SECTION 300
GENERAL CONSTRUCTION SPECIFICATIONS

PART 1 GENERAL

301 MOBILIZATION:

301.01 DESCRIPTION: This work shall consist of the pre-construction conferences, initial contact with property owners, establishing a project office, and moving equipment and materials necessary to start construction of the project onto the construction site.

301.02 MATERIALS: N/A.

301.03 CONSTRUCTION METHODS: N/A.

301.04 SPECIAL REQUIREMENTS:

a. **Pre-Construction Conference:** Prior to starting work on the project, the Contractor will participate in a pre-construction conference called by the Engineering and Construction Department. This conference will be used to coordinate all activities associated with the Contract and introduce all key personnel involved in the project.
b. **Landowner Notification:** Prior to starting work the Contractor will provide the Contract Administrator with a letter certifying that all involved landowners have been contacted.

301.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the lump sum for the project.

301.06 BASIS OF PAYMENT: Mobilization, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon completion of mobilization. When this item is included in a Contract it will be listed as follows:

BA 301 MOBILIZATION LUMP SUM

301.07 STANDARD DRAWINGS: N/A.

302 OPERATIONS MANUALS AND AS-BUILT DRAWINGS:

302.01 DESCRIPTION: This work shall consist of providing required operations manuals and as-built-drawings.

302.02 MATERIALS: Operations manuals will consist of properly indexed, 8-1/2-inch by 11-inch printed material provided in three ring binders and include electronic document files. As-built drawings will consist of one set of Plans with all modifications to the Plans shown in red line. Appropriate notes will be placed on the Plans to explain all red line changes.

302.03 CONSTRUCTION METHODS: N/A.

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302.04 SPECIAL REQUIREMENTS: The Contractor will maintain one set of Plans for the as-built drawings on the construction site at all times. When a deviation to the Plans is required, the Contractor will note the deviation and sign and date the change to the Plans. The Contractor will have the Contract Administrator approve the deviation and sign and date the Plans.

302.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the lump sum for the project.

302.06 BASIS OF PAYMENT: Operations manuals and as-built drawings, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made on the basis of 50 percent upon receipt of the draft manuals and/or Plans and 50 percent upon acceptance of the final manuals and/or Plans. When this item is included in a Contract it will be listed as follows:

BA 302 OPERATIONS MANUALS AND AS-BUILT DRAWINGS LUMP SUM

302.07 STANDARD DRAWINGS: N/A.

310 RIGHT-OF-WAY CLEARING AND RESTORING:

310.01 DESCRIPTION: This work shall consist of the removal and reconstruction or replacement of all obstructions (Obstructions include, but are not limited to trees, brush, fences, retaining walls, patios, trash burners, signs, mail boxes, outbuildings, landscaping, etc.) affected by the construction of the project, with the exception of sidewalk, curb, street, parking lot, road, alley surfaces, gravel and oiled surfaces which will be removed and repaired under Section 315 Pavement Cut and Repair. Any obstructions which are not to be reconstructed are so designated on the Plans. It shall also include compliance with the erosion control plan prepared by the Design Engineer and maintenance of erosion control facilities until final cover is full established on the site. This includes planting and watering of final cover.

310.02 MATERIALS:

a. **Waste Material:** All waste material and debris resulting from the cleaning operation or occurring within the right-of-way shall be disposed of in such a manner that air pollution regulations and solid waste disposal regulations are not violated and private or public property is not injured or endangered. Permission in writing from the property owner must be obtained by the Contractor if waste material is placed on private property. A copy of this permission shall be furnished to the Contract Administrator before the final estimate will be paid. In no case will debris or extra material be left in the right-of-way.

b. **Plant Material to be Replaced:** Shrubs or trees in the right-of way that are to be replaced will be replaced with like type shrubs or trees. When these items are encountered, they shall be removed, preserved, replaced or the Contractor may make arrangements with the property owner to replace them. Grass cover on disturbed sites shall be as stated on the Plans. If the type of grass cover is not specified, it shall be rye in the winter months, fescue in the spring and fall, and Bermuda in the summer. Unless otherwise stated, disturbed areas of front yards will be sodded and side and back yards will be seeded. Arrangements with property owners shall be in writing and the Contract Administrator shall be furnished a copy prior to payment of the final estimate.

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c. **Salvaged Material:** Material such as bricks, signs, manhole frames and covers, etc., which may, in the opinion of the Contract Administrator be suitable for use by the City shall be the property of the City and shall be neatly stacked or removed to such places along the site of the work as the Contract Administrator may direct. This will be done at no additional cost to the City.

310.03 CONSTRUCTION METHODS:

a. **General:** The Contractor shall clear and remove from the construction site all trees marked for removal, brush, roots, stumps, hedges, fences, rock, rubbish, and any other objectionable materials within or over-hanging the right of way as directed by the Contract Administrator.

b. **Clearing:**
   1. Tree Removal/Protection: No trees shall be removed, even though listed for removal until specifically marked by the Contract Administrator. Trees to be removed shall be felled in such a manner as not to injure other trees which are to remain, either on the right-of-way or adjacent thereto. Trees or plants which are to remain in place and which may be in danger of injury by construction operations or equipment shall be suitably boxed, fenced or otherwise protected. Boxing and fencing shall be constructed and removed at the direction of the Contract Administrator. The Contractor shall repair all injuries to bark, trunk limbs, and roots of remaining trees and shrubs by proper dressing, cutting, and painting according to approved methods, using only approved tools and materials.
   2. Obstruction Removal: All obstructions in the designated right-of-way shall be removed and disposed of by the Contractor in a method that is suitable for the obstruction.

c. **Maintaining Access:** Passable surfaces across or along the construction site shall be maintained at all times with gravel, steel mat or plate, or temporary bituminous surfacing material where a sidewalk, driveway, parking lot, street, road, or alley previously existed.

d. **Maintaining Streets:** The Contractor will be responsible for preventing their trucks from scattering debris, mud, and/or soil on public roads. If this occurs the Contractor will clean-up debris as required by the Contract Administrator.

e. **Reconstruction:**
   1. General: All obstructions to be replaced or reconstructed shall be restored to substantially the same condition as existed prior to the construction. The Contractor shall remove and dispose of all debris, restore the surface of the earth to the grade existing prior to construction and upon completion of the work shall leave the site in a neat clean and orderly condition, as nearly as it was prior to construction as may reasonably be done.
   2. Sodding: When the area being worked crosses the front or side yard of an existing residence or commercial establishment, the disturbed area will be sodded upon completion of other restoration activities. When sodding is required in backyards it will be called for on the Plans.
   3. Seeding: This will include seeding all disturbed areas with grass and establishing an initial growth on the seeded areas. During the normal growing season the areas will be seeded with grasses that match the surrounding grasses. During the winter months either rye or winter wheat will be used to establish ground cover.

310.04 SPECIAL REQUIREMENTS:

a. **Notification of Landowners:**
   1. Privately Held Land: It shall be the Contractor's responsibility to notify all landowners prior to entering onto their property. If an owner has an obstruction that will be affected,

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they will be notified sufficiently in advance of construction operations so that they may make such arrangements as they may desire for the protection, removal or relocation of property in advance of construction.

2. Public Owned Land or Utilities: If an obstruction is of public ownership, the Contractor shall notify the appropriate agency, and obtain any necessary permit or license, forty-eight hours before beginning any operations affecting the obstruction. All work shall conform to the current standard and specifications of the agency and shall be approved by the agency before the work is started. At the Contractor's request, the Contract Administrator will furnish information as to what licenses or permits are required.

b. **Clearing Limits:** The Contractor shall limit the clearing operation to not over one mile ahead of the construction operation and shall follow up with restoration immediately after completion of construction.

c. **Protection of Areas Outside of Construction:** Areas outside of the construction area shall be preserved in their natural state. If the Contractor damages an area outside of the construction area, the damage will be repaired to its original condition at no additional cost to the City.

d. **Compliance with Easements:** A copy of all easements associated with this Contract are included in the Special Provisions to the Contract. The Contractor shall take all actions necessary to comply with the requirements of these easements and the cost of this compliance shall be included in this item.

310.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the lump sum for the project.

310.06 BASIS OF PAYMENT: Right-of-way clearing and restoration, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made on the basis of 50 percent upon clearing of right-of-way and 50 percent upon restoration of right-of-way. For pipelines this will be based on the number of linear feet of pipeline completed divided by the total number of linear feet in the project. For all other projects it will be based on the area completed divided by the total area. When this item is included in a Contract it will be listed as follows:

BA 310 RIGHT-OF-WAY CLEARING AND RESTORING LUMP SUM

310.07 STANDARD DRAWINGS: N/A.

311 EXCAVATION:

311.01 DESCRIPTION: This work shall consist of the excavation as shown on the Plans or directed by the Contract Administrator.

311.02 MATERIALS:

a. **Common Excavation:** Common excavation shall consist of all excavation not included as rock excavation.

b. **Rock Excavation:** Rock excavation shall consist of removal of rock which can not be excavated without blasting or the use of special rock teeth, and all boulders or detached stones having a volume of 1.0 cubic yard or more. Any old concrete structures more than 1/2 cubic yard in volume encountered to be removed will be classified as rock excavation. Shales that can be excavated with normal equipment will be classified as common excavation.

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311.03 CONSTRUCTION METHODS:

a. **General:**

1. Execution of The Work: The Contractor shall excavate in accordance with the lines and grades shown on the Plans or given by the Contract Administrator. In carrying out this work, the Contractor will be required to follow the excavation as rapidly as possible with construction and backfilling. The Contract Administrator shall have the right to limit the amount of excavation that can be left open at one time to avoid inconvenience to the public or a safety hazard. All materials excavated shall be placed to interfere as little as possible with public travel and construction activities. Streets must be kept open in every case possible; exceptions are to be made only by approval of the City Manager or designee.
2. Classification of Excavation: Common excavation shall comprise all materials, wet or dry, to be excavated and removed, other than those meeting the definition of rock excavation.
3. Use of Explosives: Where the use of explosives is necessary, the Contractor shall observe all requirements of City Ordinances. All blasting shall be done by experienced personnel to avoid danger to life or property. Blasts shall be covered so that no debris or other material is discharged into the air, proper danger signals given before firing, and then be fired only at such times as may be permitted. The number and sizes of the charges shall be reduced whenever directed and no claims, for loss or delay will be allowed on this account. All explosives to be used shall be subject to the approval of the Director of Engineering and Construction. Where rock is to be excavated near existing pipelines or structures, blasting shall be done with light charges of dynamite as directed by the Director of Engineering and Construction. The Contractor shall take all necessary precautions in the use of explosives and the Contractor shall be liable for any damage resulting from blasting operations.

b. **Trench Excavation:**

1. Trench Shape: Wherever possible, trench excavations shall be made with vertical sides of a width not more than three times the nominal pipe diameter for 12-inch pipe or under. For pipe over 12 inches in diameter, the trench width shall be the width given in the table in 311.05 Method of Measurement. In all cases the trench must have no more than this maximum width and vertical sides from 1 foot above the top of the pipe to the bottom of the trench. Where necessary, trenches will be braced to obtain this result. The bottom of the trench for all types of pipelines shall be carefully and truly graded, formed and aligned according to the grades and directions furnished by the Engineer, and must be approved by the Contract Administrator before any pipe is laid. The trench bottom or bedding material shall be graded to support the pipe joint throughout its entire length. Bell holes shall be cut in the bedding material as required. Bedding requirements for each type of pipe are included in the specifications for the specified pipe.
2. Trench Depth: The contractor shall excavate the pipe trench to grade or 4 inches below grade if bedding is required. If the material at the bottom of the trench is not suitable for supporting the pipe, the Contractor will notify the Contract Administrator. The Contract Administrator will obtain required engineering assistance and provide the Contractor directions on how to proceed.
3. Trench Width: The trench shall be excavated to a width necessary to the proper laying and joining of pipes and to allow for proper tamping around the pipes after laying. Trenches shall not exceed a width of not more than 3 times the nominal pipe diameter

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for 12-inch pipe or under, or that given in the table in 311.05 Method of Measurement for pipe over 12 inches in diameter.

4. Over Excavation: When a trench is excavated below grade at any place, except as shown on the Plans or written instructions from the Contract Administrator, it shall be refilled to grade with bedding materials and thoroughly compacted by tamping, without any extra compensation to the Contractor.
5. Bracing, Shoring, and Dewatering: When necessary, sides of the excavation shall be braced and held secure until the pipe has been laid. The Contractor shall adequately shore, or sheet, and brace the excavation, or shall slope the sides in accordance with the State of Oklahoma Department of Labor requirements. The Contractor will take the necessary actions to dewater the trench during laying of the pipeline. This requirement does not extend to replacement of a gravity sanitary sewer in place. All bracing, draining, well pointing and pumping shall be done at the Contractor's expense.
6. Existing Underground Utilities in the Construction Site: The Plans provide the approximate locations of known underground utilities in the construction site. Before any excavation is started the Contractor will contact "Call OKIE" to have all utilities marked and flagged. Care shall be taken to avoid disturbing or injuring underground pipe and structures which may be encountered in the excavation. The payment for underground utility crossings will be under Section 340 Underground Utility Crossings.
7. Rock Excavation:
   a) General: Every trench in rock shall be fully opened at least 50 feet in advance of the place where pipe is being laid or concrete or masonry work is in progress.
   b) Trench Depth: The rock shall be excavated at least 4 inches below the bottom of the pipe and the trench shall be brought to grade with well compacted bedding material before the pipe is laid. Excavation for bell locations shall be of sufficient depth to provide 4 inches of bedding under the bell.
8. Open Trench: The Contractor shall no have trench open that exceeds the amount of line that can be constructed and backfilled in 2 working days. The Contract Administrator may limit the amount that can be left open for safety reasons.

c. **Excavation Structures:** Excavation for all structures shall be carried down with vertical sides and shall be of such dimensions and depths as to permit the construction of the appurtenances in accordance with the Plans. When necessary, sides of the excavation shall be braced and held secure until the structure has been placed. The Contractor shall adequately shore, or sheet, and brace the excavation, or shall slope the sides in accordance with the State of Oklahoma Department of Labor requirements. The Contractor will take the necessary actions to dewater the excavation during construction of the structure. This requirement does not extend to replacement of a gravity sanitary sewer in place. All bracing, draining, well pointing and pumping shall be done at the Contractor's expense.

311.04 SPECIAL REQUIREMENTS:

a. **Location of Underground Utilities:** The Contractor will notify the Contract Administrator when "Call OKIE" has been notified and excavation will not start until after the utilities have been flagged.

b. **Rock Excavation Notification:** When the Contractor encounters rock that he considers to be covered under the rock excavation payment item, he must notify the Contract Administrator and have the site inspected within 1 hour of encountering the rock. This notification is required for measurement for payment.

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311.05 METHOD OF MEASUREMENT:

a. **Common Excavation (Trench):** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY) as a trench with vertical sides. The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of common excavation to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, from the surface of the original ground to the bottom of the earth trench, including the 4 inches below the bottom of the pipe, if bedding is required, by the authorized trench width. The length of excavation will be measured horizontally along the pipe. The quantity of excavation will be computed by the average end area method in cubic yards.

b. **Rock Excavation (Trench):** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY) as a trench with vertical sides. The authorized width of trench shall be as given in the table in 311.05 e. for the sizes of pipes shown, and the depth of trench will be computed at all times from the top of the rock as determined in the field by the Contract Administrator, at the time of excavation, to 4 inches below the bottom of the pipe. The end areas of rock excavation paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, of rock or shale encountered in the excavation, including the 4 inches below the bottom of the pipe, by the authorized trench width. The volume of excavation will be computed by the average end area method in cubic yards.

c. **Common Excavation (Structure):** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY) as an excavation with vertical sides. Excavation for structures and appurtenances will be measured by multiplying the total authorized vertical depth of earth excavation by the area 1 foot outside the neat lines of the structure.

d. **Rock Excavation (Structure):** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY) as an excavation with vertical sides. Excavation for structures and appurtenances will be measured by multiplying the actual vertical depth of rock excavation, as determined in the field by the Contract Administrator, by the area 1 foot outside the neat lines of the structure.

e. **Trench Width Table:** Except where otherwise specified the width of the trench to be paid for in computing rock excavation shall be that given in the following table, regardless of the type of pipe to be constructed:

Pipe Size Inside Diameter (Inches)	Width of Trench (Inches)
6	30
8	32
10	34
12	36
15	39
18	42
21	45
24	48

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Pipe Size Inside Diameter (Inches)	Width of Trench (Inches)
30	54
36	60

1. The excavation of any rock outside of the width of trench given above and any rock excavated more than 4 inches below the bottom of the pipe will be at the Contractor's own expense.

311.06 BASIS OF PAYMENT: Pipeline and appurtenant structure excavation, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item. When this item is included in a Contract it will be listed as follows:

BA 311A COMMON EXCAVATION (TRENCH)	**CUBIC YARD**
BA 311B ROCK EXCAVATION (TRENCH)	**CUBIC YARD**
BA 311C COMMON EXCAVATION (STRUCTURE)	**CUBIC YARD**
BA 311D ROCK EXCAVATION (STRUCTURE)	**CUBIC YARD**

311.07 STANDARD DRAWINGS: N/A.

312 COMMON BACKFILL AND COMPACTION:

312.01 DESCRIPTION: This work shall consist of the backfill and compaction of excavations as shown on the Plans or directed by the Contract Administrator.

312.02 MATERIALS:

a. **Satisfactory Materials:** Satisfactory materials shall consist of any material classified by ASTM D2487 as GW, GP, GC, GM, SW, SP, SM, SC, CL, and CH.
b. **Select Materials:** Select backfill materials are those materials listed in Materials Specifications 602 Pipe Bedding and 603 Select Backfill.
c. **Unsatisfactory Materials:** Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 3 inches, and materials classified in ASTM D247 as PT, OH, OL, Ml and MH.
d. **Unstable Materials:** Unstable material shall consist of materials too wet to properly support the utility pipe, or appurtenant structure.

312.03 CONSTRUCTION METHODS:

a. **General:** Backfill material shall consist of satisfactory material or select materials as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machine compactors, unless otherwise specified. Unless otherwise specified, each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils.

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b. **Special Note:** Compaction requirements defined below are subject to the following modifications based on requirements of the specific site and Contract. If the natural compaction method on final backfill is used it will be so noted on the Plans and Contract documents.
   1. Initial Backfill (Bedding, Haunching, and Initial Backfill): These standards will be met for construction of water lines, sewer lines, and storm sewers.
   2. Final Backfill: These standards will be met for construction of water lines, sewer lines, storm sewers, and other utility trenches when there is not sufficient time to allow for natural trench settlement before adjacent construction starts or the work is in an area that is already developed. When sufficient time for natural settlement is available, the trench will be backfilled and mounded a minimum of one foot over the trench to allow for settlement. The Contractor will maintain the trench by adding additional fill until it has settled. This process will normally take three or four good rains.

c. **Pipe and Structure Bedding:** When bedding is specified, it will be placed in the required thickness on the bottom of the excavation and compacted in accordance with the appropriate standard drawing. Where required recesses for pipe bells or structures will be cut into the compacted bedding material. The Contractor will establish the method for compaction of bedding and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project.

d. **Pipe Haunching:** Pipe haunching will be placed on the sides of the pipe in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the haunching material reaches the appropriate depth. The Contractor will establish the method for compaction of pipe haunching and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

e. **Initial Pipe Backfill:** Initial pipe backfill will be placed on the sides of the pipe in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the initial pipe backfill reaches the appropriate depth. The Contractor will establish the method for compaction of initial pipe backfill and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

f. **Selected Backfill:** Select backfill will be placed in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the select backfill reaches the appropriate depth. The Contractor will establish the method for compaction of select backfill and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

g. **Final Backfill (Paved Areas):** Final backfill under paved areas will be placed in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the final backfill reaches the appropriate depth. The Contractor will establish the method for compaction of final backfill under paved areas and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

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h. **Final Backfill (Non-paved Areas):** Final backfill under non-paved areas will be placed in layers of appropriate thickness and compacted in accordance with the appropriate standard drawing. The process will be repeated until the final backfill reaches the appropriate depth. The Contractor will establish the method for compaction of final backfill under non-paved areas and have the Public Infrastructure Representative approve of the method. Once the compaction tests have verified the compaction method, it will be used on the remainder of the project or until the material being used changes.

312.04 SPECIAL REQUIREMENTS:

a. **Disposal of Excess, Unsatisfactory, or Unsuitable Material:** The Contractor shall dispose of all excess, unsatisfactory, or unsuitable material shall be disposed of in such a manner that air pollution regulations and solid waste disposal regulations are not violated and private or public property is not injured or endangered. Permission in writing from the property owner must be obtained by the Contractor if excess, unsatisfactory, or unsuitable material is placed on private property. A copy of this permission shall be furnished to the Contract Administrator before the final estimate will be paid. In no case will excess, unsatisfactory, or unsuitable material be left in the right-of-way.

b. **Compaction Testing:**
   1. Compaction testing for paved areas will be accomplished under Section 107.03.
   2. Compaction testing for non-paved areas will be accomplished under Section 107.02.

312.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY).

a. **Trench Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized vertical depth, in feet, from the surface of the original ground to the bottom of the earth trench, by the authorized trench width. The cross-sectional area of the pipe used will be subtracted from the end area to obtain the final end area used for volume calculations. The length of backfill will be measured horizontally along the pipe. The quantity of backfill will be computed by the average end area method in cubic yards. The volume of all select material for bedding, haunching, initial fill, and select fill for the pipeline will be subtracted from this quantity to determine the final payment quantity.

b. **Structure Backfill:** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY). Backfill for structures and appurtenances will be measured by multiplying the total authorized vertical depth of earth excavation by the area 1 foot outside the neat lines of the structure and subtracting the volume of the structure. The volume of all select material for structures and appurtenances will be subtracted to determine the final payment quantity.

312.06 BASIS OF PAYMENT: Common backfill and compaction, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the backfilled area. When this item is included in a Contract it will be listed as follows:

BA 312 COMMON BACKFILL AND COMPACTION CUBIC YARD

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312.07 STANDARD DRAWINGS: ST01, W01, SS01, SS02, SS03, SS04, and SS05.

313 SELECT BACKFILL AND COMPACTION:

313.01 DESCRIPTION: This work shall consist of furnishing, placing, and compacting select backfill as shown on the Plans or directed by the Contract Administrator.

313.02 MATERIALS: Select backfill materials are those materials listed in Materials Specifications 602 Pipe Bedding and 603 Select Backfill.

313.03 CONSTRUCTION METHODS: Placing and compaction of select backfill shall be accomplished in accordance with Section 312.

313.04 SPECIAL REQUIREMENTS:

a. **Materials Tickets:** The Contractor will provide the Contract Administrator with copies of materials tickets for select materials before payment for these items will be made.
b. **Compaction Testing:**
    1. Compaction testing for paved areas will be accomplished under Section 107.03.
    2. Compaction testing for non-paved areas will be accomplished under Section 107.02.

313.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY).

a. **Pipe Bedding:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of pipe bedding to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of pipe bedding, in feet (0.33 foot unless otherwise specified), by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the bedding will be subtracted from the end area to obtain the final end area used for volume calculations. The length of pipe bedding will be measured horizontally along the pipe. The quantity of pipe bedding will be computed by the average end area method in cubic yards.
b. **Haunching:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of haunching to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of haunching, in feet by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the haunching will be subtracted from the end area to obtain the final end area used for volume calculations. The length of haunching will be measured horizontally along the pipe. The quantity of haunching will be computed by the average end area method in cubic yards.
c. **Initial Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of initial backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the authorized thickness of initial backfill, in feet, by the authorized trench width. That portion of the pipe cross sectional area of the pipe, in the initial backfill will be subtracted from the end area to obtain the final end area used for volume calculations. The length of initial backfill will be measured horizontally along the pipe. The quantity of initial backfill will be computed by the average end area method in cubic yards.

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d. **Select Backfill:** The authorized width of trench shall be three times the nominal diameter of the pipe for pipe 12 inches in diameter and smaller. For pipe larger than 12 inches in diameter the authorized width will be as given in the table in 311.05 e. The end areas of select backfill to be paid for under this item will be measured, regardless of the width actually excavated, by multiplying the thickness of select backfill, in feet (1.0 foot unless otherwise specified), by the authorized trench width. The length of select backfill will be measured horizontally along the pipe. The quantity of select backfill will be computed by the average end area method in cubic yards.

e. **Select Structure Backfill:** When this item is included as a pay item in the Contract it will be measured by the cubic yard (CY). Select backfill for structures and appurtenances will be measured by multiplying the total authorized vertical depth of select backfill by the area 1 foot outside the neat lines of the structure less the area of the structure.

313.06 BASIS OF PAYMENT: Select backfill and compaction, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the backfilled area. When this item is included in a Contract it will be listed as follows:

BA 313A SAND BACKFILL AND COMPACTION	**CUBIC YARD**
BA 313B LIMESTONE SCREENINGS BACKFILL AND COMPACTION	**CUBIC YARD**
BA 313C 3/8" LIMESTONE CHIPS BACKFILL AND COMPACTION	**CUBIC YARD**
BA 313D 3/4" CRUSHED LIMESTONE BACKFILL AND COMPACTION	**CUBIC YARD**
BA 313E CRUSHED FOUNDATION STONE BACKFILL AND COMPACTION	**CUBIC YARD**
BA 313F FLOWABLE FILL	**CUBIC YARD**

313.07 STANDARD DRAWINGS: ST01, W01, SS01, SS02, SS03, SS04, and SS05.

314 BORED STREET CROSSINGS:

314.01 DESCRIPTION: This work shall consist of the installation of railroad, street, or other crossings by boring or tunneling as shown on the Plans or directed by the Contract Administrator.

314.02 MATERIALS:

a. **Cement Grout:** Section 601 Concrete.
b. **Backfill Material:** Section 602 Pipe Bedding and Section 603 Select Backfill.
c. **Conduit:** Section 604 Conduit.

314.03 CONSTRUCTION METHODS:

a. **General:** The conduit pipe shall be installed to the line and grades given. Conduit shall be installed using approved boring or tunneling procedures. A minimum clearance of at least 2 inches between the inner wall of the conduit and maximum outside diameter of the pipe and joint shall be provided. The Contractor shall submit the plan of their proposed installation

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procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected. The approval of this plan by the City does not relieve the Contractor from their responsibility to obtain the specified results.

b. **Boring:** The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as required to maintain a safe work area and meet all local, state, and federal safety regulations. The location of the pit shall meet the approval of the Contract Administrator. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method an approximate 2-inch pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings; jetting will not be permitted. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal and walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of conduit immediately thereafter. Over cutting in excess of 1 inch shall be remedied by pressure grouting the entire length of the installation.

c. **Tunneling:** Where the characteristics of the soil would make the use of tunneling more satisfactory than boring, a tunneling method may be used. The lining of the tunnel shall be of steel of sufficient strength to support the overburden. The Contractor shall submit their proposed liner method to the Contract Administrator for approval. Approval by the City shall not relieve the Contractor of the responsibility for the adequacy of the liner method. The space between the liner plate and the limits of excavation shall be pressure-grouted or mudjacked. Access holes for placing concrete shall be spaced at maximum intervals of 10 feet.

d. **Pipe Installation:** The pipe shall be installed on the approved casing spacers and all joints inside the conduit shall be lock type joints to allow removal of the entire section of pipeline. The space between the outside of the carrier pipe and the conduit shall be sealed with a mechanically fastened boot and encased with flowable fill.

314.04 SPECIAL REQUIREMENTS:

a. **Submission of Boring/Tunneling Plan:** Prior to starting work the Contractor shall submit the plan of their proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected.

b. **Site Approval:** The Contractor shall contact the Contract Administrator prior to starting boring or tunneling operations for approval of the pit site.

314.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the linear foot of bored or tunneled crossing. The length of boring /tunneling will be measured horizontally along the pipe.

314.06 BASIS OF PAYMENT: Bored street crossings, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the crossing. When this item is included in a Contract it will be listed as follows:

BA 314 BORED STREET CROSSING LINEAR FOOT

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314.07 STANDARD DRAWINGS: UL02.

315 CUT AND COVER STREET CROSSINGS:

315.01 DESCRIPTION: This work shall consist of the installation of street or other crossings, where conduit is required, by cut and cover construction as shown on the Plans or directed by the Contract Administrator.

315.02 MATERIALS:

a. **Backfill Material:** Section 602 Pipe Bedding and Section 603 Select Backfill.
b. **Conduit:** Section 604 Conduit.

315.03 CONSTRUCTION METHODS:

a. **General:** A minimum clearance of at least 2 inches between the inner wall of the conduit and maximum outside diameter of the pipe and joint shall be provided. When possible, the conduit will be placed through one half of the roadway at a time. This will allow the road to remain open during the construction. The Contractor shall submit the plan of their proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected. The approval of this plan by the City does not relieve the Contractor from their responsibility to obtain the specified results.
b. **Pavement Cut:** To be accomplished in accordance with Section 316 Pavement Cut and Repair.
c. **Trench Excavation:** To be accomplished in accordance with Section 311 Excavation.
d. **Conduit Placement:** The conduit pipe shall be installed to the line and grades given.
e. **Backfill of Conduit:** The conduit shall be haunched and filled to 18 inches over the top of the pipe with flowable fill. Backfill to be accomplished in accordance with Section 313 Select Backfill and Compaction.
f. **Pavement Repair:** To be accomplished in accordance with Section 316 Pavement Cut and Repair.
g. **Pipe Installation:** The pipe shall be installed on the approved pipe guides and all joints inside the conduit shall be lock type joints to allow removal of the entire section of pipeline. The space between the outside of the carrier pipe and the conduit shall be filled with sand.

315.04 SPECIAL REQUIREMENTS:

a. **Submission of Installation Plan:** Prior to starting work the Contractor shall submit the plan of their proposed installation procedures for approval. The plan shall include pipe guides, jack positions, jacking head, conduit, jointing methods, and other specifics pertinent to the procedure selected.
b. **Site Approval and Traffic Control:** The Contractor shall contact the Contract Administrator a minimum of 24 hours prior to cutting the roadway for approval to open the roadway and traffic control requirements.

315.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the linear foot of cut and cover crossing. The length of the crossing will be measured horizontally along the pipe.

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315.06 BASIS OF PAYMENT: Cut and cover crossings, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the crossing. When this item is included in a Contract it will be listed as follows:

BA 315 CUT AND COVER STREET CROSSING LINEAR FOOT

315.07 STANDARD DRAWINGS: ST01, ST02, ST07, W01, and SS01.

316 PAVEMENT CUT AND REPAIR:

316.01 DESCRIPTION: This work shall consist of pavement cut and repair of any pavement whether in parking lots, highways, streets, driveways, or sidewalks, necessary for construction as shown on the Plans or directed by the Contract Administrator. This item includes curb and gutter, concrete pavement, asphaltic concrete pavement, and double bituminous surfaces. Surfaces containing only gravel shall be replaced Section 313 Select Backfill and Compaction.

316.02 MATERIALS: See ODOT Section 700 for required materials.

316.03 CONSTRUCTION METHODS:

a. **General:** Pavement cut and repair includes the work from the bottom of the base course to the top of the surface course. The pavement shall be replaced with materials equal to or better than the existing materials. Specifications for replacement are found in ODOT Section 300 bases and ODOT Section 400 Surface Courses. This item includes the protection of the street crossings between the time the street is cut and when it is replaced.

b. **Traffic Control:** The Contractor will not be permitted to close streets to traffic at crossings. Crossings shall be made by trenching no more than one half of the street at one time or by providing adequate detours, approved by the Contract Administrator, adjacent to the street. The Contractor shall maintain a passable surface on the detour at all times. This item includes the protection of the street crossings between the time the street is cut and when it is replaced.

c. **Pavement Cut:** Pavement shall be saw cut to at least 2 feet outside the top edge of the trench on each side in order to provide a firm foundation for replacement of the pavement. Any pavement settlement or failure shall be immediately replaced by the Contractor. The Contractor shall remove and replace curb and gutter where it is required.

d. **Pavement Repair:** The pavement repair shall be accomplished with like materials to the materials in the existing pavement. The repair shall be a full depth repair matching or exceeding the strength of the materials in each layer.

e. **Finish Tolerance:** The finished surfaces of patched areas shall meet the grade of the adjoining pavements and shall not deviate more than 1/8-inch from a true plan surface within the patched area.

f. **Pavement Protection:** The Contractor shall protect the patched areas against damage prior to final acceptance of the work by the City. Traffic shall be excluded from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period.

316.04 SPECIAL REQUIREMENTS: The Contractor shall contact the Contract Administrator a minimum of 72 hours prior to cutting the roadway for approval to close the roadway and implement traffic control requirements.

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316.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the linear foot of pavement cut and repair. The length of the cut and repair will be measured horizontally along the excavation.

316.06 BASIS OF PAYMENT: Pavement cut and repair, measured as provided above, will be paid for by the linear foot and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the pavement repair. When this item is included in a Contract it will be listed as follows:

BA 316 PAVEMENT CUT AND REPAIR LINEAR FOOT

316.07 STANDARD DRAWINGS: ST07.

317 UNDERGROUND UTILITY CROSSINGS:

317.01 DESCRIPTION: This work shall consist of the location of underground utilities, protection of underground utilities during construction, utility crossings, and/or relocation of utilities as shown on the Plans or directed by the Contract Administrator.

317.02 MATERIALS:

a. **Water Lines:** Section 620 to Section 649.
b. **Sanitary Sewer:** Section 650 to Section 699.
c. **Other Utilities:** As required by the Utility Owner.

317.03 CONSTRUCTION METHODS:

a. **General:** General locations of all known lines other than services that might interfere with construction are shown on the Plans. However, exact locations and elevations are not known in all cases. The Contractor shall do necessary exploratory work in advance of construction to determine exact utility locations and elevation or that no interference exists. If any of these lines or structures conflict with the proposed construction, the Contractor shall notify the Contract Administrator in order to resolve the conflict by moving the existing facility or by revising the construction alignment. Except for services, if facilities other than those shown on the Plans are encountered, the Contractor will be reimbursed for the extra cost of crossing these lines under the unit price for the type of underground utility crossing encountered. Known meter locations for utility services are shown, but the locations of utility service lines are not shown on the Plans. The Contractor shall assume that service lines serving individual properties do exist and shall, under this item, protect them at crossings and shall be responsible for making necessary revisions or repairs as required by the particular utility company or other owner involved. If any utility service is interrupted as a result of the Contractor's operations, the Contractor shall promptly notify the Contract Administrator and the owner of the utility and shall be responsible for restoring service as quickly as possible.
b. **Storm Sewers and Culverts:** Storm sewers and culverts may be removed at the time of crossing or may be adequately braced and held in position while the new line is placed beneath them. If the storm sewer or culvert is removed, it shall be replaced with new pipe of the same type and size as that removed, and it shall be rejoined to the undisturbed line with a joint satisfactory to the Contract Administrator. Backfill over the new line up to and around the storm sewer or culvert shall be placed in accordance with Section 314 Select Backfill and Compaction.

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c. **Water Mains:** The proposed new line shall pass under all water lines, except where noted on the Plans. The Contractor shall not remove any existing water lines and shall adequately brace and protect them from damage during construction.

d. **Gas Mains:** Before crossing of any gas main, the Contractor shall notify the owner of the main in order that the owner may have a service man available at the time of any crossing. The Contractor shall not remove any gas main without permission of the owner and shall adequately brace and protect gas mains from damage. Any mains which are damaged shall be replaced or repaired to the satisfaction of the owner and the Contract Administrator.

e. **Sanitary Sewers and Services:** Where the water lines crosses sanitary sewers the sanitary sewer line will be replaced or encased as specified below.
   1. Where the water line crosses under sanitary sewers, the sewer shall be PVC C900 for a distance of 10 feet horizontally, measured at right angles to the water line, on either side of the crossing. The sewer shall also be concrete encased.
   2. Where the water line crosses over sanitary sewers with a clearance of 2 feet or less, the sewer shall be PVC C900 for a distance of 10 feet horizontally, measured at right angles to the water line, on either side of the crossing.

f. **Buried Telephone, Electrical Conduits, and Cable TV:** All buried cable and conduits to be crossed by the new line shall be protected in accordance with directions of the utility company owning the cables. The Contractor shall notify the companies and obtain their permission before making a crossing. Any marked buried cables or conduits damaged by the Contractor shall be replaced at their expense to the satisfaction of the owning company and the Contract Administrator.

g. **Cross Country Pipelines:** Before crossing of any cross-country pipelines, the Contractor shall notify the owner of the pipeline in order that the owner may have a service man available at the time of any crossing. The Contractor shall not remove any pipeline without permission of the owner and shall adequately brace and protect pipelines from damage. Any pipelines which are damaged shall be replaced or repaired to the satisfaction of the owner and the Contract Administrator.

h. **Service Line Crossings (Water, Sewer, Gas, Electrical, Telephone, and Cable TV):** The Contractor shall place the new line under all service lines. The Contractor shall protect service lines and shall not remove them except with permission of the Contract Administrator and the owner. If permission is given to remove services and the Contractor shall give the property owner adequate notice. Service lines which are removed or damaged shall be replaced to the satisfaction of the owner and the Contract Administrator.

i. **Damaged Water or Sewer Lines:** Any existing water or sewer lines previously accepted by the City which are damaged by the Contractor's operations will be repaired by the City's maintenance forces. The Contractor shall notify the City immediately of any damage to existing water or sewer lines. Repairs will be made at the Contractor's expense.

317.04 SPECIAL REQUIREMENTS:

a. **Notification of Additional Crossing:** When the Contractor determines that a utility crossing will be required that is not shown on the Plans, the Contract Administrator will be notified prior to installing the crossing.

b. **Notification of Interruption of Service:** When the Contractor interrupts service of a utility, the utility will be notified immediately, and the Contract Administrator will be notified and told what action has been taken to restore service.

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317.05 METHOD OF MEASUREMENT: N/A

317.06 BASIS OF PAYMENT: This item is considered part of the line installation and is included only for information on how to deal with underground utility crossings.

317.07 STANDARD DRAWINGS: UL01 and UL02.

330 CONCRETE PLACEMENT:

330.01 DESCRIPTION: This work shall consist of concrete placement as shown on the Plans or directed by the Contract Administrator.

330.02 MATERIALS: Section 601 Concrete.

330.03 CONSTRUCTION METHODS:

a. **Cement Storage and Use:** Unless otherwise permitted, the Contractor shall use only one brand of cement in the work, and under no conditions shall he use more than one brand of cement in the same structure. Cement which for any reason has become partially set or contains lumps or cakes will be rejected and shall be removed from the site of the work. The acceptance or rejection of cement shall rest with the Engineer and any cement failing to meet the requirements specified herein may be rejected at their discretion. All rejected cement shall be plainly marked for identification, shall be immediately removed from the work, and shall not be offered again for inspection. Cement kept in storage for several months may be subject to repeated tests, if required. Bulk cement shall be delivered by tank truck especially designed for cement transport and handling. The Contractor shall provide, at the site of the work, suitable silos or weather tight buildings, for the storage of cement. The building, or silo, shall be large enough to prevent delays or interruptions to the work which might be due to the lack of cement. Bagged cement shall be stored in such a manner to permit easy access for the proper inspection and identification of each shipment. Cement in bags shall not be piled to a height in excess of 7 feet. Suitable accurate scales shall be provided by the Contractor for weighing the cement. After it has been delivered to the job, the Contractor will not be permitted to remove any of the cement to any other job or dispose of any of this cement in any way without the consent of the Contract Administrator. At the beginning of operations and at all other times while cement is required, the Contractor shall have at the site of the work, an ample supply of acceptable cement and shall carefully guard against possible shortage on account of rejection, irregular deliveries, or any other cause.

b. **Concrete Strength and Proportion:** The concrete shall have the specified compressive strength but not less than 2,400 pounds per square inch, as determined from test cylinders at 28 days, made, cured and broken as hereinafter specified. The concrete shall be designed by the absolute volume method and shall contain not less than quantity of cement per cubic yard specified in Section 601.02. With the approval of the Contract Administrator, admixtures may be added in order to increase workability.

c. **Responsibility for Strength:** It is the intent of these specifications that the Contractor shall guarantee that concrete of the specified compressive strength is incorporated in the structures and that the responsibility for producing the required grades of concrete is assumed by the Contractor. Should the average strengths shown by test cylinders fall below the strengths required, the Director of Engineering and Construction will require any or all of the following changes: amount of cement; grading of aggregate, or ratio of the water to the cement used. If the tests disclose that the strength of the concrete is insufficient for the structure as built, the Director of Engineering and Construction may condemn the part of any structure in which

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concrete of insufficient strength has been placed and the Contractor, at their cost, shall remove and replace such concrete with concrete meeting these specifications.

d. **Experimental Concrete Mixes:** The Contractor shall make experimental mixes prior to the placing of the concrete and at any time during the progress of the work when necessary to demonstrate that the concrete will meet these specifications. Materials for making experimental mixes shall be furnished by the Contractor and these materials shall be identical with those intended for use in the work. The cost of the materials, as well as the costs of crushing test specimens made from the experimental mix, shall be borne by the Contractor and shall be included in the price bid for concrete.

e. **Mixing:** The concrete shall be mixed in an approved batch machine or mixer. The ingredients shall be accurately measured by weight, unless measurement by volume is permitted by the Director of Engineering and Construction, before being placed in the mixer. Measuring boxes or other approved measuring apparatus shall be such that the proportions can e accurately determined. The quantity of water to be added, which will vary with the degree of dryness of the material and with the weather conditions, shall be accurately measured for each batch of concrete. Means shall be provided by which a measured quantity of water can be introduced at any stage of the process. The mixing shall be done in a thorough and satisfactory manner and shall continue until every particle of aggregate is completely covered with mortar. The mixing time for each batch of 2 cubic yards or less shall be not less than 1-1/2 minutes after the materials are in the mixer. The mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof. The entire contents of the drum shall be discharged before recharging. Re-temping of concrete which has partly hardened will not be permitted.

f. **Consistency:** All reinforced concrete which is required to be spaded or puddled in forms or around reinforcing steel shall be of such consistency that:
   1. All aggregates will float uniformly throughout the mass without settling or segregation.
   2. When dropped directly from the discharge chute of the mixer, it will flatten out at the center of the pile but will stand up at the edges, the piling spreading from internal expansion and not by flowing.
   3. It will flow sluggishly when tamped or spaded.
   4. It can be readily puddled into corners and angles of forms and around reinforcing steel.
   5. It can be readily spaded to the bottom of the pour or to a depth of several feet at any time within 30 minutes after placing.
   6. A desirable consistency is one which results in a very slight accumulation of water at the top of a layer several feet in thickness, but without segregation or accumulation of laitance. If, through accident, intention or error in mixing, any concrete shall, in the opinion of the Contract Administrator, very materially from the consistency specified, such concrete shall not be incorporated in the work but shall be discharged as waste material.

g. **Placing Concrete:** Before beginning a run of concrete, surfaces of the forms, reinforcing steel and concrete previously placed shall be thoroughly wetted or oiled. Sub-grades shall be sprinkled or sealed in a manner that will prevent the removal of water from the concrete. Concrete shall be placed in the forms immediately after mixing. It shall be so deposited that the aggregates are not separated. Dropping the concrete any considerable distance, generally in excess of 5 feet depositing large quantities any point and running or working it along the forms, or any other practice tending to cause segregation of the ingredients will not be allowed. It shall be compacted by vibration or continuous tamping, spading or slicing. Care shall be taken to fill every part of the forms, to work the coarser aggregate back from the face, and to force the concrete under and around the reinforcement without displacing it. All concrete shall be thoroughly vibrated, except where specifically excepted in the specifications. The concrete shall be deposited in continuous horizontal layers and whenever practicable,

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concrete in structure shall be deposited continuously for each monolithic section of the work. Chutes and tremmies used for conveying concrete shall be mortar-tight. Work shall be arranged in order that each part of the work shall be placed as a unit if this is possible. Where necessary to stop placing concrete, the work shall be brought up in level courses and against a vertical stop board. The placing of concrete under water, where permitted, must be done by special approved methods.

h. **Placing Concrete in Cold Weather:** No concrete shall be placed without the specific permission of the Contract Administrator when the air temperature is at or below 35 degrees F. If concreting in freezing weather is permitted by the Director of Engineering and Construction, care shall be taken to prevent the use of any frozen material. In addition to adequate provisions for protecting the concrete against chilling or freezing, the Contractor shall heat the water and aggregate in order that when deposited in the forms, the concrete will have a temperature of not less than 50 degrees F, nor more than 80 degrees F. Heated water and aggregate shall be combined in the mixer before cement is added. Cement shall not be added to mixtures of water and aggregate when the temperature of the mixture is greater than 100 degrees F. The concrete shall be adequately protected in order to maintain this temperature for a minimum of 72 hours after it has been placed and a temperature above 32 degrees F for a period of two additional days. The work shall be done entirely at the Contractor's risk. No chemicals or other foreign matter shall be added to the concrete for the purpose of preventing freezing.

i. **Ready Mixed Concrete:** Ready-mixed concrete may be used on the work when the mix design is approved during the submittal process. The Contractor must demonstrate that the concrete can be furnished in accordance with these specifications and that delivery can be made at a rate that will ensure the continuity of any pour. All mixer trucks shall be equipped with water meters. Additional water shall be added at the job site only with the specific approval of the project manager. He/she will notify the Contract Administrator of the location of placements with added water.

j. **Construction Joints:** Construction joints shall be located as shown on the Plans and at other points as may be necessary during construction provided that the location and nature of additional joints shall be approved by the Director of Engineering and Construction. In general, joints shall be located at points of minimum shear, shall be perpendicular to the principal lines of stress, and shall have suitable keys having areas of approximately one-third of the area of the joints. When placing against a construction joint, the surface of the concrete previously placed shall be thoroughly cleaned of dirt, scum, laitance, or other soft material, and shall be roughened. the surface shall then be thoroughly washed with clean water and covered with at least 1/2 inch of cement mortar, after which concreting may proceed. Mortar shall be placed in a manner that will not splatter forms and reinforcing steel.

k. **Finish of Concrete Surfaces:** All surfaces exposed to view shall be free from conspicuous lines, affects or other irregularities caused by defects in the forms. If for any reason this requirement is not met, or if there are any conspicuous honeycombs, the Contract Administrator may require a correction of the defects by rubbing with carborundum bricks and water until a satisfactory finish is obtained. Immediately after removing the forms, all wires or other exposed metal shall be cut back of the concrete surface and the depressions thus made and all honeycomb and other defects shall be painted with mortar and then rubbed smooth. If the Director of Engineering and Construction deems any honeycomb or other defect to require such treatment, the defective concrete shall be cut out to a depth sufficient to expose the reinforcement and to afford a key for the concrete replacing the cut out.

l. **Curing Concrete:** Exposed surfaces of concrete shall be protected by approved methods from premature drying for a period of at least 7 days. Curing compounds, when approved by the Director of Engineering and Construction, shall be applied according to the manufacturer's recommendations and shall not be used on any surface against which

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additional concrete is to be bonded, nor on surfaces which will be painted. In dry, hot weather, forms shall be removed as early as practicable and curing started immediately. The Contract Administrator may require the frequent wetting of the concrete and the use of means to protect it from the direct rays of the sun.

m. **Placing Reinforcement:** All reinforcement, when placed, shall be free from mill scale, loose or thick rust, dirt, paint, oil, or grease, and shall present a clean surface. Bends and splices shall be accurately and neatly done and shall conform to the American Concrete Institute Manual of Standard Practice for Detailing Reinforced Concrete Structures. All reinforcing shall be placed in the exact position shown on the Plans and shall be held firmly in position by means of approved spacers and supports, by wiring to the forms, and by wiring the bars together at intersections with approved wire ties in order that the reinforcement will not be displaced during the depositing and compacting of the concrete. When the concrete surface will be exposed to the weather in the finished structure or where rust would impair the appearance, the portions of all accessories in contact with the form work shall be galvanized steel or plastic. The placing and fastening of reinforcement in each section of the work shall be approved by the Director of Engineering and Construction before any concrete is deposited in the section. Care shall be taken not to disturb the reinforcement after the concrete has taken its initial set.

n. **Forms:** Forms shall be so designed and constructed that they may be removed without injuring the concrete. The material to be used in the forms for exposed surfaces shall be sized and dressed lumber or metal in which all bolt and rivet heads are countersunk. In either case, a plain, smooth surface of the desired contour must be obtained. Undressed lumber may be used for backing or other unexposed surfaces, except inside faces of conduits. The forms shall be built true to line and braced in a substantial and unyielding manner. They shall be mortar tight and, if necessary to close cracks due to shrinkage, shall be thoroughly soaked in water. Forms for re-entrant angles shall be filleted and for corners shall be chamfered. Dimensions affecting the construction of subsequent portions of the work shall be carefully checked after the forms are erected and before any concrete is placed. The interior surfaces of the forms shall be adequately oiled with a non-staining mineral oil to ensure the non-adhesion of mortar. Form lumber which is to be used a second time shall be free from bulge or warp and shall be thoroughly cleaned. The forms shall be inspected immediately preceding the placing of concrete; any building or warping shall be remedied and all dirt, sawdust, shavings or other debris within the form shall be removed. No wood device of any kind used to separate forms will be permitted to remain in the finished work. Temporary openings shall be placed at the bottom of the column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

o. **Removal of Forms:** Forms shall be removed in such manner as to ensure the complete safety of the structure. No forms shall be removed except with the express approval of the Engineer. In general, this approval will be based on the following:

1. Forms on ornamental work, railings, parapets and vertical surfaces which do not carry loads and which will be exposed in the finished work shall be removed within 24 hours to 48 hours after placing, depending upon weather conditions.
2. Girder, beam and joist sides only, column, pier, abutment and wall forms may be removed within 24 hours to 48 hours after placing, depending upon weather conditions. No backfill shall be placed against wall, piers, or abutments unless they are adequately supported or have reached the required strength.
3. Girder, beam and joint soffit forms shall remain in place with adequate shoring underneath, and no construction load shall be supported upon nor any shoring removed from any part of the structure under construction until that portion of the structure has attained sufficient strength to support safely its weight and the loads placed thereon.

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p. **Concrete Thrust Blocks:** Thrust blocks or other restraint devices shall be adequate to prevent movement of the line at 150 psi pressure, unless otherwise specified. Thrust blocks shall be placed against undisturbed soil in the trench. The thrust block shall have sufficient surface area to transmit the thrust to the undisturbed soil. The thickness, width, and length shall be sufficient to carry the required load. The minimum thickness, width, and length for thrust blocks shall be 1 foot. Concrete placed for thrust blocks shall be consolidated to ensure that no voids remain in the block. Thrust blocks will be of fresh mixed unreinforced concrete unless otherwise specified.

q. **Concrete Encasement of Pipelines:**
   1. General: Concrete encasement of pipelines shall be a minimum of 6 inches thick at the thinnest point. Encasement shall be plain concrete with no reinforcement, unless otherwise specified. All encasements will be placed as a monolithic placement.
   2. Water Lines: Water lines shall be encased where the cover over the line is not sufficient to spread surface loading where trench widths are more than the maximum as shown on the Standard Details.
   3. Sanitary Sewer Lines: Sanitary sewers shall be encased when the depth of cut from the original ground elevation to the flow line of the pipe is 4 feet or less. Sanitary sewer lines will be encased where they cross water lines, as shown on the Plans. Concrete encasement necessitated by trench widths more than the maximum as shown on the Standard Details shall be placed as directed by the Director of Engineering and Construction. All concrete encasement required because of excessive trench width shall be placed at the expense of the Contractor.
   4. Other Utility Lines: Where other utility lines require concrete encasement, the owner of the utility shall specify the method and thickness of encasement.

r. **Concrete Slab Protection for Pipelines:** This item will be installed only as shown on the Plans or at the direction of the Director of Engineering and Construction. Where pipelines are within 2 feet of the surface or 2 feet of another pipeline, they will be covered with a 12-inch reinforced concrete slab. This slab will be placed in such a manner as to prevent accidental excavation into the pipeline. This slab shall be placed on a 2-inch-thick rock bed over the pipeline. The excavation shall then be filled to ground level.

s. **Concrete Cradle for Pipelines:** Concrete cradle of pipelines shall be a minimum of 6 inches thick at the thinnest point on the sides and bottom of the pipe. Cradle shall be plain concrete with no reinforcement, unless otherwise specified. All cradle will be placed as a monolithic placement. For sanitary sewers, a standard concrete cradle is required at any location where the depth of cut to the flow line of the pipe is 16 feet or more. Concrete cradle necessitated by trench width more than the maximum as shown on the Standard Details shall be placed as directed by the Contract Administrator. All concrete cradle required because of excessive trench width shall be placed at the expense of the Contractor.

t. **Reinforced Concrete Piers for Pipelines:** Piers shall be located and constructed as shown on the Plans and Standard Details. Forms shall be made to conform to the shape of the pier and securely braced. Reinforcing steel shall be bent as detailed and securely tied in place. Bearing area for the pipe shall be made to fit the outside diameter of the pipe and shall support the pipe at the proper grade. Steel strapping and bolts shall be installed and painted with one heavy coat of coal tar or asphalt paint after bolting in place. Any honeycomb or other unevenness in the concrete shall be patched with cement mortar immediately after form removal.

330.04 SPECIAL REQUIREMENTS:

a. **Required Minimum Concrete Strength:**
   1. Streets and Structures: 3,500 psi.
   2. Thrust Blocks and Encasement: 2,500 psi.

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b. **Pipe Thrust Table:** Thrust blocks shall be constructed to restrain not less than the larger of the thrust indicated in the Plans or according to direction of the Director of Engineering and Construction.

330.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by the cubic yard. The method of measurement for each type of concrete placement is as follows:

a. **Structural Concrete:** Structural concrete will be computed by calculating the concrete volume, in cubic yards, of the vertical reinforced concrete structure being built. This type of structure includes all structures that require forming on at least four sides and the forms are higher than 18 inches. Examples include wet wells, headwalls, cast in place vaults, cast-in-place manholes, piers, etc.

b. **Reinforced Concrete:** Reinforced concrete will be computed by calculating the concrete volume, in cubic yards, of the horizontal reinforced concrete structure being built. This type of structure includes all structures that require forming on at least four sides and the forms are 18 inches or lower. Examples include manhole bases, pipeline protection slabs, vault bases, etc.

c. **Plain Concrete:** Plain concrete does not require reinforcing steel unless otherwise specified.
   1. Thrust Blocks: Computing the size of a thrust block is site dependent and in most cases, the quantity of concrete actually used will be the accepted quantity of concrete for the thrust block. When the Contractor over excavates a thrust block site, the maximum quantity for a thrust block will be calculated and that quantity will be paid regardless of the amount used by the Contractor. The maximum volume of concrete paid for in a thrust block will be computed as a rectangle with the required surface area for pipe support serving as the thickness and width of the rectangle and the trench width serving as the length.
   2. Concrete encasement: Concrete encasement shall be computed by taking the authorized trench width, times the authorized encasement length, times the exterior width of the pipe plus 1 foot and subtracting the volume of the pipe in the encasement.
   3. Concrete Cradle: Concrete cradle shall be computed by taking the authorized trench width, times the authorized cradle length, times the one half the exterior width of the pipe plus 6 inches and subtracting the one half of the volume of the pipe in the cradle.
   4. Formed Plain Concrete: Formed plain concrete will be computed based on the authorized volume of the formed area less the volume of any penetrations.

d. **Reinforcing Steel:** Reinforcing steel shall be measured by the pound.

330.06 BASIS OF PAYMENT: Concrete and reinforcing steel, measured as provided above, will be paid for by the cubic yard and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon acceptance of the concrete placement. When this item is included in a Contract it will be listed as follows:

BA 330A STRUCTURAL CONCRETE	**CUBIC YARD**
BA 330B REINFORCED CONCRETE	**CUBIC YARD**
BA 330C PLAIN CONCRETE	**CUBIC YARD**
BA 330D REINFORCING STEEL	**POUND**

330.07 STANDARD DRAWINGS: ST03.

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340 MATERIALS FURNISHED BY CONTRACTOR/INSTALLED BY CITY:

340.01 DESCRIPTION: This work shall consist of providing materials as shown on the Plans or directed by the Contract Administrator.

340.02 MATERIALS: See Materials requirement for the items being furnished.

340.03 CONSTRUCTION METHODS: The Contractor shall provide the required materials at the time and location specified by the Contract Administrator. For installation specifications see construction requirements for the items being furnished.

340.04 SPECIAL REQUIREMENTS: See special requirements for the items being furnished.

340.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by each item requested.

340.06 BASIS OF PAYMENT: Materials furnished by the Contractor and installed by the City, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon delivery of the materials. When this item is included in a Contract it will be listed as follows:

BA 340 MATERIALS FURNISHED BY CONTRACTOR/ INSTALLED BY CITY	**LUMP SUM**

340.07 STANDARD DRAWINGS: N/A.

341 MATERIALS FURNISHED BY CITY/INSTALLED BY CONTRACTOR:

341.01 DESCRIPTION: This work shall consist of installing materials as shown on the Plans or directed by the Contract Administrator.

341.02 MATERIALS: See Materials requirement for the items being furnished.

341.03 CONSTRUCTION METHODS: The City shall provide the required materials at the time and location specified by the Contractor. For installation specifications see construction requirements for the items being furnished.

341.04 SPECIAL REQUIREMENTS: See special requirements for the items being furnished.

341.05 METHOD OF MEASUREMENT: When this item is included as a pay item in the Contract it will be measured by each item requested.

341.06 BASIS OF PAYMENT: Materials furnished by the City and installed by the Contractor, measured as provided above, will be paid for by the lump sum and such payment shall be full compensation for all equipment, materials, tools, labor, and incidentals necessary to complete the work as specified. This item will be paid as a separate bid item and payment will be made upon installation of the materials. When this item is included in a Contract it will be listed as follows:

BA 340 MATERIALS FURNISHED BY CITY/INSTALLED BY CONTRACTOR	**LUMP SUM**

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341.07 STANDARD DRAWINGS: N/A.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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