shall be available for the removal and disposal of all surface and ground water and water from other sources entering excavations for the structure, trenches or other parts of the work.

Bracing and Sheeting

1. All excavation and trenches shall be properly and substantially braced and sheeted where necessary to prevent caving and sliding and to provide adequate protection to the workmen.
2. If at any time during the progress of the work, bracing and sheeting as provided appear to the Engineer to be inadequate to insure the protection desired, he may order the developer to improve the bracing and/or sheeting used.
3. Neither compliance with such orders nor the failure of the Engineer to issue such orders shall relieve the Contractor from his obligations to secure the degree of safety required by this contract.
4. The Developer alone shall be responsible for the safety and adequacy of all bracing and sheeting methods used.

Trench Backfill

1. In all locations where ledge rock, shale, boulders or large stones are encountered and at any other location directed by the Engineer, the trench shall be backfilled with dry sand or select material the full width of the trench from a depth of four inches below the pipe to six inches above the pipe.
2. No rock greater than three inches in diameter shall be used for trench backfill within one foot of the pipe.
3. The entire backfill shall be thoroughly compacted in six-inch lifts by the use of hand or pneumatic tampers or wheel rolling where practical.
4. The lower portion of all trenches shall be filled around the pipe at an elevation of at least six

inches above the top of the pipe with sand or select backfill placed by hand unless otherwise approved by the Engineer.

Sewage System Crossings

1. A minimum horizontal distance of ten feet shall be maintained between parallel water and sewer lines.
2. A minimum horizontal distance of 10 feet shall be maintained between water and sewer lines. At points where sewers cross water mains, the sewer shall be constructed of cast iron, plastic pipe with solvent welded joints, or pipe encased in concrete for a distance of 10 feet in each direction of the crossing, unless the water main is at least 2 feet above the sewer.

Disposal of Surplus Material

All excavated material of any kind not required for backfilling of trenches or other excavation shall be disposed of in a manner so as not to impede drainage or create any unsightly areas.

WATER MAINS

Plastic Pipe

1. Thermoplastic water pipe shall be used (hereinafter referred to as plastic pipe) and shall be rigid polyvinyl chloride (PVC) plastic pipe produced by a continuous extrusion process.
2. The pipe shall be homogeneous throughout, and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in inclusions or other defects. The pipe shall be as uniform as commercially practical in color. The use of white is preferred to reduce heat generated by sunrays.
3. Pipe must be delivered to the job site by means which will adequately support it and not subject it to undue stresses. Pipe ends shall be covered and the cover shall remain in place until the pipe is ready to be coupled.
4. All materials used by the extruder shall be virgin materials and no scrap material other than clean rework material generated from the manufacturer's own pipe production shall be used.
5. Plastic pipe shall be gasketed and joint coupled.

Conformance

1. PVC pipe, water mains (4" and larger) and piping systems shall meet or exceed the requirements of the following standards:

Pipe:	AWWA C900
Certification:	NSF No. 14
Gasket:	ASTM F477
Push-On-Joint:	ASTM D3139
2. The plastic pipe used shall conform to the dimension ratio DR18, Class 150 with a working pressure rating of 150 psi.

Gasketed Joint PVC Pipe

1. All gasketed joint coupled pipe shall have both ends tapered for entry into the gasket couplings or fittings and the ends shall have a ring painted around it to provide a method of checking the depth of socketing after the pipe is coupled.
2. All gasketed joint belled end pipe shall have the plain ends tapered for entry into the gasketed belled couplings or fittings and shall have a ring painted around the ends to provide a method of checking the depth of socketing after the pipe is coupled. The bells of all belled end pipe

shall in no case have thinner walls than that of the pipe.

Gasketed Joint Fittings and Couplings

1. The use of the word "coupling" in the following paragraphs shall apply to couplings for plain end pipe and bell couplings for belled end pipe.
2. All couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used
3. Gasketed joint fittings and couplings shall be of the same material as the pipe and in no case shall any part of the fitting have thinner walls than that of the pipe furnished.
4. Elbows, service tees, adapters and tees shall conform to the same requirements as the pipe.
5. Rubber gaskets shall be installed in all fittings and couplings immediately prior to pipe installation.
6. A lubricant shall be applied to all pipe ends to insure smooth and accurate installation of all fittings and couplings. The lubricant shall be furnished and applied in accordance with the pipe manufacturer's recommendations.
8. The lubricant shall be water soluble, nontoxic, unobjectionable in taste and odor imparted to the fluid, be nonsupporting of bacteria growth and have no deteriorating effect on the PVC or rubber gaskets.

Cutting

1. Plastic pipe shall be cut by use of an ordinary hand hacksaw or power saw only. A miter box or similar guide shall be used when cutting by hand.
2. All cuts shall be square and smooth. The cut ends shall be beveled on the exterior with a manual beveling tool or a hand file and the interior shall be deburred with a regular tool or knife. Care should be taken to copy the factory bevel angle.
3. Dust and chips resulting from field cuts shall be thoroughly removed from the interior of the pipe.
4. The pipe shall be well supported and protected from nicks and scratches during field cutting operations.

Cleaning and Protecting Pipe

1. The interiors of all pipes and fittings shall be thoroughly swabbed and cleaned of all foreign matter before being installed and shall be kept clean during and after installation.
2. Whenever pipe laying is stopped at the end of the day's work because of rain or for any other reason, the open end of the line shall be sealed with a watertight plug. All water that may have entered the trench shall be removed prior to removing the plug. It is essential that no mud, trench water or other foreign matter be permitted to get into the line at any time.
3. Pipe, fittings, valves and other appurtenances shall be handled in a manner that will ensure their installation in the work in a sound and undamaged condition conforming in all respects to specified requirements.

Pipe Laying

1. The pipe, fittings and valves shall be placed in the trench with care. Under no circumstances shall pipe or other material be dropped or dumped into the trench. The pipe shall not be dragged in a manner, which would cause scratching of the pipe surface. An excessive amount of scratching on the surface of the pipe will be considered cause for rejection.
2. No pipe shall be laid when trench conditions or weather are unsuitable for proper grading, laying or jointing operations.

3. Metal foil trench indicator tape shall be installed for the full length of the waterline. Tape manufactured by Line-Tech, or an approved equivalent shall be used.

Thrust Blocking

1. Thrust blocking shall be required where fittings are used to change the direction of the pipeline and at all valves, reducers and caps.
2. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force crated by the fitting. All blocking shall bear against undisturbed earth.
3. Thrust blocks shall be concrete with a minimum compressive strength of 2000 psi unless otherwise approved by the Engineer.

Service Connections

1. Service saddles and corporation stops shall be used to complete all service line connections.
2. Service saddles shall be brass body, wide brass or stainless steel strap, Buna-N rubber seal, AWWA thread, Ford Style S90 or 101BS.
3. Corporation stops shall be square, brass body design, AWWA threaded inlet connection and copper outlet as manufactured by Ford Meter Box Company or approved equal.
4. Service lines shall be Type K soft copper.
5. The method used for tapping shall remove the coupon from the pipe.

Testing

1. It is the intent of these specifications that the water lines constructed hereunder shall be and shall remain tight and free from weakness and from leakage under all working and service conditions. All joints that are found to leak, either by observation or test, shall be repaired and made watertight by the Developer at his own expense.
2. The Developer shall make pressure and leakage tests as specified herein under the observation of the County or its agent. He shall provide all necessary connections between the pipeline or piping and the nearest available source of test water, test pumping equipment, pressure gauge, water meter (leakage test only) and other equipment, materials, and facilities necessary for the required tests. In the event of water not being available at the time of completion of the water lines, the pressure and leakage tests may be delayed until it is available. However, the Developer shall be required to make the tests as promptly as possible and shall have the sole responsibility for all repairs that may be necessary. The test pressure shall be applied and maintained in each case by means of a hand-operated force pump or other approved device.
3. In making the tests the section to be tested shall be slowly filled with water. All air shall be expelled from the line by opening all available service valves and vents.
4. Test pressures shall be applied with a force pump of such design and capacity that the required pressures can be applied and maintained without interruption for the duration of the test.
5. The test line shall be subjected to a hydrostatic pressure equal to the rated working pressure of the pipe. Under no circumstances will a section of line be tested without notifying the County or its agent in advance.
6. Acceptable line leakage shall not exceed the amounts determined from the following formula:

$$L = NDP^{0.5} \text{ where } L = \text{allowable leakage, gal/hr.;} \\ \text{-----} \quad N = \text{number of joints in a test section;}$$

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D = nominal pipe diameter, inches;

P = test pressure, psig.

If leakage is observed or if a drop in pressure indicates undisclosed leakage in excess of the rate given herein, the leaks shall be located and repaired. After such repair, the line shall be again brought to the test pressure and tested for rate of leakage. No pipeline or section thereof shall be accepted if the leakage rate disclosed by the test exceeds the allowable limits previously specified. The test period shall be conducted for at least four hours. Replacement water shall be pumped from a container and accurately measured.

7. If any pipe, fittings, valves or appurtenances are found defective during the test, they shall be removed and replaced with sound units at the Developer's expense. The Developer shall furnish all the necessary appliances and appurtenances for the test and make the test at his own expense.

Disinfection

1. All newly constructed water lines shall be disinfected. In the event of water not being available at the time of completion of the water lines, disinfection may be delayed until it is available.
2. On approval of the County or its agent, a mixture of water and a chlorine-bearing compound of known chlorine content may be used. The chlorine-bearing compounds, which may be used, are Calcium Hypochlorite (HTH), Perchloron and Pittchlor.
3. A 5 percent solution of powder shall be prepared consisting of 5 percent of powder to 95 percent of water by weight, due attention being given to the chlorine content of the product being used. The slurry shall be injected or pumped into the newly laid pipe after preliminary flushing. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall be at least 50 mg/l. This treated water shall be retained in the pipe at least eight hours and longer, if directed by treatment.
4. After this retention time, the chlorine residual at the pipe extremities shall be at least 10 mg/l. All valves and appurtenances shall be operated while the treated water is in the line. The lines shall be thoroughly flushed after treatment.

Flushing Water Lines

1. All water lines shall be thoroughly flushed prior to and following the disinfection process. Initial flushing shall take place with the ends of all dead-end lines and/or all cleanouts being open. Water shall be added at a rate capable of maintaining a minimum velocity of 2.5 feet per second in the pipeline. Flushing will continue until the water is clear and free from all foreign material. As the initial flushing progresses, the ends may be capped and the cleanouts closed.
2. Following disinfection, all water lines shall be flushed free of heavily chlorinated water-using water with a chlorine residual of between 0.3 and 1.0 mg/l. The heavily chlorinated water will be flushed from the water lines through cleanouts, service taps that may have been installed during construction of the water line. This work shall be completed prior to placing the system in service.
3. Water used for flushing shall not be discharged within the trench limits, inside meter boxes or at any location where erosion may be a problem. The Developer shall be responsible for installing all temporary discharge piping that may be required. Special care shall be

exercised in the discharge of the chlorinated water to prevent damage from occurring due to the chlorine chemical.

VALVES AND HYDRANTS

Underground Gate Valves

1. Gate valves shall be cast iron body, bronze stem, resilient seat, non-rising stem epoxy coated gate valves complying with AWWA Specification C509 for 200 psi working pressure as manufacture by Mueller, Clow or approved equal.
2. All valves shall be PVC push-on style and be equipped with a two inch operating nut.
3. Valve boxes shall be furnished with all valves installed and shall be designed for such purpose. Covers shall have the word "WATER" cast into the top surface. All cast iron parts shall be coated by dipping in hot asphaltum varnish.

Setting of Gate Valves

1. Valves and valve boxes shall be plumb with the valve box placed directly over the valve. Valves shall be set on hard, undisturbed soil or a concrete base such that the valve is adequately supported to resist any settlement and the torque associated with the valve operation. Bell holes shall be dug for all valves to insure continuous support of the pipe and valve.
2. Before installing any valve, care shall be taken to see that all foreign material is removed from within the valve body. The valve shall be opened and closed to see that all parts are in first-class working condition.
3. Each valve installed shall be covered and enclosed by a valve box designed for such purposes. Pipe substitute is not allowed. The Developer shall furnish the valve box, and the material and equipment to set the valve box. The box shall be centered on the valve, plumbed, brought to the proper grade, and backfilled.

Fire Hydrants

1. The Developer shall install a minimum of one fire hydrant per subdivision, where the subdivision is served by a public water system. The Developer must enter into an agreement with the individual public water system for any requirements specific to their water system. Pottawatomie County's material specifications for fire hydrants are as follows:
2. Hydrants shall be post style, gate or compression type, suitable for 150 pound working pressure and tested and guaranteed for pressure of 300 pounds per square inch. Hydrants shall open to the left (counter-clockwise), and shall conform top the AWWA Standard Specifications. Hydrant size shall be designated as the nominal size of the main valve opening, and the net area of the smallest part shall not be less than 120 percent of the fully opened valve. Hydrants shall be for a minimum four-(4) foot depth of bury.
3. Hose caps shall be provided for all outlets and shall be securely chained to the barrel with one-eighth (1/8) inch galvanized steel, non-kinking chain. A leather, rubber or lead washer shall be provided in the hose cap. To prevent the washer from dropping out, it shall be set into a groove in the hose cap. The hose cap nuts shall be identical in size and shape to the operating nut.

SECTION 8 - SANITARY SEWER

Excavation and Trenching

General

1. This section covers the excavation and embankment work required for sewer line excavation and trenching including excavation, trenching, backfilling, all necessary sheeting, shoring and protection work, pumping and dewatering as necessary or required, materials and methods for sewer line construction and other subsidiary or appurtenant work.

Trench Excavation

1. Trenches in soil for sanitary sewer mains and lateral lines shall be provided a minimum depth of cover above the top of the pipe of 30". Where the 30" minimum cover cannot be obtained, cast iron pipe or concrete encasement must be utilized.
2. The Developer shall not open more trench in advance of pipe laying than is necessary to expedite the work.
3. Trench bottoms should be kept dry and stable during trench preparation and until the pipe line installation is completed to the extent that no damage from hydrostatic pressure, floatation, or other causes will result.

Trench Widths

Wherever possible, trench widths shall not be more than 24 inches greater than the pipe diameter or pipe 30 inches in diameter or less.

Blasting

1. Blasting, when required, including necessary and proper safety precautions shall be performed in compliance with all laws, ordinances and applicable safety code requirements and regulations relative to the handling, storage and use of explosive and the protection of life and property. The developer shall be responsible for all damages to life and property caused by his blasting operations.
2. The Developer shall be responsible for removing all rocks, which may be brought to the ground surface by blasting, or other means of excavation. Insofar as possible, the ground surface shall be returned to its original condition.

Removal of Water

Proper and adequate dewatering equipment shall be available for the removal and disposal of all surface and ground water and water from other sources entering excavations for the structure, trenches or other parts of the work.

Bracing and Sheeting

1. All excavation and trenches shall be properly and substantially braced and sheeted where necessary to prevent caving and sliding and to provide adequate protection to the workmen.
2. If at any time during the progress of the work, bracing and sheeting as provided appear to the Engineer to be inadequate to insure the protection desired, he may order the developer to improve the bracing and/or sheeting used.
3. Neither compliance with such orders nor the failure of the Engineer to issue such orders shall relieve the Contractor from his obligations to secure the degree of safety required.
4. The Developer alone shall be responsible for the safety and adequacy of all bracing and sheeting methods used.

Trench Backfill

1. In all locations where ledge rock, shale, boulders or large stones are encountered and at any other location directed by the Engineer, the trench shall be backfilled with dry sand or select material the full width of the trench from a depth of four inches below the pipe to six inches above the pipe.
2. No rock greater than three inches in diameter shall be used for trench backfill within one foot of the pipe.
3. The entire backfill shall be thoroughly compacted in six-inch lifts by the use of hand or pneumatic tampers or wheel rolling where practical.
4. The lower portion of all trenches shall be filled around the pipe at an elevation of at least six inches above the top of the pipe with sand or select backfill placed by hand unless otherwise approved by the Engineer.

Disposal of Surplus Material

All excavated material of any kind not required for backfilling of trenches or other excavation shall be disposed of in a manner so as not to impede drainage or create any unsightly areas.

Sewer Pipe

1. Thermoplastic water pipe referred to hereafter, as sewer pipe shall be rigid polyvinyl chloride (PVC) plastic pipe produced by a continuous extrusion process.
2. The pipe shall be homogeneous throughout, and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color. The use of white pipe is preferred to reduce heat generated by sunrays.
3. Pipe must be delivered to the site by means which will adequately support it and not subject it to undue stresses. Pipe ends shall be covered and the cover shall remain in place until the pipe is ready to be coupled.
4. All materials used by the extruder shall be virgin materials and no scrap material other than clean rework material generated from the manufacturer's own pipe production shall be used.
5. Sewer pipe shall be gasketed joint coupled.

Conformance

1. PVC pipe and fittings shall meet or exceed the requirements of the following standards:
 8" Pipe: ASTM C-2680 PVC Composite Truss
 4" Pipe: ASTM D3034 SDR 35 - Type PSM Poly Vinyl Chloride (PVC)
 Gaskets: ASTM F477
 Joints: ASTM D3212
 Installation: ASTM D2321

Gasketed Joint PVC Pipe

1. All gasketed joint coupled pipe shall have one end tapered for entry into the gasket coupling or fitting and one end shall have a ring painted around it to provide a method of checking the depth of socketing after the pipe is coupled.
2. All gasketed joint belled end pipe shall have the plain ends tapered for entry into the gasketed belled couplings or fittings and shall have a ring painted around the ends to provide a method of checking the depth of socketing after the pipe is coupled. The bells of all belled end pipe shall in no case have thinner walls than that of the pipe.

Gasketed Joint Fittings and Couplings

1. The use of the work "coupling" in the following paragraphs shall apply to couplings for plain end pipe and bell couplings for belled end pipe.
2. All couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used.
3. Gasketed joint fittings and couplings shall be of the same material as the pipe and in no case shall any part of the fitting have thinner walls than that of the pipe furnished.
4. A lubricant shall be applied to all pipe ends to insure smooth and accurate installation of all fittings and couplings. The lubricant shall be applied in accordance with the pipe manufacturer's recommendations.
5. The lubricant shall be water soluble, nontoxic, be non-supporting of bacterial growth and have no deteriorating effect on the PVC or rubber gaskets.

Cutting

1. Sewer pipe shall be cut by use of an ordinary hand hacksaw or power saw only. A miter box or similar guide shall be used when cutting by hand.
2. All cuts shall be square and smooth. The cut ends shall be beveled on the exterior with a manual beveling tool or a hand file and the interior shall be deburred with a regular tool or knife. Care should be taken to copy the factory bevel angle.
3. Dust and chips resulting from field cuts shall be thoroughly removed from the interior of the pipe.
4. The pipe shall be well supported and protected from nicks and scratches during field cutting operations.

Pipe Laying

1. The pipe and fittings shall be placed in the trench with care. Under no circumstances shall pipe or other material be dropped or dumped into the trench. The pipe shall not be dragged in a manner, which would cause scratching of the pipe surface. An excessive amount of scratching on the surface of the pipe will be considered cause for rejection.
2. No pipe shall be laid when trench conditions or weather are unsuitable for proper grading, laying or jointing operations.
3. Sewers should be laid with straight alignment between manholes.
4. A minimum horizontal distance of 10 feet shall be maintained between water and sewer lines. At points where sewers cross water mains, the sewer shall be constructed of cast iron, plastic pipe with solvent welded joints, or pipe encased in concrete for a distance of 10 feet in each direction unless the water main is at least 2 feet above the sewer.
5. Sewer laterals shall have a minimum slope 1-%. The end of each lateral shall be plugged and a 2" x 4" board shall be installed from the lateral end to three (3) feet above the finished ground. Also, a metal T-Post shall be placed alongside the 2" x 4" and placed 2 inches below the ground. The top of the board shall be painted red.
6. Saddle tees and wyes shall be installed as per the manufacturer recommendations and shall include the placement of the two stainless steel bands around the pipe and saddle.
7. Installation shall meet all KDHE requirements.

Pipe Inspection

The County or its agent may reject the pipe for any defects in workmanship such as visible cracks, holes, foreign inclusions, nonuniformity in color, opacity or density and any other defects which, in his opinion, might render the pipe unsuitable for installation in the system.

Pipe Testing

1. It is the intent of these specifications that the sanitary sewer lines constructed hereunder shall be and shall remain tight and free from weakness and from leakage under all working and service conditions. All joints that are found, either by observation or test, to leak shall be repaired and made watertight by the Developer at his own expense.
2. Hydrostatic or air pressure tests shall be conducted on sewers before acceptance by the County. Infiltration-exfiltration shall not exceed 250 gallons per day, per inch of nominal pipe diameter, per mile of sewer line for any section of the system.
 - a. For hydrostatic tests where sewers are laid above the ground-water table, exfiltration tests shall be conducted. Where sewers are laid within the groundwater table, infiltration testing shall be conducted. Exfiltration tests must be conducted with a minimum of four feet of static water head above the invert of the sewer at the upstream manhole. Infiltration -exfiltration shall be less than 1.14 gallons per day per vertical foot of manhole (equals 6,000 gallons per day per vertical mile.
 - b. Low pressure air testing may be conducted on any type of 8 inch to 12-inch diameter pipe. Testing methods and air leakage rates shall conform to ASTM C828-76T or the latest revision thereof as a minimum.
4. If any pipe or fittings are found defective during the test, they shall be removed and replaced with sound units at the Developer's expense.

SECTION 11 - TERMS OF FINAL ACCEPTANCE

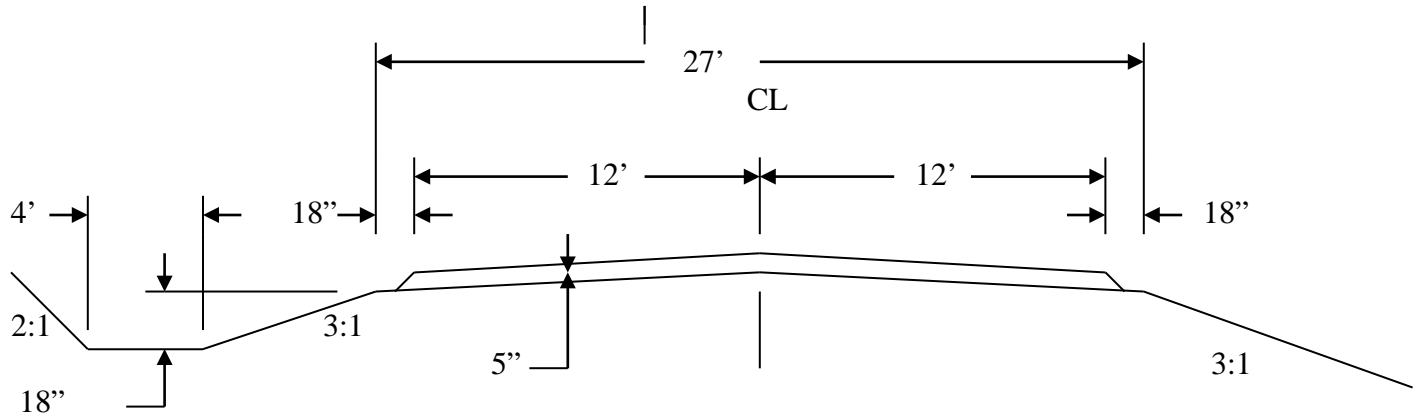
Gravel Roads

- 1) Final acceptance shall be provided after all phases of construction, according to the plans and specifications, have been met. This will include, but is not limited to all grading, surfacing, drainage structures and seeding.
- 2) Only after completion of all improvements to the satisfaction of the Pottawatomie County Public Works Department, may the streets and roads be accepted into the maintenance system of the Pottawatomie County Public Works System.
- 3) Final acceptance of the improvements into the Pottawatomie County Public Works road system shall be by Pottawatomie County Public Works Director.

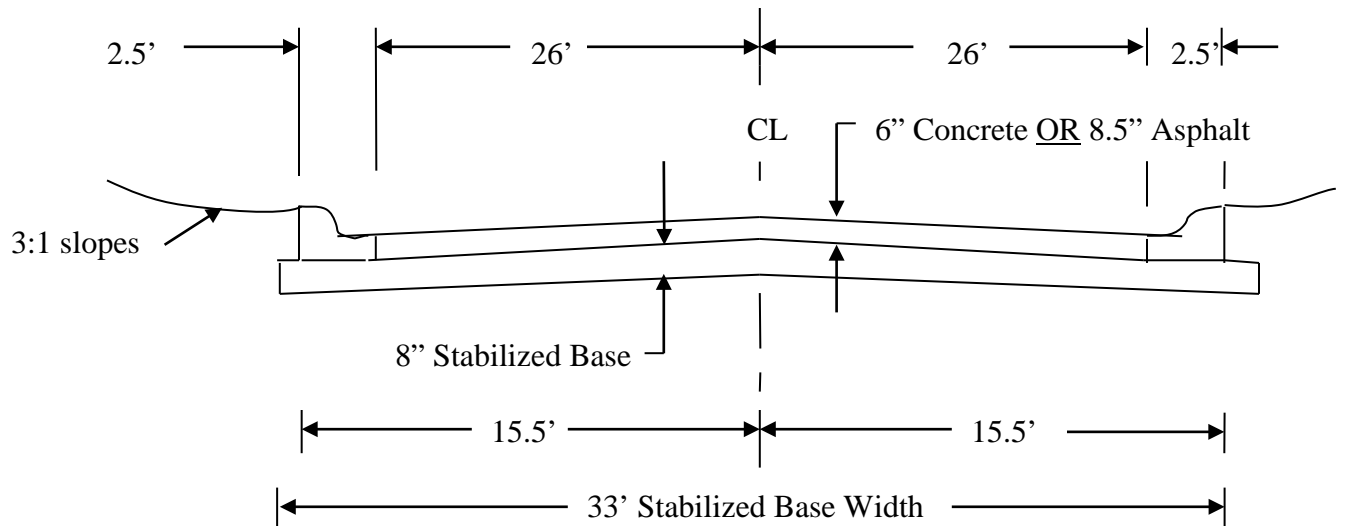
Paved Roads

- 1) Final acceptance shall be given one year after initial completion of the project improvements on all paving, sewer and water lines.
- 2) For a period of one year from completion of initial construction the owners or developers of the development shall maintain the improvements, with the exception of snow removal.
- 3) All damage to improvements due to construction shall be repaired at the owners or developer's expense.
- 4) Only after completion of all improvements to the approval of the Pottawatomie County Public Works Department may the streets and roads be accepted into the maintenance system of the Pottawatomie County Public Works System.
- 5) Final acceptance of the improvements into the Pottawatomie County Public Works road system shall be by the Pottawatomie County Public Works Director.

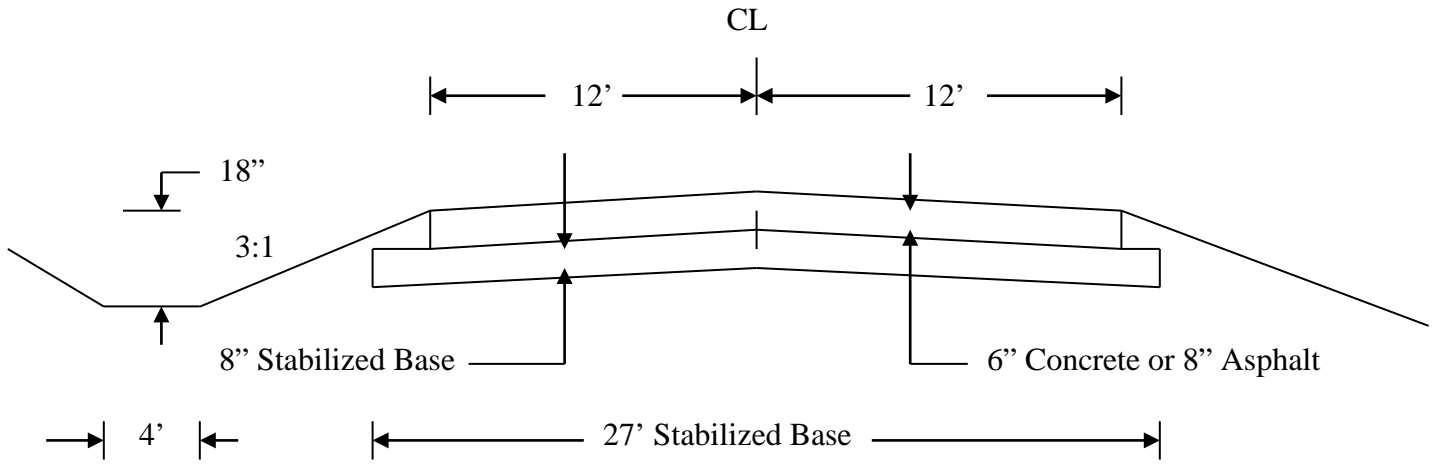
SECTION 12 – TYPICAL CROSS SECTIONS



GRAVEL ROAD
Minimum Typical Cross Section
(Not to Scale)



PAVED ROAD (W/ CURBS)
Minimum Typical Cross Section
(Not to Scale)



PAVED ROAD (W/O CURB)
 Minimum Typical Cross Section
 (Not to Scale)