

SECTION 02222 - EARTHWORK FOR UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Specifications for the stripping of topsoil and vegetation, excavation, trenching, bedding, filling, backfilling, compaction, and related work in connection with the installation of water mains, gravity sanitary sewers, storm sewers, and force mains are included in this Section.

- B. Definitions
 - 1. Excavation: Removal of earth and rock to form a trench for the installation of a water main, gravity sanitary sewer, storm sewer, or force main.
 - 2. Earth: Unconsolidated material in the crust of the Earth derived by weathering and erosion. Earth includes:
 - a. Materials of both inorganic and organic origin;
 - b. Boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay;
 - c. Materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
 - 3. Rock: A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:
 - a. Limestone, sandstone, dolomite, granite, marble, and lava;
 - b. Boulders 1/3 cubic yard or more in volume;
 - c. Materials which cannot be excavated by equipment which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers;
 - d. Materials which cannot be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
 - 4. Undercutting: Excavation of rock and unsuitable earth below the bottom of the pipe or conduit to be installed in the trench.
 - 5. Subgrade: Undisturbed bottom of a trench.
 - 6. Bedding: Earth placed in trench to support pipe and conduit.

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7. Backfill and Fill: Earth placed in trench from the top of bedding to finished grade, or to subbase or pavement.
8. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

1.2 BLASTING

Blasting shall not be permitted.

Requests for a variance to this shall be considered on a case by case basis after a written request from the contractor is received by the Town's Superintendent.

1.3 SUBMITTALS

Contractor shall submit materials test reports, as applicable.

1.4 JOB CONDITIONS

- A. All information provided by the Town, including drawings relating to borings, materials encountered, and rock elevations, is furnished only for the information and convenience of the Contractor. The Town does not warrant or guarantee that the materials and conditions encountered during construction will be the same as indicated by the boring samples or by information shown on the drawings as the information has been obtained from surveys performed by outside consultants.
- B. Existing storm sewers, sanitary sewers, water mains, gas mains, electric ducts, telephone ducts, steam mains and other underground structures, lines, and their house connections, have been shown on the plans according to the best available information. The exact location and protection of these facilities and structures, their support and maintenance in operation during construction (in cooperation with the proper authorities), is the responsibility of the Contractor in the performance of his contract.

PART 2 - PRODUCTS

2.1 BEDDING

- A. Class I bedding shall be angular 6 to 12 mm (1/4 to 1/2 inch) graded stone, coral, slag, cinders, crushed stone or crushed shells.
- B. Class II bedding shall be coarse sands and gravels with maximum particle size of 20 mm (3/4 inch). Class II bedding includes variously graded sands and gravels containing small percentage of fines generally granular and non-cohesive, either wet or dry. Soil types GW (well-graded gravel), SW (well-graded sand), and SP (pea gravel and/or crushed stone mixed with sand) are included in this class.

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2.2 BACKFILL

- A. General: Backfill shall be earth of such gradation and moisture content that the soil will compact to the specified density and remain stable. Unsuitable materials shall not be used.
- B. Cover Material: Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to 1 inch) in size in a substantially uniform combination. Unwashed bank run sand and crushed bank-run gravel will be considered generally acceptable. Bedding material may be used for cover material.
- C. Granular Backfill - Special Backfill: Granular backfill, when indicated on the plans or as ordered by the Engineer, shall be used for backfilling providing it meets the following soils classified by the Unified Soils Classification System ASTM D-2487 or the Indiana State Highway Standard Specifications Section for Special Fill and Backfill ("B" Borrow).

Group

Symbols Typical Names

GW Well-graded gravels and gravel-sand mixtures, little or no fines

GP Poorly graded gravels and gravel-sand mixtures, little or no fines

SW Well-graded sands and gravelly sands, little or no fines

SP Poorly graded sands and gravelly sands, little or no fines

- D. Gravel Backfill: When the material excavated from the trench is suitable for granular backfill, the Town reserves the right to order, in writing, the use of this excavated material in place of the granular backfill specified to be paid for as a separate pay item.
- E. Suitable Excavated Materials as Backfill: Excavated material shall be used when earth backfill is specified on the plans or where granular backfill is not specifically specified, provided that such material consists of loam, clay, or other materials which, in the judgment of the Engineer, are suitable for backfilling. Unsuitable backfill or frozen backfill material shall not be used. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

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<u>Group Symbols</u>	<u>Typical Names</u>
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

- F. Unsuitable Materials: Materials which are unsuitable for backfill include stones greater than 8 inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, and the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

<u>Group Symbols</u>	<u>Typical Names</u>
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

- G. Concrete Backfill: Concrete used for backfill around sewers, water mains, or other utility piping shall be Class B Concrete.

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- H. Cellular Concrete: Light weight cellular concrete may be used for filling of abandoned sewers as a grouting mixture for filling voids and as a substitute for backfill concrete in tunnels or casing pipes. The cellular concrete shall be produced by blending preformed foam with cement-sand grout slurry produce a concrete having a fresh weight per cubic foot or not less than 75 pounds.

PART 3 - EXECUTION

3.1 EXISTING UTILITIES, STRUCTURES, AND PROPERTY

- A. All poles, fences, sewer, gas, water or other pipes, wires, conduits and manholes, railroad tracks, buildings, structures, and property along the routes of water mains, force mains, and sewers shall be supported and protected from damage by the Contractor.
- B. Movable items such as mail boxes may be temporarily relocated during construction. Place movable items in their original location immediately after backfilling is completed, unless otherwise shown on the drawings. Replace movable items which are damaged during construction.
- C. The Contractor shall proceed with caution in the excavation and preparation of trenches so that the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- D. Whenever, in the opinion of the Town, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make explorations and excavations for such purpose.
- E. Wherever sewer, gas, water, or other pipes or conduits cross the trench, the Contractor shall support said pipes, and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes, etc., shall be subject to the approval of the utility involved.
- F. When utility lines that have to be removed or relocated are encountered within the area of operations, the Contractor shall notify the Town in ample time for the necessary measure to be taken to prevent interruption of the service.
- G. The Contractor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work unless he shall have first obtained the property owner's written consent thereto and shall have shown said written consent to the Town.
- H. All excavated material shall be piled in a manner that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes,

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curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

- I. All streets, alleys, pavements, parkway, and private property shall be thoroughly cleaned of all surplus materials, earth, and rubbish placed thereon by the Contractor.

3.2 CLEARING

- A. Clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site as required to perform work.
- B. Do not remove or damage trees that do not interfere with the work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.
- C. Debris from the tree removal, including trunk, branches, leaves, roots and stumps, shall not be buried or burned on the job site, but must be completely hauled away and disposed of at the Contractor's expense.

3.3 STRIPPING AND STOCKPILING OF TOPSOIL

- A. Strip topsoil and vegetation from the excavated areas. Clean topsoil may be stockpiled for reuse as the upper 6 inches of those areas to be seeded.
- B. Do not intermix grass, weeds, roots, root mat, brush, and stones larger than 3 inches with stockpiled topsoil. Dispose of root contaminated topsoil.

3.4 PAVEMENT AND WALK REMOVAL

- A. Remove existing pavement and walks from the excavated areas. Remove excavated asphalt and concrete materials from the job site as these materials are excavated.
- B. The width of pavement removed along the normal trench for the installation of pipe and structures shall not exceed the width of the trench by more than 12 inches on each side of the trench when the amount of pavement removed is less than 75% of the total existing pavement width. Remove all existing pavement when the excavation requires the removal of 74% or more of the total existing pavement width.
- C. Remove walks completely when excavation is along the length of a walk and requires the removal of part of the walk. Remove walks to existing joints in the walks when excavation crosses walks. If there are no joints in an existing walk,

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the width of walk removed shall not exceed the width of the trench by more than 12 inches on each side of the trench.

- D. Use methods to remove pavement and walks that will assure the breaking or cutting of pavement and walks along straight lines. The face of the remaining pavement and walk surfaces shall be approximately vertical.

3.5 EXCAVATING

- A. General: After stripping of topsoil and vegetation, perform excavations of every description regardless of material encountered within the grading limits of the project to lines and grades as indicated on the drawings or as otherwise specified.
 - 1. Materials removed below the depths indicated without specific direction of the Engineer shall be replaced at no additional cost to the Town, to the indicated excavation grade with satisfactory bedding materials placed and compacted.
- B. Dewatering: Keep excavations free from water until the water mains, force mains, sewers, structures, and appurtenances to be constructed in the excavations are completed and will safely withstand forces from water. Provide sufficient dewatering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property, or damage to the environment.
 - 1. Operate dewatering equipment ahead of pipe laying and keep the water level below the pipe invert until the pipe is secured by backfill.
- C. Trenching: Trees, boulders, and other surfaces encumbrances, located so as to create a hazard to those involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
 - 1. Do not open more than 100 feet of trench in advance of the installed pipe, unless otherwise directed or permitted by the Town's Representative. Excavate the trench within 6 inches of full depth for a distance of at least 30 feet in advance of the pipe laying, unless otherwise directed or permitted.
 - 2. Contractor shall be responsible for the determination of the angle of repose of the soil in which the trenching is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting, or where shoring or trench box is to be used.

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3. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.
4. Flatten the trench sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
5. Shoring, sheeting, trench box, or other means shall be used to support sides of trenches in hard or compact soil when the trench is more than 5 feet in depth and 8 feet or more in length. Sides of trenches shall include embankments adjacent to trenches. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2-foot horizontal. Provide a bench of 4 feet minimum at the toe of the sloped portion of the trench wall when the outside diameter of the pipe to be installed is greater than 6 feet.
6. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.
7. Excavations shall be inspected by a competent Contractor's Representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased, if necessary.
8. Do not store excavated or other material nearer than 4 feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.
9. The width of trenches in earth for water main pipe, sewers, basin connections, house connections, and other drains up to and including 33 inches in internal diameter shall provide a clearance of not less than 8 inches or more than 10 inches on each side of the pipe. Trenches for pipe larger than 33 inches in internal diameter shall provide a clearance of not less than 10 inches or more than 14 inches on each side of the pipe.
10. The maximum clear width of trenches in earth for manholes shall be the greatest external width of the structure plus the space necessary for the construction and removal of the forms and construction of masonry work.

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11. The design of the water main, force main, and/or sewer pipe and structures is predicated upon the width of trench specified in this Article. The Contractor shall be responsible for the provision and installation, at his own expense, of such remedial measures as may be directed by the Engineer, should the trench width limits specified in this Article be exceeded.
 12. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to assure acceptable atmospheric conditions. Provide adequate ventilation and eliminate sources of ignition when flammable gases are present. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, and basket stretcher, shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.
 13. Provide walkways or bridges with guardrails where employees or equipment are required or permitted to cross over excavations.
 14. Provide ladders where employees are required to be in trenches 4 feet deep or more. Ladders shall extend from the floor of the trench to at least 3 feet above the top of the excavation. Locate ladders to provide means of exit without more than 25 feet of lateral travel.
 15. Provide adequate barriers and physically protect all remotely located excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, pits, shafts, and similar excavations upon completion of exploration and similar operations.
- D. Quicksand: Carry on the work with utmost vigor and proceed with the work expeditiously when running sand, quicksand, or other bad or treacherous ground is encountered. Install bedding to support the pipe as directed by the Town.

3.6 SHEETING

- A. The Contractor shall be responsible for construction means, methods, techniques, and procedures, and for providing a safe place for the performance of the work by the Contractor, Subcontractors, suppliers and their employees, and for access use, work, or occupancy by all authorized persons.
- B. The Contractor shall be solely responsible for all obligations prescribed as employer obligations under Chapter XVII of Title 29, Code of Federal Regulations, Part 1926, otherwise known as "Safety and Health Regulations for Construction."
- C. Adequate supporting systems, such as sheeting, shoring, piling, cribbing, and bracing shall be furnished and installed by the Contractor as required to protect

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existing buildings, utilities, and property from damage during the progress of the work

3.7 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled in on-site locations as approved by the Town, until the material is ready to be placed.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as trenches are backfilled.

3.8 TEMPORARY PLUGS

Prevent foreign matter from entering pipe while it is being installed. Do not place debris, tools, clothing, or other material in the pipe. Close the open ends of pipe by watertight plugs when pipe laying is not in progress. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open pipe end. Remove earth and other materials at no additional cost to the Town.

3.9 BACKFILLING WATER MAIN AND FORCE MAIN TRENCHES

- A. Backfilling of water main and force main trenches shall meet the requirements of ANSI/AWWA C600, unless otherwise specified in this Section.
- B. Do not backfill trenches and excavations until all utilities have been inspected by the Town's Representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings. Required hydrostatic tests may be applied to the line either before or after the trench is backfilled, subject to the approval of the Town.
- C. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.
- D. Material from the trench subgrade to the centerline of the pipe shall be Class II bedding. Place bedding by hand or approved mechanical methods in layers of 8 inches loose depth. Compact bedding by hand tamping or with power operated hand vibrating compactor. Deposit bedding in the trench for its full width on each side of the pipe simultaneously.
- E. Place pipe cover material from the centerline of the pipe to 12 inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified in this Article.
- F. Do not use the following materials for backfill:

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1. Unsuitable materials;
 2. Frozen materials;
 3. Materials which are too wet or too dry to be compacted to the densities specified in this Article.
- G. Trenches Requiring Special Backfill When Specified: Where the edge of the trench is 5 feet or less from the edge of the existing or proposed roadway pavement and trenches across roadways, driveways, utility crossing, or in areas to be paved or subjected to traffic, the trench shall be backfilled with Special Backfill. Backfill any trench specifically indicated on the drawings with Special Backfill. Place Special Backfill in lifts. Compact each lift of backfill to not less than 95% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Town.
- H. Trenches in State Highway Right-of-Way: Where excavation occurs within the right-of-way of a state highway, all areas within 12 feet of the pavement edge shall be backfilled with Grade “B Borrow” Special Backfill. All areas beyond 12 feet shall be backfilled in the manner specified in the following paragraph.
- I. Trenches Not Requiring Special Backfill: Backfill trenches not requiring granular backfill with suitable excavated material. Place and compact backfill to produce an adequate foundation for the applicable paved or unpaved surface treatment. Fill and restore any settlement of the backfill. In paved areas, backfill shall be maintained to subbase elevation. In unpaved areas, backfill shall be mounded above finish grade to allow for settlement. Grade unpaved area to be restored 6 inches below finish grade after settlement of backfill and immediately before restoration of vegetated areas. Place 6 inches of topsoil over area to be restored.
- J. Trenches in Traveled Pavements: All cuts and trenches in paved streets or other paved areas shall be backfilled within suitable excavated material unless granular backfill is specifically indicated on the plans or ordered by the Town to within 12 inches of the street surface. The remainder of the trench is to be filled with crushed stone and compacted in place, prior to opening the street to traffic. The Contractor shall maintain the trenches, adding crushed stone and grading as necessary, until sufficient settlement has taken place and final restoration is made.

3.10 BACKFILLING SANITARY SEWER AND STORM SEWER TRENCHES

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Town’s Representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.

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- B. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.
- C. Bedding procedures for sanitary sewers and storm sewers shall be as specified in the Section for the applicable pipe material.
- D. If bedding does not cover the pipe, place pipe cover material from the top of bedding to 12 inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified in this Article.
- E. Do not use the following materials for backfill:
 - 1. Unsuitable materials;
 - 2. Frozen materials;
 - 3. Materials which are too wet or too dry to be compacted to the densities specified in this Article.
- F. Trenches Requiring Special Backfill When Specified: Where the edge of the trench is 5 feet or less from the edge of the existing or proposed roadway pavement and trenches across roadways, driveways, utility crossings, or in areas to be paved or subjected to traffic, the trench shall be backfilled with Special Backfill. Backfill any trench specifically indicated on the drawings with Special Backfill. Place Special Backfill in lifts. Compact each lift of backfill to not less than 95% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Town.
- G. Trenches in State Highway Right-of-Way: Where excavation occurs within the right-of-way of a state highway, all areas within 12 feet of the pavement edge shall be backfilled with Grade "B Borrow" Special Backfill. All areas beyond 12 feet shall be backfilled in the manner specified in the following paragraph.
- H. Trenches Not Requiring Special Backfill: Backfill trenches not requiring granular backfill with suitable excavated material. Place and compact backfill to produce an adequate foundation for the applicable paved or unpaved surface treatment. Fill and restore any settlement of the backfill. In paved areas, backfill shall be maintained to subbase elevation. In unpaved areas, backfill shall be mounded above finish grade to allow for settlement. Grade unpaved area to be restored 6 inches below finish grade after settlement of backfill and immediately before restoration of vegetated area. Place 6 inches to topsoil over area to be restored.
- I. Trenches in Traveled Pavement: All cuts and trenches in paved streets or other paved areas shall be backfilled within suitable excavated material unless granular backfill is specifically indicated on the plans or ordered by the Town to within

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12 inches of the street surface. The remainder of the trench is to be filled with crushed stone and compacted in place, prior to opening the street to traffic. The Contractor shall maintain the trenches, adding crushed stone and grading as necessary, until sufficient settlement has taken place and final restoration is made.

3.11 CLEANUP AND MAINTENANCE

- A. Cleanup the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction. Grade area to be restored. Leave backfill mounded over trenches which are not backfilled with Special Backfill. Cleanup and restoration specified in this paragraph shall be completed within 1,000 feet of excavation.
- B. Restoration of grass, bushes, trees, and other plants shall be completed by Contractor to original condition.
- C. Restoration of pavement and walks shall be specified in Section 02500, Paving and Surfacing. A temporary driving surface, such as crushed stone, shall be compacted in place in the trench area as backfilling is complete. Cold-mix asphalt patching material may be used as a temporary driving surface at the Contractor's option or when specifically called for in the plans or specifications. Temporary pavement shall not be more than 1,000 feet behind the excavation. When no existing pavement remains after excavation, a temporary compacted aggregate surfacing may be provided instead of the permanent pavement or a temporary cold-mix asphalt pavement. When the pavement is asphaltic concrete, placement of the asphaltic concrete surface course may be delayed until all other heavy construction is completed.
- D. Maintain the job site until the work has been completed and accepted. Fill trenches which settle when settlement is visible. Restore items damaged by construction or improper restoration. Keep dust conditions to a minimum by the use of water, salt, calcium chloride, or other means.

END OF SECTION 02222