

DIVISION 2 – SITE WORK

SECTION 02205

SOIL AND AGGREGATE MATERIALS

1.0 GENERAL

1.1 Section Includes

- A. Type I Backfill.
- B. Type II Backfill.
- C. Type III Backfill.
- D. Type IV Backfill
- E. Type I Drain Rock.
- F. Controlled Density Fill.
- G. Stockpiling.

1.2 Related Sections

- A. Section 02220, EXCAVATING, BACKFILLING, AND COMPACTING.
- B. Section 03300, CAST-IN-PLACE CONCRETE.

1.3 References

- A. ASTM C136 – "Test Method for Sieve Analysis of Fine and Coarse Aggregate."
- B. ASTM D422 – "Test Method for Particle-Size Analysis of Soils."
- C. ASTM D2419 – "Test Method for Sand Equivalent Value of Soils and Fine Aggregate."
- D. ASTM D2844 – "Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils."
- E. ASTM G51 – "Test Method for Measuring pH of Soil for Use in Corrosion Testing."
- F. ASTM G57 – "Test Method for Field Measurement of Soil Resistivity using the Wenner Four-Electrode Method."
- G. STANDARD SPECIFICATIONS and STANDARD PLANS – California Department of Transportation (Caltrans), July 1999.

1.4 **Submittals**

- A. Submit the following to the Construction Administrator for review:
1. Material Source: Submit the name of source for all imported materials.
 2. Grading and Quality Requirements: Submit compliance with backfill grading and quality requirements. Submit testing results for all materials, prior to placement.

2.0 **PRODUCTS**

2.1 **Backfill Materials**

- A. General: No material shall be used for backfill which, because of excessive moisture or any other reason, cannot be compacted to the degree specified. Any such material shall be considered unsuitable, and if it is deposited in the trench, it shall be removed and replaced with suitable material.
- B. Type I Backfill: Type I Backfill shall meet the following requirements:
1. Material shall meet the gradation and quality requirements of STANDARD SPECIFICATIONS, Section 26-1.02A for Class II Aggregate Base, ¾-inch maximum size.
 2. Resistivity: Material shall have a minimum resistivity of 3000 ohm-cm, as determined by ASTM G57.
 3. pH: Material shall have a pH between 5.5 and 8.5, as determined by ASTM G51.
- C. Type II Backfill: Type II Backfill shall meet the following requirements:
1. Material may be excavated and re-used from the site, or may be imported from off site borrow areas.
 2. Material shall be free from organic matter, debris, asphaltic material, or other unsuitable materials, or lumps or rocks larger than three (3) inches.
 3. Material shall meet the following grading requirements, as determined by ASTM D422:

PERCENTAGE PASSING	
SIEVE SIZE	OPERATING RANGE
3 inch	100
1 inch	90-100
No. 200	10-40

4. Resistance R-Value: Material shall have a minimum Resistance R-Value of 10, as determined by ASTM D2844.
5. Resistivity: Material shall have a minimum resistivity of 2000 ohm-cm, as determined by ASTM G57.
6. pH: Material shall have a pH between 5.5 and 8.5, as determined by ASTM G51.

D. Type III Backfill: Type III Backfill shall meet the following requirements:

1. Material shall be clean, sound, and durable natural sand.
2. Material shall meet the following grading requirements, as determined by ASTM C136:

PERCENTAGE PASSING	
SIEVE SIZE	OPERATING RANGE
3/4 inch	100
No. 4	90-100
No. 20	0-60
No. 200	0-15

3. Sand Equivalent: Material shall have a minimum sand equivalent value of thirty (30), as determined by ASTM D2419.
4. Resistivity: Material shall have a minimum resistivity of 2000 ohm-cm, as determined by ASTM G57.
5. pH: Material shall have a pH between 6.5 and 8.5, as determined by ASTM G51.

E. Type IV Backfill: Type IV backfill shall meet the following requirements:

1. Material shall be imported, washed and graded sand, graded creek or bank gravel, river run rock, or combinations thereof. The reuse of native material is not permitted.
2. The material shall form a dense, well-compacted embedment and shall not contain any crushed particles.
3. Material shall conform to the following grading requirements:

PERCENTAGE PASSING	
SIEVE SIZE	OPERATING RANGE
3/4 inch	90-100
3/8 inch	65-90
No. 4	50-75
No. 40	15-30
No. 200	0-5

4. Sand Equivalent: Material shall have a minimum sand equivalent value of 75, as determined by ASTM D2419.
5. Resistivity: Material shall have a minimum resistivity of 3000 ohm-cm, as determined by ASTM G57.
6. pH: Material shall have a pH between 5.5 and 8.5, as determined by ASTM G51.

F. Type I Drain Rock: Type I Drain Rock shall meet the following requirements:

1. Material shall meet the requirements of STANDARD SPECIFICATIONS, Section 68-1.025, for Class II Permeable Material.
2. Material shall be clean and durable natural gravel or crushed stone.
3. Material shall not slake or decompose with alternate wetting and drying.

G. Controlled Density Fill (CDF): Controlled Density Fill (CDF) shall meet the following requirements:

1. Material shall be composed of a cementitious material, water, fine and coarse aggregate, and an admixture. References to ASTM testing requirements and submittal requirements for aggregate, cement, and admixtures may be found in Section 03300, **CAST-IN-PLACE CONCRETE**.
 - a. The cementitious material shall be portland cement in combination with fly ash.
 - b. The admixture shall be an air-entraining agent.
2. The unconfined twenty-eight (28) day compressive strength shall be a minimum of 50 psi and a maximum of 150 psi.
3. The wet density of the CDF shall not be greater than one-hundred thirty two (132) pounds per cubic foot.

H. **!! Any additional requirements for soil materials may be included here.!!**

3.0 **EXECUTION**

3.1 **Stockpiling**

- A. Stockpile materials at locations designated by the Construction Administrator.
- B. Separate differing materials with dividers, or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- D. Stockpiled area must not direct runoff onto private property, roads, or storm drain systems.

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SECTION 02220

EXCAVATING, BACKFILLING, AND COMPACTING

1.5 GENERAL

1.6 Section Includes

- A. General Excavation.
- B. Trench Excavation.
- C. General Backfill and Compaction.
- D. Trench Backfill and Compaction.

1.7 Related Sections

- A. Section 02205, SOIL AND AGGREGATE MATERIALS.
- B. Section 02500, PAVING AND SURFACING.
- C. Section 02600, UTILITY PIPING.
- D. Section 03300, CAST-IN-PLACE CONCRETE.

1.8 References

- A. Standard Details:
 - 1. City of Clayton – Latest edition.
 - 2. City of Concord – Latest edition.
 - 3. City of Martinez – Latest edition.
 - 4. City of Walnut Creek – Latest edition.
 - 5. Contra Costa County – Latest edition.
 - 6. City of Pleasant Hill – Latest edition.
 - 7. Contact individual agencies for additional information.
- B. ASTM D1556 – “Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.”
- C. ASTM D1557 – “Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.”
- D. ASTM D2922 – “Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods.”
- E. STANDARD SPECIFICATIONS and STANDARD PLANS – California Department of Transportation (Caltrans), July 1999.
- F. Construction Safety Orders, California Code of Regulations, Title 8, Chapter 4 – State of California Occupational Safety and Health Standards Board (CAL/OSHA), 1999.

1.9

Submittals

- A. Submit the following to the Construction Administrator for review:
 - 1. Excavation Permit: The Contractor shall submit a CAL/OSHA excavation permit prior to commencing with work.
 - 2. Groundwater and Surface Water Handling Plan: The Contractor shall submit a groundwater and surface water-handling plan; detailing the methods of keeping the excavation free of water.
- B. Submittal shall be in accordance with Section 01300, **SUBMITTALS**.

1.10

Quality Assurance

- A. Perform work in accordance with all referenced codes, specifications, and standards, except as modified herein.
- B. Verify that survey, benchmark, control point, and intended elevations for the work are as shown on the Drawings.

1.11

Dewatering

- A. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- B. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems it proposes for handling groundwater and surface water encountered during construction of structures and pipelines.

2.2

PRODUCTS

2.3

Backfill Materials

- A. General: No material shall be used for backfill which, because of excessive moisture or any other reason, cannot be compacted to the degree specified. Any such material shall be considered unsuitable, and if it is placed, it shall be removed and replaced with suitable material.
- B. Type I Backfill: Type I Backfill shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.
- C. Type II Backfill: Type II Backfill shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.
- D. Type III Backfill: Type III Backfill shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.
- E. Type IV Backfill: Type IV Backfill shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.
- F. Type I Drain Rock: Type I Drain Rock shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.

- G. Controlled Density Fill (CDF): Controlled Density Fill (CDF) shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.
- H. Topsoil: Topsoil shall be as specified in Section 02205, **SOIL AND AGGREGATE MATERIALS**.

3.2 **EXECUTION**

3.3 **Preparation**

- A. Identify required lines, levels, contours, and datum locations.
- B. Protect plant life, lawns, and other features remaining as a portion of the final landscaping.
- C. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic. Any modification or relocation of such items shall be made at the Contractor's expense.
- D. Prior to excavation, the Contractor shall notify the appropriate regional center of all excavations, as required under Government Code Section(s) 4216-4216.9. The Contractor shall contact Underground Service Alert at 1-800-642-2444 for the location of subsurface installations. It shall be the responsibility of the Contractor to determine the exact location and depth of all utilities, including service connections, which have been marked by the respective owners, and which the Construction Administrator believes may affect or be affected by the Contractor's operations.
- E. Prior to excavations, the area within five-feet on either side of the trench alignment shall be graded to within 0.25 feet of the future subgrade elevation in accordance with the approved site grading plan. All construction survey staking is to be unobstructed from viewing (e.g. piles of excavated soil shall not obscure construction survey staking).
- F. Locations of known underground utilities and structures are shown on the drawings as they are supposed to exist. Appurtenances and service laterals are not usually shown. Locations shown may be based on information furnished by the utility owners at the time of design, derived from visible surface facilities, or based on subsurface exploration.
- G. The Contractor shall notify the District, County, City, and other agencies having jurisdiction, and any other parties directly or indirectly affected by the project, forty-eight (48) hours in advance of the intention to commence excavation.
- H. The Contractor shall identify a suitable location to store excavated materials that will minimize the obstruction of traffic.

3.4 **General Excavation**

- A. General:
 - 1. All lines and grades shall be established by the Contractor, in accordance with the Project Drawings and Specifications. The Contractor shall submit verification record of all such survey work to the Construction Administrator, as may be required. The Contractor shall carefully preserve all survey stakes and reference points. Should any stakes or points be removed or destroyed during the installation, they shall be reset by the Contractor at the Contractor's expense.

2. Remove all materials encountered that may interfere with the completion of the work.
3. Blasting will not be permitted.
4. Excavation shall be kept dry throughout construction operations.
5. Sawcut existing concrete or asphalt concrete pavement, as outlined in Section 02500, **PAVING AND SURFACING**. Use proper tools and equipment to break pavement to the correct lines.
6. Excavated surfaces shall be properly graded to provide good drainage.

B. Stripping:

1. Topsoil and other materials unsuitable for use in the work shall be removed from excavation and fill areas, as required to expose satisfactory material or foundation.
2. Topsoil and other unsuitable materials shall be offhauled and disposed of legally off the project site.

C. Excavation:

1. Excavate to the required lines and grades, as shown on the Drawings.
2. Material below the foundation grade shall not be disturbed, except where so indicated on the Drawings or by the Construction Administrator. The foundation grade for concrete placement shall not be more than ½-inch above the specified grade at any point, and the average elevation over any selected area, ten (10) square feet in dimension, shall be at or below the established grade.
3. Where the material at the bottom of the excavation is of soft or unstable material, has been saturated and degraded, or is otherwise considered unsuitable for the support of structures, the Contractor shall overexcavate to an additional depth, as required by the Construction Administrator, backfill with Type I Backfill Material, and compact in accordance with the requirements of these specifications.
4. Excavation shall include the removal of all soil, rock, pavement, tree stumps and other vegetation or vegetable matter, waste or debris, abandoned pipelines and other structures shown on the Drawings, ground water and materials of any nature which interfere with the construction work.

D. Bracing Excavations:

1. Excavations shall be braced and supported such that ground adjacent to the excavation will not settle or slide, and so that all surfaces or subsurface improvements, both public and private, will be fully protected from damage.
2. If any damage does result to such improvements, the Contractor shall perform the necessary repairs or reconstruction at their own expense, and to the satisfaction of the owner of the damaged improvement as directed by the Construction Administrator.

- E. **Safety:** The Contractor shall make sufficient excavation to construct all the work contained in the contract documents and shall abide by the requirements of the State of California Occupational Safety and Health Standards Board (CAL/OSHA) "Construction Safety Orders" and "General Industrial Safety Orders."
- F. **Disposal of Unsuitable Material:**
 - 1. All excavated material not utilized in the construction shall become the property of the Contractor and be removed and disposed of legally off the project site.
 - 2. No excavated materials shall be removed from the site of the work or disposed of by the Contractor, except as approved by the Construction Administrator. Materials shall be neatly piled until used or otherwise disposed of as directed. Material shall be stored in an area of sufficient distance from excavations so as not to create a surcharged soil loading adjacent to the excavation.

3.5 **Trench Excavation**

- A. **General:**
 - 1. The Contractor shall lay out the work in advance of beginning construction. The Contractor is responsible for constructing the work to the lines and grades shown in the Contract Documents. All trenches shall be excavated to a flat, undisturbed bottom, and shall be cut true and even to the established grade.
 - 2. The Contractor shall excavate five lengths of pipe in advance of pipe laying and expose all facilities that cross or infringe on the trench prism and determine the depth and character of the obstruction. The Contractor shall immediately notify the Construction Administrator of any facilities found to differ from those facilities shown on the Drawings.

- B. **Trench Width:**
 - 1. **Maximum:** The maximum trench width shall be two (2) feet greater than the outside diameter of the pipe. The trench may be excavated three (3) feet greater than the outside diameter of the joints of welded steel pipe.
 - 2. **Minimum:** The minimum trench width shall be as follows:

NOMINAL PIPE DIAMETER	MINIMUM TRENCH WIDTH
Service Lines	One foot, or as required by the governing agency.
6" and less	18 inches
8" to 12"	24 inches
Greater than 12"	One foot greater than the outside diameter of the pipe.

- C. **Trench Depth:** Minimum trench depth, unless otherwise specified, shall be sufficient to provide cover as follows:
 - 1. **In Permanently Unpaved Areas:** Three (3) feet, eight (8) inches of cover from top of pipe to finished grade.

2. In Existing Paved Area: Three (3) feet, eight (8) inches from top of pipe to top of pavement.
 3. In Areas to be Paved: Three (3) feet from top of pipe to subgrade, but in no case less than three (3) feet, eight (8) inches from top of pipe to finished grade.
- D. Maximum length of open trench: unless otherwise specified or directed by the construction administrator, the maximum length of open trench shall be two-hundred (200) feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench in public areas shall be left open during periods when the contractor is not at the site of work. Trenches in these areas shall be backfilled and temporarily paved, where applicable, with the end of the trench covered with up to two non-skid steel trench plates. Steel trench plating shall be left in place no longer than seven (7) days. Temporary paving shall be left in place no longer than thirty (30) days.
- E. Unsuitable Material on Bottom of Trench
1. Rock Material: Where, in the opinion of the Construction Administrator, the bottom of the excavation will not afford the pipe a firm and uniform bearing surface because of rock, hard pan, shale or any other similar material which cannot be readily excavated, the Contractor shall excavate a minimum of six (6) inches below the proposed grade of the bottom of the pipe, refill the trench with Type I Backfill material, compact the material in accordance with the requirements of this section, and reshape the trench bottom to the required section and grade.
 2. Soft Soils: Where the material at the bottom of the excavation is of soft or unstable material, has been saturated and degraded by pipeline leaks, or is otherwise considered unsuitable for the support of the pipe, the Contractor shall overexcavate to an additional depth as required by the Construction Administrator, backfill with Type I Backfill material, compact the material in accordance with the requirements of this section, and reshape the trench bottom to the required grade and section to afford the pipe a firm and uniform bearing surface.
 3. Thrust Blocks: If, in the opinion of the Construction Administrator, the material, in its undisturbed natural condition, at or below the normal grade of the excavation as indicated on the Drawings is unsuitable for thrust blocks, it shall be removed to such depth and width as required by the Construction Administrator, and shall be replaced with Type I Backfill material, compacted to the requirements of this section.
- F. Water, Rock and Other Ground Conditions: Trench excavation shall include the removal of all soil, rock, pavement, tree stumps and other vegetation or vegetable matter, waste or debris, abandoned pipelines and other structures shown on the Drawings, ground water and materials of any nature which interfere with the construction work. The excavation shall be hand trimmed as necessary to remove loose matter.
- G. Bracing Excavations:
1. Excavations shall be braced and supported such that ground adjacent to the excavation will not settle or slide, and so that all surfaces or subsurface improvements, both public and private, will be fully protected from damage. No bracing or sheeting shall remain in the trench after backfilling.

2. If any damage does result to such improvements, the Contractor shall perform the necessary repairs or reconstruction at their own expense, and to the satisfaction of the owner of the damaged improvement as directed by the Construction Administrator.
- H. Safety: The Contractor shall make sufficient excavation to construct all the work contained in the contract documents and shall abide by the requirements of the State of California Department of Industrial Relations "Construction Safety Orders" and "General Industrial Safety Orders."
- I. Access: Where existing driveways occur on the street, the Contractor shall make provisions for the trench crossing at these points, either by means of backfill or by temporary bridges. All excavated material shall be piled in a manner that will not obstruct sidewalks, driveways, or pedestrian crossings. All work shall be performed to the requirements and satisfaction of the Construction Administrator and the City or County having jurisdiction.
- J. Disposal of Unsuitable Material:
1. All excavated material not utilized in the construction shall become the property of the Contractor and be removed and disposed of legally off the project site.
 2. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as approved by the Construction Administrator. Materials shall be neatly piled until used or otherwise disposed of as directed. Material shall be stored in an area of sufficient distance from excavations so as not to create a surcharged soil loading adjacent to the excavation.
- K. Tolerances: The elevation of the bottom of any completed excavation shall not vary more than 1/2 inch from the elevation indicated in these Plans and Specifications.

3.4 **General Backfill and Compaction**

- A. General:
1. Remove all loose material, wood, and debris from the trench prior to backfilling.
 2. Backfill to level of original ground surface, to underside of pavement base course, or as shown on the Drawings. Backfill for concrete structures shall not be placed until the concrete has attained at least ninety percent (90%) of design strength.
 3. Remove sheeting, shoring, and bracing using methods that minimize caving. Metal sheeting, shoring, and bracing may be left in place on approval by the Construction Administrator.
 4. Backfill and compaction requirements specified in this section do not apply to CDF. The requirements and allowable use of CDF shall be as determined by the Construction Administrator.
- B. Structure Backfill:
1. When material beneath the foundation grade for structures is required to be excavated, the excavation shall be backfilled with material shown on the drawings, or as directed by the Construction Administrator. Material shall be placed and spread in successive, approximately horizontal lifts

not exceeding eight (8) inches in loose thickness.

2. The sides of structures shall be backfilled as shown on the Drawings. Material shall be placed and spread in successive, approximately horizontal lifts not exceeding eight (8) inches in loose thickness.

C. Fill:

1. Fills shall be constructed from Type II Backfill Material, unless otherwise shown on the Drawings or directed by the Construction Administrator.
2. All topsoil shall be stripped, and the foundation prepared for constructing the fill.
3. Exposed surfaces shall be scarified to a depth of at least six (6) inches (unless the surface is rock), and compacted at a moisture content that will permit proper compaction as outlined in these specifications.
4. Prior to placing fill material, obtain the Construction Administrator's approval of the site preparation in the area to be filled.
5. Place and spread the material in successive, approximately horizontal layers, not exceeding eight (8) inches in loose thickness.
6. Earth slopes shall be keyed into as the work is brought up.
7. Portions of the fill surface shall be moistened, scarified, or plowed, as directed by the Construction Administrator, to a depth of at least six (6) inches, and recompact when necessary to produce a uniform, stable fill.

D. Compaction:

1. Structure Fill or Backfill:
 - a. Sides of Structures: Compact each lift to not less than ninety percent (90%) relative compaction, in accordance with ASTM D1557.
 - b. Structure Foundation: Compact each lift to not less than ninety-five percent (95%) relative compaction, in accordance with ASTM D1557.
2. Fill: Compact each lift to not less than ninety percent (90%) relative compaction, in accordance with ASTM D1557. Compact upper six (6) inches of road subgrade to not less than ninety-five percent (95%) relative compaction, in accordance with ASTM D1557.
3. Type I Drain Rock: Compact each lift with a minimum of two (2) complete coverages of a vibrating roller or plate-type of equipment.
4. At the time of compaction, the moisture content of the fill and backfill material shall be such that the required relative compaction will be obtained. Condition material which contains insufficient moisture or excess moisture until the moisture content is such that the relative compaction will be obtained.
5. Compaction Equipment shall be standard type capable of producing the specified relative compaction with the specified fill and backfill materials.
6. Hand-operated tampers shall be used only in areas which are inaccessible

to self-propelled or towed mechanical compacting equipment, or where damage to existing facilities by the use of self-propelled or towed compacting equipment is probable.

7. If the compacted fill material fails to pass the compaction test requirements of these specifications, no additional material shall be placed until the unsatisfactory fill has been reworked or replaced and satisfactory compaction test results are obtained.
8. Tolerances: The elevation of the top layer of any one compacted fill material shall not vary more than ½-inch from the elevation indicated on the Drawings.

3.5 **Trench Backfill and Compaction**

A. General:

1. Backfill and compaction shall be in accordance with the Standard Details of the local governing agency.
2. Remove all loose material, wood, and debris from the trench prior to backfilling.
3. Backfill pipeline trenches to the level of the original ground surface or underside of the pavement base course.
4. All backfill material shall be placed in the trench to the full width as excavated. Backfill material shall not be dropped directly upon the pipe.
5. Backfill shall begin simultaneously and uniformly on both sides of the pipe immediately after the section of pipe has been joined. Sufficient material shall be hand-shoveled to securely anchor the pipe so that no movement will occur when the next section of pipe is being placed or when additional material is placed.
6. Low points along the pipe trench shall not be backfilled until all backfill at adjacent higher elevations has been completed. Water collecting at the low points along the trench from jetting operations or other causes shall be removed by pumping or other approved means in order to avoid softening of adjacent natural ground. An adequate number of sump pumps at proper spacing shall be supplied to prevent the accumulation of excess water in the trench.
7. Backfill shall be completed within the shortest possible time so that the construction area or street can be opened to traffic. If for any reason construction of the pipeline or appurtenances thereto is delayed, the Construction Administrator may require that the trench be backfilled, and such areas or streets opened to traffic.
8. A dense, well-compacted backfill shall be placed around the pipeline. The Contractor shall produce such a backfill under all circumstances. The Contractor will be held responsible for all displacement or instability of the pipeline, settlement of the backfill or adjacent ground, or all damage to the pipe coating caused by improper installation of backfill materials.

9. Backfill and compaction requirements specified in this section do not apply to CDF. The requirements and allowable use of CDF shall be as determined by the Construction Administrator.

B. Pipe Bedding and Compaction:

1. Install Type I Backfill as shown on the Drawings and respective Standard Detail.
2. Bedding support under pipe: Bring to a uniform grade to provide continuous support for the pipe sections as they are laid in final position. Maximum lift, as it is placed before compaction, shall be six (6) inches.
3. Pipe bedding above grade line:
 - a. Bring up pipe bedding simultaneously on both sides of pipe. Maximum lift, as it is placed before compaction, shall be six (6) inches.
 - b. Pipe bedding material above grade line shall extend to a minimum of twelve (12) inches above the crown of the pipe.
4. Compaction:
 - a. Compact by means of impact, vibration, or a combination of these methods. Care shall be taken to ensure no damage to the pipe or pipe coatings during compaction procedures.
 - b. Pipe bedding material shall be compacted to a minimum ninety percent (90%) relative compaction, in accordance with ASTM D1557, unless more stringent requirements are outlined by the local governing agency.
 - c. Compaction by hydraulic jetting will not be permitted.

C. Backfill and Compaction Above Pipe Bedding:

1. Install Type I Backfill material where excavation is in a paved public or private road.
2. Install Type II Backfill material at other locations, unless otherwise directed by the Construction Administrator. Type I Backfill material may be used in place of Type II Backfill material at the Contractor's option.
3. Maximum Lift: Maximum lift, as it is placed before compaction, shall be six (6) inches.
4. Compaction:
 - a. Compact by means of impact, vibration, or a combination of these methods. Compaction methods and equipment are subject to approval by the Construction Administrator.
 - b. Only hand-operated motor driven mechanical compacting equipment shall be used over pipelines until the backfill has been compacted to twenty-four (24) inches over the crown of the pipe.
 - c. Paved public or private roads:
 - 1) Compact Type I Backfill material that is more than three

(3) feet below the existing surface to at least ninety percent (90%) relative compaction, in accordance with ASTM D1557, unless more stringent requirements are outlined by the local governing agency.

2) Compact Type I Backfill material that is in the upper three (3) feet of the excavation to at least ninety-five (95%) relative compaction, in accordance with ASTM D1557, unless more stringent requirements are outlined by the local governing agency.

d. Minimum Requirements: Compact all backfill material to a minimum of ninety percent (90%) relative compaction, in accordance with ASTM D1557, if no compaction requirements are specified.

e. Moisture Content: When the moisture content of the fill material is below that specified, water shall be added until the moisture content is as specified to obtain the required compaction values. When the moisture content of the fill material is above that specified, the fill material shall be aerated by blading or other satisfactory method until the moisture content is as specified.

f. Compaction by hydraulic jetting will not be permitted.

D. Tolerances: The elevation of the top layer of any one compacted fill material shall not vary more than ½-inch from the elevation indicated on the Drawings.

3.6

Existing Landscaping

A. Protection of Trees, Shrubs and Hedges:

1. When it is necessary to excavate adjacent to existing trees, shrubs, or hedges, the Contractor shall use all possible care to avoid injury to the trees, shrubs, or hedges and their roots. Excavation to be done in areas where roots are two inches in diameter and larger shall be done by hand. No roots or limbs two inches or larger in diameter shall be cut without the express approval of the Construction Administrator. All roots two inches in diameter and larger left in place shall be wrapped with burlap to prevent scarring or excessive drying.

2. Whenever a trenching machine is used close to plants having roots smaller than two inches in diameter, the trench wall adjacent to the tree or plant shall be hand trimmed and roots cleanly cut. All cuts through ½-inch roots or larger shall be properly painted with an emulsified asphalt type tree seal. Trenches adjacent to trees shall be closed within twenty-four (24) hours and where this is not practicable, the trench wall adjacent to the tree shall be kept shaded with moistened burlap or canvas.

3. When it is necessary to cut limbs and branches of trees to provide clearance for equipment used in construction, the Contractor shall repair the damaged areas by properly painting with an emulsified asphalt type tree seal. In no case shall any limbs be cut or trees removed without first obtaining approval from the Construction Administrator and the tree owner.

B. Restoration: The Contractor shall restore all existing landscaped improvements, which are removed or damaged during its work, to a condition equal to or better

than their original condition. Stored topsoil shall be used in restoring existing landscaping. The Contractor shall properly water and maintain restored landscaping for a period of at least thirty (30) days after acceptance of the work, unless otherwise directed by the Construction Administrator.

3.7 **Testing**

- A. General: As part of the inspection program, the Construction Administrator or designee will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these Specifications. The Contractor shall remove surface material at locations designated by the Construction Administrator and provide such assistance as necessary for sampling and testing by the Construction Administrator.
- B. Standards: Unless otherwise specified, the most recent standard of the following test methods shall be used:

TEST DESCRIPTION	ASTM TEST METHOD NUMBER
Maximum Density and Optimum Moisture Content	D-1557
Relative Compaction	D-1556 or D-2922

3.8 **Unusual Conditions**

- A. In the event that any unusual conditions not covered by the special provisions are encountered during grading operations, the Construction Administrator shall be immediately notified in accordance with the General Requirements.

*** END OF SECTION **

SECTION 02500

PAVING AND SURFACING

1.0 **GENERAL**

1.1 **Section Includes**

- A. Asphalt Concrete Paving.
- B. Portland Cement Concrete Paving.
- C. Slurry Seal.

1.2 **Related Sections**

- A. Section 02220, **EXCAVATING, BACKFILLING, AND COMPACTING**.
- B. Section 03300, **CAST-IN-PLACE CONCRETE**.

1.3 **References**

- A. Standard Details:
 - 1. City of Clayton – May 1990, or latest edition.
 - 2. City of Concord – March 1992, or latest edition.
 - 3. City of Martinez – September 1991, or latest edition.
 - 4. City of Walnut Creek – August 1976, or latest edition.
 - 5. Contra Costa County – August 1966, or latest edition.
 - 6. City of Pleasant Hill – Latest edition.
 - 7. Contact individual agencies for additional information.
- B. STANDARD SPECIFICATIONS and STANDARD PLANS – California Department of Transportation (Caltrans), July 1999.

1.4 **Submittals**

- A. Submit the following to the Construction Administrator for review:
 - 1. Asphalt Concrete Mix Design: Submit sources, proportions, and testing data for all constituent materials, and mixture characteristics for all designs of asphalt concrete. The design mix shall be performed by an approved testing laboratory.
 - 2. Portland Cement Concrete Mix Design: Refer to Section 03300, **CAST-IN-PLACE CONCRETE** for submittal requirements.
 - 3. Slurry Seal Mix Design: Submit sources, proportions and testing data for

all constituent materials, and mixture characteristics for all designs of slurry seal. The design mix shall be performed by an approved testing laboratory.

4. Admixtures: Submit specification sheets and a statement of suitability provided by manufacturer for all admixtures used in the asphalt concrete and slurry seal mix designs.

1.5 **Quality Assurance**

- A. Perform work in accordance with all referenced codes, specifications, and standards, except as modified herein.
- B. The design of asphalt concrete and slurry seal mixtures shall be the responsibility of the Contractor, and shall be subject to review and approval by the Construction Administrator.
- C. Obtain materials from same source throughout the term of this Contract, unless otherwise approved by the Construction Administrator.

1.6 **Delivery, Storage, and Handling**

- A. Delivery and storage of mixing materials shall be in accordance with STANDARD SPECIFICATIONS, Section 39-3.
- B. Store and protect all materials on the jobsite in accordance with the manufacturer's recommendations.

2.0 **PRODUCTS**

2.1 **Materials**

- A. Asphalt Concrete: Asphalt concrete shall meet the requirements of STANDARD SPECIFICATIONS, Section 39, for Type B asphalt concrete.
 1. Asphalt Binder: The asphalt binder to be mixed with the aggregate shall meet the requirements of STANDARD SPECIFICATIONS, Section 92-1.02, for Grade AR4000 steam-refined paving asphalt.
 2. Aggregate: Aggregate used in the asphalt concrete mix design shall meet the requirements of STANDARD SPECIFICATIONS, Section 39-2.02, for Type B, 1/2 inch maximum aggregate, medium grading.
 3. Prime Coat: Prime coat shall meet the requirements of STANDARD SPECIFICATIONS, Section 93-1.01, for SC-70 liquid asphalt.
 4. Paint Binder (Tack Coat): A paint binder of asphaltic emulsion meeting the requirements of STANDARD SPECIFICATIONS, Section 94, for Type SS1.

5. Seal Coat: Fog seal coat shall consist of a mixture of slow setting type asphaltic emulsion and additional water. The asphaltic emulsion shall meet the requirements of STANDARD SPECIFICATIONS, Section 93-1.01, for SC-250 liquid asphalt.
- B. Portland Cement Concrete: Portland Cement concrete shall meet the requirements of STANDARD SPECIFICATIONS, Section 90-1.01, for Class 3 concrete. Refer to Section 03300, **CAST-IN-PLACE CONCRETE**, for mix design and submittal requirements.
 - C. Slurry Seal: Slurry seal shall meet the requirements of STANDARD SPECIFICATIONS, Section 37-2.
 1. Aggregate: The aggregate shall meet the requirements of STANDARD SPECIFICATIONS, Section 37-2.02C, for Type II aggregate. The use of crushed granite or other gray-colored aggregate will not be allowed. Aggregate shall consist of Table Mountain or other rock similar in color (black) and nature, except that the aggregate or combination of aggregates shall be produced by crushing rock. All materials shall be free from organic matter and other deleterious substances, oversized particles, and caked lumps.
 2. Latex Asphalt Emulsion: The latex asphalt emulsion shall meet the requirements of STANDARD SPECIFICATIONS, Section 94, for QS1 or CQS1 quick-setting asphaltic emulsion.
 3. Mineral Filler: Mineral filler shall be Portland Cement or other approved mineral filler, if required by the mix design. Portland Cement, if used, shall be commercially available Type I-II and shall be free of lumps and clods.
 - D. Water: Clean and free from injurious amounts of oils, acid, alkali, organic matter, or other deleterious substances.
 - A. **II Any other required paving materials, such as admixtures or special coatings, may be included here!!**

3.0 **EXECUTION**

3.1 **Site Examination**

- A. Prior to performing any work, carefully examine site and verify all pipe installation, final grading, valve can installations, adjacent concrete work, and backfill work is completed.
- B. Verify site is dry and non-frozen, and that paving work may proceed.

3.2 **Site Preparation**

- A. Removal of Existing Pavement: In paved areas, cut and remove pavement on the neat lines to the minimum trench width specified in Section 02220, **EXCAVATING, BACKFILLING, AND COMPACTING**, or as indicated on the

Drawings. Prior to placement of the permanent pavement, the pavement shall be saw cut and removed for an additional six (6) inches on each side of the trench. The edges shall be thoroughly cleaned of all mud, dirt, and dust before placing the surface material.

- B. Removal of Temporary Asphalt: Remove and dispose of any temporary asphalt material.
- C. Pavement Grinding Before Resurfacing: Only cold planing methods are allowed. Equipment shall not produce dust, fumes, or smoke. The cutting chamber shall be enclosed and equipped with a fog spray system. Materials shall be completely removed from the pavement, gutters, and sidewalks each day.

3.3

Pavement – General

- A. General: Pavement shall be replaced to neatly sawed or scored edges. If the pavement is scored, first the center, then both edges shall be scored. The pavement shall be replaced to clean straight lines. Care shall be taken to match the color and texture of the new pavement to that of the existing pavement.
- B. Notification: Prior to placement of paving material, notify local governing agency a minimum of forty-eight (48) hours in advance for inspection of opening.
- C. Temporary Paving: Trenches in areas used by public traffic shall be backfilled as soon as possible. If the trench is within existing pavement, it shall be paved immediately with temporary paving and maintained in a condition that will provide for the safe passage of traffic until the permanent paving is placed. Temporary paving shall consist of premixed bituminous treated aggregate. Unless specifically approved by the Construction Administrator, all trenches within traveled roadways shall be backfilled and temporarily paved by the end of each working day. Placement of permanent pavement immediately following backfill may be allowed subject to the approval of the Construction Administrator.
- D. Permanent Paving: No pavement over the trench shall be left unrepaired for a period longer than that approved by the local governing agency.
- E. Pavement Thickness: The thickness of the pavement shall be as required by the local governing agency, but in no case less than 3 inches, or as indicated on the Drawings, whichever is greater. The Contractor shall be responsible for contacting the local governing agency for thickness requirements prior to submittal of bid. Any discrepancy between these Specifications, Drawings, and local governing agency standards shall be superceded by the decision of the local governing agency. Should the Contractor choose not to contact the local governing agency for thickness requirements prior to submittal of bid, no additional compensation will be allowed for variations in pavement thickness.
- F. Replacement of Surface Features: All striping, street markings, signs, signal systems, curbs, gutters, etc., which have been disturbed by the construction operations, shall be restored to their original condition by the Contractor within the time frame established by the Construction Administrator.

3.4

Asphalt Concrete Paving

- A. General: Asphalt concrete shall be placed where indicated on the Drawings and where existing asphalt concrete pavement is removed. Storing, proportioning, mixing, equipment, spreading, compacting, and miscellaneous asphalt concrete shall conform to the requirements of STANDARD SPECIFICATIONS, Sections 39-3, 39-5, 39-6 and 39-7.
- B. Aggregate Base and Sub-base: Compact and prepare aggregate base or subbase according to respective Standard Detail, and as outlined in Section 02220, **EXCAVATING, BACKFILLING, AND COMPACTING**. Compact base course to plus or minus ½-inch from line and grade.
- C. Prime Coat and Paint Binder (Tack Coat): Wherever indicated in these Specifications and/or on the Drawings, prime coat and paint binder (tack coat) shall be applied in accordance with STANDARD SPECIFICATIONS, Section 39-4.02. A prime coat shall be applied for all locations where asphalt concrete pavement is removed and replaced. Paint binder (tack coat) shall be applied to all vertical surfaces of existing pavement, curbs, gutters, and construction joints in the surfacing against which additional material is to be placed, and shall also be applied to pavement to be surfaced.
- D. Seal Coat: Wherever indicated on the Drawings and/or specified herein, a fog seal shall be applied. Application shall conform to the requirements of STANDARD SPECIFICATIONS, Section 37. The application of the fog seal coat (asphaltic emulsion and added water) shall be such that the original emulsion will be spread at a rate of 0.07 gallon per square yard.
- E. Sand Seal: After placement of the finished asphalt concrete, the joints between the existing pavement and the trench or overlay paving shall be filled flush with liquid asphalt and covered with sand.
- F. **!! Any additional requirements for asphalt concrete paving may be included here!!**

3.5

Portland Cement Concrete Paving

- A. General: Concrete pavement shall be placed where indicated on the Drawings and where existing concrete pavement is removed, in accordance with the provisions of Section 03300, **CAST-IN-PLACE CONCRETE**, and STANDARD SPECIFICATIONS, Section 40.
- B. Aggregate Base and Sub-base: Compact and prepare aggregate base or sub-base according to respective Standard Detail, and as outlined in Section 02220, **EXCAVATING, BACKFILLING, AND COMPACTING**. Compact base course to plus or minus 1/2 inch from line and grade.
- C. Reinforcement: Reinforcement shall be as shown on the Drawings, and shall be installed in accordance with Section 3300, **CAST-IN-PLACE CONCRETE**.
- D. Thickness: The minimum concrete thickness shall be four (4) inches, or as indicated on the Drawings, whichever is greater. Minimum cover requirements

shall be as specified in Section 03300, **CAST-IN-PLACE CONCRETE**.

- E. Removal and Replacement of Existing Concrete: Existing concrete pavement, curbs, sidewalks, driveways, and valley gutters removed in connection with construction shall be replaced to neatly sawed edges. Saw cuts shall be a minimum depth of 1½- inches in concrete pavement or driveway and a minimum depth of one (1) inch in concrete sidewalk.
 - 1. Concrete sidewalks or driveways shall be removed so that a minimum thirty (30) inch square is replaced. If the saw cut in the sidewalk or driveway falls within thirty (30) inches of a construction joint, expansion joint or edge, the concrete shall be removed and replaced to the joint or edge. If the saw cut falls within twelve (12) inches of a score line, the concrete shall be removed and replaced to the score line.
 - 2. Removal of concrete pavement shall be by jackhammer rather than by mechanical stomper.

3.6 **Slurry Seal**

- A. General: The slurry seal shall be mixed and placed in accordance with the requirements of STANDARD SPECIFICATIONS, Section 37.
- B. Removal of Pavement Markings: Prior to placement of the slurry seal, all existing thermoplastic traffic stripes, pavement markings, and pavement markers shall be removed in accordance with the provisions of STANDARD SPECIFICATIONS, Sections 15-2.02B and 15-2.02C.
- C. Construction Joints: Construction joints shall be neat in appearance and shall be tapered or feathered to conform to the existing surfacing. All excess materials shall be removed from surfaces upon completion of each run.
- D. Clean-up and Acceptance: Once the slurry seal has cured and is open to traffic, any excessive raveling of the aggregate from the mixture shall be swept up by the Contractor and the surface maintained until such time as the raveling ceases or the surface is rejected by the Construction Administrator.
- E. **!! Any additional requirements for slurry seal may be included here!!**

3.7 **Inspection**

- A. Ponding: Run or spray water on asphalt concrete or portland cement concrete surfaces to detect low spots or ponding. Immediately correct any low spots to provide smooth surface and eliminate ponding.
- B. Deficient Work: Contractor shall remove and rework all surfaces and sub-grade areas that do not meet requirements of the respective Drawings, Standard Details, or local governing agency requirements at no additional cost to the District.

*****END OF SECTION*****