

## SECTION 02225

### EXCAVATION AND BACKFILL OPERATIONS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for trenching and backfilling for underground pipelines.
- B. Excavating and backfilling operations adjacent to and under structures including boxes, headwalls, or other structures as required by City Engineer.
- C. Backfilling and compacting operation for construction and reconstruction of roadways, embankments, streets, parking lots, and other paved surface areas.
- D. Excavation permit requirements.

##### 1.02 DEFINITIONS

- A. Pipe Zone: That zone in an excavation which supports, surrounds, and extends to 1 foot above the top of the pipe barrel.
- B. Bedding: Process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to 12 inches over the top of the pipe.
- C. Roadway: Area within the street right-of-way, including the area under the street, curb, gutter, and one (1) foot behind curb.

##### 1.03 SUBMITTALS

- A. Cut Sheets: In accordance with Section 00700.
- B. Material Analysis Reports: In accordance with Sections 02205 or 02206 as applicable.
- C. Density Test Reports: In accordance with Section 02250.
- D. Depth of backfill lift. This information shall be contingent upon type of equipment used in compaction operation. Engineer may order lesser thickness if compaction is not achieved.

##### 1.04 STORAGE AND HANDLING

- A. Stockpile excavated material in a manner as to cause a minimum of inconvenience to public travel and provide for emergency traffic as necessary.
- B. Maintain free access to all existing fire hydrants, water and gas valves, and meters.
- C. Maintain clearance for free flow of storm water in all gutters, conduits, and natural water courses.
- D. Utilize appropriate traffic signs, markers, and procedures in all product storage and handling activities.
- E. Promptly remove all other material from site.

## 1.05 SITE CONDITIONS

- A. Unsuitable Weather Limitations: Do not place, spread, or roll any fill material during unsuitable weather conditions. Do not resume operations until moisture content of material is satisfactory.
- B. Protection of Graded Areas: Protect graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or unsuitable weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Prior to excavation operations, photograph existing surfaces along which Work may take place in order to determine, after construction is completed, whether any damage of existing improvements occurred prior to construction operations.
- E. Grading: In compaction operations, do not vary the surface of finished aggregate base course more than 1/4" above or below grade.

## PART 2 PRODUCTS

### 2.01 WATER

- A. Make arrangements for source of water during construction and make arrangements for delivery of water to site. Comply with all local laws and regulations when securing water from water utility company at no additional cost to City.

### 2.02 SOIL MATERIALS

- A. Over-excavation Fill: Select Fill: in accordance with Section 02206.
- B. Common Fill: in accordance with Section 02205.
- C. Select Fill: in accordance with Section 02206.
- D. Native Backfill:
  - 1. When approved by City Engineer, native backfill material obtained from project excavations may be used as backfill, provided organic material, rubbish, debris, rocks larger than 8 inches, and other objectionable materials are removed.
  - 2. Bituminous pavement obtained from project excavations will not be permitted as backfill except for the following:
    - a. May be mixed with road sub-base if material meets section 02205.2.01 gradation.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify areas to be backfilled are free of debris, snow, ice, or water and ground surfaces are not frozen.

- B. Verify foundation of basement walls are braced to support surcharge forces imposed by backfilling operations.
- C. Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of work area.

### 3.02 PREPARATION

- A. For pipelines, use means necessary to avoid displacement, and injury to, pipe and structures while compacting soil or operating equipment next to pipeline.
- B. Movement of construction machinery over a pipeline at any stage is solely at Contractor's risk.
- C. When excavation is required in jurisdictions other than City, satisfy all conditions of the appropriate agencies.
- D. Identify required lines, grades, contours, and benchmarks.
- E. Notify all affected utility companies and Blue Stakes prior to commencing excavation operation.
- F. Support and protect from damage, until completion of the Work, any existing facilities and structures which exist in, pass through, or pass under the site.

### 3.03 CONTROL OF GROUNDWATER

- A. All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and embedment operations.
- B. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in cases where the static groundwater elevation is above the bottom of any trench or bell holed excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress.

### 3.04 SHORING

- A. Comply with Section 02150 when required by field condition.

### 3.05 GENERAL EXCAVATION OPERATIONS

- A. If topsoil is on site, remove and store it for later use on site.
- B. Excavate site to required grade for Work. Use all means necessary to control dust on or near Work and on or near all off-site borrow and disposal areas.
- C. Notify Engineer of unexpected subsurface conditions.
- D. Underpin adjacent structure which may be damaged by excavation work, including service utilities and pipe chases.
- E. If unstable material is encountered at the bottom or face of excavation, do not perform extra excavation without Engineer's written approval. Correct unauthorized extra excavations at no cost to City.
- F. Provide necessary protection to excavation walls as required. If conditions permit, slope excavation side to maintain a safe and clean working area. Remove loose materials.

- G. Correct excavation beyond the specified lines and grades by filling the resulting voids with approved compacted fill. If the fill is to become the subgrade for other fill, use material approved by Engineer. Do not proceed until Engineer has approved the material and the proposed method of backfilling for over excavation errors.

### 3.06 EXCAVATION FOR PIPELINES

- A. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:
  - 1. Except in ledge rock, cobble rock, stones or water saturated earth, mechanical excavation of trenches shall not extend below an elevation of 4 inches below the bottom of the pipe after placement in its final position.
  - 2. All additional excavation necessary for preparation of the trench bottom shall be made manually.
  - 3. Excavation for trenches in ledge rock, cobble rock, stones, mud or other material unsatisfactory for pipe foundation, shall extend to a depth of at least 4 inches below the bottom of the pipe.
  - 4. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in 4-inch lifts to provide a smooth, stable foundation.
  - 5. Special foundation material shall consist of suitable earth material free from roots sod or vegetable matter.
  - 6. Trench bottoms shall be hand shaped as specified in paragraph (2) above.
  - 7. The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible but a minimum of 6 inches on each side of the pipe.
  - 8. Where ground water is encountered, clay dikes and/or filter fabric may be required at a minimum of 100 feet or as directed by the City Engineer.
- B. Grade bottom of trenches to provide uniform bearing surface.
- C. If necessary, make bell holes and depressions required to complete joining of pipe or box.
- D. In public thoroughfares and regardless of trench depth, safely barricade and limit open trenches to a maximum of 200 lineal feet in the daytime, except in traveled roadways where a maximum of 80 lineal feet of open trench will be allowed.
- E. Close trenches during nighttime conditions.

### 3.07 GRAVEL FOUNDATION FOR PIPE

- A. Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load; where water must be drained to maintain a dry bottom for pipe installation and at other locations as previously defined, the subgrade shall be excavated to a minimum of 12 inches and replaced with crushed rock or gravel.
- B. Gravel for pipe foundations shall conform Drain Rock in Section 02206.

- C. Drain Rock material shall be deposited over the entire trench width in 18-inch maximum layers, each layer shall be compacted by tamping, rolling, or vibrating.
- D. The material shall be graded to produce a uniform and continuous support for the installed pipe.

### 3.08 BEDDING

- A. Excavate pipe trench in accordance with this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on native subsoil according to standard drawings.
- C. Place bedding material at trench bottom in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.

### 3.09 BACKFILLING FOR PIPELINES

- A. Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage.
- B. Bedding requirements are as defined in the Specifications for each specific pipe material.
- C. Trench backfilling above the level of the pipe bedding shall normally be accomplished with A-1 material. Native excavated materials shall be free from rocks larger than 8-inches in diameter.
- D. Compaction Requirements
  1. Under pavements, shoulders, or other surface improvements the in-place density shall be a minimum of 95% of laboratory standard maximum dry density as determined by AASHTO T-99.
  2. In other areas the in-place density shall be a minimum of 92% of the maximum dry density as determined by the same laboratory method.
  3. See Section 01450.2.04.C.6.
- E. Clay cut off dikes shall be constructed as required by City Engineer.

### 3.10 STRUCTURAL EXCAVATION

- A. Provide all required shoring, cribs, cofferdams, and caissons including all pumping, bailing, draining, sheathing, bracing, and related items.
- B. If conditions permit, slope excavation sides as excavation progress to maintain a safe and clean working area as required by OSHA.
- C. Support excavation. Do not interfere with the bearing of adjacent foundations, pipelines, etc.

- D. All unauthorized excavation below the specified structure subgrade shall be replaced with concrete, monolithic with that of the slab above or with coarse gravel thoroughly compacted into place.
- E. Subgrade soil for all concrete structures shall be firm, dense, thoroughly compacted, and consolidated.
- F. Subgrade soil shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen engaged in subgrade surfacing, laying reinforcing steel, and depositing concrete.
- G. Coarse gravel or crushed stone may be used for subsoil reinforcement if results satisfactory to the City Engineer can be obtained thereby.
  - 1. Material shall be applied in lifts of 6" or less.
  - 2. Each lift shall be embedded in the subsoil by thorough tamping.
  - 3. All excess soil shall be removed to compensate for the displacement of the gravel or crushed stone and the finished elevation of any subsoil reinforced in this manner shall not be above the specified subgrade.

### 3. 11 BACKFILLING FOR STRUCTURES

- A. Do not fill adjacent to structures until approval is obtained from Engineer.
- B. All forms shall be removed and the excavation shall be cleaned of all trash and debris.
- C. Backfill areas to contours and elevations indicated. Do not use frozen materials.
- D. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become overstressed or moved from final alignment.
- E. Place select fill a minimum of 3 feet around the outside of structures.
- F. Place and compact select fill materials in continuous lifts not exceeding 12" loose depth.
- G. Place and compact common fill material in continuous lifts not exceeding 8" loose depth.
- H. Do not disturb or damage foundation perimeter drainage, foundation, damp proofing, foundation waterproofing and protective cover, or utilities in trenches.
- I. Backfill against foundation walls simultaneously on each side. Do not backfill against walls until concrete has obtained 7 day strength.
- J. Make smooth changes in grade. Blend slopes into level areas.
- K. Remove surplus backfill materials from site.
- L. Leave stockpile areas completely free of excess fill materials.
- M. Slope grade away from structure at a minimum of 3" in 10 feet unless otherwise indicated.

- N. Compaction: Each layer of material shall be compacted by hand or machines tampers or by other suitable equipment to a density equal to 95% of maximum dry density as measured by AASHTO T-99.
- O. Restore any damaged structure to its original strength and condition and re-backfill to specifications.

3.12 ROADWAY EXCAVATIONS

- A. In advance of setting line and grade stakes, clean subgrade area of brush, weeds, vegetation, grass, and debris. Drain all depressions or ruts which contain water.
- B. A soils classification, as determined by AASHTO T-27, shall be made on the proposed subgrade, and the following shall be required based on that classification:

SOIL CLASSIFICATIONS	REQUIREMENT
A-1	The subgrade shall be scarified to a depth of 12" and the loosened material shall be moistened and compacted to the equivalent of 95% of maximum dry density as measured by AASHTO T-99.
A-2, A-3, A-4 or A-5	The subgrade shall be over-excavated a minimum of 12" subgrade scarified and compacted, replaced with A-1 granular material, and be moistened and compacted as above.
A-6 or A-7	The subgrade shall be over-excavated a minimum of 18" subgrade scarified and compacted, replaced with A-1 granular material, and be moistened and compacted as above.

- C. No organic material, soft clay, spongy material, or other deleterious material will be permitted in the scarified or imported subgrade layer.
- D. Rough sub-grades shall be shaped and graded to within a tolerance of 0.15 feet of design grade and drainage shall be maintained at all times.
- E. Moisture content of the subgrade layer shall be maintained at not less than 95% or more than 105% of optimum moisture content, during the compaction process. The entire roadbed, to one foot in back of curb, must be compacted to the specified density to a minimum depth of 8 inches.
- F. If removal of boulders, rubble, or existing improvements, found within the excavated area results in a lower excavation elevation than indicated, backfill over excavation in a manner approved by Engineer.
- G. Remove all deposits susceptible to frost heave.
- H. Excavations through or under City streets, sidewalks, street shoulders, driveways, etc. shall comply with the following requirements:
  - 1. Material removed by excavation is not to be used as backfill or placed back into the trench under any paved portion of the street. However, sand may be used for backfill up to one foot above top of pipe.
  - 2. The remaining trench shall be filled with select fill as per section 02206.

3. The trench shall be filled to the existing asphalt level and guarded from traffic until set.
4. Within 10 days of the fill, sufficient fill material shall be removed and replaced with material comparable to the adjacent surface material shall meet the requirements of Section 02504 of these specifications.
5. The City Engineer shall inspect all work.

### 3.13 SUBGRADE PREPARATION

- A. Compact subgrade surfaces to density specified for overlying backfills. Refer to Section 02250.
- B. If areas of subgrade not readily capable of in-situ compaction, secure City Engineer's authorization for extra excavation and backfill.
- C. Maintain minimum overburden cover of 2 feet over pipelines or conduits during subgrade preparation.

### 3.14 BACKFILLING FOR PAVEMENT

- A. Before beginning backfilling operations obtain Engineer's approval of excavation operation.
- B. Do not damage subsurface structures or service lines.
- C. Process backfill and avoid segregation. Keep base course free from pockets of coarse or fine material.
- D. Deposit base course on the roadbed in a uniform manner which will provide the required compacted thickness. Maintain moisture content.
- E. Shoulders are an integral part of the embankment. Do not build shoulders to a grade higher than that of the adjacent granular base course. Maintain efficient surface runoff at all times.
- F. Compaction: in accordance with Section 02250.
- G. Prior to placing pavements, proof roll in accordance with Section 01450.

### 3.15 BLASTING

- A. Blasting will not be allowed except by permission from the City Engineer.
- B. The Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property.
- C. And he shall be fully responsible for all damage attributable to his blasting operations.
- D. Excessive blasting or overshooting will not be permitted and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed by the Contractor.

### 3.16 COMPACTION OF BACKFILL

- A. In accordance with Section 02250.

### 3.17 IMPORTED BACKFILL MATERIAL

- A. In the event the native excavated material is not satisfactory for backfilling as determined by the City Engineer, the Contractor shall provide imported granular fill in accordance with Section 02205.

3.18 DISPOSAL OF EXCESS MATERIALS

- A. All excess material shall be hauled away from the construction site and disposed of by the Contractor.

END OF SECTION