Chapter amendments approved:	OMPC	Owensboro	Daviess Co.	Whitesville
2002 Revised Public Improvement Specifications (new chapter)	08-Aug-02	No action required by legislative bodies		

12.0 PURPOSE. The purpose of this chapter is to outline the requirements for proper construction and installation of structures.

12.1 DESCRIPTION OF WORK. Work shall consist of the construction of manholes, inlets, catch basins, junction boxes, headwalls, box culverts and other sanitary sewer or storm drainage structures of the kind and dimensions shown on the Plans. The construction shall be accomplished in accordance with these Specifications and in conformity with the lines, grades, cross-sections, and detail shown on the Plans or established by the Engineer. The Work shall include such labor, material, equipment, removal and abandonment of structures, brick masonry, cast-in-place concrete construction, precast concrete construction, rims and covers, frames and grates, misc. iron castings, and all other items as necessary to complete the structures as shown on the Plans.

12.2 MATERIALS

12.2.1 Concrete. Concrete for all cast-in-place sanitary sewer and storm drainage structures shall be Class A concrete as specified in KTC Specifications. All precast structures shall be a minimum 4,000 psi concrete. See standard drawing for minimum wall thickness and other minimum dimensions.

12.2.2 Steel Reinforcement. Deformed steel reinforcing bars shall be a Grade 60 bar of the sizes, dimensions, spacings and locations shown on the Plans.

12.2.3 Grout. Grout shall consist of a mixture of water and cement or cement with fly ash, or water and one part cement or cement with fly ash to two parts mortar sand as defined in the KTC Specifications, by volume. The water may be adjusted to produce a mixture of a consistency suitable for job conditions; however, not over 5 1/2 gallons of water shall be used per sack of cement.

12.2.4 Non-Shrink Grout. Non-shrink grout shall be an approved non-shrink, non-staining grout consisting of either a mixture of hydraulic cement, water, fine aggregate, and an approved nonferrous expansive admixture, or a packaged commercial product and shall meet the requirements of the KTC Specifications.

12.3 PRECAST STRUCTURES - shall be approved by the Engineer. Wall thickness shall conform to the appropriate current ASTM standards.

Structures that require specially designed footings, cut-off walls, etc. will not be allowed as precast.

Openings in precast structures for pipes shall be the outside diameter of the pipe plus a maximum of six (6) inches. In order to use non-shrink grout, the opening shall be the outside diameter of pipe plus three (3) inches. (Outside diameter of pipe plus 4 1/2 inches is permissible when tapered-hole forms are utilized).

For precast structures (other than those with knockout panels) the opening around the pipe shall either be filled with non-shrink grout for the wall thickness of the structure or the pipe shall be encased with minimum six (6) inch collar of concrete from the inside face of the wall to 1 '0" outside the outer face of the wall. The pipe shall be adequately supported to prevent settling while the grout or the concrete encasement is setting up. The inside face of the structure walls shall be finished with a trowel and wet brush finish.

For circular structures and rectangular structures (other than those with knockout panels) the minimum vertical distance from the holes for the pipes to the top of the structure wall shall be four (4) inches. If this vertical distance is less than 12 inches, then additional reinforcing steel (minimum bar size #5) shall be furnished for this section.

For precast structures with knockout panels, holes for the pipes shall not be cut into the structural members (top beams and comer columns) and non-shrink grout shall not be allowed to be placed around the pipes. The pipes shall be encased with concrete, a minimum six (6) inch collar

around the outside of pipe or a minimum of three (3) inches beyond the hole knocked in the wall, whichever is greater. Also, the concrete encasement shall extend from the inside face of the wall to 1'-0" outside the outer face of the wall.

Precast structures with knockout panels shall not be used with more than two (2) feet of earth cover unless load calculations are supplied.

For rectangular structures where pipe will be installed in adjacent walls (other than those with knockout panels), at least 6 inches of wall (measured from the interior comer) is required on each side of the pipe beyond the precast opening for the pipe. This is not applicable for structures that have pipe installed in opposite walls or where one outlet reinforced concrete pipe is utilized.

A wash is required in the bottom of all structures (except curb inlets) to provide positive drainage (sloped toward outlet).

12.3.1 Precast Manhole Sections. All precast concrete manhole risers, cones, grade rings, flat slab-tops, and bases shall conform to the requirements of ASTM C 478, Standard Specification for Precast Reinforced Concrete Manhole Sections, and Standard Drawings. All cone and transition sections shall be eccentric in shape. Base and riser sections shall be custom-made with openings to meet indicated pipe alignment conditions. The following applies as to the maximum inside diameter (or horizontal dimension) of concrete pipe to be used with a given size of manhole.

Diameter of Structure	Maximum Size Pipe*
4'-0"	24 inches
5'-0"	36 inches
6'-0"	48 inches
* Outside diameter may be considered on a case-by-case basis for other pipe materials.	

The minimum distance allowed between precast holes for the pipes shall be 12 inches or one-half the outside diameter, whichever is larger.

12.4 EXECUTION OF WORK FOR CONNECTIONS

12.4.1 Connections. The Contractor shall verify the exact locations and elevations of existing structures or sewers prior to construction and any differences between actual and plan locations and elevations shall be brought to the attention of the Engineer before proceeding with the work. If a bulkhead opening of adequate size, or a stub of proper size, elevation, location and direction exists, the connection shall be made as required for normal pipe laying.

For all storm drainage pipes, an opening may be saw cut in the structure to permit inserting the pipe at the required elevation, direction, and slope. The circumference of the opening shall be sawed to allow approximately two inches of space between the inserted pipe and the structure. Care shall be used to avoid unnecessary damage to existing concrete or brick masonry. All loose material shall be removed from the cut surfaces and the cut surfaces shall be completely coated with non-shrink grout. Before setting the pipe, a sufficient thickness of grout shall be placed at the bottom and sides of the opening for proper bedding of the pipe. After setting the pipe, all spaces around the pipe shall be solidly packed and filled with non-shrink grout which shall be neatly pointed up on the inside to present a smooth joint, flush with the inner wall. When making connections to existing stubs, approved pipe adapters shall be used. Modifications to the existing invert shall be made as needed to provide a smooth plastered channel to accommodate the flow of the new pipe.

When reconstruction of a manhole is required, the manhole shall be at the elevation on the Plans or at the invert of the manhole.

12.4.2 Manholes and Wet-Wells. Manholes shall be neatly and accurately built in accordance with the plans and Standard Drawings. Precast manhole and wet-well bases, when used for sanitary sewer manholes and wet-wells, shall be supplied with watertight sewer pipe connections. When the manhole base slab will consist of cast-in-place concrete, the sewer pipe and the lower precast barrel section shall be in place and supported by concrete blocks prior to placing concrete for the slab. All rough openings between pipes and precast sections shall be thoroughly and completely filled with non-shrink grout, applied so that there will be no leakage around pipes. The grout shall be finished smooth and flush with the interior and exterior manhole or wet-well wall surfaces. Field modifications will be allowed to precast structures if approved by the Engineer. When core drilling is not possible, saw cutting shall be performed when modifying an existing structure

Manhole inverts shall consist of Class A concrete, placed to conform to the shapes indicated on Standard Drawings. Inverts shall include both channel and wash

sections with channels so constructed as to create the least resistance to flow. A smooth, uniform dense finish shall be required. Inverts may be either precast or cast-in-place. Joints between precast manhole sections shall be sealed with approved flexible plastic gaskets (type B), rubber gaskets (type A), or rubber O-rings. Bituminous mastic joint sealing material is allowed only if it is a one (1) inch molded mastic compound. Joint sealant materials shall be of the sizes recommended by the manufacturer to provide watertight seals between precast manhole sections. When indicated on the Plans, provisions for future sewers shall be provided at manholes by providing a minimum of one pipe joint stub (minimum six (6) foot length) of the sizes, lines and grades shown. The upstream ends shall consist of the bell or spigot ends, and they shall be sealed with removable watertight stoppers or bulkheads.

Manhole frames shall be placed in the positions shown on the Standard Drawings and shall be set to the correct elevations or adjusted to match final grade. Frames shall be set concentrically with the precast concrete collars and in beds of grout or Butyl resin (i.e., rubber gaskets, type B) may be used when the remaining annular space is filled with grout so that the spaces between the collars and the bottom flanges of the frames shall be completely filled and made watertight. Bituminous mastic and grout shall extend to the outer edges of the masonry and shall be finished smooth and flush with the tops of the flanges. A frame shall not be disturbed until the grout has hardened to adequate strength.

12.4.3 Small Structures. Inlets catch basins, drains, junction structures, and other small structures shall be neatly and accurately built in accordance with the Plans and Standard Drawings. The structure shall be either of cast, concrete or of precast concrete provided the precast sections have been approved by the Engineer. Inlet and outlet pipes shall be cut off flush with the inside surfaces of the wall. Pipe bells shall not be allowed inside the structure wall. The pipes shall intersect at the structure so that the invert channel between the inlet and outlet pipes can be smoothly formed. Invert channels shall be of Class A concrete and shall conform to the shapes indicated on the Plans, Standard Drawings, or as otherwise directed by the Engineer. The invert channels shall be so constructed as to cause the least possible resistance to flow. The shapes of the invert channels shall conform uniformly to inlet and outlet pipes (except curb inlets). Smooth and uniform finishes will be required. All inlets, and junction structures deeper than four (4) feet, as measured from the top of the rim or frame to the invert of the structure, shall be provided with steps unless otherwise shown on the Plans or directed by the Engineer.

Steps shall be spaced not more than 12 inches, vertically aligned, and shall be so arranged that the lowest rung shall not be more than 12 inches above the bench, and the top rung shall be 30 inches below the structure rim or frame. The steps shall be arranged out of alignment of the flow channel, and shall be centered horizontally of the grate or lid opening.

All cast-in-place structures shall be built using Class A concrete. The structures shall be built on prepared foundations and conform to the dimensions and shapes shown on the Plans and Standard Drawings.

Any required reinforcement shall be of the kind, type, and size and shall be located, spaced, bent, and fastened as shown in the Plans or Standard Drawings.

Connections for inlet and outlet pipes shall conform to the sizes, alignments, and elevations shown on the Plans or Standard Drawings.

No sledgehammer modifications are allowed to precast structures. Saw cuts or core drills should be utilized when modifying an existing structure.

12.4.4 Concrete Box Culverts, Retaining Walls and Headwalls.

12.4.4.1 Footings. Footings shall be constructed to the elevations and dimensions shown on the Plans. Footing dimensions may be changed when it is determined by the Engineer that modifications are necessary to provide sufficient bearing or to prevent undermining. Footing thickness may be reduced when solid rock is encountered at elevations above those shown if approved by the Engineer.

The outside faces of all footings of concrete headwalls for pipe, box, or arch culverts shall be formed to full depths of the footings. Whenever the natural foundation material is insufficiently stable to support the structure or whenever it is anticipated that high water may cause excessive erosion around the footings, the Engineer may require additional support or protection.

12.4.4.2 Culvert Inverts, Aprons, Curtain Walls and Headwalls. All box culverts shall be constructed with a reinforced concrete slab through the invert or stream bed. This slab shall terminate at each end of the

culvert in a turn down carried to a depth that will eliminate danger of undermining.

The apron space between wing walls shall be reinforced concrete. The apron will extend in a straight line between the ends of the wings. A turn down shall be provided at the end of the apron as shown on the Plans or Standard Drawings.

When headwalls for pipe culverts are located at the shoulder of a road, the tops of the headwalls shall be parallel to the shoulder line for both line and grade (see Standard Drawings in other sections of these specifications).

12.4.4.3 Retaining Walls. All retaining walls shall be constructed of Class A concrete and shall be constructed as shown on the Plans.

12.4.4.4 Placing Concrete. Concrete shall be placed as directed in Chapter 13 "Concrete Construction Materials and Methods" of these Specifications. The base slab or footing shall be placed and allowed to cure a minimum of 12 hours before the remainder of the structure is constructed. When shown on the Plans or directed by the Engineer, suitable provisions shall be made for bonding the walls to the base by means of longitudinal keys formed by insertion and subsequent removal of beveled timbers. Base slabs, footings, and apron walls shall be constructed as monolithic units, when practicable. When construction joints are necessary, they shall be placed at right angles to the culvert barrel or retaining wall and suitable provision shall be made for bonding adjacent sections by means of keys formed by beveled timbers.

Before concrete is placed in the walls, the footings shall be thoroughly cleaned of all debris, or other extraneous material and the surface carefully chipped and roughened in accordance with the method of bonding construction joints, as specified under Chapter 2 "Materials" of these Specifications.

In the construction of all box culverts having a clear height of five (5) feet or more, concrete in the sidewalls shall be placed and allowed to set a minimum of 12 hours before the top slab is placed.

At the Contractor's option, culverts having a clear height of less than five (5) feet, the culvert may be poured monolithic. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

Each wing wall shall be constructed as a monolithic unit. Construction joints, where unavoidable and when not shown, shall be horizontal.

12.4.4.5 Placing Fill. Surfaces shall be finished in accordance with the requirements of the KTC Specifications. Backfill or embankment shall not be placed against culverts, retaining walls, and headwalls until the Engineer gives permission. Backfill and embankment shall be constructed as specified in Chapter 3 (Streets Section) of these Specifications.

12.4.5 Adjusting Manholes, Inlets and Trapped Catch Basins. All frame height and alignment adjustments shall be subject to field inspection by the Engineer, and be subject to correction as directed by the Engineer.

Concrete or clay brick may be used when adjusting the casting no more than four (4) inches.
Precast concrete riser rings may be used when the casting is raised more than four (4) inches or when total combined height of existing and proposed exceeds four (4) inches. If the concrete riser ring height will exceed twelve (12) inches, use 1-foot barrel sections. Use the least number of standard size rings as required for proper grade. No wood shims, wood blocks or shot rock shall be used to adjust or reset the frame height.

All workmanship shall be first class and in conformity with RWRA Specifications.

In pavement, the excavated area around the manhole or catch basin that is raised shall be backfilled with a minimum of eight (8) inches Class A concrete to a level two (2) inches below the new top of grate or lid elevation. The remaining two (2) inches shall be paved with Class I Bituminous concrete surface.

12.4.6 High-Density Polyethylene (HDPE) Grade Adjustment Rings. If approved by the Engineer, HDPE adjustment rings may be used. Plastic adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM D 1248 (Standard Specification Or Polyethylene Plastic Molding and Extrusion Materials). Material properties shall be tested and qualified for usage per the ASTM Test Methods reference in ASTM D 1248. Recycled material meeting the above requirement may be used.