SECTION 625 - SEWER SYSTEM

625.01 Description. This section describes constructing sewer systems and appurtenances.

Terms "Sewage" or "Wastewater" and "Division of Sewers" or "Division of Wastewater Management" (DWM) will be interchangeable depending on respective County.

625.02 Materials.

Bed Course Materials for Crushed Rock Cradle	703.16
Structure Backfill Material	703.20
Trench Backfill Material	703.21
Joint Mortar for Pipe	705.02
Jointing Compound for Sewer Pipe	705.11
RCP for Sewer System	706.02(B)
Vitrified Clay Pipe (VCP) and Fittings for Sewer System	706.08
PVC for Sewer System	706.09
Cast Iron Pipe and Fittings for Sewer System	707.01(A)
Ductile Iron Pipe, Fittings and Special Castings for Water System	707.01(B)
Reinforcing Steel	709.01
Cullet Materials for Utility Structures	717.03

Conform concrete for sewer structures to Section 601 – Structural Concrete. Use Class C concrete for non-reinforced concrete blocks, cradles, and jackets. Use Class B concrete for reinforced concrete blocks, cradles, and jackets.

Modify concrete in contact with sewage or sewage gases as follows:

(1) Incorporate water reducing admixture conforming to Subsection 711.03(B) – Admixture Acceptance.

(2) Use Type II portland cement or modified Type I portland cement with

maximum limit of 8 percent on tricalcium aluminate.

Use 2-inch square redwood, or 1-1/2 inch diameter PVC pipe, of required length for markers for house connection reducers.

625.03 Construction

(A) Open Trench Excavation for Sewer Pipes. Excavate trenches in accordance with Section 204 – Excavation and Backfill for Miscellaneous Facilities and below:

(1) Trench Widths. Construct trench widths in accordance with Table 625.03-1 – Trench Widths for Sewer Pipes.

TABLE 625.03-1 - TRENCH WIDTHS FOR SEWER PIPES

Pipe Size - Inches	Trench Width – Inches
6	24
8	24
10	24
12	30
15	38
18	41
21	45
24	50
27	53
30	57
36	69
42	76
48	84
54	91

Increases in widths over those specified in Table 625.03-1 - Trench Widths for Sewer Pipes may be made at no increase in contract price or contract time.

If trench width is greater than that specified in Table 625.03-1 – Trench Widths for Sewer Pipes, and such condition results in greater load of overburden than Department designed pipe for, provide at no increase in contract price or contract time:

(a) Higher strength replacement pipe.

(b) Higher class of bedding.

Pile excavated material next to trench, or haul and store to site acceptable to the Engineer. Obstructing movement of vehicular traffic and pedestrian walkways will not be allowed. Maintain access to existing driveways, fire hydrants, and meters.

For pipe installation in new embankment, construct embankment:

(a) To required height.

(b) For a distance on each side of pipe location not less than five times diameter of pipe.

Excavate trench with sides as nearly vertical as permitted by soil conditions. Shore trench in accordance with OSHA requirements.

Excavating more than 300 feet ahead of installed pipe will not be allowed. Trench left unfilled more than 300 feet behind installed pipe will not be allowed.

(2) Trench Depths. Excavate trench to depth in accordance with contract documents. Follow OSHA requirements.

If trench excavation is deeper than specified in the contract documents, bring trench to specified grade, at no increase in contract price or contract time:

(a) With bed course material.

(b) Class C concrete placed with cradle.

If mud or other unsuitable material is encountered at specified grade, excavate below specified grade to depth and width ordered by the Engineer, and backfill with bed course material.

If contract documents specify concrete to bed pipe, consider top of concrete as top of bedding. Bedding material includes one of

following:

(a) Concrete.

(b) Beach sand conforming to Subsection 703.01 – Fine Aggregate for Concrete.

(c) No. 8 or No. 67 aggregate conforming to gradation requirements of ASTM C 33.

(d) Native free-draining granular material having a minimum sand equivalent of 30 or having a coefficient of permeability greater than 0.001 centimeter per second.

(e) Other materials acceptable to the Engineer.

(3) Sheathing and Bracing.

(a) General. Provide and maintain sheathing and bracing required to support excavation. Follow OSHA requirements.

(b) PVC Pipe. If timber sheeting is used below top of PVC pipe, drive timber sheeting approximately 2 feet below bottom of pipe. Leave timber sheeting in place about 1-1/2 feet above top of pipe.

(c) Movable Trench Sheeting, Trench Boxes or Shields. If bottom of sheeting, box, or shield extends below top of pipe, use movable trench supports only:

1. On shelf above pipe with pipe installed in narrow, vertical-wall subditch.

2. If located at least 2-1/2 pipe diameters away from flexible pipe.

unless means to reconsolidate bedding or side support material disturbed by shoring removal is acceptable to Engineer.

(4) Dewatering of Trenches. Keep drainage or seepage water below level of subgrade:

(a) When installing pipe, cradles or jackets.

(b) During periods of construction work inspection.

(c) During leakage tests.

Consider subgrade as bottom of concrete blocks or jacket. Keep trenches free of water while installing and testing pipe and backfilling trench. Comply with NPDES requirements and other applicable regulations. Obtain NPDES construction dewatering permit for discharge of uncontaminated ground water.

(B) Installation of Sewer Pipe.

(1) General. Lay pipe starting from lowest point with spigots facing direction of flow. Fit and match pipe together to provide sewer true to line and grade with smooth and uniform invert.

Do not use blocks and wedges to adjust pipe to proper line and grade, except as required for jackets and cradles. Uniformly support pipe for its entire length.

Close exposed ends of sewers with accepted temporary covers at end of each work day. If water, mud or other foreign matter enters joints after pipe installation, open, clean, and replace affected joints.

Check pipes that become submerged in water during the night each morning. Re-lay pipes that have floated from their proper positions at no increase in contract price or contract time. Before final inspection, visually inspect lines, and remove mud and other foreign matter within sewer line.

Comply with requirements of Hawaii Occupational Safety and Health (HIOSH) Confined Space Standard §12-67.2-2.

For sewer manhole, see Subsection 626.03(B)(2) - Sewer Manholes.

(2) Vitrified Clay Pipe. Install vitrified clay pipe with compression joints. Wipe or brush the pipe with lubricant or adhesive recommended by pipe manufacturer on contact surfaces of joints. Push spigot into bell until joint snaps into position.

Do not use poured or formed joints using cement, sulfur compounds, bituminous materials, or other materials forming rigid joint.

Use jointing compound recommended by pipe manufacturer for

joining 6-inch by 4-inch extra heavy cast iron or ductile iron reducer to 6-inch vitrified clay sewer pipe and 4-inch house sewer.

(3) Cast Iron and Ductile Iron Pipe and Appurtenances. Construct in accordance with Subsections 624.03(D) – Laying Pipe and 624.03(F) – Joints for Ductile Iron Pipe and Appurtenances.

(4) Reinforced Concrete Pipe. Clean inside surface of concrete bell and concrete spigot end, including groove, before making joint. Lubricate rubber gasket and annular groove in spigot. Stretch and place gasket uniformly in annular groove in spigot. Lubricate inside bell surface 2 inches from end of pipe. Use soft vegetable soap compound lubricant recommended by manufacturer.

Before assembling joint, place metal or wooden spacers against shoulder of bell and provide proper space between abutting ends of pipe.

Telescope and seat spigot into bell. Do not mortar joints, inside or outside.

Insert thin metal feeler gage between bell and spigot. Check position of rubber gasket around complete circumference of pipe. If gasket is not in proper position;

(a) Withdraw pipe.

(b) Check gasket for cuts and damages.

(c) Re-lay pipe.

(d) Recheck gasket position.

Provide joint openings:

(a) Within tolerance recommended by manufacturer.

(b) Consistent with design of pipe.

(c) To not exceed 1/2 inch.

If joint opening exceeds any of above requirements, withdraw pipe, correct defect, and re-lay pipe.

(5) PVC Pipe. Wipe clean and lubricate compression joints with lubricant provided by manufacturer before inserting spigot end of pipe

into bell end.

Handle, load, unload, and store PVC pipe with care. Store pipe and fittings under cover. Transport pipe and fittings in vehicle with bed long enough to allow length of pipe to lie flat.

Place four inches of bedding material below pipe, plus additional bedding material above the bottom of pipe equal to 0.4 times outside diameter of pipe. If laying pipe in rock excavation, remove six inches of rock below pipe and place six inches of bedding below pipe.

Cover pipe with minimum of 3 inches of accepted backfill material within 24 hours after placing pipe in trench.

Bedding from bottom of pipe to 12 inches above pipe may be compacted by jetting, provided applied water does not soften or damage foundation material. Use 1-1/2 inch nozzle curved to circumference of installed pipe with sufficient length to reach invert of pipe. Conduct compaction along entire length of pipe on alternate sides with each side compacted four times. Provide additional material and compaction if settlement is greater than 1/6 diameter of pipe. Maintain required grades. Compact backfill from 12 inches above pipe to finish surface in accordance with Section 204 – Excavation and Backfill for Miscellaneous Facilities.

Provide special watertight manhole couplings for manhole connections. Cast couplings directly into cast-in-place manholes, or grout couplings into precast concrete manholes with non-shrink or expansion-type grout.

(6) Leakage Tests.

(a) General. Test sewers and sewer manholes for leakage in presence of the Engineer. Provide equipment and material necessary for tests including water and labor. Perform leakage test with results acceptable to the Engineer before placing backfill, concrete cradles, concrete jackets, or permanent resurfacing.

(b) Force Mains. Test force mains in accordance with Subsection 624.03(J) - Testing.

(c) Gravity Lines. Do not perform exfiltration leakage test if difference in elevation between inverts of adjacent manholes exceeds 10 feet.

If ground water is above top of pipe, perform leakage (infiltration) tests as follows:

(1) After laying pipe and completing connections to manholes, backfill pipe trench to prevent floating of pipe.

(2) Close end of sewer at upper structure to prevent entrance of water. Stop pumping of ground water for at least three days. Test the test portion for infiltration.

(3) Use maximum quantity of infiltration of 200 gallons per day per inch of inside diameter per mile of pipe.

(4) Reduce infiltration over limit specified above to within permissible limit before sewer is acceptable the Engineer. Repair visible leaks, despite limits of leakage tests.

If ground water is below top of pipe laid, perform leakage (exfiltration) tests as follows:

(1) Test each portion of sewer between successive manholes by closing the inlet of the lower manhole and and closing the inlet of upper manhole with stoppers. Fill pipe and upper manhole with water:

(a) At least 4 feet above invert of upper manhole.

(b) Or, not less than 1 foot above high end of highest house connection on test portion.

(2) If construction of manhole is delayed, use barrel on bank to provide necessary pressure required for testing.

(3) Keep water present in trench below level of subgrade of sewer during test, and during patching or repairing required by test.

(4) Use maximum quantity of exfiltration 200 gallons per day per inch of inside diameter per mile of pipe.

(5) Reduce exfiltration over limit specified above to within permissible limit before acceptance by the Engineer. Repair visible leaks, despite limits of leakage tests.

(d) Low Pressure Air Test

(1) Clean pipe to be tested.

(2) Plug pipe outlets with test plugs. Securely brace each plug.

(3) Add air until internal pressure of line reaches approximately 4 pounds per square inch. After reaching this pressure, allow pressure to stabilize. Pressure will normally drop as air temperature stabilizes, usually taking two to five minutes depending on pipe size. Reduce pressure to 3-1/2 pounds per square inch before starting test.

(4) Start test when pressure:

(a) Has stabilized.

(b). Is at or above starting test pressure of 3-1/2 pounds per square inch.

If pressure does not drop more than 1 pound per square inch during test time, line has passed test.

(5) Ground water above pipe will reduce air loss. If section of line under test shows significant infiltration, perform infiltration test.

(6) Air test may be dangerous if line is prepared improperly. Install and brace plugs to prevent blowouts.

Provide pressurizing equipment with regulator set at 10 pounds per square inch to avoid over-pressurizing and damaging acceptable line. Do not allow workers in manholes during testing.

TABLE 625.03-2 - MINIMUM AIR TEST TIME FOR VARIOUS PIPE SIZES			
Nominal Pipe Size, Inches	**T (Time) minutes / 100 feet**	**Nominal Pipe Size, Inches**	**T (Time) minutes / 100 feet**
3	**0.2**	**21**	**3.0**
4	**0.3**	**24**	**3.6**
6	**0.7**	**27**	**4.2**
8	**1.2**	**30**	**4.8**
10	**1.5**	**33**	**5.4**
12	**1.8**	**36**	**6.0**
15	**2.1**	**39**	**6.6**
18	**2.4**	**42**	**7.3**

(7) Mandrel Test for Deflection of PVC Pipe. Perform mandrel test 30 days after completing trench backfill. In roadway areas, 30-day period begins after installation and compaction of bedding, backfill and subbase to within 2 feet of finished pavement grade.

Pull rigid nine-sled mandrel through pipe by hand between adjacent manholes to measure for obstructions such as deflections, joint offsets, and lateral pipe intrusions. Use mandrel conforming to ASTM D 3033 and ASTM D 3034. Furnish material, equipment, and labor required for test, and perform test in presence of the Engineer.

If mandrel fails to pass, pipe is considered overdeflected. If pipe is not damaged, uncover and reinstall pipe. Remove damaged pipe from work site. Do not reround or use other methods or processes to reduce or remedy overdeflections.

(8) Connections to Existing Sewers.

(a) General. Arrange with County Division of Sewers for making connections to existing sewers.

(b) Breaking into Existing Manholes. Connect to existing manholes and channelize inverts in presence of County

Division of Sewers inspector. In making connection, place tight fitting false form on inside portion of manhole. Remove materials falling inside existing sewer pipe. Pay for damages to existing manhole and sewer pipe resulting from this work. After completing connection, work on required channelizing within existing manhole.

(c) Sewer Enclosed Within New Manhole. If building new manhole over existing sewer main, cut existing sewer line in presence of County Division of Sewers inspector. Clear new manhole of mud, debris, and standing water before cutting existing sewer line.

(d) Saddle Wye. If required to install new lateral from existing sewer main, provide saddle wye tap-in in presence of County Division of Sewers inspector.

(C) Trench Backfill. Do not place backfill until testing of pipe and appurtenances is acceptable to the Engineer. After installing and testing pipe, immediately backfill trench and around manhole. Backfill in accordance with Section 204 – Excavation and Backfill for Miscellaneous Facilities.

If using sheathing, fill and tamp cavities formed below invert grade before proceeding with backfill of trench.

Place and tamp trench backfill material placed below horizontal plane 12 inches above top of pipe by hand shoveling so that backfill material is in contact with entire periphery of pipe. Use Trench Backfill A material conforming to Subsection 703.21 – Trench Backfill Materials.

Backfill remainder of trench with Structural Backfill B or Trench Backfill B material conforming to Subsection 703.20 – Structure Backfill Material or 703.21 - Trench Backfill Materials.

For sewer pipes that are cradled, bring initial backfill up to top of pipe, moisten, and tamp.

In lawns, gardens, and other cultivated areas, backfill upper 12 inches with planting soil or loam and tamp. Plant grass, reset plants and shrubs, and irrigate area for seven days.

(D) Concrete Blocks. Provide concrete blocks next to each bell on both pipes and fittings.

(E) Concrete Cradle. Provide concrete cradles under entire length of pipe as specified in contract documents. Before placing concrete, rest pipes

firmly on concrete blocks. Keyway or curing is not required. Provide reinforcement as specified in contract documents.

(F) Crushed Rock Cradle. Provide crushed rock cradle under entire length of pipe as specified in contract documents. Provide bed course material in layers not exceeding 8 inches in loose thickness and compact.

(G) Concrete Jackets. Provide concrete jackets as specified in contract documents. Use small concrete blocks to support pipes, and provide reinforcement as specified in the contract documents. Cure reinforced concrete jackets for five days. Plain concrete jackets do not require curing.

(H) House Sewer Connection. Arrange connections to cause least inconvenience for sewer user.

(I) Removing or Abandoning Existing Sewer System. If requested by the Engineer, expose portions of existing sewer pipe to be removed or abandoned. Excavate in accordance with Subsection 625.03(A) – Open Trench Excavation for Sewer Pipes.

If top of pipe is less than 24 inches below finished grade, and the Engineer orders pipe removed, proceed with pipe removal work. The Engineer will order exact position of cutting for pipe removal work. Plug open ends of abandoned pipes with Class B concrete. Plug ends of existing pipes to remain in use with vitrified clay cap.

Backfill open trench with accepted select material and tamp in uniform horizontal layers not exceeding 8 inches in loose thickness. Use backfill tampers to provide relative compaction of not less than 95 percent.

Clean and deliver salvaged materials as ordered by the Engineer.

625.04 Measurement. Sewer systems will be paid on a lump sum basis. Measurement for payment will not apply.

625.05 Payment. The Engineer will pay for accepted sewer systems on a contract lump sum basis. Payment will be full compensation the work prescribed in this section and contract documents.

The Engineer will pay for following pay item when included in proposal schedule:

Pay Item	Pay Unit
Sewer Systems	Lump Sum

The Engineer will pay for excavation and backfill for sewer pipes under

Section 204 – Excavation and Backfill for Miscellaneous Facilities.

The Engineer will not pay separately for concrete blocks, cutting and plugging of abandoned sewers, concrete plugs for ends of abandoned sewers, and vitrified clay caps at ends of existing sewers that will remain in use. Consider cost for these items as included in sewer system contract pay items.

END OF SECTION 625