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SECTION 1
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Purpose for these Construction Standards
B. Required design standards.
C. Requirements for drawings.
D. One year Guarantee of work.
E. General requirements for licenses, permits, temporary utilities and traffic regulation.
F. Requirements for testing and inspection.

1.2 PURPOSE OF CONSTRUCTION STANDARDS

A. These Construction Standards set forth minimum standards for improvements constructed within existing or proposed public streets, right-of-ways and easements within Ephraim City Limits. Nothing in these Construction Standards shall be construed to prohibit improvements constructed to higher standards.

B. These Construction Standards are for guidance and consistency, but are not to restrict professional judgment. Where unusual or exceptional conditions exist, variations and exceptions from these Construction Standards may be made by Ephraim City Council after receipt of written request and due consideration.

C. All instructions in these Construction Standards are addressed to Developer, unless otherwise noted. These Construction Standards consist of written text and drawings.

1.3 DEFINITIONS

A. Developer: Individual, association, firm, partnership, corporation, or entity proposing to make improvements within existing or proposed public streets, right-of-ways and easements within Ephraim City Limits.
1.4 SUBMITTALS

A. Unless otherwise noted, submit one copy to Ephraim City.

B. Test results shall be submitted no later than 7 days after date of test.

1.5 DESIGN STANDARDS

A. Streets:
   1. Width: As determined by Ephraim City Council.
   2. Pavement Section: Minimum section shall be 2.5 inches of asphalt concrete pavement with 6 inches of untreated base course, unless pavement design requires greater section. Submit pavement design prepared by engineer licensed in State of Utah.
   3. Longitudinal Grade:
      a. Major Collector: Not exceed 8 percent.
      b. Other Streets: Not exceed 15 percent.
   4. Cross Grade: Minimum of 2 percent.
   5. Curb Corner Radius:
      b. Other Streets: Minimum of 15 feet.
   6. Street Monuments: Place at center line angle points and intersections.
   7. Signs: Street name and traffic signs required.

B. Culinary Water: In accordance with Utah Department of Environmental Quality requirements.
   1. Design: Size main lines to maintain minimum of 20 psi pressure at all points of system during peak instantaneous demand condition and when fire flows are added to peak daily flow. Loop main lines.
   2. Main Lines: 8 inch diameter minimum size. 4 feet minimum cover to top of pipe.
   3. Service Lines: 1 inch diameter minimum size. 3.5 feet minimum cover to top of pipe.
   4. Fire Hydrants: Space no greater than 500 feet. Meet Fire Department regulations.
   5. Valves: Install at all connections and not more than 600 feet apart. Locate at street intersections in line with property line extension. Use gate valves for valves less than 12 inches diameter and butterfly valves for valves 12 inches diameter and greater.

C. Sanitary Sewer: In accordance with Utah Department of Environmental Quality requirements.
   1. Design: Use annual average flow rate of 100 gallons per capita per day. Place at depth to service basements and prevent freezing.
   2. Main Lines: 8 inch diameter minimum size and 0.334 percent minimum slope. Uniform slope and straight alignment between manholes.
      a. Lateral and Collector: Design for peak flow of 400 gallons per capita per day.
      b. Interceptor and Outfall: Design for peak flow of 250 gallons per capita per day.
   3. Service Lines: 4 inch diameter minimum size and 2 percent minimum slope.
4. Manholes: Place at changes in pipe size or grade, intersections and not more than 400 feet apart. Use drop manhole for sewer line entering manhole 24 inches or more above manhole invert.

D. Maintain at least 10 feet horizontal separation between culinary water lines and sanitary sewer lines. Where culinary water lines and sanitary sewer lines cross, install culinary water line at least 18 inches above sanitary sewer line. Measure separation distances from outside edge to outside edge of pipe. If separation requirement is not met, then use special pipe material and joint construction.

E. Drainage: Design drainage system for 10 year return frequency.

F. Flood Control: Where flood control measures are required, design for 100 year return frequency.

G. Power System:
   1. Design: Place at back or front lot lines. Do not place in water or sewer trench.
   2. Layout: Provide easements not less than 10 feet wide. Wider easements may be required for commercial and industrial uses. Place power lines 3 feet from property line within utility easement. Do not place structures within 10 feet in front of transformer pad or within 18 inches of any other side of transformer pad.
   3. Minimum Burial Depth:
      a. Primary Lines: 42 inches.
   4. Streetlights: Provide in accordance with Section 16.

1.6 DRAWINGS

A. Construction drawings shall be prepared by engineer licensed in State of Utah. Construction drawings shall be clear, legible and conform to standard engineering and drafting practices. All drawings shall conform to following:
   1. Sheet Size: 11 inch by 17 inch minimum to 24 inch by 36 inch maximum.
   2. Have border and title block.
   3. Indicate sheet title, project name, preparer’s name, engineer’s stamp, date, scale, elevation datum, north arrow for plans, and sheet number.
   4. Use appropriate scale as required to clearly show existing features and proposed improvements.

B. Street improvement drawings shall show:
   1. Plan and profile.
   2. Elevations and grades.
   3. Stationing and curve data.

C. Utility improvement drawings shall show:
   1. Location, size and type of utility.
   2. Plan and profile with elevations and grades for sanitary sewer and storm drain.
   3. Connections to existing utilities.
D. Drawings shall include sufficient detail sheets to clearly describe proposed improvements.

E. Submit 4 sets of construction drawings to Ephraim City for review. If disapproved, one set of construction drawings will be retained by Ephraim City and 3 sets will be returned with reasons for disapproval. If approved, 2 sets of construction drawings will be retained by Ephraim City and 2 sets of construction drawings will be returned.

F. Receipt of approved sets of construction drawings from Ephraim City shall authorize Developer to proceed with construction. Do not start construction until construction drawings are approved.

G. Use one set of approved construction drawings to document any changes made during construction. After construction has been completed, submit as-constructed drawings to Ephraim City

1.7 LICENSES AND PERMITS

A. Developer shall obtain all licenses and permits required to complete improvements.

1.8 WARRANTY

A. Developer shall guarantee improvements in good condition for period of one year after date of final inspection. Guarantee shall include all improvements such as utilities, roadways, curb and gutter, sidewalks and accessories.

B. If during one year guarantee period Ephraim City determines that completed improvements need repairs or reconstruction, then Ephraim City will give written notification to Developer. Developer shall have 30 calendar days from receipt of written notification to complete repairs or reconstruction. If Developer fails to make repairs or reconstruction within 30 calendar days, then Ephraim City will arrange for repairs or reconstruction to be completed and cost will be billed to Developer.

PART 2 PRODUCTS

2.1 SIGNS, SIGNALS AND DEVICES

PART 3 EXECUTION

3.1 TEMPORARY UTILITIES

A. Provide and pay cost for any required temporary utilities such as but not limited to: electricity, telephone, water, and sanitary facilities.

3.2 BARRIERS AND TRAFFIC REGULATION

A. Provide barricades, barriers, and signs to prevent unauthorized entry to construction areas, protect existing improvements from damage, and protect public.

B. Provide warning, detour, and other signs to direct traffic safely through or around construction areas. When working within traffic lanes, close road and detour traffic or use flaggers to direct traffic.

C. Use flares and lights during hours of low visibility to delineate traffic lanes, guide traffic, and protect public.

D. Relocate barricades, barriers, signs and other traffic control devices as work progresses to maintain effective traffic control and public protection. Remove when no longer required.

3.3 TESTING

A. Material testing required by these Construction Standards shall be performed by independent testing laboratory approved by Ephraim City. All testing shall comply with current AASHTO, ASTM, AWWA or State of Utah standards as indicated.

B. Cost for testing and bringing materials into compliance shall be borne by Developer.

C. Ephraim City reserves right to perform verification testing to verify test results submitted by Developer. Verification testing governs over test results submitted by Developer. Ephraim City will pay cost for verification testing, unless verification testing reveals unacceptable work, then cost for verification testing and cost for corrective work shall be paid by Developer.

3.4 INSPECTION

A. All improvements shall be subject to inspection by Ephraim City. Do not cover or backfill excavations for improvements until improvements have been inspected by Ephraim City. If any installation is covered before being inspected and approved, Developer shall uncover installation.
B. After improvements are completed, Ephraim City will conduct final inspection. Any faulty or defective work noted at final inspection shall be corrected within 30 calendar days after date of final inspection. If Developer fails to complete corrective work within 30 calendar days, then Ephraim City will arrange for corrective work to be completed and cost will be billed to Developer.

C. Requests for inspections shall be made to Ephraim City at least 24 hours in advance of need for inspection.

D. Developer shall pay Ephraim City for cost of inspections.

END OF SECTION
SECTION 2
REMOVAL AND REPLACEMENT OF EXISTING IMPROVEMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for protection, restoration or replacement of existing improvements on public or private property.

B. Replacing improvements removed or damaged during trenching or other construction operations.

1.2 REFERENCES

A. Related Sections:
   1. Section 4 - Trenching.
   2. Section 9 - Untreated Base Course.
   4. Section 11 - Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Existing Improvements: Include but are not limited to gravel surfacing, asphalt concrete pavement, portland cement concrete pavement, curb, gutter, sidewalk, driveway, fence, ditch, culvert, utility, sign, structure, wall and landscaping.

PART 2 PRODUCTS

2.1 MATERIALS

A. Untreated Base Course: In accordance with Section 9.

B. Asphalt Concrete Pavement: In accordance with Section 10.

C. Portland cement concrete: In accordance with Section 11.

D. Other Materials: Match existing materials or better.
PART 3 EXECUTION

3.1 REMOVAL

A. Remove existing improvements only when necessary to construct proposed improvements.

B. Remove existing improvements damaged during construction.

C. When removing asphalt concrete pavement, saw cut through full depth of pavement and in straight line. If pavement is cracked, broken or deteriorated, make cut so defective area is removed. When possible, make saw cut parallel or perpendicular to center line of street. For trenching, make saw cut 6 inches beyond edge of trench.

D. When removing portland cement concrete, remove back to nearest cold joint or saw cut in straight line beyond damaged area.

E. Broken asphalt concrete pavement and portland cement concrete may be used as backfill in trenches if broken up small enough to meet requirements of Section 4. Dispose of unusable damaged materials off site.

3.2 REPAIR, RESTORATION AND RECONSTRUCTION

A. Repair, restore or reconstruct improvements to equal or better condition than existed prior to start of construction.

B. Replace gravel surfacing with untreated base course to depth equal to existing gravel surfacing, but not less than 6 inches. Place and compact untreated base course in accordance with Section 9. If gravel surfacing is different from untreated base course, replace with material equal to existing.

C. Replace asphalt concrete pavement and untreated base course in accordance with Sections 10 and 9 respectively. Place untreated base course to depth equal to existing base, but not less than 6 inches. Place asphalt concrete pavement to depth equal to existing pavement, but not less than 2.5 inches.

D. Replace concrete improvements to match adjacent concrete improvements, unless adjacent improvements do not meet current Ephraim City Construction Standards, then match current standards.

E. Restore or replace landscaping improvements.

END OF SECTION
SECTION 3
EARTH WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for excavation, embankment, backfill and compaction for structures and site improvements.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   2. AASHTO T99 - Moisture-Density relations of Soils Using a 5.5 lb (2.5 kg) Rammer and a 12-in. (305 mm) Drop.
   3. AASHTO T180 - Moisture-Density relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18 in. (457 mm) Drop.
   4. AASHTO T193 – California Bearing Ratio

B. American Society for Testing and Materials (ASTM):
   1. ASTM D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

C. Occupational Safety and Health Act (OSHA).

D. Related Sections
   1. Section 9 – Untreated Base Course.
   2. Section 11 – Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Clearing: Removal and disposal of logs, limbs, sticks, vegetation, rubbish, debris, and other material on ground surface.

B. Grubbing: Removal and disposal of roots, buried logs, debris, and other underground material.

C. Soil Classification: As determined in accordance with AASHTO M145.
1.4 SUBMITTALS

A. Test Results: Submit one copy of soil classification, proctor and density test results.

PART 2 PRODUCTS

2.1 MATERIALS

A. Granular Borrow: Granular material.
   2. CBR Value: AASHTO T193, 20 percent of greater.

B. Borrow: A-1-a through A-4 material as classified in accordance with AASHTO M145.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, grades, and elevations.

B. Locate, identify, and protect utilities that remain from damage.

C. Set bench marks, control points and other survey stakes as needed to meet tolerances.

3.2 WATER CONTROL

A. Grade construction area to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect construction areas from puddling or running water. Provide water barriers as required to protect construction areas from soil erosion.

C. Provide temporary drainage for storm and irrigation water. Make repairs to correct any damage caused by temporary or lack of temporary drainage.

3.3 DUST CONTROL

A. Provide adequate water supply for dust control at any time.

B. Do not waste water or over saturate construction area.
3.4 CLEARING AND GRUBBING

A. Clear and grub all vegetation and debris within roadway.

B. Dispose of material off site.

C. Backfill holes, cuts, and depressions resulting from clearing and grubbing. Compact to density of surrounding ground.

3.5 EXCAVATION

A. Excavate soil as necessary to construct improvements. Stockpile excavated soil sufficient distance from edge of excavation to prevent slides and cave-ins. Stockpile soil in manner to minimize inconvenience for traffic and minimize damage to existing improvements.

B. Remove and dispose of unsuitable excavated materials off site.

C. Use suitable excavated materials for backfill and embankments. Dispose of surplus materials off site.

D. Slope bank of excavation to meet soil conditions and OSHA requirements. Under cutting will not be permitted. Where needed, provide shoring.

E. Excavate subgrade for structure to original undisturbed soil. Correct excavation below subgrade for structure with concrete or untreated base course in accordance with Sections 11 and 9 respectively.

3.6 EMBANKMENT

A. Use suitable excavated materials to build embankments. Do not use frozen, organic, rubbish, debris, or other objectionable materials.

B. If embankment height is 6 feet or less and underlying ground consists of loose material, scarify and compact top 8 inches of ground to at least 90 percent of maximum laboratory density.

C. Do not place embankment over porous, wet, frozen, or spongy subgrade.

D. Do not use rocks, concrete or pavement materials over 6 inches in largest dimension. Mix rocks and large material with finer materials to minimize voids.
3.7 OVER EXCAVATION

A. If soft areas appear, scarify, aerate, and re-compact.

B. If soft areas persist, excavate unsuitable soil and dispose off site.

C. Backfill excavated areas with granular borrow and compact.

3.8 BACKFILLING

A. Use excavated materials to backfill excavated area to match required contours and elevations.

B. Do not backfill over porous, wet, frozen or spongy subgrade. Remove shoring.

C. Employ placement method that does not disturb or damage other work.

D. Slope finish grade away from structure. Make gradual grade changes. Blend slope into level areas.

3.9 BORROW

A. If quantity of excavated material is not sufficient to complete backfill and embankment, import borrow material as needed.

B. Use granular borrow for areas subject to traffic and other loads such as roadways, concrete elements and structures.

C. Use fine grained materials for landscaping and non-traffic areas.

D. Do not use frozen, organic, rubbish, debris or other objectionable materials.

3.10 COMPACTION

A. Place backfill and embankment materials in layers not exceeding 12 inches non-compactive depth. If tests indicate unsatisfactory density, reduce layer thickness.

B. Compact with self-propelled compaction equipment. Use hand-operated compaction equipment in areas inaccessible to self-propelled compaction equipment.

C. Maintain optimum moisture content of backfill and embankment materials to obtain required density.
D. Required Subgrade Density:
   1. Structures: Original undisturbed soil or engineered fill compacted to 96 percent of maximum laboratory density.
   2. Concrete elements including curb, gutter, flatwork and pavement: 96 percent of maximum laboratory density.
   3. Traveled areas including roads, shoulders, parking lots, and driveways: 96 percent of laboratory density.
   4. Non-traveled areas: 90 percent of maximum density.

3.11 FINISHING

A. Finish excavated areas and embankment to reasonably smooth and uniform surface.

B. Grade to blend in with existing contours and features and provide positive drainage.

3.12 TOLERANCES

A. Moisture Content: Plus or minus 2 percent of optimum.

B. Finish Subgrade Surface: Plus or minus 0.1 feet of required elevation.

3.13 TESTING

A. Soil Classification: One per material source for granular borrow in accordance with AASHTO M145.

B. Soil Proctor: One per each significant soil type encountered as necessary to provide density testing. Determine maximum laboratory density in accordance with AASHTO T180, Method D for A-1 soils and AASHTO T99, Method D for other soils.

C. Density: Perform with nuclear gauge in accordance with ASTM D2922.
   1. Frequency:
      a. Backfill and Embankment: One test per 500 cubic yards.
      b. Subgrade: One test per 1500 square yards.
   2. Acceptance: Average daily density equals or exceeds density requirements of article 3.10. Reject single density tests greater than 4 percent below required density.
   3. If test results are is not acceptable, re-compact and retest.
3.14 PROTECTION

A. Protect features remaining.

B. Maintain subgrade until next layer is placed.

END OF SECTION
SECTION 4

TRENCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavating trenches for utilities and utility structures.
B. Backfilling and compaction for utility trenches.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   2. AASHTO T99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-in. (305 mm) Drop.
   3. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
B. American Society for Testing and Materials (ASTM):
   1. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
C. Occupational Safety and Health Act (OSHA).
D. Related Sections:
   1. Section 12 - Flowable Fill.

1.3 DEFINITIONS

A. Soil Classification: As determined in accordance with AASHTO M145.
B. Utility: Any buried pipe, duct, conduit, cable and appurtenance.

1.4 SUBMITTALS

A. Test Results: Submit one copy of proctor and density test results.
PART 2 PRODUCTS

2.1 MATERIALS

A. Backfill:
   1. Excavated material free from rubbish, debris, organic material, frozen material, or other objectionable material.
   2. Rocks originating from trench and not exceeding 12 inches.
   3. Broken portland cement concrete and asphalt concrete pavement originating from trench and not exceeding 6 inches.
   4. If excavated material is not suitable for backfill, import granular material.

B. Imported Foundation Material: Crushed rock or gravel with 2 inch maximum gradation.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required location and elevation of utility lines and structures.

B. Locate, maintain and protect above and below grade utilities which are to remain.

C. When working on shoulders or within roadway, place barricades, warning signs, and flag persons as needed to protect public and direct traffic.

D. When trench is within pavement, saw cut trench prior to trenching.

3.2 EXCAVATION

A. Excavate soil required for installation of utilities and utility structures.

B. Cut trenches sufficiently wide to enable installation of utility and utility structure, provide compaction and allow inspection. Cut slope of trench walls to meet Utah State Industrial Commission and OSHA requirements and soil conditions. Provide shoring where needed. Take all necessary precautions to protect personnel in or around excavations.

C. Remove water from trench. Provide, operate, and maintain pumping equipment as needed.

D. Hand trim excavation for bell and spigot pipe joints. Remove lumped soil, boulders, rock and other materials that interfere with utility and utility structure.

E. Correct areas over excavated by backfilling and compacting to 96 percent of maximum laboratory density.
F. Stockpile excavated material along side of trench or in other areas to minimize damage to improvements.

G. If unstable soil, mud or muck is encountered which is unsuitable to support utility, remove unsuitable material 12 inches below grade. Backfill with imported foundation material and compact to 96 percent of maximum laboratory density.

H. When required, install utility by boring, jacking, moleing or augering.

I. When trench is within existing roadway or other traveled area, place temporary gravel surface in top 6 inches of trench backfill until final surfacing is placed.

3.3 ROCK EXCAVATION

A. If rocks are encountered which require removal by blasting, notify Ephraim City.

B. Comply with laws, ordinances, regulations and safety code requirements for blasting. Exercise care when handling explosives and during blasting. Assume all responsibility for damage and injuries caused by blasting.

C. In locations where solid rock, ledge rock, and cobble rock are encountered, excavate rock 6 inches below grade. Backfill with material required for utility bedding and compact to 96 percent of maximum laboratory density.

3.4 BACKFILL

A. After utilities, utility structures, appurtenances, and bedding have been installed, backfill trenches. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces. Remove shoring.

B. Do not place rocks larger than 2.5 inches in backfill placed within 12 inches of pavement subgrade.

C. Employ placement method that does not disturb or damage utilities and utility structures.

D. Grade surplus material to blend in with existing contours or remove surplus materials from site if necessary.

E. Backfill trench as soon as possible. No more than 500 linear feet of open trench permitted. Minimize length of trench left open during night time.

F. When trench is within existing roadway, backfill with flowable fill in accordance with Section 12.
3.5 **COMPACTION**

A. Place backfill in layers not exceeding 12 inches non-compactive depth. If tests indicate unsatisfactory density, reduce layer thickness.

B. Compact with self-propelled compaction equipment or use hand-operated compaction equipment in areas inaccessible to self propelled compaction equipment.

C. Maintain optimum moisture content of backfill materials to obtain required density.

D. Required Density:
   1. Class “B” Backfill: 96 percent of maximum laboratory density for traveled areas including roads, shoulders, parking lots, and driveways.
   2. Class “D” Backfill: 90 percent of maximum laboratory density for non-traveled areas.

3.6 **TOLERANCES**

A. Moisture Content of Backfill: Plus or minus 2 percent of optimum.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.7 **TESTING**

A. Soil Proctor: One per each significant soil type encountered as necessary to provide density testing. Determine maximum laboratory density in accordance with AASHTO T180, Method D for A-1 soils and AASHTO T99, Method D for other soils.

B. Backfill Density: Perform with nuclear gage in accordance with ASTM D2922.
   1. Frequency: Minimum of two random tests per day after roller pattern is established.
      a. Roller Pattern: Take three random density tests per 6 inch layer for 300 linear foot section of trench. Repeat tests for next layer. Establish roller pattern to obtain required density.
   2. Acceptance: Average daily density equals or exceeds density requirements of article 3.5. Reject single density tests greater than 4 percent below required density.
   3. If tests results are not acceptable, re-compact, and retest.
3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Reshape and re-compact trenches subjected to vehicular traffic during construction. Maintain trench surface flush with adjacent pavement or other surfacing.

END OF SECTION
SECTION 5

CULINARY WATER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for pipe, fittings, valves, fire hydrants, services, thrust restraint devices and bedding for culinary water lines.

B. Disinfection and pressure testing for culinary water lines.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   2. AASHTO T99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-in. (305 mm) Drop.
   3. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. American Society for Testing and Materials (ASTM):
   1. ASTM D1248 - Polyethylene Plastics Molding & Extrusion Materials.
   2. ASTM D2239 - Polyethylene Plastic Pipe (SDR-PR).
   4. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association (AWWA):
   1. AWWA C110 - Gray-Iron and Ductile-Iron Fittings, 2 inch Through 48 inch for Water and Other Liquids.
   3. AWWA C502 - Dry Barrel Fire Hydrants.
   4. AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
   5. AWWA C651 - Disinfecting Water Mains.
   6. AWWA C800 - Threads for Underground Service Line Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3-inch, for Water.

D. National Sanitation Foundation (NSF):

E. Related Sections:
   1. Section 4 - Trenching.
   2. Section 11 - Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe to 12 inches above top of pipe, prior to subsequent backfill operations.

B. Soil Classifications: As determined in accordance with AASHTO M145.

1.4 SUBMITTALS

A. Test Results: Submit one copy of pressure, bacteriological, proctor and bedding density test results.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of Utah Department of Environmental Quality.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Unload, stockpile and install pipe by mechanical equipment or by hand using method that will not damage pipe. Stockpile pipe in units or crates as shipped. Do not allow pipe to fall to ground or in trench.

PART 2 PRODUCTS

2.1 PIPE

A. PVC Pipe:
   1. Class 200 PVC pipe in accordance with ASTM D2241.
   2. Bell and spigot joints with elastomeric gaskets in accordance with ASTM F477.
   3. SDR of 21.
   4. Be NSF approved and bear NSF label.
   5. Pipe Fittings: Cast iron or ductile iron in accordance with AWWA C110 and rubber gasket joints in accordance with AWWA C111.
2.2 VALVES

A. Gate Valve: AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends. Rated for 200 pounds per square inch working pressure. Valve shall open by turning nut counter-clockwise.

B. Butterfly Valve: AWWA C504, class 150B, tight-closed rubber seated type. Shall be bubble-tight at rated pressure in either direction and suitable for operation after long periods of inactivity. Provide with mechanical joint ends and rated for 200 pounds per square inch working pressure.
   2. Valve Shaft: Solid 18-8, type 304 or type 316 stainless steel, ground and polished.
   3. Valve Operator: Traveling nut, self-locking type designed to hold valve in any position without creeping or fluttering. Equipped with mechanical stop-limiting device to prevent over travel of disc. Valve shall open by turning counter-clockwise.

C. Valve Box and Cover: Cast iron, extension sleeve type, word "WATER" cast on cover.

D. Concrete Collar: Class AA (AE) reinforced concrete in accordance with Section 11.

2.3 FIRE HYDRANTS

A. Hydrant: AWWA C502, dry barrel type, with minimum 5.25 inch diameter valve seat opening, break-off flange at ground level, drip valve, 200 psi working pressure, 4 feet minimum burial depth. Shall open by turning pentagon operating nut counter-clockwise. Manufactured by Waterous or Kennedy Valve.

B. Hose and Steamer Connection: Two 2.5 inch hose nozzles and one 4.5 inch pumper nozzle with standard threads, caps, gaskets and attaching chains.

C. Finish: Primer and two coats of red enamel.

2.4 SERVICES

A. Tap Saddle:
   1. Nylon coated saddle with stainless steel straps.
   2. Provide full support around circumference of pipe.
   3. Provide 2 inch minimum bearing area along pipe.
   4. Not have lugs which will dig into pipe.
   5. Not have U-bolt type strap.

B. Corporation Stop: Bronze body in accordance with AWWA C800. Standard iron pipe threads, compression fittings for polyethylene pipe and stainless steel inserts stiffeners.
C. Service Line: High density polyethylene pipe, 200 psi, iron pipe size, in accordance with ASTM D1248, ASTM D2239, NSF-14, and AWWA C901.

D. Service Meter:
   1. Copper Setter: 15" height, shutoff valve on inlet, dual check valve outlet.
   2. Meter: Precision PMM for 2 inch and smaller. If larger than 2 inches, consult Ephraim City. Shall be touch read adaptable.
   3. Meter Barrel: High density polyethylene, white, or approved equal.
   4. Meter Ring and Lid: Cast iron with words “WATER METER” cast on lid.

E. Fittings: Bronze.

2.5 ACCESSORIES

A. Thrust Restraint Devices:
   1. Concrete Thrust Blocks: Class B or B (AE) concrete in accordance with Section 11.
      Mechanical Restrained Joints:
      a. Pipe: Bell and spigot joint restraint harness or clamp. Rated at pressure class of pipe or greater.
      b. Pipe Fittings: Mechanical joint with restrained follower gland. Rated at pressure class of pipe or greater. Megalug as manufactured by EBAA Iron Sales, Inc. or approved equal.

B. BEDDING:
   1. Excavated materials consisting of earth, loam, sandy clay, sand, and gravel which are free from clods of earth, rocks larger than 1.5 inch, frozen material, organic material and debris.
   2. Imported bedding consisting of pit run gravel, crushed rock, or sand with 1.5 inch maximum size gradation.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify location, depth, material, and size of existing water lines.

B. Trenching shall be in accordance with Section 4. Hand trim excavation for accurate placement of pipe.

C. Remove large rocks or other hard matter which could damage pipe or impede installation.
3.2 INSTALLATION

A. Install pipe and fittings in accordance with manufacturer’s recommendations. Seal joints watertight. Route pipe in straight line.

B. Set valve on solid bearing. Center and plumb valve box over valve. Set top of valve box flush with finished grade. When within improved roadway, construct concrete collar at finish grade of valve box.

C. Set fire hydrant on solid bearing and plumb. Locate pumper nozzle perpendicular to and facing roadway. Install valve next to fire hydrant and place valve box to finish grade. Provide drainage rock around fire hydrant drain.

D. Install service line and connect to water main and copper setter. Install meter on City side of property line. Install meter barrel plumb and lid flush with finish ground.

E. Install thrust restrain devices at any change of pipe direction, fittings and fire hydrant. Install mechanical restrained joints in accordance with manufacturer’s recommendations. Thrust restraints shall be one of following methods:
   1. Install mechanical joint restraint on all joints of fitting and install concrete thrust block, or
   2. Install mechanical joint restraint on all joints of fitting and install restraint harness or clamp on pipe joints for required length.

F. If excavated material is unsuitable for bedding, import granular bedding. Place bedding at sides and over pipe in layers not exceeding 6 inches compacted depth. Place bedding to minimum compacted thickness of 12 inches above top of pipe.

G. Compact bedding to 96 percent of maximum laboratory density. Maintain moisture content of bedding material within plus or minus 2 percent of optimum to attain required density.

3.3 WATER PIPING DISINFECTION

A. After completing pressure testing, flush pipe to remove dirt or other foreign objects.

B. Add liquid chlorine or liquid calcium hypochlorite to pipe to obtain 50 ppm concentration of chlorine. Maintain 25 ppm chlorine residual at the end of 24 hours. Disinfection procedures shall comply with Utah State Rules for Public Drinking Water Systems, Part II, and AWWA C651.
C. Flush chlorinated water from pipe. Dispose of discharged chlorinated water in acceptable manner and in conformance with rules of Utah Water Quality Board (See R317 of Administrative Code).

3.4 TESTING

A. Pressure Test: Test water mains at lesser of 200 psi or pressure rating of pipe. Test shall be witnessed by representative of Ephraim City.
   1. Fill pipe with water and place under slight pressure for at least 48 hours.
   2. Bring pipe pressure to test pressure and maintain for 4 hours minimum.
   3. Provide accurate means for measuring quantity of water needed to maintain test pressure on pipe for test period.
   4. If volume of water added to pipe is 10 gallons per inch of pipe diameter per mile of pipe per 24 hours or less, pipe passes test.
   5. If pipe does not pass test, find source of leakage, repair or replace, and retest. Repeat until pipe passes test.

B. Bacteriological Test: After flushing chlorinated water from water lines, take sample for bacteriological test. If necessary, re-chlorinate until satisfactory bacteriological test is obtained. Do not put piping into service until test results are satisfactory.

C. Bedding Soil Proctor: One per each significant soil type encountered as necessary to provide density testing. Determine maximum laboratory density in accordance with AASHTO T180, Method D for A-1 soils and AASHTO T99, Method D for other soils.

D. Bedding Density: Perform with nuclear gage in accordance with ASTM D2922.
   1. Frequency: One random test per 500 linear feet of trench.
   2. Acceptance: Average daily density is 96 percent or greater. Reject single tests less than 92 percent.
   3. If tests are not acceptable, recompact and retest.

3.5 PROTECTION

A. Protect pipe from damage or displacement.

B. Prevent mud, silt, gravel, and other foreign materials from entering pipe and keep off joint surfaces.

C. Install plug in pipe end when pipe laying is not in progress.

END OF SECTION
SECTION 6

SANITARY SEWER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for sanitary sewer pipe, fittings, accessories and bedding.

B. Cleaning and testing requirements for sanitary sewer pipe.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   2. AASHTO T99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-in. (305 mm) Drop.
   3. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. American Society of Testing and Materials (ASTM):
   1. ASTM D1248 - Polyethylene Plastics Molding & Extrusion Materials.
   3. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
   4. ASTM D2321 - Underground Installation of Flexible Thermoplastic Sewer Pipe.
   6. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   7. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   8. ASTM F477 - Elastomeric Seals (Gaskets) for joining plastic pipe.

C. UNI-BELL PVC Pipe Association (UNI-B):
   1. UNI-B-6 - Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

D. RELATED SECTIONS:
   1. Section 4 – Trenching.
1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe to 12 inches above top of pipe, prior to subsequent backfill operations.

B. Soil Classification: As determined in accordance with AASHTO M145.

1.4 SUBMITTALS

A. Test Results: Submit one copy of proctor, bedding density, pressure and deflection test results.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of Utah Department of Environmental Quality.

1.6 DELIVERY STORAGE AND HANDLING

A. Unload, stockpile and install pipe by mechanical equipment or by hand using method that will not damage pipe. Stockpile in units or crates as shipped. Do not allow pipe to fall to ground or in trench.

PART 2 PRODUCTS

2.1 PIPE

A. PVC Gravity Sewer Pipe:
   1. ASTM D3034.
   2. PVC material conforming to ASTM D1784.
   3. Minimum pipe stiffness of 46 psi according to ASTM D2412.
   4. SDR of 35.
   5. Joints: Bell and spigot style with elastomeric gaskets conforming to ASTM F477.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.2 ACCESSORIES

A. Bedding:
   1. Excavated materials consisting of earth, loam, sandy clay, sand, and gravel which are free from clods of earth, rocks larger than 1.5 inch, frozen material, organic material and debris.
2. Imported bedding consisting of pit run gravel, crushed rock, or sand with 1.5 inch maximum size gradation.

**PART 3 EXECUTION**

**3.1 PREPARATION**

A. Verify Location, depth, material, and size of existing sanitary sewer lines.

B. Trenching shall be in accordance with Section 4. Hand trim excavations to required elevations.

C. Remove large rocks or other hard matter which could damage pipe or impede installation.

**3.2 INSTALLATION**

A. Install pipe, fittings, and accessories in accordance with ASTM D2321 and manufacturer's instructions. Seal joints watertight.

B. Install gravity sewer pipe using laser equipment. Lay pipe at constant slope between manholes.

C. Install cleanout plumb. Install top of cleanout flush with finish ground surface.

D. If excavated material is unsuitable for bedding, import granular bedding. Place bedding at sides and over top of pipe in lifts not exceeding 6 inches compacted depth. Place bedding to minimum compacted thickness of 12 inches above top of pipe.

E. Compact bedding to 96 percent of maximum laboratory density. Maintain optimum moisture content to attain required density.

F. Flush sewer pipe clean with water or other approved method. Prevent dirt and debris from entering existing sewer lines in service. Remove dirt and debris from pipe.

**3.3 TOLERANCES**

A. Pipe Invert: Plus or minus 0.04 feet. Level or reverse gradients not permitted. Minimum slopes shall be as required by Utah Department of Environmental Quality.

B. Moisture Content of Bedding: Plus or minus 2 percent of optimum.
3.4 TESTING

1. Bedding Soil Proctor: One per each significant soil type encountered as necessary to provide density testing. Determine maximum laboratory density in accordance with AASHTO T180, Method D for A-1 soils and AASHTO T99, Method D for other soils.

2. Bedding Density: Perform with nuclear gage in accordance with ASTM D2922.
   1. Frequency: One random test per 500 linear feet of trench.
   2. Acceptance: Average daily density is 96 percent or greater. Reject single tests less than 92 percent.
   3. If tests are not acceptable, re-compact and retest.

3. Low Pressure Air Test: Perform in accordance with UNI-B-6.
   1. Perform on each section of main pipe line and service pipe line between manholes.
   2. Perform after sewer line has been backfilled and cleaned.
   3. Cap and brace all wyes, tees, and lateral stubs to withstand test pressures.
   4. Plug pipe in manholes or at ends of pipe.
   5. Use accurate gauge to measure internal gauge pressure in tenths of pounds per square inch. Test pressures are measured as gauge pressure.
   6. Determine required time for test for sewer line based on length and size of pipe shown in Table 6-1.
   7. Before starting air test, determine groundwater level. If groundwater level is below sewer pipe invert, perform test at air pressure indicated in subparagraphs 8, 9, & 10. If groundwater level is above sewer pipe invert, increase air pressure for test. Calculate required air pressure for test as follows:
      a. Determine average vertical height in feet of groundwater above sewer pipe invert.
      b. Divide vertical height by 2.31. Result is air pressure correction in pounds per square inch.
      c. Add air pressure correction to normal starting pressure of 3.5 pounds per square inch to determine air pressure for test.
      d. Do not exceed 9 pounds per square inch for starting test pressure.
   8. Slowly introduce low pressure air into pipe until internal air pressure reaches 4.0 pounds per square inch.
   9. After constant pressure of 4.0 pounds per square inch is reached, throttle air supply for at least 2 minutes to allow air temperature to equalize.
   10. When temperature has equalized and pressure has stabilized at 4.0 pounds per square inch or any convenient pressure between 4.0 to 3.5 pounds per square inch, start timing with stop watch.
   11. Record drop in pressure for test period.
   12. If pressure drop is 0.5 pound per square inch or less during test period, sewer line passes test.
13. If pressure drop is greater than 0.5 pound per square inch during test period, sewer line fails test. Find source of leakage, repair or replace, and retest. Repeat test until sewer line passes test.

### TABLE 6-1
MINIMUM SPECIFIED TIME REQUIRED FOR 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015 cf/min/sf

<table>
<thead>
<tr>
<th>Pipe Length</th>
<th>Nominal Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4&quot;</td>
</tr>
<tr>
<td>50</td>
<td>1:53</td>
</tr>
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<td>75</td>
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<tr>
<td>375</td>
<td>1:53</td>
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<tr>
<td>450</td>
<td>1:53</td>
</tr>
<tr>
<td>600</td>
<td>1:53</td>
</tr>
</tbody>
</table>
4. Deflection Test:
   1. Test main sewer pipe lines by one of following methods:
      a. Deflectometer which produces continuous record of pipe deflection.
      b. Mandrel go/no-go device with diameter set at 95 percent of nominal pipe diameter.
   2. No mechanical pulling devices permitted.
   3. Complete test after backfill has been in place for minimum of 14 days.
   4. If ring deflection is 5 percent or less of pipe diameter, sewer pipe passes test.
   5. If ring deflection is greater than 5 percent of pipe diameter, sewer pipe fails test. Relay or replace pipe and retest after 30 day period. Repeat test until pipe passes test.

5. Closed Circuit TV Inspection:
   1. Ephraim City reserves right to visually inspect interior of sewer pipe mains using television camera following deflection test and prior to one year warranty.
   2. Correct defects found by inspection.
   3. Ephraim City will pay costs for initial TV inspection. Additional TV inspections required because of defects shall be paid by Developer.

3.5 PROTECTION

A. Protect pipe from damage or displacement.

B. Prevent mud, silt, gravel and other foreign materials from entering pipe and keep off joint surfaces.

C. Install plug in pipe end when pipe laying is not in progress.

END OF SECTION
SECTION 7

MANHOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast concrete manholes, frame and cover and accessories.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A48 - Gray Iron Castings.
   2. ASTM C361 - Reinforced Concrete Low Head Pressure Pipe.
   4. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
   5. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

B. Related Sections:
   1. Section 4 - Trenching.
   2. Section 11 - Cast-in-Place Concrete.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478.
   1. Precast reinforced concrete base with invert channels and pipe openings monolithic-poured.
   2. Concentric with eccentric cone top section.
   4. Watertight joints with pre-lubricated rubber gaskets conforming to ASTM C361 and C443.
   5. Inside Diameter: 4 feet minimum.

B. Steps: Fiberglass or steel encased in copolymer polypropylene, placed inside manhole with 12 inch vertical spacing.
C. Manhole Frame and Cover: Conform to ASTM A48, Class 30B Cast Iron.
   1. H-20 traffic load bearing.
   2. Machined flat bearing surface.
   3. Removable lid with word "SEWER" cast on top.
   4. Use vented cover unless approved otherwise.
   5. D&L Supply Model A-1180 or approved equal.

D. Rubber Boot Couplers: Conform to ASTM C923 and have stainless steel pipe clamp.

E. Grade Rings: Reinforced precast concrete in accordance with ASTM C478.

F. Granular Base: Granular material, well graded with 1/4 inch minimum to 1 inch maximum size aggregate, 8" depth.

G. Dust Pan: Non-corrosive, durable material.

H. Grout: Nonshrinkage and high strength.

I. Concrete Collar: Class AA (AE) reinforced concrete in accordance with Section 11.

PART 3 EXECUTION

3.1 PREPARATION

A. Trenching shall be in accordance with Section 4.

3.2 INSTALLATION

A. Place and compact granular base to 96 percent of maximum laboratory density.

B. Place manhole sections plumb, level, and to correct elevation. Install rubber gaskets at manhole joints. Install manhole watertight.

C. Install pipe in rubber boot coupler and secure with adjustable pipe clamp. Seal joints watertight.

D. Install grade rings as required. Use no more than 2 grade rings to establish finish grade elevation. Grout grade ring joints.

E. Set frame and cover flush to match finish grade elevation. When within improved roadway, construct concrete collar at finish grade of manhole frame and cover.
3.3 TOLERANCES

A. Manhole Invert Elevation: Plus or minus 0.04 feet from required elevation.

END OF SECTION
SECTION 8

DRAINAGE/IRRIGATION

PART 1  GENERAL

1.1 SECTION INCLUDES

A. Requirements for pipe culverts, fittings, structures and accessories for drainage or irrigation purposes.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M36 - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Under drains.
   3. AASHTO T99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-in. (305 mm) Drop.
   4. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. American Society for Testing and Materials (ASTM):
   1. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. Related Sections:
   1. Section 4 - Trenching.
   2. Section 11 - Cast-in-Place Concrete.

1.3 DEFINITIONS:

A. Bedding: Fill placed under, beside, and directly over pipe to 12 inches above top of pipe, prior to subsequent backfill operations.

B. Soil Classification: As determined in accordance with AASHTO M145.

1.4 SUBMITTALS

A. Test Results: Submit one copy of concrete, proctor and bedding density test results.
PART 2 PRODUCTS

2.1 PIPE

A. Corrugated Steel Pipe and Pipe-Arch: AASHTO M36, nominal size indicated on drawings, minimum 16 gage.

B. Coupling Bands: Galvanized steel, with two neoprene "O" ring gaskets, galvanized steel bolts, watertight.

C. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in configurations required.

D. Bedding:
   1. Excavated material consists of earth, loam, sandy clay, sand, and gravel which are free from clods of earth, rocks larger than 1.5 inch, frozen material, organic material and debris.
   2. Imported bedding consisting of pit-run gravel, crushed rock, or sand with 1.5 inch maximum size.

2.2 STRUCTURES

A. Concrete: Class AA (AE) in accordance with Section 11 or pre-cast reinforced concrete.

B. Reinforcing Steel: In accordance with Section 11.

C. Granular Base: Crushed rock, 1 inch maximum size.


PART 3 EXECUTION

3.1 PREPARATION

A. Verify location and elevation of improvements.

B. Trenching shall be in accordance with Section 4. Hand trim excavation for accurate placement.

C. Remove large rocks or other hard matter which could damage pipe or structures.
3.2 INSTALLATION

A. Install pipe and fittings in accordance with manufacturer's instructions. Install pipe starting at downstream end. Secure joints water tight.

B. Place and compact granular base for structure. Form and place cast-in-place concrete structure or place precast concrete structure.

C. After structure has sufficient strength, place backfill around structure.


3.3 TESTING

A. Bedding Soil Proctor: One per each significant soil type encountered as necessary to provide density testing. Determine maximum laboratory density in accordance with AASHTO T180, Method D for A-1 soils and AASHTO T99, Method D for other soils.

B. Bedding Density: Perform with nuclear gage in accordance with ASTM D2922.
   1. Frequency: One random test per 500 linear feet of trench.
   2. Acceptance: Average daily density is 96 percent or greater. Reject single tests less than 92 percent.
   3. If tests are not acceptable, re-compact and retest.

C. Concrete: In accordance with Section 11.

3.4 PROTECTION

A. Protect pipe and structures from damage or displacement.

END OF SECTION
SECTION 9

UNTREATED BASE COURSE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Untreated base course.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T11 - Amount of Material Finer Than 0.075 mm Sieve in Aggregate.
   2. AASHTO T19 - Unit Weight and Voids in Aggregate.
   3. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates.
   4. AASHTO T90 - Determining the Plastic Limit and Plasticity Index of Soils.
   5. AASHTO T96 - Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
   6. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in. (457mm) Drop.

B. American Society for Testing and Materials (ASTM):
   1. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. Related Sections:
   1. Section 13 - Concrete Curb, Gutter and Flatwork.

1.3 DEFINITIONS

A. Mean of Deviations: Sum of absolute values of deviations from job-mix gradation divided by number of samples.

B. Lot: One day’s production.
1.4 SUBMITTALS

A. Prior to Production:
   1. Identification of Aggregate Source.
      a. New Source: Submit results of tests required in Article 2.1 of this Section.
      b. Previously Approved Source: Submit evidence that source has been approved by Utah Department of Transportation.

   2. Job-Mix Gradation: Submit gradation indicating single values within band for each sieve size shown on Table 9-1.

B. Changes to Job-Mix Gradation: Submit in writing prior to start of day’s production. Changes are subject to approval. Retroactive changes are allowed only for first day’s production.

C. Test Results: Submit one copy of proctor, density and gradation test results.

1.5 QUALITY ASSURANCE

A. Obtain materials from same source throughout.

PART 2 PRODUCTS

2.1 MATERIALS

A. Untreated Base Course: Natural gravel, crushed rock or crushed slag meeting following requirements:
   1. Aggregate Passing No. 40 Sieve: AASHTO T90, non-plastic.
   2. Wear: AASHTO T96, not exceed 50 percent.
   3. Dry-Rodded Unit Weight: AASHTO T19, not less than 75 pounds per cubic foot.
   4. Gradation: AASHTO T27 & T11, 3/4 or 1 inch maximum per Table 9-1.

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<tr>
<th>Sieve Size</th>
<th>Percent Passing of Total Aggregate (Dry Weight)</th>
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<tbody>
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<tr>
<td>1 inch</td>
<td>-</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>100</td>
</tr>
<tr>
<td>½ inch</td>
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</tr>
<tr>
<td>3/8 inch</td>
<td>78-92</td>
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<td>No. 16</td>
<td>28-38</td>
</tr>
<tr>
<td>No. 200</td>
<td>7-11</td>
</tr>
</tbody>
</table>

Table 9-1

Gradation Limits
PART 3 EXECUTION

3.1 PREPARATION

A. Correct irregularities in subgrade gradient and elevation by scarifying, reshaping, and recompacting.

B. Do not place untreated base course on soft, muddy, or frozen surfaces.

C. Do not place untreated base course until subgrade is accepted.

3.2 AGGREGATE PLACEMENT

A. Spread untreated base course over prepared subgrade.

B. Maintain optimum moisture content of untreated base course. If excess water is apparent, aerate to reduce moisture content. If too dry, add water and mix uniformly.

C. Place aggregate in maximum 6 inch compacted layers.

D. If untreated base course is placed in successive layers, do not place next layer until previous layer has been tested and accepted.

E. Level and contour surfaces to require elevations and gradients.

F. Compact with self-propelled compaction equipment. Use hand-operated compaction equipment in areas inaccessible to self-propelled compaction equipment.

3.3 TOLERANCES

A. Moisture Content: Plus or minus 2 percent of optimum.

B. Compacted Thickness: Plus or minus ¼ inch. If thickness exceeds tolerance, remove excess material and re-compact. If thickness is less than tolerance, scarify, add material, and recompact.
C. Surface Smoothness: Plus or minus 3/8 inch measured with 10 foot straight edge or string line or string line.

D. Gradation: In accordance with Table 9-2.

<table>
<thead>
<tr>
<th>Table 9-2</th>
<th>TOLERANCE LIMITS FOR GRADATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
<td>MEAN OF DEVIATIONS FROM JOB-MIX GRADATION</td>
</tr>
<tr>
<td></td>
<td>1 Sample</td>
</tr>
<tr>
<td>½ inch and larger</td>
<td>0-15</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>0-15</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-14</td>
</tr>
<tr>
<td>No. 16</td>
<td>0-11</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-4.5</td>
</tr>
</tbody>
</table>

3.4 TESTING

A. Proctor: One per job-mix gradation. Determined maximum laboratory density in accordance with AASHTO T180, Method D.

B. Density: Perform with nuclear gage in accordance with ASTM D2922.

1. Frequency: Minimum of 1 random test for each sub lot of 1,500 square yards.
   a. Roadway: Take minimum of 1 random test for each sub lot of 1,500 square yards.
   b. Curb and Gutter and Flatwork: Take minimum of 1 random test for each 500 linear feet.
2. Acceptance: Average density is 96 percent or greater for each lot. Reject sub lot tests less than 92 percent.
3. If tests are not acceptable, recompact, and retest.

C. Gradation: Perform in accordance with AASHTO T27 and T11.

1. Frequency: Random samples from window or on grade prior to compaction in accordance with Table 9-3.
2. Acceptance: Mean of deviation for each sieve size meets tolerances indicated in Table 9-2 for each lot.
3. If tests indicate material exceeds tolerances, remove and replace untreated base course or blend with additional untreated base course to meet tolerances.
<table>
<thead>
<tr>
<th>Lot (tons)</th>
<th>Minimum No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 2,500</td>
<td>4</td>
</tr>
<tr>
<td>1,500 to 2,500</td>
<td>3</td>
</tr>
<tr>
<td>Less than 1,500</td>
<td>2</td>
</tr>
</tbody>
</table>

### 3.5 PROTECTION

A. Maintain untreated base course until surface course is placed.

**END OF SECTION**
SECTION 10

ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for asphalt concrete pavement.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M140 - Emulsified Asphalt.
   2. AASHTO M226 - Viscosity Graded Asphalt Cement.
   3. AASHTO M303 - Lime for Asphalt Mixtures.
   4. AASHTO T19 - Unit Weight and Voids in Aggregate.
   5. AASHTO T90 - Determining the Plastic Limit and Plasticity Index of Soils.
   7. AASHTO T104 - Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
   8. AASHTO T176 - Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

B. The Asphalt Institute (TAI):
   1. TAI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

C. Utah Department of Transportation Test Procedures (UDOT):
   1. UDOT 8-946 - Extraction of Bitumen from Paving Mixtures Using a Vacuum Extractor.
   2. UDOT 8-947 - Sieve Analysis of Extracted Aggregate.

1.3 DEFINITIONS

A. Mean of Deviations: Sum of absolute values of deviations from mix design divided by number of samples in lot.

B. Lot: One day's production.
1.4  SUBMITTALS

A. Aggregate Source: If not previously UDOT approved, submit test results showing aggregate meets requirements of Article 2.1 paragraph A.3.

B. Mix Design: Submit at least 10 days before paving begins.
   1. Include all test data used to develop mix design.
   2. Indicate single value for percentage of aggregate passing each sieve and asphalt cement content.
   3. Submit changes in writing prior to production.

C. Test Results: Submit one copy of density, gradation, and asphalt content test results.

1.5  QUALITY ASSURANCE

A. Obtain materials from same source throughout.

1.6  ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt concrete pavement when ambient air or base surface temperature in shade is less than 50 degrees F.

B. Do not place asphalt concrete pavement when base has free surface water or is over saturated.

C. Do not place asphalt concrete pavement during adverse weather conditions such as rain or fog.

PART 2 PRODUCTS

2.1  MATERIALS

A. Asphalt Concrete Pavement:
   1. Asphalt Cement: AC10 in accordance with AASHTO M226, Table 2.
   2. Hydrated Lime: AASHTO M303, use minimum 1% of dry weight of aggregate.
      a. Chemical Limits:
         1) Hydrated Alkalinity: Minimum 90 percent by weight CaCOH2.
         2) Hydrated Lime Content: Maximum 7 percent by weight CaO.
         3) Free Water Content: Maximum 3 percent by weight.
      b. Physical Requirements:
         1) Residue Retained on No. 30 Sieve: Maximum 2 percent by weight.
         2) Residue Retained on No. 200 Sieve: Maximum 12 percent by weight.
3. Aggregate: Natural gravel, crushed rock, or slag with uniform density and quality. Gradation per Table 10-1.
   a. Course Aggregate: Clean, hard, durable, and sound fragments free from organic matter or other detrimental substances.
      1) Retained on No. 4 sieve.
      2) All Rounded Particles: Maximum 50 percent by weight.
   b. Fine Aggregate: Clean, hard grained, and angular.
      1) Pass No. 4 sieve.
      2) Non-plastic in accordance with AASHTO T90.
      3) Vegetable Matter or Other Detrimental Substances: Maximum 2 percent by weight.
      4) Dry-Rodded Unit Weight: AASHTO T19, minimum 75 pounds per cubic foot.
      5) Wear: AASHTO T96, maximum 40 percent.
      6) Weight Loss: AASHTO T104, maximum 16 percent by weight when subjected to five cycles of sodium sulfate.
      7) Sand Equivalent: AASHTO T176, minimum 40.

<table>
<thead>
<tr>
<th>Table 10-1</th>
<th>GRADATION LIMITS FOR MIX DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
<td>Percent of Total Aggregate (Dry Weight)</td>
</tr>
<tr>
<td>½ inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>60-80</td>
</tr>
<tr>
<td>No. 16</td>
<td>28-42</td>
</tr>
<tr>
<td>No. 50</td>
<td>11-23</td>
</tr>
<tr>
<td>No. 200</td>
<td>5-9</td>
</tr>
</tbody>
</table>

B. Tack Coat: AASHTO M140, grade SS-1 emulsified asphalt.

2.2 EQUIPMENT

A. Asphalt Paver: Use self-propelled paver with screed unit.

B. Rollers: Use rubber tire and steel drum self-propelled rollers in sufficient number to keep up with paver. Use release agent other than diesel.

2.3 MIXES

A. Develop mix design in accordance with TAI MS-2, Marshall Method.
   1. Determine optimum asphalt content by test data curves.
   2. Use test samples containing 0.5 percent increments of asphalt content.
   3. Include minimum of 2 test samples above and below optimum asphalt content.
B. Mix Design Requirements:
   2. Flow (0.01 inch): 10 to 18.
   3. Air Voids: 3 to 5 percent.
   5. Index of Retained Strength: Minimum 75 percent.
   6. Dry Stability: Minimum 200 pounds per square inch.

C. If material source changes, develop new mix design prior to using new materials.

D. Mix materials at central mixing plant. Use shortest mixing time needed to uniformly coat aggregate. Do not use material improperly mixed.

E. Adjust production at mixing plant and delivery to maintain steady paving speed.

PART 3 EXECUTION

3.1 PREPARATION

A. Do not place asphalt concrete pavement until base course has been accepted.

B. Locate and reference utility covers prior to paving operations.

C. Remove dirt, sand, leaves, and other objectionable materials from prepared surfaces.

D. Prime coat is not required, but may be used.

3.2 PREPARATION - TACK COAT

A. Clean contact surface of materials that prevent tack coat from bonding.

B. Apply tack coat to contact surfaces of curbs, gutters, cross gutters, existing pavement, previously placed pavement and other surfaces. Apply tack coat to all pavement joints. Apply tack coat with pressure distributor at uniform rate of 0.15 gallons per square yard.

C. Cover surfaces of manholes, valve boxes, and other utility boxes to prevent bond with asphalt pavement. Do not tack coat these surfaces.

D. Apply tack coat same day pavement is placed.

3.3 PLACING ASPHALT PAVEMENT

A. Place asphalt pavement at temperature between 250 and 325 degrees F with self-propelled laydown machine. Adjust paver speed to match plant production and delivery for continuous paving operation.
B. Pave full-width where possible. If more than one pass is required, leave straight, vertical edge adjacent to next lane to be paved. Compact each pass and apply tack coat to longitudinal edge before placing adjacent pass.

C. Compact pavement by rolling to 96 percent of Marshall density. Do not displace or extrude pavement from position. Use hand-operated compaction equipment in areas inaccessible to self-propelled compaction equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks. Do not allow rollers to pass over unprotected end of freshly placed pavement. Bevel end of pavement subjected to traffic.

E. Where pavement is placed in more than one layer, offset joints:
   1. Longitudinal Joints: Offset 6 to 12 inches.
   2. Transverse Joints: Offset minimum 6 feet.

F. Hand rake only when necessary around obstacles.

3.4 TOLERANCES

A. Smoothness: Maximum variation of 1/4 inch measured longitudinally, transversely, and at construction joints with 10 foot straight edge.
   1. If more than one layer is placed, applies only to top layer.
   2. Correct depressions or humps exceeding tolerances.

B. Compacted Thickness: Not more than 1/2 inch greater nor 3/8 inch less than thickness indicated on Drawings.
   1. Engineer may allow excess thickness to remain in place without payment or may require removal. If removal is required, remove and replace entire depth of asphalt concrete pavement.
   2. If thickness is deficient, add minimum thickness of 1 inch asphalt concrete pavement.

C. Gradation: In accordance with Table 10-2.

D. Asphalt Content: In accordance with Table 10-3.

3.5 TESTING

A. Gradation and Asphalt Content: Perform tests in accordance with UDOT 8-946 and 8-947.
   1. Frequency: Random samples immediately behind paver before compaction in accordance with Table 10-2.
   2. Acceptance: Mean of deviation for each sieve size and asphalt content meets tolerances indicated in Table 10-3 and 10-4 for each lot.
   3. If tests indicate materials exceed tolerances, remove and replace asphalt concrete pavement.
Table 10-2
GRADATION & ASPHALT CONTENT SAMPLING

<table>
<thead>
<tr>
<th>Lot (tons)</th>
<th>Minimum No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 2,500</td>
<td>4</td>
</tr>
<tr>
<td>1,500 to 2,500</td>
<td>3</td>
</tr>
<tr>
<td>Less than 1,500</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 10-3
TOLERANCE LIMITS FOR GRADATION

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Mean of Deviations from Mix Design</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Sample</td>
</tr>
<tr>
<td>½ Inch and Larger</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-9</td>
</tr>
<tr>
<td>No. 16</td>
<td>0-7</td>
</tr>
<tr>
<td>No. 50</td>
<td>0-6</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-3</td>
</tr>
</tbody>
</table>

Table 10-4
TOLERANCE LIMITS FOR ASPHALT CONTENT

<table>
<thead>
<tr>
<th>Mean of Deviations from Mix Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sample</td>
</tr>
<tr>
<td>0-0.7</td>
</tr>
</tbody>
</table>

B. Density: Perform with nuclear gage or take core samples.
   1. Frequency: Take minimum of 1 random test for each sub lot of 1,500 square yards.
   2. Acceptance: Average density is 96 percent or greater for each lot. Reject sub lot tests less than 92 percent.
   3. If tests are not acceptable, re-compact and retest. If necessary, remove and replace asphalt concrete pavement.

3.6 PROTECTION

A. Protect curb and gutter, structures, and other objects from being spattered or marred by tack coat or prime coat. Do not damage curb and gutter with rollers.

B. Immediately after placement, protect pavement from traffic until surface temperature is less than 140 degrees F. Prevent traffic from crossing vertical edge of pavement.

END OF SECTION
SECTION 11

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for formwork, reinforcing steel and accessories for cast-in-place concrete.

B. Requirements for mixing, testing, concrete placement and curing for cast-in-place concrete.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M6 - Fine Aggregate for Portland Cement Concrete.
   2. AASHTO M80 - Coarse Aggregate for Portland Cement Concrete.
   3. AASHTO M85 - Portland Cement.
   4. AASHTO M154 - Air-Entraining Admixtures for Concrete.
   5. AASHTO M157 - Ready-Mixed Concrete.
   6. AASHTO M194 - Chemical Admixtures for Concrete.
   7. AASHTO T22 - Compressive Strength of Cylindrical Concrete Specimens.
   8. AASHTO T23 - Making and Curing Concrete Test Specimens in the Field.
   9. AASHTO T119 - Slump of Portland Cement Concrete.
  10. AASHTO T152 - Air Content of Freshly Mixed Concrete by the Pressure Method.

B. American Concrete Institute (ACI):
   1. ACI 305R - Hot Weather Concreting.
   2. ACI 306R - Cold Weather Concreting.
   3. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. American Society for Testing and Materials (ASTM):
   1. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
   2. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
   3. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

D. Related Sections:
   1. Section 5 - Culinary Water.
   2. Section 7 - Manholes.
   3. Section 8 - Drainage/Irrigation.
1.3 SUBMITTALS

A. Mix Design: Submit mix design and information based on batch test results to verify mix design strength at least 5 days prior to placement of concrete.

B. Delivery Ticket: When requested by Ephraim City, furnish delivery ticket for each load of concrete delivered to site with information as follows:

1. Name of batch plant.
2. Name of Contractor and project.
3. Class of concrete and type of cement.
4. Time and date of batching.
5. Cubic yards of concrete.
6. Weights of cement and each size of aggregate.
7. Amount of water added at plant.
8. Amount of any additional water added.

C. Test Results: Submit one copy of air, slump, and strength test results.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. Procure cement and aggregate from same source for all work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cement protected from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Conform to ACI 305R when concreting during hot weather.

B. Conform to ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: AASHTO M85, Type II, low alkali, Portland type.
B. Coarse Aggregate:
   1. AASHTO M80 as modified herein.
   2. Use gradation per Table 11-1.
   3. Do not allow material passing No. 200 sieve to exceed 1.75 percent by weight of combined coarse and fine aggregate.
   4. Do not exceed percentages of deleterious substances per Table 11-2.

   **TABLE 11-1**
   Gradation - Coarse Aggregate

<table>
<thead>
<tr>
<th>Course Aggregate</th>
<th>2 ½&quot;</th>
<th>2&quot;</th>
<th>1 ½&quot;</th>
<th>1&quot;</th>
<th>3/4&quot;</th>
<th>½&quot;</th>
<th>3/8&quot;</th>
<th>No. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; to No. 4</td>
<td>100</td>
<td>95-100</td>
<td>35-70</td>
<td>10-30</td>
<td>0-5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ½&quot; to No. 4</td>
<td>100</td>
<td>95-100</td>
<td>35-70</td>
<td>10-30</td>
<td>0-5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot; to No. 4</td>
<td>100</td>
<td>95-100</td>
<td>25-60</td>
<td>0-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4&quot; to No. 4</td>
<td>100</td>
<td>90-100</td>
<td>20-55</td>
<td>0-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   **TABLE 11-2**
   Deleterious Substances - Coarse Aggregate

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percent (by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft fragments</td>
<td>2.0</td>
</tr>
<tr>
<td>Coal and lignite</td>
<td>0.3</td>
</tr>
<tr>
<td>Clay lumps</td>
<td>0.3</td>
</tr>
<tr>
<td>Other deleterious substances</td>
<td>2.0</td>
</tr>
</tbody>
</table>

C. Fine Aggregate:
   1. AASHTO M6 as modified herein.
   2. Use gradation per Table 11-3.
   3. Do not allow material passing No. 200 sieve to exceed 1.75 percent by weight of combined coarse and fine aggregate.
   4. Do not exceed percentages of deleterious substances per Table 11-4.

   **TABLE 11-3**
   Gradation - Fine Aggregate

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing (by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>95-100</td>
</tr>
<tr>
<td>No. 16</td>
<td>45-80</td>
</tr>
<tr>
<td>No. 50</td>
<td>10-30</td>
</tr>
<tr>
<td>No. 100</td>
<td>2-10</td>
</tr>
</tbody>
</table>
Table 11-4
Deleterious Substances - Fine Aggregate

<table>
<thead>
<tr>
<th>Substances</th>
<th>Percent (by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay lumps</td>
<td>0.5</td>
</tr>
<tr>
<td>Coal and lignite</td>
<td>0.3</td>
</tr>
<tr>
<td>Other Deleterious Substances</td>
<td>2.0</td>
</tr>
</tbody>
</table>

D. Water: Potable.

2.2 ADMIXTURES

A. Air Entrainment: AASHTO M154 including Section 5.

B. Water Reducers: AASHTO M194, Type A and Type D. Obtain approval prior to use.

C. Fly Ash: Obtain approval prior to use.

D. Calcium Chloride: Do not use.

2.3 ACCESSORIES

A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

B. Curing Compound: ASTM C309, contain pigment or dyes.

2.4 FORM MATERIALS

A. Forms: Be suitable material, type, size, shape, quality, and strength to ensure construction as designed. Earth forms are not permitted.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.

2.5 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars; unfinished or epoxy coated. Bars shall be free of rust, scales, flakes, or other bond-reducing coatings.

B. Stirrup Steel: ASTM A82, unfinished.

C. Tie Wire: Minimum 16 gage annealed type.

D. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
2.6 **CONCRETE MIX**

A. Determine mix design with required proportions of cement, aggregate, admixtures, and water.

B. Provide concrete per Table 11-5:

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Coarse Aggregate Size (inches)</th>
<th>Maximum Water/Cement (Gal/Sack)</th>
<th>Minimum Cement Content (Sacks/C. Y.)</th>
<th>Slump (inches)</th>
<th>Air Content (Percent)</th>
<th>Mix Design Compress Strength (PSI)</th>
<th>28 Day Minimum Compress Strength (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA(AE)</td>
<td>2&quot; to No. 4</td>
<td>5.0</td>
<td>6.0</td>
<td>1-3.5</td>
<td>5.0-7.5</td>
<td>5210</td>
<td>3650</td>
</tr>
<tr>
<td></td>
<td>1 ½&quot; to No. 4</td>
<td>5.0</td>
<td>6.0</td>
<td>1-3.5</td>
<td>5.0-7.5</td>
<td>5210</td>
<td>3650</td>
</tr>
<tr>
<td></td>
<td>1&quot; to No. 4</td>
<td>5.0</td>
<td>6.5</td>
<td>1-3.5</td>
<td>5.0-7.5</td>
<td>5210</td>
<td>3650</td>
</tr>
<tr>
<td></td>
<td>3/4&quot; to No. 4</td>
<td>5.0</td>
<td>6.5</td>
<td>1-3.5</td>
<td>5.0-7.5</td>
<td>5210</td>
<td>3650</td>
</tr>
<tr>
<td>A or A(AE)</td>
<td>1 ½&quot; to No. 4</td>
<td>6.0</td>
<td>5.0</td>
<td>1-3.5</td>
<td>4.5-7.5</td>
<td>3910</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>1&quot; to No. 4</td>
<td>6.0</td>
<td>5.0</td>
<td>1-3.5</td>
<td>4.5-7.5</td>
<td>3910</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>3/4&quot; to No. 4</td>
<td>5.5</td>
<td>5.25</td>
<td>1-3.5</td>
<td>4.5-7.5</td>
<td>3910</td>
<td>3000</td>
</tr>
<tr>
<td>B or B(AE)</td>
<td>7.0</td>
<td>4.0</td>
<td>2-5</td>
<td>3.0-6.0</td>
<td>3260</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>C or C(AE)</td>
<td>8.0</td>
<td>4.0</td>
<td>2-5</td>
<td>3.0-6.0</td>
<td>2610</td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

(AE) = Air-Entrainment

C. Maximum size of coarse aggregate:
   1. Not larger than 1/5 of narrowest dimension between sides of forms.
   2. Not larger than 1/3 depth of slabs.
   3. Not larger than 3/4 of minimum clear distance between reinforcing bars or between bars and forms, whichever is least.

D. Mix and deliver concrete in accordance with AASHTO M157.
PART 3 EXECUTION

3.1 ERECTION OF FORMWORK

A. Verify lines, levels and centers before proceeding with formwork.

B. Erect, brace and tie forms. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Align joints and make watertight. Keep form joints to minimum.

D. Provide formed openings where required. Provide temporary openings in formwork where required to facilitate cleaning and inspection.

E. Apply form release agent on formwork in accordance with manufacturer’s recommendations. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.2 PLACEMENT OF REINFORCEMENT AND EMBEDDED PARTS

A. Verify requirements for concrete cover over reinforcement.

B. Accurately place anchors, seats, plates, reinforcement and other items to be cast into concrete. Securely positioned to not allow movement or displacement.

3.3 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer’s instructions.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

C. Keep concrete subgrade firm and free from water. If concrete subgrade is dry, dampen with water prior to placing concrete.

D. Keep materials concrete is to come in contact with free from frost.
3.4 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify Ephraim City minimum 24 hours prior to placing concrete.

C. Ensure reinforcement, inserts and embedded parts are not disturbed during concrete placement.

D. Place concrete continuously between predetermined expansion, control, and construction joints.

E. Do not interrupt successive placement; do not permit cold joints to occur.

F. After concrete has been conveyed from mixer, do not add water. Adding water to placed concrete will be cause for rejection.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Spray exposed concrete surfaces with concrete curing compound after free water has disappeared. Apply at rate recommended by manufacturer.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surface scheduled for exposure to view.

C. Clean forms to remove foreign matter. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
3.7 TESTING

A. Take minimum of 1 random test for each 50 cubic yards or fraction thereof placed per day:
   2. Air Test: AASHTO T152.
   3. Strength Test: AASHTO T22 and T23, cast 3 cylinders for each test. Test cylinders after 28 days. Strength will be average of 3 cylinders.

B. Tests shall meet requirements of Table 11-5.

C. If slump test does not meet specification, repeat test on same load. Concrete will be accepted if second test meets specification. Concrete will be rejected and removed from site if second test does not meet specification.

D. If air test does not meet specification, repeat test on same load. Concrete will be accepted if second test meets specification. Concrete will be rejected and removed from site if second test does not meet specification.

E. If strength test does not meet specification, Ephraim City may reject concrete and require removal.

3.8 PATCHING

A. Allow inspection of concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Ephraim City upon discovery. Patch imperfections.

3.9 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replace defective concrete.

END OF SECTION
SECTION 12

FLOWABLE FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flowable fill for bedding in utility trenches.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials: (AASHTO):
   1. AASHTO M85 - Portland Cement.
   2. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C618 - Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a 
      Mineral Admixture in Portland Cement Concrete.

C. Related Sections:
   1. Section 4 - Trenching.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: AASHTO M85, Portland Cement, Type I or II.

B. Fly Ash: ASTM C618, Class F, except maximum 3 percent loss on ignition.

C. Fine Aggregate:
   1. Use natural sand.
   2. Gradation: AASHTO T27, in accordance with Table 12-1.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 3/4</td>
<td>100</td>
</tr>
<tr>
<td>No. 100</td>
<td>0-10</td>
</tr>
</tbody>
</table>
2.2 MIXES

A. Mix Design:
   1. 28 Day Compressive Strength: 50 to 150 psi.
   2. Portland Cement: Minimum 50 pounds per cubic yard.
   3. Fly Ash: Minimum 300 pounds per cubic yard.

PART 3 EXECUTION

3.1 PLACEMENT

A. Use flowable fill for backfill in utility trenches when trench is within existing roadway.

B. Place flowable fill minimum of 8 inches on each side of utility.

3.2 PROTECTION

A. Do not damage or displace utility during placement of flowable fill.

B. Do not permit vehicular traffic for minimum of 24 hours after placement.

END OF SECTION
SECTION 13

CONCRETE CURB, GUTTER, AND FLATWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for concrete curb and gutter, cross gutter, sidewalk, curb ramp, and driveway.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M213 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

B. Related Sections:
   1. Section 3 - Earthwork.
   2. Section 9 - Untreated Base Course.
   3. Section 11 - Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Concrete Flatwork: Includes sidewalks, driveways, and curb ramps.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, base has free surface water, or base is saturated.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Class AA (AE) in accordance with Section 11.

B. Curing Compound: In accordance with Section 11.

C. Reinforcing Steel: In accordance with Section 11.

E. **Base:**
   1. Curb and Gutter and Cross Gutter: Untreated base course in accordance with Section 9.
   2. Concrete Flatwork: Pea gravel with 3/8 inch maximum gradation or untreated base course in accordance with Section 9.

**PART 3 EXECUTION**

### 3.1 PREPARATION

A. Prepare subgrade in accordance with Section 3.

B. Place and compact base material. For untreated base course, compact in accordance with Section 9. For pea gravel, proof roll with compaction equipment.

C. Verify gradients and elevations of base are correct.

### 3.2 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

D. Slip form curb and gutter machine will be accepted.

E. Place reinforcing steel at required locations.

### 3.3 PLACING CONCRETE

A. Notify Ephraim City minimum 24 hours prior to placing concrete.

B. Moisten base to minimize absorption of water from fresh concrete.

C. Place concrete continuously between predetermined construction joints in accordance with Section 11.

D. Slope concrete uniformly to drain without bird baths.

E. Spray exposed concrete with curing compound in accordance with Section 11.
3.4 JOINTS

A. Curb and Gutter and Cross Gutter:
   1. Control Joints: Score or saw cut at 10 feet on center.
   2. Expansion Joints: Place premolded joint filler at 50 feet on center and at beginning and ending of curb returns at intersections. When concrete is placed with slip form curb and gutter machine, place at beginning and end of each continuous run.

B. Flatwork:
   1. Control Joints: Score or saw cut at 5 feet on center.
   2. Expansion Joints: Place premolded joint filler at 50 feet on center and at beginning and ending of curb returns at intersections.

C. When curb and gutter and sidewalk are back to back, align joints.

3.5 FINISHING

A. Round edges.

B. Remove marks or irregularities from finish surface.

C. Provide light broom finish.
   1. Flatwork: Finish transverse to traffic.
   2. Curb and Gutter and Cross Gutter: Finish parallel to flow line.

3.6 BACKFILLING

A. After concrete has cured sufficiently to prevent damage, place and compact backfill.

3.7 TOLERANCES

A. Maximum Variation of Surface Smoothness: 1/4 inch in 10 feet.

3.8 TESTING

A. Subgrade: In accordance with Section 3.

B. Untreated Base Course: In accordance with Section 9.

C. Concrete: In accordance with Section 11.
3.9 Protection

A. Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, mechanical injury and defacing.

B. Do not permit vehicular traffic over or operate compaction equipment near concrete for at least 7 days after placement.

END OF SECTION
SECTION 14

STREET MONUMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for street monuments.

1.2 REFERENCES

A. Related Sections:
   1. Section 11 - Cast-in-Place Concrete.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete: Class AA (AE) in accordance with Section 11.

B. Monument Post: Bass, D&L Supply Model K-9085 or approved equal.

C. Monument Cover and Frame: Cast iron, D&L Supply Model K-6313 or approved equal.

D. Rock: 1 inch maximum size material.

PART 3 EXECUTION

3.1 PREPARATION

A. Measure location of street monument from reference points.

B. Construct street monument after pavement has been placed to finish grade.

3.2 CONSTRUCTION

A. Remove asphalt concrete pavement to 24 inches diameter around street monument location.
B. Excavate as necessary to install street monument.

C. Install monument post in concrete and mark location of point.

D. Backfill with rock as needed. Set monument cover and frame centered over monument post and flush with pavement surface.

E. Place and consolidate concrete. Match pavement surface and monument elevation.

3.3 TOLERANCES

A. Cover Elevation: Plus or minus 1/8 inch of finish grade.

3.4 PROTECTION

A. Protect concrete from damage until sufficient strength is obtained to support traffic loads.

END OF SECTION
SECTION 15

STREET AND TRAFFIC SIGNS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for street and traffic signs.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A570 - Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
   2. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 DEFINITIONS

A. Substrate: Base material upon which background sheeting is attached. Substrate is aluminum as indicated.

B. Sheet: Material comprising background, legend, border, and symbols. Sheet is reflective or non-reflective as indicated.

C. Panel: Assembly consisting of substrate and attached sheeting. Several panels may be necessary to complete one sign.
   1. Type A-1 - Non-reflective legend, symbols, and borders.
   2. Type A-2 - Reflective legend, symbols, and borders.

D. Sign: Complete assembly comprised of post, frame, and panel.
PART 2 PRODUCTS

2.1 SIGN POST

A. Steel Post: ASTM A570, Grade 50, 2 inch by 2 inch square tube, 14 gauge, with pre-cut holes.
   1. Finish: ASTM A653, G90, galvanized followed by conversion coating and clear organic polymer top coat.

B. Anchor Post: One size larger than sign post, 12 gauge, 30 inch minimum length.

2.2 SUBSTATE

A. Aluminum: 0.08 inch thick in accordance with ASTM B209 Alloy 5052-H38.

2.3 SHEETING

A. Reflective Sheeting: Encapsulated lens sheeting in accordance with Standard Specifications for Construction of Road and Bridges on Federal Highway Projects FP-85, Type III A.

B. Non-reflective Sheeting: In accordance with Military Specification MIL-M 43719B Type I, Class 1.

2.4 ACCESSORIES

A. Fasteners:
   1. Panel to Post: Drive rivet with washer.
   2. Post to Anchor: Cad-plated corner bolt.

PART 3 EXECUTION

3.1 INSTALLATION

A. Securely fasten panel to post.

B. Drive anchor post into ground. Attach sign post to anchor post. Install in accordance with manufacturer’s recommendations.

C. Install sign at proper elevation and orientation.

3.2 PROTECTION

A. Protect sign from damage. If damaged, replace sign.

END OF SECTION
SECTION 16

ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for construction of power systems.

B. Requirements for streetlights and yard lights.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T90 - Determining the Plastic Limit and Plasticity Index of Soils.

B. National Electric Code (NEC).

C. Related Sections:
   1. Section 4 - Trenching.
   2. Section 11 - Cast-in-Place Concrete.

D. Underwriters Laboratories, Inc. (UL).

1.3 ELECTRICAL SERVICE REQUIREMENTS

A. Electric Service Agreement: For electrical service in Ephraim City, complete and sign
   Ephraim City’s standard electric service agreement. Provide required information including
   amount of load, voltage, phase and purpose service will be used. In absence of signed
   agreement, acceptance of electric service will be deemed as constituting acceptance of
   Ephraim City Electrical Department regulations. Large industrial and commercial customers
   will be required to meet special requirements established by Ephraim City.

B. Any proposed change in existing meter, service locations, or conditions must be approved
   by Ephraim City Electrical Department, or service may be disconnected.
1.4 CUSTOMER SERVICE FACILITIES REQUIREMENTS

A. Meters will not be permitted in areas as follows:
   1. Locations not readily accessible.
   2. Locations hazardous to Ephraim City personnel.
   3. Surfaces subject to excessive vibration.
   4. Elevated or depressed areas not having access by ramp or clear stairway of normal tread and use conforming to building code requirements.
   5. Substation areas or transformer vaults.
   6. Common areas with dog.

B. Provide approved meter socket having proper terminal arrangement and capacity to adequately handle service requirements.

C. Extend building wiring from meter socket to service attachment.

D. Provide adequate and substantial means for Ephraim City Electrical Department to attach appropriate service line equipment to building.

E. For service attachments, provide minimum clearance of 10 feet above ground level or above other areas where people could come in contact with electrical lines.

F. Provide ample space around meter attachment to permit unobstructed area for meter installation and maintenance.

G. Provide 3 inch minimum space between each meter socket and between meter socket and other equipment.

H. Ephraim City will furnish meter and metering equipment. Developer shall furnish all equipment on load side of building service attachment.

I. Provide adequate and proper protective equipment to protect against over load, over or under voltage or phase failure. Ephraim City takes reasonable precaution to prevent such conditions, but does not guarantee such conditions will not occur.

J. Provide switch or other approved disconnecting device. Install disconnecting device on load side of meter to control energy registered by meter.
1.5    URD CABLE REQUIREMENTS

A. Size of cable for residential distribution systems shall be in accordance with Table 16-1.

<table>
<thead>
<tr>
<th>Load Per Cable</th>
<th>Neutral Wire Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 300 KVA</td>
<td># 2</td>
</tr>
<tr>
<td>300 KVA to 600 KVA</td>
<td>#1/0</td>
</tr>
<tr>
<td>Greater than 600 KVA</td>
<td>#4/0*</td>
</tr>
</tbody>
</table>

*Note: If connected loads exceed 600 KVA per cable, use backbone-feeder system. Divide connected load by either #2 or #1/0 feeders. Tap feeders off backbone in 200 ampere rated fused device. Do not use unfused taps off backbone system.

B. When connected load exceeds 115 KVA, loop feeder circuits for residential areas. For each #2 cable, loads shall not exceed 300 connected KVA per leg or 600 KVA per loop. For each #1/0 cable, loads shall not exceed 600 connected KVA per leg or 1200 connected KVA per loop.

C. When projects are built in phases, establish loop feeds as load limits are met. In areas where subsequent phases might be delayed, close loop with temporary tie and abandon temporary tie as subsequent phases are developed.

D. For fuse coordination and other special problems encountered, contact Ephraim City.

1.6    STREETLIGHT REQUIREMENTS

A. Streetlights shall be installed by Ephraim City in all new subdivisions and projects at Developer’s expense. Pay total cost of streetlights prior to installation.

B. Ephraim City will install streetlights in existing subdivisions or at specific projects at appropriate fee.

C. Existing subdivisions with non-standard streetlights may continue to install non-standard streetlights if luminaries are high pressure sodium lamps and approval is given by Ephraim City. Non-standard streetlights will require approved contract with Ephraim City and homeowner’s association or similar party. Contract will require streetlights to be maintained by homeowner’s association or similar party.
1.7  YARD LIGHT REQUIREMENTS

A. Where existing power and pole are available, yard light will be installed by Ephraim City on existing pole for appropriate fee determined by Ephraim City.

B. Where existing power and pole are not available, customer will be required to pay actual cost of installing yard light.

C. Ephraim City will be responsible to repair or replace yard light and customer will be responsible to notify Ephraim City when yard light is not functioning properly. Monthly maintenance charges will be subject to adjustment by mutual written agreement between Ephraim City and customer.

1.8  REGULATORY REQUIREMENTS

A. All materials, equipment, and workmanship shall conform to requirements of current edition of National Electrical Code. Where conflicts occur, these Construction Standards and local regulations shall govern.

B. Products: Listed and classified by Underwriters Laboratories, Inc.

PART 2 PRODUCTS

2.1  COMPONENTS

A. Streetlight Pole:
   1. Round aluminum or galvanized steel with single arm. Square poles and arms when approved by Ephraim City.
   2. Designed to withstand 100 mile per hour winds.
   3. Have access hole at or near base for access to wiring.
   4. Arms shall be 2.75” outside diameter (2 inch pipe) and have luminaire mount.
   5. Meet requirements of Table 16-2

<table>
<thead>
<tr>
<th>Table 16-2 Streetlight Standards</th>
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<tr>
<td>Asphalt Width (feet)</td>
</tr>
<tr>
<td>Under 45</td>
</tr>
<tr>
<td>Over 45</td>
</tr>
</tbody>
</table>
B. Streetlight Luminaries: 120 volt, high pressure sodium lamps with photo control, Crouse-Hinds OVM Swing-Down Roadway Lighting or approved equal. For more aesthetic look, Crouse-Hinds RCL successor cutoff luminaire or approved equal may be used where asphalt width is 35 feet.

C. Vaults: Approved enclosure or room above or below ground with installed equipment. Include cable or duct entrance, draw bolts, ground rods, vents and related hardware. Train and rack all cables for clear working space.

D. Manholes: Approved enclosure below ground with installed equipment. Include cable or duct entrance, draw bolts, ground rods, vents and related hardware. Train and rack all cables for clear working space.

E. Pull or Splice Boxes: Approved precast boxes for electrical below ground use with no equipment, except cable and splices. Do not install facilities for operating cables, such as elbows.

F. Transformer and Equipment Pads: Concrete unless otherwise approved by Ephraim City.

G. Concrete: In accordance with Section 11.

H. Sand Bedding: Well graded granular material with rounded to sub-rounded particles.
   1. Gradation: In accordance with Table 16-3.
   2. No open-graded material such as pea gravel.
   3. Non-plastic in accordance with AASHTO T90.

| Table 16-3: Gradation for Sand Bedding |
|-----------------------------|--------------------------|
| Sieve Size     | Percent of Total Aggregate (Dry Weight) |
| 3/8 inch       | 100                       |
| No. 200        | 0-20                      |

PART 3 EXECUTION

3.1 PREPARATION

A. When power system is installed along back lot lines, do not begin until rough grading has been completed to establish permanent ground elevation.

B. When power system is installed along front lot lines, do not begin until water, sewer, curb and gutter, and street light footings are completed.
3.2 **CONSTRUCTION**

A. Trenching shall be in accordance with Section 4.

B. Where soil conditions require bedding material, use sand bedding above and below direct buried cable or conduit. Place sand bedding minimum depth of 4 inches below and 8 inches above cable or conduit. Place and compact sand bedding in two lifts.

C. Install wiring with correct color coding standards and tagging.

3.3 **ELECTRICAL CONNECTION**

A. Only authorized employees of Ephraim City’s Electrical Department will be permitted to connect or disconnect electrical service to or from Ephraim City electric lines.

B. Ephraim City’s Electrical Department will seal all meters and enclosures for meters, metering equipment and service entrance equipment on line side of meter. Do not break seal. Do not tamper or interfere in any with meter or connections placed by Ephraim City.

3.4 **INSPECTION**

A. No work shall be embedded in concrete, backfilled, or otherwise covered or concealed until inspected by Ephraim City Electrical Department.

END OF SECTION
# STANDARD DRAWINGS

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>TITLE</th>
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<td>TYPICAL STREET SECTION</td>
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<td>R2</td>
<td>TYPE B1 CURB &amp; GUTTER</td>
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<td>R3</td>
<td>TYPE B2 CURB &amp; GUTTER</td>
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<td>R4</td>
<td>CURB &amp; GUTTER TAPERED END DETAIL</td>
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<td>CONCRETE CROSS CUTTER</td>
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<td>TYPICAL CONCRETE JOINTS</td>
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<td>R10</td>
<td>PAVEMENT EDGE DETAIL &amp; TYPICAL EXPANSION JOINT AROUND OBJECTS</td>
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<tr>
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<td>R16</td>
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<tr>
<td>R17</td>
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<tr>
<td>R18</td>
<td>SIGN &amp; POST DETAIL</td>
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<tr>
<td>R19</td>
<td>RECOMMENDED TURNAROUNDS</td>
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<tr>
<td>S1</td>
<td>SEWER MANHOLE DETAIL</td>
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<tr>
<td>S2</td>
<td>DROP SEWER MANHOLE DETAIL</td>
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<td>S3</td>
<td>MANHOLE CONCRETE COLLAR</td>
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<td>SEWER SERVICE CONNECTION DETAIL</td>
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<td>SEWER CLEANOUT DETAIL</td>
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<td>W1</td>
<td>FIRE HYDRANT DETAIL</td>
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<td>W5</td>
<td>THRUST BLOCK CONDITIONS</td>
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<td>W6</td>
<td>THRUST BLOCK BEARING AREA AND NOTES</td>
</tr>
<tr>
<td>W7</td>
<td>TYPICAL RESTRAINED JOINTS</td>
</tr>
</tbody>
</table>
TYPICAL STREET SECTION

6" MIN. U.B.C.

2-1/2" MIN. A.C.
PAVEMENT

CURB & GUTTER.

CURB & GUTTER.

SEE STD. DWG. NO. R6.

SEE STD. DWG. NO. R6.

SIDEWALK

SIDEWALK

W/2

W/2

2.5'

2.5'

5.0' MIN.

5.0' MIN.

2 %

2 %

2.5'

2.5'

5.0' MIN.

5.0' MIN.

5.0' MIN.

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5.0' MIN.

5.0' MIN.

5.0' MIN.

5.0' MIN.

5.0' MIN.
STANDARD CURB

DRIVE DEPRESSION CURB

TYPE B1 CURB & GUTTER

NOTE: SEE TYPICAL CONCRETE JOINTS ON STD. DWG. NO. R9
3" MIN. UNTREATED BASE COURSE,

STANDARD CURB

3" MIN. UNTREATED BASE COURSE,

DRIVE DEPRESSION CURB

TYPE B2 CURB & GUTTER

NOTE: SEE TYPICAL CONCRETE JOINTS ON STD. DWG. NO. R9
CURB & GUTTER
TAPERED END DETAIL
CONCRETE CROSS GUTTER

NOTE: SEE TYPICAL CONCRETE JOINTS
ON STD. DWG. NO. R9

SECTION A-A

8" THICK CONCRETE
3" UNTREATED BASE COURSE

(6) EQUALLY SPACED #4 BARS, CONTINUOUS.

TACK COAT REQ'D, TYP.
CONCRETE SIDEWALK

NOTES: 1. AT DRIVEWAYS, CONSTRUCT 6" DEPTH CONCRETE SLAB
2. SEE TYPICAL CONCRETE JOINTS ON STD. DWG. NO. R9
3. CURB & GUTTER AND SIDEWALK MAY BE PLACED MONOLITHICLY.
SECTION A-A

4" DEPTH CONCRETE SLAB.

FLOWLINE OF GUTTER (NO LIP)

PEA GRAVEL OR U.B.C.

CONSTRUCT EXPANSION JOINT AT INTERSECTIONS. SEE DETAIL ON STD. DWG. NO. R9

SIDEWALK

5' MIN.

SIDEWALK

5' MIN.

EDGE OF GUTTER

4' MIN.

EDGE OF GUTTER

CURB RAMP DETAIL

REVISION DATE

STD. DWG. NO. R8

Jones & DeMille Engineering
45 East 500 North - Richfield, Utah
Voice (435) 896-8266
Fax (435) 896-8268

EPhraim City
Road Standards

1/99
CONTROL JOINT

SAW CUT OR SCORE.

EXPANSION JOINT

SEALANT

PREFORMED JOINT FILLER.

TYPICAL CONCRETE JOINTS

NOTE: USE FOR CURB & GUTTER, CROSS GUTTER, AND SIDEWALK.
PAVEMENT EDGE DETAIL

TYPICAL EXPANSION JOINT AROUND OBJECTS

NOTE: SEE EXPANSION JOINT DETAIL ON STD. DWG. NO. R9

STD. DWG. NO. R10
CATCH BASIN

NOTES:
1. PLACE REINFORCING STEEL IN CENTER OF CONCRETE.

REVISION DATE

STD. DWG. NO. R11
SECTION A—A

3'-0" SQUARE

6" 2'-0" SQUARE 6"

A.C. PAVEMENT

SQUARE FRAME & COVER
D & L SUPPLY MODEL H-9077
OR APPROVED EQUAL

4" MIN.

8" VARES

#4 BARS @ 12" O.C.
BOTH WAYS. PLACE IN
CENTER OF SLAB

6" DEPTH
ROCK BASE

CONCRETE STRUCTURE

SQUARE FRAME & COVER
D & L SUPPLY MODEL H-9077
OR APPROVED EQUAL

PLAN

JUNCTION BOX

PIPE CULVERTS
AS REQ'D

A

A

REVISION DATE

STD. DWG. NO. R12

Jones & DeMille Engineering
45 East 500 North – Richfield, Utah
Voice (435) 896-8266
Fax (435) 896-8288

EPHRAIM CITY
ROAD STANDARDS
UTILITY TRENCH DETAIL

CLASS "D" BACKFILL

SEE ROADWAY REPAIR DETAIL ON STD. DWG. NO. 15.

90% DENSITY REQ'D FOR BACKFILL COMPACTION.

SLOPE VARIES TO MEET O.S.H.A. REQUIREMENTS AND SOIL CONDITIONS.

96% DENSITY REQ'D FOR BACKFILL COMPACTION.

96% COMPACTED BEDDING MATERIAL IN 6" LIFTS.

MAXIMUM ALLOWABLE WATER LEVEL DURING CONSTRUCTION.

CLASS "B" BACKFILL

4'-0" MIN. FOR WATER

1'

PIECE O.D.

6'

VARIATION

4'-0" MIN. FOR WATER

1'

PIECE O.D.

6'

VARIATION
NOTES:

1. **DO NOT PLACE NEW PAVEMENT OR PERMIT VEHICULAR TRAFFIC OVER TRENCH FOR AT LEAST 24 HOURS AFTER PLACING FLOWABLE FILL.**

2. **IF NEW PAVEMENT SURFACE WILL NOT BE PLACED WITHIN 7 DAYS AFTER TRENCHING, BACKFILL WITH FLOWABLE TO MATCH ELEVATION OF EXISTING PAVEMENT. REMOVE FLOWABLE FILL AS REQUIRED TO PLACE NEW PAVEMENT.**

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**UTILITY TRENCH WITH FLOWABLE FILL**
ROADWAY REPAIR DETAIL

CLASS "A"

CLASS "B" BACKFILL
SEE TRENCH DETAIL.
STD. DWG. NO. R13

BEDDING

CLASS "C"

GRAVEL

ASPHALT CONCRETE PAVEMENT.
EQUAL TO ADJACENT SURFACE
THICKNESS BUT NOT LESS THAN 2 1/2".

6" DEPTH U.B.C.

2 1/2" MIN.
STREET MONUMENT DETAIL
NOTES:
1. LOCATE CULINARY WATER & SANITARY SEWER LINES ON OPPOSITES SIDES OF STREET
2. LOCATE WATER VALVES IN LINE WITH PROPERTY LINES.

TYPICAL SIGN

SIDEWALK

12'-16'

4'

S S S S S S S

MANHOLE

S S S S S S S

STREET MONUMENT

W W W W W W

WATER VALVE

W W W W W W

WATER VALVE

WATER LINE

SIDEWALK

CURB RAMP (TYP.)

NOTE:
R=25' COLLECTOR & MAJOR STREETS
R=15' ON OTHER STREETS.

STREET INTERSECTION
AND UTILITY LOCATION DETAIL

STD. DWG. NO. R17

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EPHRAM CITY
ROAD STANDARDS

1/99
TYPICAL CURB & SIDEWALK INSTALLATION

TYPICAL RURAL INSTALLATION

NOTE:
SIGNS SHALL BE IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

SIGN & POST DETAIL

STD. DWG. NO. R18
60' HAMMERHEAD

120' HAMMERHEAD

ACCEPTABLE ALTERNATE TO 120' HAMMERHEAD

96' CUL-DE-SAC

70' CUL-DE-SAC

ACCEPTABLE ALTERNATE TO 120' HAMMERHEAD

RECOMMENDED TURNAROUNDS
SEWER MANHOLE DETAIL

HEAVY DUTY MANHOLE FRAME AND COVER.

DUST COVER.

GRADE RINGS.

PRECAST REINFORCED CONCRETE ECCENTRIC MANHOLE CONE.

ALL MANHOLES SHALL BE WATERTIGHT. USE GASKET JOINTS.

PRECAST REINFORCED CONCRETE MANHOLE SECTION WITH STEPS.

RUBBER BOOT COUPLER.

CONCRETE FILLETS WITH MIN. 2" SLOPE. TROWEL SMOOTH.

PRECAST CONCRETE BASE.

GRANULAR BASE.

STEPS @ 12" C.C.

2'-0" MIN.

4'-0"

12" TYP.

8" TYP.

STD. DWG. NO. S1
DROP SEWER MANHOLE DETAIL

CONCRETE FILLETS WITH MIN. 2" SLOPE, TROWEL SMOOTH.

12" TYP.

8" TYP.

PRECAST CONCRETE BASE.

HEAVY DUTY MANHOLE FRAME AND COVER.

DUST COVER.

GRADE RINGS.

PRECAST REINFORCED CONCRETE ECCENTRIC MANHOLE CONE.

STEPS @ 12" C.C.

MIN.

4' - 0"

ALL MANHOLES SHALL BE WATERTIGHT, USE GASKET JOINTS.

CONCRETE REQ'D UNDER PIPE FOR SUPPORT.

45° WYE.

45° BEND.

90° BEND.

HATCHED AREA TO BE SEPARATELY INSTALLED THRUST BLOCK. DROP MANHOLE PIPE FITTINGS TO BE CONNECTED IN PLACE BEFORE POURING CONCRETE THRUST BLOCK.

RUBBER BOOT COUPLER.

PIPE SPACE SECTION TO FIT.
MANHOLE CONCRETE COLLAR

NOTE: 1. USE GRADE RINGS AS NECESSARY TO ARRIVE AT REQ'D FINISH GRADE.
SEWER SERVICE CONNECTION DETAIL

SLOPE

SEWER MAIN.

SERVICE CONNECTION.

PROPERTY LINE.

INSTALL CLEANOUT ON CITY PROPERTY.

4'-0"

GASKETED SADDLE, WYE OR TEE.

BEND AS REQ'D, VARIES 20' TO 70'.

2.00% MIN. SLOPE

COMPACTED BEDDING AROUND PIPE.
SEWER CLEANOUT DETAIL

GROUND SURFACE

DEEPTH VARIES

SLOPE TO SEWER MAIN

PLUG.

CLEANOUT.

45° BEND.

45° WYE.

SEWER PIPE.

PLUG
FIRE HYDRANT DETAIL

HYDRANT TIE RODS OR OTHER APPROVED RESTRAINTS MAY BE USED AS ALTERNATE TO CONCRETE THRUST BLOCKS.

6" DIA. PIPE.

TEE CONNECTED TO MAIN LINE.

THRUPT BLOCK.

6" GATE VALVE.

4 CU. FT. CRUSHED ROCK, 1" MAX.

PUMPER NOZZLE.

FIRE HYDRANT

LID.

VALVE BOX.

GROUND LINE

12" MIN.

BACKFILL MATERIAL.

THRUPT BLOCK.
GATE VALVE DETAIL

CONCRETE COLLAR

VALVE BOX.

GATE VALVE

PIPE

CONCRETE THRUST BLOCK
TO BE USED ON VALVES
12" DIA. & LARGER.

(8) #4 BARS, 12" LONG

3" MIN.

24" DIA.

CONCRETE COLLAR

LID.

24" DIA.

STD. DWG. NO. W2
CAST IRON LID WITH WORDS "WATER METER" CAST IN LID.

EXIST. GROUND

CAST IRON RING.

COPPER SETTER

SHUTOFF VALVE.

FLOW

20" MIN. DIA. x 36" LONG METER BARREL

DUAL CHECK VALVE

CONNECT SERVICE LINE TO COPPER SETTER.

METER PLAIN

METER SECTION

METER BOX DETAIL

STD. DWG. NO. W3
WATER SERVICE CONNECTION DETAIL

Gooseneck bend reg'd on service line.

Corporation stop.

Full body saddle reg'd on water line.
THRUST BLOCKS

CONDITION 1

CONDITION 2

VERTICAL BEND DETAIL

#4 BAR BENT AROUND PIPE AND SET IN CONCRETE.

CONDITION 3

CONDITION 4

22.5° BEND.

45° TYP.

CONDITION 5

CONDITION 6

AREA (A) SAME AS CONDITION 1

AREA (B)

CONDITION 7

CONDITION 8

REDUCER THRUST BLOCK

8" x 4" REDUCER - BEARING AREA = 7.5 SQ. FT.
8" x 6" REDUCER - BEARING AREA = 4.4 SQ. FT.
10" x 6" REDUCER - BEARING AREA = 10.0 SQ. FT.
10" x 8" REDUCER - BEARING AREA = 5.6 SQ. FT.
12" x 6" REDUCER - BEARING AREA = 17.0 SQ. FT.
12" x 10" REDUCER - BEARING AREA = 6.9 SQ. FT.

NOTE: SEE STANDARD DRAWING NO. W6 FOR THRUST BLOCK BEARING AREAS.
<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>CONDITION NUMBER &amp; PIPE WORKING PRESSURE</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2&quot;</td>
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<tr>
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<td>10&quot;</td>
<td>15.7</td>
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<tr>
<td>12&quot;</td>
<td>22.6</td>
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*NOTE: BEARING AREAS ARE IN SQUARE FEET. AREA APPLIES TO EACH INDIVIDUAL BLOCK (2 REQ'D).

**NOTES**

1. ALL THRUST BLOCKS SHALL BE POURED WITH BEARING SURFACES AGAINST UNDISTURBED EARTH OR AN APPROVED COMPACTED FILL.
2. CONCRETE SHALL BE 2500 psi OR HIGHER.
3. ALL THRUST BLOCK SIDES SHALL BE FORMED.
4. ALLOWABLE SOIL BEARING PRESSURE ASSUMED TO BE 1000 psi.
5. THE RATIO OF "X" TO "Y" (THRUST BLOCK AREA) SHALL BE NO GREATER THAN 3:1.
6. MINIMUM CURE TIME FOR THRUST BLOCKS IS 3 DAYS PRIOR TO PRESSURIZING SYSTEM.
7. THRUST BLOCKS SHALL NOT INTERFERE WITH NUTS & BOLTS OF FITTINGS.
8. SEE PIPE CONDITIONS ON STD. DWG. NO. W5.
9. INSTALL MECHANICAL JOINT RESTRAINT ON ALL JOINTS OF FITTINGS.
10. APPROVED MECHANICAL RESTRAINED JOINTS MAY BE USED AS ALTERNATE TO CONCRETE THRUST BLOCKS. SEE STD. DWG. NO. W7.
NOTES
1. ALL JOINTS WITHIN DISTANCE “L” SHALL BE RESTRAINED.
2. RESTRAIN JOINTS ON FITTING.
3. DISTANCE REQ'D FOR JOINT RESTRAINTS DEPENDS ON FITTING TYPE, SOIL TYPE AND WORKING PRESSURE.
4. DESIGN CRITERIA:
   a. WORKING PRESSURE: 200 p.s.i.
   b. SAFETY FACTOR: 1.5.
5. DISTANCE REQUIRED FOR JOINT RESTRAINTS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

TYPICAL RESTRAINED JOINTS