

SANITARY SEWERS

DESCRIPTION

- 1701.1 Sanitary sewer pipe of the specified size, class and type shall be placed to line and grade given by the Engineer and in accordance with the design shown on the Plans.

MATERIALS

- 1702.1 **Submittal Requirements:** The design data and calculations, and the construction plans for proposed sewers are to be submitted by the Design Engineer to the Engineer, for review and approval prior to construction.

Requests to use materials not listed in these standards shall require special consideration and approval of the Engineer.

- 1702.2 **Pipe and Conduits:**

- a) **Vitrified Clay Pipe (V.C.P.):** Sewer mains, fittings, and laterals shall be extra strength vitrified clay pipe conforming to ASTM Designation C700, latest revision, except as specified on the plans for certain water main crossings. Sewer joints shall be compression joints conforming to ASTM Designation C425, latest revision. Sewer main joints shall be bell and spigot and sewer lateral joints may be both bell and spigot or band seal type.

Polyvinyl chloride pressure pipe, where specified on the plans at water main crossings, shall conform to AWWA C900, latest revision, Class 200, with cast iron equivalent outside diameter. Joints to vitrified clay pipe shall be band seal type and be no closer than ten feet (10') to the water main crossing. See *"Required Separation between Water Mains and Sanitary Sewers"* detail.

- b) **Polyvinyl Chloride (P.V.C.) Plastic Sewer Pipe (SDR-35):** All pipe and fittings shall meet the requirements of ASTM Specification D3034 for SDR-35 pipe. The pipe shall be colored green or labeled with lettering identifying it as sewer pipe for in-ground identification.

Pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring, factory assembled, securely locked in place to prevent displacement during installation.

Rubber rings shall provide a tight, flexible seal and shall meet the requirements of ASTM F-477.

Connection to manholes shall be achieved by use of manhole coupling adapters, rubber ring water-stops, or other approved methods.

SDR-35 Polyvinyl chloride pipe is allowable for use in all non-industrial applications to a maximum sized diameter of twelve inches (12"). SDR-35 pipe used as sewer laterals shall be connected to mains with wye or saddle fittings only.

All connections to this pipe shall be made by the use of fittings with rubber rings and/or banded seal couplings or as approved by the Engineer.

- C. Deflection: When it is necessary to deflect the pipe from a straight vertical or horizontal alignment, the deflection shall not exceed that shown in Table 17-1 or 17-2, the manufacturer's recommendations or that shown on the Plans, whichever is smallest. See Table 17-1 & 17-2 for "*Maximum Deflection for Vitrified Clay Pipes*", and "*Maximum Deflection for Polyvinyl Chloride Pipes*", respectively.

CONSTRUCTION PROCEDURE

- 1703.1 Excavation: The Contractor shall perform all excavation necessary or required to construct all pipelines and structures covered by these Plans and Specifications.
- 1703.1A Heavy-duty machinery for cutting and breaking pavement shall be used only when permitted by the Engineer.
- 1703.1B Street surfaces along the edge of the trench shall be cut to a neat line with a cutting device. All street surfacing, within the limits of the trench excavation shall be removed and disposed of as excess material before excavating the trench. None of this material will be allowed in the backfill.
- 1703.1C Excavation for pipe shall be open cut and the width of the trench at a depth of twelve inches (12") above the top of pipe shall not exceed the external diameter of the pipe plus eighteen inches (18").
- 1703.2 Bracing and Shoring: The Contractor shall do all bracing, shoring and sheathing necessary to perform and protect all excavations as required for safety, and to conform to the governing laws, or as directed by the Engineer
- 1703.3 Bedding: The surface upon which the pipeline is to be constructed shall be firm and true to grade. The sub-grade for the pipe shall be so prepared that the entire length of each pipe section shall have a firm and uniform bearing. When SDR-35 pipe is used, preparing sub-grade shall include loosening, shaping and recompacting the material beneath the pipeline finished grade to a depth of at least twenty-five percent (25%) of the nominal diameter of the pipe being installed. Where the bottom of the trench, when excavated to proper depth, does not provide suitable foundation for the pipe, all such unsuitable material under the pipe shall be removed and the space backfilled with a suitable material properly compacted to provide adequate support for the pipe.

1703.4 **Suitable Trench Material for SDR-35:** In addition to all other provisions of these specifications when using SDR-35 pipe, any material (existing or imported) to be used for pipe bedding or trench backfill to one foot (1') above the top of the pipe shall have a minimum Sand Equivalent of thirty (30) or better.

1703.5 **Pipe Laying:** Pipe and fittings shall be carefully inspected in the field before and after placing. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. The Engineer shall approve any corrective work and no additional compensation will be allowed for such corrective work.

1703.6 Sewer pipe and fittings shall be laid to true line and grade, and jointed in compliance with the manufacturer's recommendation and shall be carefully adjusted to grade by scraping away or filling and tamping the trench bottom to eliminate any possible sag or high point in the pipe. Occasional variations as follows will be permitted: above grade, ¼ inch; below grade, not to exceed ½ inch; alignment not to exceed 2 inches if gradual over a distance of 20 feet. Use of blocks to support the pipe is prohibited. Each joint of pipe must be fully pressed into place so that there will be no unevenness or settlement of one length of pipe with the other at the joint.

Suitable excavations shall be made to receive the bell collar to prevent any possibility of bells resting on original trench bottom.

- A. All pipe shall be laid upgrade with bell end upgrade.
- B. The interior of the pipe shall be kept free from dirt and other foreign materials as the pipe laying progresses. The open ends of all pipelines shall be tightly plugged whenever the work is stopped for any reason.
- C. **Existing sewage flow:** When the pipe laying interferes with the existing flow of sewage, the Contractor shall provide satisfactory by-pass facilities at the Contractor's expense.

1703.7 **Detector Wire:** All non-metallic sewer lines and laterals shall have a No. 10 coated solid copper detector wire placed over the pipeline prior to any backfilling. The detector wire shall be brought up to the manhole frames and at each end of the pipe or lateral. Lateral wires shall also be brought up to the top of clean-outs.

1703.8 **Abandoned Pipes:** Plug all ends of pipelines to be abandoned in place with Class "A" concrete unless otherwise noted.

1703.9 **Order of Work:** The Contractor shall submit a schedule of work for approval by the Engineer prior to commencing work.

1703.9A After placement of the pipe, trench backfilling shall commence. The pipe shall be shaded by hand shovel method with suitable material to one foot (1') above the top of the pipe. If clods exist in the spoil pile, which may damage the pipe, shall be removed. The backfill material shall be placed and compacted by hand around the pipe in six inch (6") lifts and compacted as detailed in "***Backfill Requirements for AC Streets***" Detail. Backfill placed above this point shall be free of clods or objects larg-

er than four inches (4") in diameter, which shall be removed prior to continuation of backfilling of said trench.

- 1703.9B **Compaction Testing:** All pipeline trenches shall be compacted as per "*Backfill Requirements for AC streets*" Detail.

The first compaction test will be paid for by the Owner when the Contractor notifies the Public Works Inspector forty-eight hours (48 hours) prior to the testing, otherwise the Contractor will be responsible for paying for that test. If the first test fails, each successive test thereafter will be the responsibility of the Contractor.

- 1703.9C **Sewer Balling:** The Contractor shall ball the sewer mains with a "*Wayne,*" ball or equal before any tests are performed on the pipe and prior to placement of AC pavement. The Contractor shall be responsible for supplying all necessary equipment, its operation and disposal of all materials removed at the Contractor's expense. Sewer balling shall be witnessed by the city Sewer Division.

- 1703.9D **Mandrell Test (SDR-35 Pipe):** After the balling, the SDR-35 sewer main shall be checked for pipe deflection by the use of a "*HURCO,*" Mandrell with interchangeable sized plates with a maximum of five percent (5%) downsize (or equal).

If the deflection test indicates deflection of the pipe, the Contractor shall locate the deflected section and make repairs and replacements as are necessary. The Contractor shall then retest the affected segment of sewer line.

- 1703.9E **Low-Pressure Air Tests:** Following the balling and mandrell pulling, a Low Air Pressure Test shall be performed on all SDR-35, and any VCP sewer mains and laterals with less than thirty inches (30") of cover, and/or, which are ten feet (10') or less clear horizontally from a water main. The tests shall conform to ASTM Designation C828-03 for all V.C.P. pipe and the "*Public Works Construction,*" Standards and said procedure as described in Table 17-3, "*Low Pressure Air Test for SDR-35 Sewers.*" The Contractor shall be responsible for supplying all necessary equipment and its operation at Contractor's expense.

Each section of sewer shall be tested between successive manholes by plugging and bracing all openings with trust blocking as necessary on the sewer main.

If the air test indicates leakage greater than the specified limits, the Contractor shall locate the defects by inspection and shall make such repairs and replacements as are necessary. The Contractor shall then retest the affected segment of sewer line.

- 1703.9F **Initial Television Inspection (VCP only):** After the V.C.P. sewer main is cleaned and trench compacted, but prior to the placement of Asphalt Concrete, the Contractor shall provide access to inspect the inside of the sewer main by television. Manholes brought to the surface will provide suitable access. Access will be required at both ends of the reach being tested.

The Contractor shall notify the Sewer Division when each reach is available for inspection. Provided all television equipment is functioning properly, the Sewer Division shall inspect the inside of each reach of the sewer main within seventy-two hours (72 hours) of when the reach being inspected is first available for inspection.

1703.9G **Final Acceptance:** Prior to the final acceptance of the sewer system (after the placement of Asphalt Concrete), the Contractor shall provide access to inspect the inside of all sewer main by television prior to the final Acceptance. The Contractor shall notify the Sewer Division when the sewer system is ready for the final inspection. If the camera shows debris within the pipe, the Contractor shall remove all debris from pipe before it is approved for acceptance by the City of Tulare.

1704.0 **As-Built Plans:**

1704.1 Any deviations from the original plans involving location, alignment, or grade of any part of the sewer improvements shall be noted and shown on the original set of improvement drawings prior to their submittal to the City and marked "*As-Built.*"

1704.2 The distance of each sewer lateral, at the property line, from the centerline of the nearest manhole and its approximate depth, shall be measured and recorded on the as-built drawings. All distances shall be determined by level chaining before any backfill is begun.

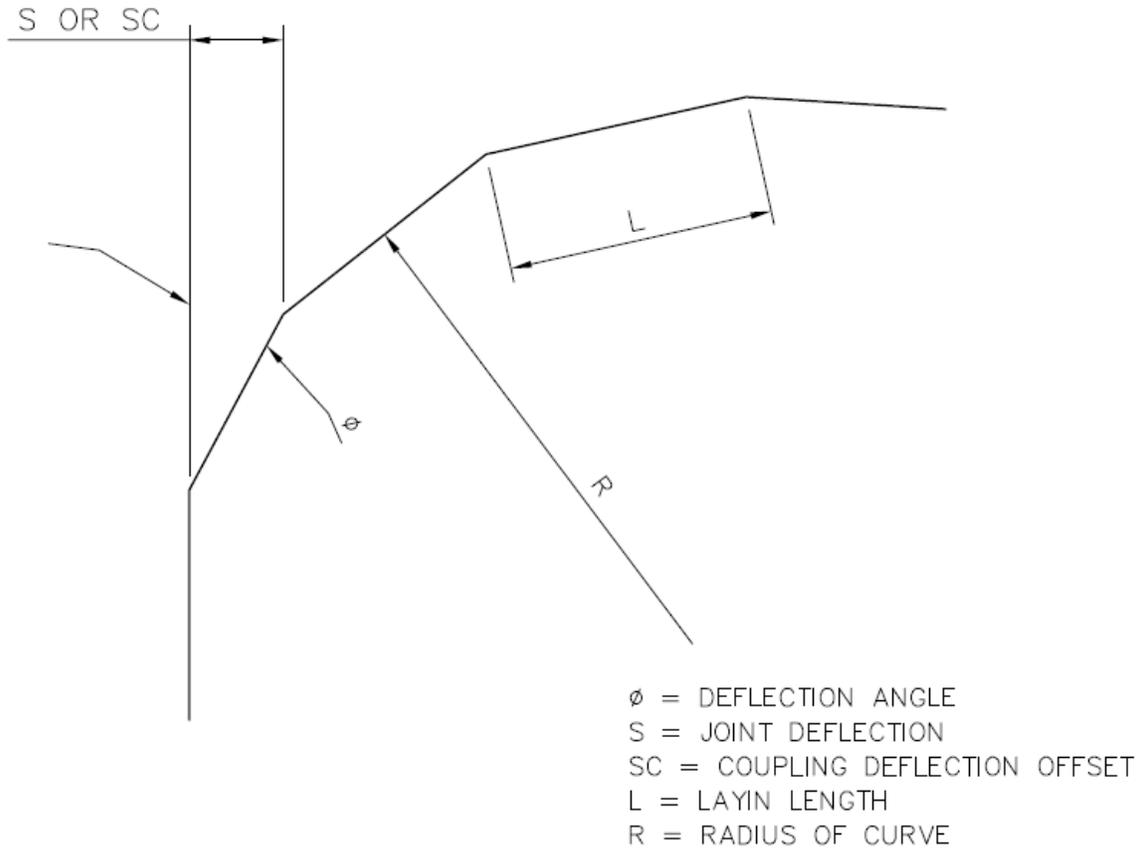
MEASUREMENT AND PAYMENT

1705.1 **Measurement:** The work performed under "*Sanitary Sewers,*" and paid for by contract items will be measured by the linear foot, or by the number of items or by other methods specified on the Plans or in the Special Provisions.

1705.2 **Payment:** Items of work, measured as specified above, will be paid for at the unit price per linear foot or number of items installed, or as otherwise provided by the Plans or Special Provisions.

The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in installation of sanitary sewer mains or manholes, or other items being installed as specified in these specifications and the Special Provisions and as directed by the Engineer.

TABLE 17-1
Maximum Deflection for Vitrified Clay Pipes

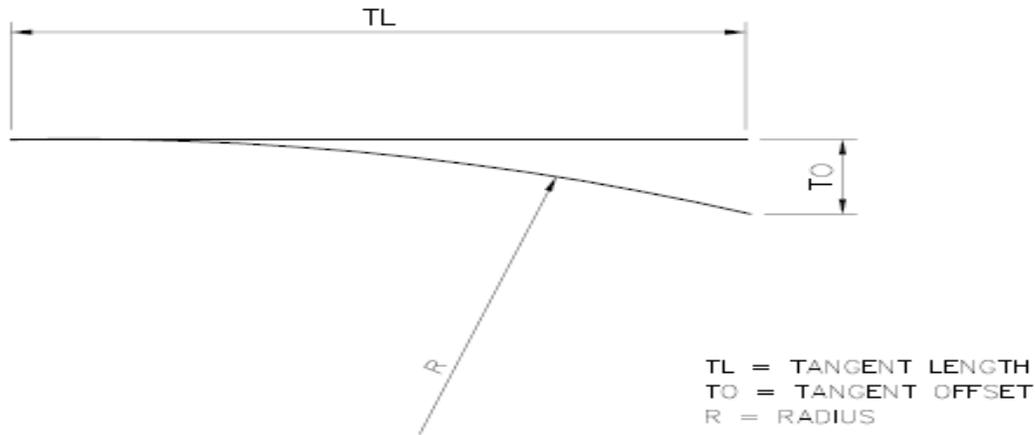


RIGID PIPELINE CURVE GEOMETRY

Nominal Pipe size (inches)	Maximum Allowable Deflection in./ft. of pipe angle, θ	Equation for <u>Minimum</u> radius of curvature, ft. (L=pipe length)	r (feet) Minimum Radius of Curva- ture,			
			For pipe length, L. of:			
			4'	6'	8'	10'
3 to 12	1/2" (2.4°)	$r = 24.0 * (L)$	96	144	192	-
15 to 24	3/8" (1.8°)	$r = 32.0 * (L)$	128	192	256	320
27 to 36	1/4" (1.2°)	$r = 48.0 * (L)$	192	288	384	480
39 to 42	3/16" (0.9°)	$r = 64.0 * (L)$	256	384	512	640

* Based on ASTM C425

TABLE 17-2
Maximum Deflection for Polyvinyl Chloride Pipes (SDR-35)



FLEXIBLE PIPELINE CURVE GEOMETRY

Nominal Pipe Size (Inches)	Maximum Tangent Offset - TO (Feet)											Minimum Radius of Curvature - R (Feet)
	Tangent Length - TL (Feet)											
	20	40	60	80	100	120	140	160	180	200	220	
6	1.0	4.0	9.2	16.7	26.8	40.0	57.2	80.	112.8	200.0	-	200
8	0.8	3.2	7.3	13.1	20.8	30.7	42.9	57.9	76.5	100.0	131.3	250
10	0.7	2.7	6.1	10.9	17.2	25.0	34.7	46.2	60.0	76.4	96.0	300
12	1.5	2.1	4.8	8.6	13.6	19.7	27.1	35.8	46.0	57.3	71.3	375

**TABLE 17-3
LOW PRESSURE AIR TEST FOR SEWERS**

TABLE 17-3, LOW PRESSURE AIR TEST FOR SDR-35 SEWERS													
Time in Seconds for Pressure to drop from 2.5 to 1.5 psi Gage Pressure													
Main Line		4 inch House Connection					Main Line		6 inch House Connection				
Nominal Diameter inches	Length feet	House Connection Length					Nominal Diameter inches	Length feet	House Connection Length				
		0 ft.	100 ft.	200 ft.	300 ft.	400 ft.			0 ft.	100 ft.	200 ft.	300 ft.	400 ft.
8	0	0	20	40	50	70	8	0	0	40	80	100	100
	50	40	50	70	90	80		50	40	70	110	110	110
	100	70	90	100	100	90		100	70	110	120	110	110
	150	110	120	110	100	100		150	110	120	120	110	110
	200	140	120	110	110	100		200	140	130	120	120	110
	300	140	130	120	110	110		300	140	130	120	120	120
	400	140	130	120	120	110		400	140	130	130	120	120
10	50	50	70	90	100	90	10	50	50	90	120	120	110
	100	110	130	120	110	110		100	110	140	130	130	120
	200	170	150	140	130	120		200	170	150	140	140	130
	300	170	160	150	140	130		300	170	160	150	140	140
	400	170	160	150	150	140		400	170	160	150	150	140
12	50	80	100	110	110	110	12	50	80	160	140	130	120
	100	160	170	150	140	130		100	160	120	150	140	140
	200	200	180	170	160	150		200	200	170	170	160	150
	300	200	190	180	170	160		300	200	180	180	170	160
	400	200	190	180	180	170		400	200	190	180	180	170

Air shall be introduced into the pipeline until three psi (3.0 psi) gage pressure has been reached, at which time the flow of air shall be reduced and the internal air pressure shall be maintained between two and one-half (2.5) and three and one-half psi (3.5 psi) gage pressure for at least two minutes (2 minutes) to allow air temperature to come to equilibrium with the temperature of the pipe walls.

After the temperature has stabilized and no air leak at the plugs have been found, the air pressure shall be permitted to drop and when the internal pressure has reached two and one-half psi (2.5 psi) gage pressure, a stopwatch or sweep-second hand watch shall be used to determine the time lapse required for the air pressure to drop to one and one-half psi (1.5 psi) gage pressure.

If the time lapse (in seconds) required for the air pressure to decrease from two and one-half to one and one-half psi (2.5 to 1.5 psi) gage pressure exceeds that shown in Table 17-3, "*Low Pressure Air Test for SDR-35 Sewers*," above, the pipe shall be presumed to be within acceptable limits for leakage.