



Electric Trench Backfill

ISSUING DIVISION: Electric Engineering
SVP SPONSOR: Orville Plum, Manager

Signed by O J Plum
Date Signed Sept 17, 2013

SHEET: Sheet 1 of 8

SECTION: Substructures

UG 0345

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Scope of Standard	
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The UG 1000 Document includes information regarding standard backfill requirements for electric trenches. This document is intended to provide guidance and direction to installers of SVP electric conduit systems about the acceptable trench backfill methods and related material specifications. Please refer to specific design and construction drawings for details and locations where one of these backfill mixes may be required.

Purpose of Revision

This is a new document in the Substructures section of the Underground Construction documents. There is no revision at this time

References

- SVP Standard Document UG 1000 Revision 5, 2004, “Installation of Underground Substructures by Developers”
- Occupational Safety and Health Administration (OSHA), Publication OSHA 2226, 2002 (Revised), “Excavations”
- National Ready Mixed Concrete Association (NRMCA), CIP-17, 2000, “Flowable Fill Materials”
- State of California Department of Transportation (CalTrans), Standard Specifications, 2010, Section 19, “Earthwork”, Subsection 19-3.02 “Structure Backfill”
- SVP Public Works Contract 2114B Project Specifications, 2012, Section 3310, “Fluidized Thermal Backfill”
- Transmission & Distribution World, April 1, 2003, “Underground Cables Need a Proper Burial”, Deepak Parmar and Jan Steinmanis

Rescissions

None – This is an original document that has not been previously issued by the SVP Electric Engineering Division.

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Definition of Terms

- **Backfill:** Compacted material required over and around substructures, such as conduits and enclosures, to prevent damage to the substructures from vehicles or heavy equipment operating over or near the substructures.
- **Building Inspector:** City of Santa Clara Building Dept. Inspector, responsible for verifying proper installation and repair of all private building facilities. This includes the electric service entrance and meter service panel.
- **Developer:** A developer is any person who causes land to be divided into two or more parcels for himself or others; or is engaged in the development of property, in whole or in part, by the placing of any improvements thereon, whether the property was previously developed in whole, in part, or at all.
- **Contractor:** The person or persons, firm, partnership, corporation or combination thereof, who has entered into a contract with the City of Santa Clara, as a party or parties of the second part of his or their legal representative.
- **City:** City of Santa Clara or the City Council of the City of Santa Clara.
- **City Engineer:** City Engineer of the City of Santa Clara.
- **Flowable Fill:** A self-compacting low strength material with a flowable consistency that is used as an alternative backfill material to granular fill (sand). Flowable fill is a self-leveling material, placed with minimal effort, that does not require vibration or tamping. It hardens into a strong material with minimal subsidence. Also known as Controlled Low Strength Material (CLSM)
- **Public Works Inspector:** City of Santa Clara Public Works Dept. Inspector, responsible for verifying proper installation and repair of all facilities within City right of ways and easements.
- **Silicon Valley Power (SVP):** Municipal Electric Department of the City of Santa Clara.
- **SVP Inspector:** Silicon Valley Power Electric Inspector responsible for verifying proper installation of electric substructures installed for use of SVP.
- **Thermal Backfill:** Engineered backfill designed to maintain a relatively constant thermal resistivity less than 90°C-cm/W when placed around distribution and transmission cables.
- **Trench:** A narrow below grade excavation that is deeper than it is wide. Typical SVP width is 2 feet, but wider widths, up to 15 feet are possible.

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Inspections:

A. Work in a Public Right of Way or Public Easement

The Public Works Inspector shall be responsible for inspection. The Public Works Inspector will inspect all backfill. The Silicon Valley Power Inspector will be responsible only for inspecting conduits, manholes, vaults, boxes, SVP equipment pads, and streetlight foundations.

Phone: 408-615-3000 for Public Works Inspector (Have permit number available).
408-640-6302 for S.V.P. Inspector (Give Estimate Number of job when calling).

B. Work outside of a Public Right of Way or Public Easement

The Silicon Valley Power Inspector shall be responsible for inspection and will inspect all work including backfill.

Phone: 408-640-6302 (Give Estimate Number of job when calling)

C. Inspector Notification

The Inspector shall be informed at least 24 hours in advance before commencing any item of construction or installation of material in order to permit proper inspection of materials and workmanship. No work shall be embedded, backfilled or otherwise covered until such time as it has been inspected and approved by the Inspector. Any materials and / or workmanship failing to meet the requirements of this Specification, good acceptable engineering or construction practices, or installed without prior notice to Inspector shall be subject to rejection. If required by the Inspector, the Developer or Contractor shall, at his own expense, remove rejected work, finish and install approved material and /or workmanship.

D. Private Electric Equipment

For all work performed on the "Service Entrance" and other private-electrical equipment, a permit shall be obtained from the City Building Inspectors Division.

E. Safety Regulations

It is the Developer's and Contractor's responsibility to comply with all State and OSHA Safety Regulations.

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Permits:

For all work performed within a public right of way, electric easement, or public easement, an encroachment permit shall be obtained from the City Engineer's Office.

An encroachment permit is not required for work outside of a public right of way, electric easement or other public easement.

Guarantee:	
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It shall be the responsibility of the Developer or Contractor to repair and correct any defects or deficiencies in a backfilled electric trench excavation (the Work), due to workmanship or material, which are discovered within one year from date of acceptance by the City. Repairs and corrections will be made at no charge to SVP or the City of Santa Clara.

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within 48 hours after receipt of written notice from the SVP to commence and continue correction of such default or neglect with diligence and promptness, the SVP may, after 48 hours following receipt by the Contractor of an additional written notice and without prejudice to any other remedy make good such deficiencies. SVP reserves the right to make the necessary repairs or replacements at the expense of the Developer or Contractor. SVP will, as much as it is practicable, preserve the available evidence of cause of the failure for examination by the Developer or Contractor.

The City also reserves the right to perform any portion of the work due to an emergency threatening the safety of the Work, the Public, City, and any property or equipment.

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Sand Backfill	
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Sand is the typical and preferred trench backfill component. Sand that is backfilled around electric substructures should be a significantly different color so as not to get confused with surrounding soils. A sudden and drastic color change in soils can serve as a visual alert to anyone excavating in the area that an electric utility trench is in the immediate vicinity. This does not replace any need for marking and locating electric utilities. Rather, it is intended to serve as an additional visual reminder of the presence of electric substructures, and reduce the chance of an accidental dig-in and damage to SVP facilities.

Sand is to be clean with no clay or organic materials. Sand is to be free of toxic constituents at or above State or Federal hazardous waste levels. Manufactured sand is not approved as a backfill material around SVP electrical conduits. The total chloride content shall be ≤ 500 ppm. The total sulfate content shall be ≤ 150 ppm. The pH of the sand shall be ≥ 4.5 , but < 9 .

Approved sand sources are:

- Quail Hollow “Utility Trench Sand”
- Decker Island “DI Fill Sand”

When sand is used as a trench backfill component, it is to be installed in such a manner so as not to displace, damage, or collapse the trench substructures. A minimum compaction of 90% is required in landscaped areas. A minimum compaction of 95% is required in paved areas, such as streets, parking lots or sidewalks. Higher compaction in all areas may be required by appropriate permits or inspectors. Compaction may be achieved utilizing mechanical means in 8 inch lifts. Compaction may also be accomplished by jetting with pressurized water.

A concrete cap is required over sand backfilled conduits installed in landscaped areas or in areas where the depth of cover is less than 24 inches. The concrete cap is to cover the full width of the trench for the length of the applicable trench segment. The concrete cap shall be a minimum of 3 inches thick, have a minimum strength of 2500 pounds psi, and be red in color.

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Concrete Slurry Backfill Mixes

In cases where trenching is done in paved street areas or areas with a higher probability of trench settling in the future, other types of backfill or encasement may be required. Some acceptable alternatives to sand for backfilling around SVP's electric conduits include flowable fill, controlled density fill, and concrete encasement. Flowable fill and controlled density fill may be used in paved street or parking lot areas. Concrete should be used for conduit encasement when the minimum amount of soil cover is less than 24" or when making a transition from a bridge abutment to a concrete bridge. Approved mix designs for these alternate backfills are listed below.

- Flowable Fill Mix:

Slump:	10"
Maximum aggregate size:	No. 4
Minimum strength:	60 psi
Maximum strength:	120 psi (must be able to dig)
Minimum water/cement:	2.5 lbs/lb
Minimum cement/yd ³ :	94 lbs/yd ³
Type II cement	

- **Controlled Density Fill (CDF):**

Controlled Density Fill shall consist of sand, water, flyash, and cement in the following proportions:

Clean sand with no clay or organic material:	71.6% by volume
Water:	23.7% by volume
Flyash:	2.4% by volume
Type II Cement:	2.3% by volume

- Conduit Encasement Concrete Mix:

Maximum slump: 4”
Maximum aggregate size: ¾”
Minimum strength: 2000 psi
Maximum water/cement: 0.85 lbs/lb
Minimum cement/yd³: 453 lbs/yd³
Type II cement
Red dye added to indicate electric conduits are encased in the concrete.

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Fluidized Thermal Backfill

Fluidized Thermal Backfill is a form of controlled low-strength material specially designed to dissipate the heat generated by underground transmission cables within city streets. It is a free flowing and non-segregating slurry that provides consistent heat dissipation along the full length of the underground transmission line. It provides a consistent structural embedment support for the conduits while also serving as a medium with low thermal resistivity. The expected 28 day compressive strength is approximately 300 psi. The maximum thermal resistivity of Fluidized Thermal Backfill in a totally dry condition is 100°C-cm/W.

The approved mix design for Fluidized Thermal Backfill is:

#8 Elliot 3/8" (Cemex)	1420 lb/yd ³
Blended Sand	1985 lb/yd ³
Flyash "Type F"	235 lb/yd ³
Portland Cement Type II/V	95 lb/yd ³
Potable water	425 lb/yd ³

The dry density is not to exceed 138 pcf. The Thermal Resistivity at a set moisture content of 11% is 39°C-cm/W. Air entraining agents are not to be used in Fluidized Thermal Backfill.

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