

SECTION 17

BORING, TRENCHING, POTHOLING, AND DEWATERING

17-1 GENERAL

A. Boring

1. The scope of this Work shall include boring of conduit and surface restoration. Conduit shall be installed in accordance with Standard Drawing number 402.

B. Trenching

1. The scope of this Work shall include trench excavation, backfill and surface restoration, and shall be in accordance with Standard Drawing numbers 401, 403 and as included herein.

C. Trench Plates

1. The scope of this Work shall include trench plates and shall be in accordance with Standard Drawing number 404-405.

D. Potholing

1. The scope of this Work shall include potholing, backfill and surface restoration. The contractor shall be required to pothole all utilities by hand digging or core drilling and vacuum methods in every intersection crossing the excavation or boring alignment. The Contractor shall pothole as necessary to determine the exact locations of pipes in critical situations prior to or during construction. Critical situations shall be defined by the Engineer.
2. Where connecting to or crossing existing underground utilities, the Contractor shall uncover these utilities and verify the locations and elevations prior to performing any installation Work within one-hundred-fifty (150) feet of these locations.

E. Existing Utilities

1. The location of existing utility mains and lateral lines including storm drain, sanitary sewer, water, gas, underground electrical and communication conduits crossing the trench excavation shall be verified by the Contractor. The Contractor shall be responsible for notifying Underground Services Alert (USA) at 811 or 800-642-2444 at least five (5) working days prior to beginning underground work so that existing utilities can be marked in the field, unless otherwise stated by City contract.

Contractor shall expose all crossing utilities ahead of any boring or trench operations.

2. Any existing utility cut or damaged, including but not limited to during potholing or trenching operation shall be called to the attention of the Engineer. Remedial measures required due to the Contractor's action shall be at the Contractor's expense. All exposed utility mains and lateral lines shall be backfilled in accordance with Standard Drawing, number 401. Exposed gas mains require inspection by the Engineer prior to backfilling.

F. Design Plans

1. The City may require design plans to include an engineering plan and profile of each street block, showing the location of existing underground utilities in the proposed path of the conduit installation. These plans shall also show the location of the proposed conduit relative to the nearest utilities maintaining a minimum clearance of twelve (12) inches.
2. The design plans shall also include the approximate locations and dimensions for surface restoration. All boring and trenching is subject to the City's Trench Cut Fee per the City's ordinance.

G. Safety, Bracing and Shoring

1. Excavations shall be supported and excavation operations conducted in accordance with the rules of the California Occupational Safety & Health Administration (OSHA). If in the opinion of the Engineer, there exists a situation of imminent danger to the workers, the Engineer may order the work stopped and the contractor shall comply with rules of the California Occupational Safety & Health Administration (OSHA).

H. Street Cut Fee

1. The Contractor shall pay to the City a street cut fee to recover the increased repaving and reconstruction costs incurred by the City that are reasonably attributable to the impact of excavation in City streets. See the City's Municipal Fee Schedule for street cut fees.

I. Five-Year Moratorium

1. In order to maintain structural integrity and minimize pavement degradation from the effects of utility cuts, the City has implemented a five (5) year moratorium on cutting or opening all new pavement surfaces. After any street

has been constructed, reconstructed, paved, or overlaid by City crews, under City contract, or under permit, the pavement shall not thereafter be cut or opened for a period of five years.

The City Engineer may grant exemptions to this restriction to facilitate private development on adjacent properties or for emergency repairs. The City may impose conditions deemed necessary to the restoration of the pavement surface when granting exemptions, which may include requiring the repair of base/sub-base, and grinding and repaving up to the full-width of the pavement surface.

All utility cuts performed on pavement that has been slurry sealed or microsurfaced within the past two years shall be slurry sealed or microsurfaced after trench restoration has been completed. The length and width of the required patch work shall be dependent on the length and width of the trench and its proximity to adjacent features such as lane lines and gutters, as determined by the City Engineer.

17-2 RELATED WORK

- A. Refer to Section 3 for Temporary Controls and Section 5 for Requirements for Work in City Right of Way and Stormwater Pollution Prevention per City Standard Specification Section 8.
- B. Refer to “Asphalt Concrete” in Section 13 and “Concrete” in Section 16 for pavement materials.
- C. Refer to City of Palo Alto Utilities Department Water, Gas and Wastewater Utility Standards and the Electric Service Requirements Manual for design and construction of all water, gas, wastewater, and electrical utility facilities.
- D. Refer to Standard Drawing number 403 for trench limits of restoration.
- E. Refer to Tree Restriction Zones and Tunneling and Directional Boring in the Tree Technical Manual (TTM) Section 2.20.C and Section 2.20.D.

17-3 PRODUCTS

- A. Backfill for Boring
 - 1. Backfill shall be sand or granular material falling within the limits described in the Standard Drawing 401. Aggregate base, asphalt concrete, Portland cement concrete shall conform to the requirements within these specifications.

2. The use of controlled density fill (CDF) is permissible provided the specifications have been approved by the Engineer.
- B. Boxes
1. Vaults or other service boxes shall be located within the sidewalk unless the Engineer approves an alternative location. Boxes and lids must be AASHTO H20 traffic-rated and have the approval of the Engineer.
- C. Backfill for Trenching
1. Improved Areas
 - a. Initial backfill (pipe zone) and subsequent backfill shall be sand or granular material falling within the limits described in the Standard Drawing, number 401. Aggregate base, asphalt concrete, Portland cement concrete, and reinforcing fabric shall conform to the requirements within these Specifications.
 2. Unimproved Areas
 - a. Initial backfill shall be as above and subsequent backfill may be native soil.
- D. Conduit
1. All conduits shall be per the City of Palo Alto Utilities Department Water, Gas and Wastewater Utility Standards and the Electric Service Requirements Manual.
- E. Dowels
1. Dowels shall be twelve (12) inches long and either A36 steel, Grade 60 #4 rebar or smooth coated dowels epoxied in place with slip covers.
- F. Trench Plates
1. Steel plates shall have a surface that was manufactured with a nominal Coefficient of Friction (COF) of 0.35 as determined California Test Method 342.
 2. For ADA compliance, all cutback or premix around trench plate shall be placed so there will be a 12:1 slope to allow for disabled access.
 3. A maximum of three-hundred (300) feet or one (1) City block of trench, whichever is greater, may be opened at one time. Refer to Standard Drawing number 404-405 – Trench Plates for further details.

4. Refer to Section 17-4 C and Drawing 405 for special cases where recessed trench plates are required.

G. Backfill for Core Drilled Potholing

1. Asphalt Concrete & Asphalt Overlayed Portland Cement Concrete Streets - Backfill for core drilled potholing shall be twelve (12) inches of sand above the pipe or conduit then fill the holes with Control Density Fill as described per Specifications Section 17-4F4b – Controlled Density Fill (CDF) and cap with two (2) inches of three-eighths (3/8) inch mix of Asphalt Concrete per Specifications Section 13 – Asphalt Concrete.
2. Portland Cement Concrete (PCC) Streets – Backfill for core drilled potholing shall be twelve (12) inch of sand above the pipe or conduit then fill the holes with be Control Density Fill as described per Specifications Section 17-4F4b - CDF to the surface of the PCC street and finished to meet the existing street pavement.

17-4 EXECUTION

A. Conduit

1. The Contractor shall install the conduit in accordance with the approved street work permit. All conduits shall be installed underground using directional boring method. Micro-tunneling or other methods shall be approved by the Public Works Engineering Division. The conduits shall be installed with tracer wire approved by the Engineer per City of Palo Alto Utilities Department Water, Gas and Wastewater Utility Standards. Refer to Standard Drawing 402.

B. Trench Excavation

1. The Contractor shall remove the necessary pavement, excavate to the lines and grades shown on the drawings, place and maintain all required temporary steel plating for traffic; sheeting, shoring, and bracing of all trench excavations; if dewatering is necessary, disposing of all drainage or ground water per Specifications Section 17-4B6 – Dewatering Operations.
2. Excavations in the street shall be performed in such a manner as to prevent unnecessary damage to streets, sidewalks, landscaping, street trees (see Section 26 – Tree Protection) and other existing improvements or underground utilities.
3. The Contractor shall remove any water seepage into trench excavation by furnishing and operating appropriate pumps. Refer to Specifications Section 17-4B6 – Dewatering Operations.

4. Trenches shall not be left open at the end of the day. Adequate provisions shall be made for the placing of temporary steel plates in addition to barricades, signing and lighting. Stockpiling of excavated material within the public right-of-way shall not be allowed. A maximum of three-hundred (300) feet or one (1) City block of trench, whichever is greater, may be opened at one time. For temporary patching, a minimum thickness of two (2) inches of cutback will be used.
5. The Contractor shall notify and receive approval from the Engineer for the removal of any areas of unsuitable soil material along the trench bottom in order that an approved select granular backfill material may be placed. This authorized work shall be paid for as extra work in accordance with these specifications.
6. Dewatering Operations
 - a. Sediment Control
 1. The Contractor shall follow the City's Guidelines for Dewatering During Basement or Below Ground Garage Construction, and when permitted route water through a control measure, such as a sediment trap*, sediment basin, or Baker tank, to remove settle-able solids prior to discharge to the storm drain system.
 2. Approval of the control measure shall be obtained in advance from the Engineer.
 3. Filtration of the water following the control measure may be required on a case-by-case basis.
 4. If the Engineer determines that the dewatering operation would not generate an appreciable amount of settleable solids, the control measure requirement in 1) above may be waived.
 5. The Contractor shall reuse water for other needs, such as dust control or irrigation, to the maximum extent practicable.
 - b. Contaminated Groundwater
 1. If the project is within an area of known groundwater contamination, then water from dewatering operations shall be tested prior to discharge. If the water quality meets the Palo Alto Regional Water Quality Control Plant (PARWQCP) approval, then it may be discharged to the storm drain. If the water quality meets City of Palo Alto Municipal Code section 16.09.110, then it may be discharged to the sanitary sewer

with prior approval from the Palo Alto Regional Water Quality Control Plant. Otherwise, the water shall be treated or hauled off-site for proper disposal.

2. If the project is not within an area of known groundwater contamination, then monitoring shall only be required if directed by the Engineer. The Contractor shall follow section 17-4B6b above, if contamination is found.
3. If the project is found to be within an area of groundwater contamination not identified by the City in the project specifications, a change order shall be negotiated to cover additional work performed by the Contractor.

** See California Stormwater Best Management Practice Handbook - Construction Activity and Regional Water Quality Control Plant Handbook – Dewatering from Construction Sites and In-Ground Utilities Maintenance Project.*

C. Trench Plates

1. Temporary steel plates over trench openings shall be removed within fourteen (14) calendar days after placement. If steel plates are not removed within fourteen (14) calendar days after placement, a penalty may be imposed as determined by Public Works Engineering.
2. Trench plates installed along Class I & II bike lanes, bike boulevards, arterial roadways, or along roads with a posted speed limit of 35 MPH or greater shall be set flush with the surrounding asphalt concrete surface. This requirement does not apply to PCC surfaced streets. See Standard Drawing Number 405.
3. Trench plates installed in Class I & II bike lanes, and bike boulevards shall be skid resistant and have a reflective coating or tape for additional safety, and shall be set flush with the surrounding asphalt concrete surface (Refer to Standard Drawing 405). Additional warning signage shall be posted on Type II flashing barricades.

D. Trench Plate General Notes

1. Steel plates must be able to withstand H-20 traffic load without any movement.
2. Steel plates must meet ASTM A36 steel requirements (min).

3. When two or more plates are used, the plates shall be tack welded together, metal connectors shall be used only with prior approval from the Engineer.
4. Steel plates shall resist bending, vibration, noise, etc., and anchored to resist movement under traffic loads. If these conditions are not met, daily backfill and paving of excavation will be required.
5. All steel plates shall be properly marked with the utility and contractor name, and after-hours contact phone number in the event the plates need to be secured. Alternatively, this information can also be prominently posted on a barricade.
6. All steel plates within the right-of-way, whether used in or out of the traveled way, shall be without deformation. The plate surface must not deviate more than 1/4" when measured with a 10-foot straight edge along the length of the plate.
7. It is the responsibility of the permittee to perform and document daily inspections of all active plate(s) or unattended plate(s) location(s), and where necessary take appropriate measures to protect the public safety until work is completed. This documentation shall be available to the City inspector upon request. No un-plated excavation shall be left unattended overnight.
8. In the event of improper installation of the steel plates that presents a nuisance or a public safety problem, the permittee shall respond to all excavation restoration requests by the City immediately upon notification. Non-responses will result in the required restoration work being done by the City, with all expenses to be paid by the permittee.
9. Steel plates must extend a minimum of 12-inches beyond the edges of the excavation. Contractor shall follow steel plate manufacturer's recommendation.
10. Steel plate thickness must be minimum 1", and increases to 1-1/4" for 5-foot wide trench. Steel plate for trench widths greater than 5 feet shall require a special structural design.
11. Before steel plates are installed, the excavation shall be adequately shored to support the bridging and traffic loads.
12. Temporary paving with a cold asphalt mix should be used to feather the edges of the plate to form a wedged taper to cover the edges of the steel plate. Other alternative methods to accomplish this will be considered for approval.

13. Wedges or other non-asphaltic devices shall be used for leveling as required to eliminate rocking of the plates. Compacted temporary asphalt shall be used to fill all gaps between the plates and existing pavement surfaces.
14. Contractor shall install "STEEL PLATE AHEAD" sign in advance of all temporary steel plates used on roadways open to vehicular/bicycle traffic.

E. Saw-Cutting or Milling

1. Prior to excavation of trenching, potholing or sending/receiving pits, the asphalt concrete or Portland cement concrete shall be cut or mill to a neat line full depth with a saw-cutting or milling device approved by the Engineer.
2. The edge of excavations broken during construction shall be saw-cut or mill neatly and removed before surface restoration. Saw-cutting or milling details are shown in Standard Drawing Number 401.
3. The disposal of materials and/or slurry from saw-cutting or milling shall conform to Section 8-3, "Stormwater Pollution Prevention", of these Standard Drawings and Specifications.

F. Backfill

1. Backfill material shall be compacted to 90 percent minimum relative compaction except the top twenty-four (24) inches, which shall be mechanically compacted to 95 percent minimum relative compaction. Mechanically compacted lifts using alternative equipment, complying with manufacture's specification, will require the approval of the Engineer. Use of alternative compaction equipment shall not relieve the Contractor from responsibility for any damage to the conduit, surrounding ground, or existing and new improvements.
2. Initial Backfill - The bedding material shall have a minimum thickness of four (4) inches or one-sixth (1/6) of the outside pipe diameter below the bottom of the pipe, whichever is greater. After bedding has been placed, the pipe shall be laid true to line and grade using material described as initial backfill (pipe zone), and the material shall extend twelve (12) inches above the top of the pipe.
3. Relative compaction shall be 90 percent. When sand is selected for initial backfill, the Contractor may elect to "jet" provided excess water is collected at the low points and removed by pumping. Refer to Standard Drawing number 401.

4. Initial Backfill Material.

- a. The initial backfill zone extends from the bottom of the trench to one foot above the top of the pipe. There are four alternative materials which may be used for this material:
 - i. Clean natural sand in accordance with Caltrans Section 19.3.025B. Backfill around gas and water facilities shall be clean natural sand.
 - ii. Class I, Type A and B Permeable Material in accordance with the Caltrans Standard Specifications Section 68-1.025. The specifications contain gradation requirements as well as the requirement that the material's Durability Index be at least 40.
 - iii. A graded granular material which has 100 percent of sizes smaller than one (1) inch between 90 and 100 percent smaller than one-half (1/2), 50 to 90 percent smaller than the No. 4 sieve, between 10 and 30 percent smaller than the No. 50 sieve, and less than 15 percent smaller than the No. 200 sieve. The gradation of the material should be determined in accordance with ASTM Test D416-39. The minimum sand equivalent of this alternative material shall be 30.
- b. Controlled Density Fill (CDF) as described below.
 - i. CDF shall be a mixture of Portland cement, fly ash, aggregates, water, and admixture proportioned to provide a non-segregating, self-consolidating, free-flowing, and excavatable
 - ii. Material that will result in a hardened, dense, non-settling fill.
 - iii. CDF shall be composed of Portland cement, aggregate, fly ash, and water and shall conform to the following requirements:
 - iv. Portland cement: ASTM C150, Types I or II.
 - v. Aggregate: Sand with or without fine gravel, maximum size three-quarters (3/4) inch. Aggregate shall be free of foreign material or organics and shall have less than 10 percent finer than the No. 200 sieve, unless clean coarse aggregates are added to the mix.
 - vi. Water (potable).
 - vii. Fly Ash: Class F ASTM C618, unless otherwise approved.

- c) CDF shall be proportioned to be a flowable, non-segregating, consolidating, low shrink slurry with a slump and unconfined compressive strength of 100 psi (+50 psi, -20 psi) at fourteen (14) and twenty-eight (28) days. Maximum density 130 pcf.
- d) The Contractor and its supplier shall determine the materials and proportions used to meet the requirements of these Specifications. The Contractor shall make daily checks of the aggregate gradation and adjust the mix design as required to meet these specifications. The CDF mix shall be modified as necessary to meet the flowability, pumpability, and set time requirements for each individual pour.
- e) At least thirty (30) days before placing CDF, the Contractor shall submit to the Engineer a mix design for the CDF to be used. The mix design shall include trial lab and field data, with six (6) inch by twelve (1) inch cylinder breaks performed at fourteen (14) and twenty-eight (28) days.
- f) No CDF shall be placed until the Engineer has approved the mix design. The Engineer's approval of the mix design shall be understood to indicate conditional acceptance. Final acceptance will be based on tests conducted on field samples and conformance with these Specifications.

G. Subsequent Backfill

1. Improved Areas: Material described as subsequent backfill shall be compacted to 90 percent minimum relative compaction except the top twenty-four (24) inches, which shall be mechanically compacted to 95 percent minimum relative compaction.
2. Mechanically compacted subsequent backfill shall be placed in horizontal layers not exceeding eight (8) inches. Thicker compaction lifts using alternative equipment, complying with the manufacturer's specification, will require the approval of the Engineer.
3. Use of alternative compaction equipment shall not relieve the Contractor from responsibility for any damage to the pipe, surrounding ground, or existing and new improvements. Compaction of subsequent backfill by jetting (except the top twenty-four (24) inches) may be permitted by the Engineer when the backfill material is sand and the foundation materials will not soften or otherwise be damaged by the applied water. Jetting and "point" vibration shall be as indicated in the Standard Drawing, number 401.

4. Backfill Zone -The subsequent backfill zone shall extend from the top of the initial backfill zone up to the bottom of the pavement section. In unimproved areas, those not within the street areas, the subsequent backfill zone should extend from the top of the initial backfill zone up to the final grade. Unimproved areas may be backfilled with excavated native material or the following materials recommended for the improved areas of the project.
5. Subsequent Backfill Material
 - a. Five alternative materials may be used for the subsequent backfill zone in improved areas:
 - i. Clean natural sand in accordance with Caltrans Section 19.3.025.B
 - ii. Clean quarry fines.
 - iii. Class II Aggregate Base in accordance with Caltrans Standard Specifications Section 26-1.02. Either one-and-one-half (1-1/2) inch or three-quarters (3/4) inch maximum Class II Aggregate Base may be used.
 - iv. A graded granular material which contains no organics and has 100 percent of sizes smaller than three-quarters (3/4) inch, between 60 and 100 percent smaller than three-quarters (3/4) of an inch, 45 to 90 percent smaller than the No. 4 sieve, between 5 and 30 percent smaller than the No. 100 sieve, and less than 15 percent smaller than the No. 200 sieve. The gradation of the material shall be determined in accordance with ASTM Test D316-39.
 - v. Controlled density backfill as described above.
6. Unimproved Areas
 - a. Shall be defined as any area where hard-scaped or landscaped improvements do not exist and where trench settlement would not be detrimental to existing or anticipated improvements. In the unimproved areas described above, the Engineer may permit the use of native material as subsequent backfill. The subsequent backfill may be jetted or mechanically compacted to 85 percent minimum relative compaction.

H. Trench Surface Restoration

1. Street Restoration on Open Cut Installation

- a. If installing utility laterals by open trenching methods to 50% of houses per block or more on an Asphalt Concrete (AC) street rated to be "Excellent" or in "Very Good" Condition, then the Contractor shall wedge cut and install a minimum one-and-one-half (1-1/2) inch asphalt overlay covering the entire street as determined by Public Works Engineering Services. When an overlay covering the entire street is required, the street cut fee may be waived as determined by the City Engineer.
- b. If a trench is to be installed parallel to and within two (2) feet of an existing trench or lip of gutter then the Contractor shall remove and replace the existing pavement section between the new trench and the outside edge of the existing trench and/or lip of gutter as determined by Public Works Engineering Services.
- c. If a trench is to be installed parallel partially or fully within a bike lane, then the Contractor shall remove and replace the full width of the affected bike lane section, typically from lip of gutter to bike lane line, there shall be no longitudinal/parallel joints within the bike lane in addition to other requirements as determined by Public Works Engineering Services.
- d. a, b, & c will not apply if the street is scheduled by Public Works Engineering Services to be resurfaced within one (1) year after completion of trenching work.

2. Street Restoration on Bore/Pipe Bursting or similar Installation

- a. If installing utility laterals to 50% of the house per block and/or mains by bore technology on a street that has been slurry or micro surface sealed in the past two (2) years and is rated to be "Excellent" or in "Very Good" condition, then the Contractor shall install slurry seal or microsurfacing utilizing black volcanic rock to match the surrounding pavement conditions to prevent the road from having a checkerboard appearance.
- b. Contractor shall remove USA markings from all surfaces once a project has been completed, using an appropriate method approved by the Engineer.

3. Improved Areas - Pavement shall be replaced either in-kind or in accordance with the following table, whichever is greater.

Existing Pavement Material	Minimum Structural Section
Asphalt Concrete (AC)	2" AC over 8" Aggregate Base or 8" AC Deep Lift
Portland Cement Concrete (PCC)	6" PCC over 6" Aggregate Base
AC over PCC	2" AC over 6" PCC over 6" Aggregate Base

4. Unimproved area – Trench shall be replaced in kind
5. Limits of Trench restoration.
 - a. Portland Cement Concrete surfaced streets.
 - i. Restore all materials in kind to match existing elevations and grades.
 - ii. If a trench is within three (3) feet of Top of Curb of Type B rolled curb or within two (2) feet of the Face of Type A curb, remove and replace curb monolithically.
 - iii. If a trench is within two (2) feet of a deep control joint, remove and replace the section between the control joint and the trench monolithically with the trench restoration. This method of restoration does not alleviate the requirement for a T-Cut elsewhere.
 - iv. If a trench is to be installed on a PCC slab with minimal cracking and is in excellent condition, the entire PCC slab shall be replaced per Standard Drawings Number 401 and 403.
 - b. Asphalt Concrete surfaced streets with no exposed gutter pan.
 - i. The asphalt shall be removed (approximate where the lip of gutter shall be) to verify width of existing gutter pan.
 - ii. Restore all materials in kind to match existing elevations and grades.
 - iii. When “trench limits” are within three (3) feet of the Lip of Gutter for either Type A or Type B curb and gutter on a PCC surface street, extend the “T – Cut” to the Lip of Gutter as shown in Standard drawing number 403.

- iv. If trench limit is NOT within two (2) feet at the Lip of Gutter, the “T-Cut” limit shall be located twelve (12) inches from Trench Limit as per Standard drawing number 403.
 - v. If Trench is within three (3) feet of Top of Curb of Type B rolled curb or within two (2) feet of the Face of Type A curb, remove and replace curb monolithically.
- c. Asphalt surfaced street with an exposed gutter pan.
- i. Restore all materials in kind to match existing elevations and grades.
 - ii. When “trench limits” are within three (3) feet of the Lip of Gutter for either Type A or Type B curb and gutter on a PCC surface street, extend the “T – Cut” to the Lip of Gutter as shown in Standard drawing number 403.
 - iii. If “trench limit is NOT within three (3) feet at the Lip of Gutter, the “T- Cut” limit shall be located twelve (12) inches from Trench Limit as per Standard drawing number 403.
 - iv. If Trench is within three (3) feet of Top of Curb of Type B rolled curb or within two (2) feet of the Face of Type A curb, remove and replace curb monolithically.
 - v. If a trench to be installed is perpendicular and through the gutter pan (such as a service lateral), to more than 50% of the houses per block, the existing section of curb and gutter disturbed by the work shall be restored to the nearest cold joint.

I. Testing

- a. Testing shall be performed to ensure compliance with these specifications. The test(s) shall be conducted at no cost to the City. Field density tests shall comply with ASTM D2916-71 and D3017-78 (determination of in-place density and water content of soils and soil-aggregate by nuclear methods). Laboratory determination of maximum density shall comply with ASTM D1557-78.

END OF SECTION