SECTION 8 TRENCH EXCAVATION, BACKFILL AND RESURFACING

8-01 GENERAL

This work shall consist of trench excavation, backfill and resurfacing, all as required for the installation of underground utilities and shall be in accordance with the Standard Plans.

8-02 MATERIALS

8-02.01 Select Backfill Material

Select backfill material shall be sand or granular material of the quality herein specified. Select backfill material shall have a size and gradation falling within the following limits:

Sieve Size	Percentage Passing Sieve
1/2"	100
No. 4	50-100
No. 200	15 Maximum

The portion of the material passing the No. 200 sieve expressed as a percentage multiplied by the Plasticity Index shall not exceed one hundred (100). The material shall be compacted to a relative compaction of ninety percent (90%) as determined by Test Method No. California 216.

8-02.02 Aggregate Base (AB)

Aggregate base shall be Class 2 as specified in Section 3, "Aggregate Base and Subbase," of these Standard Specifications.

8-02.03 Asphalt Concrete (AC)

Asphalt concrete shall be Type B of the one-half inch (1/2") maximum (medium) grading as specified in Section 6, "Asphalt Paving and Surfacing," of these Standard Specifications.

8-02.04 Coldmixed Asphalt (Cutback)

The percentage composition by weight of the aggregate shall conform to the following gradings:

Sieve Sizes	Percentage Passing
3/8”	100
No. 4	90-100
No. 8	71-83
No. 30	30-44
No. 200	3-12

The asphalt binder to be mixed with aggregate shall conform to the provisions in the Caltrans Specifications Section 92, “Asphalts,” and shall be of the grade SC-650, unless otherwise specified by the Engineer. The amount of asphalt binder to be mixed with the aggregate shall be seven percent (7%), based on dry weight of aggregate.

8-02.05 Controlled Density Fill (CDF)

Controlled density fill (CDF) shall consist of a fluid, workable mixture of aggregate, cement and water. CDF may be accepted in lieu of sand or granular fill as a nonstructural backfill material only upon written approval by the Engineer, unless otherwise specified in these Standard Specifications. In no case shall CDF be used for structural backfill.

Cement shall meet the standards as set forth in ASTM C-150 for Type II Cement.

Fly ash shall meet the standards as set forth in ASTM C-618 for Class F Pozzolans, except the maximum allowable loss on ignition shall be 6 percent. The fly ash shall not inhibit the entrainment of air and shall be added with the cement.

Air entrainment agent shall meet the standards as set forth in ASTM C-260.

Coarse aggregate shall be no larger than three-eighths inch (3/8") (pea gravel), nor shall the three-eighths inch (3/8") aggregate comprise more than forty percent (40%) of the total aggregate content. Fine aggregate shall be commercial quality concrete sand and not comprise more than seventy percent (70%) of the total aggregate content.

Water shall be fresh, clean and potable; free from oil, salts and other impurities which would have an adverse effect on the quality of the backfill material.

The aggregate, cement and water shall be proportioned either by weight or by volume. Not less than ninety (90) pounds (1-sack) nor more than one hundred eighty (180) pounds (2-sacks) of cement shall be used for each cubic yard of material produced. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed. Entrained air content shall be a minimum of 8.0 percent. The material produced shall reach unconfined compressive strengths from 50 psi to a maximum of 150 psi at 28 days.

Materials for CDF shall be thoroughly machine mixed at a batch plant and delivered to the job site by means of transit mixing trucks. Material tags from the CDF supplier shall be provided to the City Engineer’s Inspector by the end of each working day. CDF shall be placed in the work within one hour after mixing.

8-03 CONSTRUCTION

TRENCH EXCAVATION

8-03.01 Existing Paving

Prior to excavation, the existing pavement shall be neatly sawcut along the limits of the proposed excavation. Existing pavement over the trench shall be removed and hauled away from the job site. If a longitudinal pavement joint or edge of pavement is located within three feet (3') of the limit of the excavation, the Contractor shall remove and replace all intervening pavement after completing the trench backfill and prior to the installing permanent trench surfacing. All utilities shall be laid in open trench and/or tunnels as indicated on the Plans or as directed by the Engineer.

8-03.02 Trench Width

The allowable trench width at the top of pipe shall conform to the following:

Pipe Type (Abbreviation)	Trench Width (Maximum)
Vitrified Clay Pipe (VCP)	Outside Diameter of Barrel + 18"
Polyvinylchloride Pipe (PVC)	
Concrete Cylinder Pipe (CCP)	
Ductile Iron Pipe (DIP)	
Welded Steel Pipe (WSP)	
Corrugated Metal Pipe (CMP)	Outside Diameter of Barrel + 24"
Reinforced Concrete Pipe (RCP)	

The maximum trench width shall be inclusive of all shoring.

Whenever the maximum allowable trench width is exceeded for any reason, the Contractor shall, at his expense, embed or cradle the pipe in concrete in a manner satisfactory to the Engineer. In no case shall the free working space on each side of the barrel be less than six inches (6").

8-03.03 Pipe Bedding

The trench shall be excavated below the grade of the pipe bottom for the following minimum depths:

Pipe Type (Abbreviation)	Depth
Vitrified Clay Pipe (VCP)	6"
Polyvinylchloride Pipe (PVC)	6"
Ductile Iron Pipe (DIP)	6"
Welded Steel Pipe (WSP)	6"
Concrete Cylinder Pipe (CCP)	6"
Corrugated Metal Pipe (CMP)	6"
Reinforced Concrete Pipe (RCP)	6"

Sufficient "Select Backfill Material" as specified above shall be placed in the trench and tamped to bring the trench bottom up to the grade of the bottom of the pipe. The relative compaction of the tamped material shall not be less than ninety percent (90%) as determined by Test Method No. California 216. The "Select Material" shall be shaped by hand. Holes for bells and fittings shall be excavated by hand. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a width of at least sixty percent (60%) of the external diameter.

When the trench bottom is unstable due to a wet or spongy foundation, the trench bottom must be stabilized with gravel or crushed rock. If the unstable condition was caused by the operations of the Contractor, such gravel or crushed rock shall be furnished at the Contractor's expense. The Engineer shall be the sole judge of the suitability of the trench bottom and as to the amount of gravel or crushed rock needed to stabilize a soft foundation. The Contractor shall remove any soft material and replace it with gravel or crushed rock when ordered to do so by the Engineer. Payment for removal of any soft material not caused by operations of the Contractor, and replacement with gravel or crushed rock, shall be paid for as extra work.

8-03.04 Excavated Material

Material excavated in streets and roadways shall be laid alongside the trench and kept trimmed so as to cause as little inconvenience as possible to public traffic. All material excavated in streets or roadways and not required for backfill shall be immediately removed and properly disposed of by the Contractor. No surplus material shall be placed on private property unless written permission, signed by the owner of the property, is furnished to and approved by the Engineer.

8-03.05 Open Trench

No more than three hundred feet (300') of trench shall be open at any one time. No trenches shall be left open during non-working hours. All open trenches at

the end of the work day shall be completely covered using steel plates and as directed by the Engineer.

At all street crossings, existing driveways, water gate valves and fire hydrants, the Contractor shall make provisions for trench crossings and for free access either by backfill or temporary bridges, as the Engineer may direct.

Provisions shall be made whereby all surface runoff water can flow uninterrupted in gutters or drainage channels.

8-03.06 Bracing and Shoring

Excavation and trenches shall be supported and excavation operations conducted in accordance with Article 6, "Excavations, Trenches and Earthwork," of the State Division of Industrial Safety Construction Safety Orders, as amended.

During backfilling, the bottom of the shoring shall be kept above the level of the backfill at all times.

8-03.07 Finishing Trench Excavation

Prior to pipe laying and trench backfill, the Engineer shall inspect and approve the condition of the trench.

TRENCH BACKFILL

8-03.08 Initial Backfill

"Select Backfill Material" as specified in Paragraph 8-02.01 of these Standard Specifications shall be used for initial backfill unless CDF has been approved by the Engineer as a backfill material or as otherwise specified in these Standard Specifications. When CDF has been approved as a backfill material, steel dowel stakes (rebar), or other material approved by the Engineer, may be used to secure the pipes to the bottom of the trench to prevent the pipes from floating in the CDF. After the pipe has been properly laid and inspected, select backfill material shall be placed on both sides of the pipe to such a depth that after thorough consolidation hand-tamping, the final depth of select backfill material shall be as follows:

Pipe Type (Abbreviation)	Depth
Vitrified Clay Pipe (VCP)	12" Above Top of Pipe
Polyvinylchloride Pipe (PVC)	
Ductile Iron Pipe (DIP)	
Welded Steel Pipe (WSP)	
Concrete Cylinder Pipe (CCP)	
Corrugated Metal Pipe (CMP)	1/2 Outside Diameter of Pipe (Pipe Springline)
Reinforced Concrete Pipe (RCP)	

8-03.09 Initial Backfill Compaction

The initial backfill shall be compacted by hand-tamping. The use of machine tampers will not be permitted. The initial backfill material shall be hand-tamped in layers not exceeding four inches (4") in uncompacted depth. The final depth of compacted initial backfill shall be as noted above. After hand-tamping, the relative compaction of the initial backfill material shall be not less than ninety percent (90%) as determined by Test Method No. California 216.

8-03.10 Subsequent Backfill

A. Above the level of initial backfill, the trench shall be backfilled with select backfill material. Subsequent backfill within two and one-half feet (2-1/2') of the finished surface grade or one and one-half feet (1-1/2') of the finished subgrade, whichever is lowest in elevation, shall be mechanically compacted by tamping or rolling. Subsequent backfill, below two and one-half feet (2-1/2') of the finished surface grade or one and one-half feet (1-1/2') of the finished subgrade, whichever is lowest in elevation, shall be compacted by mechanical compaction.

The backfill material shall be placed in layers not exceeding eight inches (8") in loose depth, each layer being thoroughly compacted before succeeding layers are placed. The use, setup and operation of free-fall hammers, vibratory plates and mini-sheep's foot mechanical compactors are subject to the Engineer's approval. The use of double acting mechanical compactors will NOT be permitted. Compaction test shall be conducted by the contractor on each lift every 100 feet of trench.

B. Subsequent backfill placed by tamping or rolling shall be free from stones or lumps exceeding three inches (3") in greatest dimension, vegetable matter or other unsatisfactory material, and shall be compacted to a relative compaction of not less than ninety percent (90%) as determined by Test Method No. California 216, except that the relative compaction shall not be less than ninety-five percent (95%) within two and one-half feet (2-1/2') of finished permanent surfacing grade or one and one-half feet (1-1/2') below the finished subgrade, whichever is greater.

C. Where CDF has been approved by the Engineer as a backfill material; it shall be placed in a uniform manner that will prevent voids in, or segregation of, the backfill. Foreign material which falls into the trench prior to or during placing of the CDF shall be immediately removed. Backfilling over or placing any material over the CDF shall not commence until it has sufficiently self-consolidated and the surface water is gone so that the surface will withstand the process of subsequent backfilling without displacement or disruption.

TRENCH SURFACING

8-03.11 General

In unimproved areas not in a traveled way, the trench shall be restored to its original surface.

Where a gravel surface is encountered, surfacing shall be replaced over the width of the trench with Class 2 aggregate base as specified in Section 3, "Aggregate Base and Subbase," of these Standard Specifications to a minimum depth of six inches (6").

Where the existing surface is some type of paving, surfacing shall be restored with a temporary surface followed by a permanent surface specified herein.

8-03.12 Temporary Surfacing

The temporary surfacing shall consist of two and one-half inches (2-1/2") of asphalt concrete (Type B, 3/4" maximum aggregate) on twelve inches (12") of Class 2 aggregate base. As noted in Paragraph 8-03.13, "Permanent Surfacing," of these Standard Specifications, asphalt concrete (Type B) in excess of two and one-half inches (2-1/2") and aggregate base in excess of twelve inches (12") may be required in order to use the temporary surfacing as part of the permanent surfacing.

Cold mixed asphalt (cutback) may be used as temporary surfacing with approval from the Engineer.

All temporary surfacing shall be laid within one (1) day after backfilling or as specified. Before the trenching area is opened for traffic, all excess dirt, rock and debris shall be removed and the street surface shall be swept clean. Temporary surfacing shall be constantly maintained so that at no time will there be any mudholes, nor shall the surface settle below one inch (1") or be raised more than one inch (1") from the existing pavement grade.

8-03.13 Permanent Surfacing

Permanent surfacing shall not be constructed until the compaction requirements for backfill and subgrade of these Standard Specifications are satisfied.

All trenches shall be permanently surfaced within thirty (30) calendar days after compacting backfill.

Prior to installing permanent surfacing, any irregularities in the original wheelcut along the limits of the excavation shall be corrected by wheelcutting and removing the jagged pavement. Also, adjacent pavement noted to be removed per Paragraph 8-03.01, "Existing Paving," of these Standard Specifications shall be removed.

The base rock for permanent surfacing shall be Class 2 aggregate base as specified in Section 3, "Aggregate Base and Subbase," of these Standard Specifications. The aggregate base shall be equal in depth to the existing pavement structural section but not less than twelve inches (12") in depth.

The wearing surface for permanent surfacing on improved streets shall be asphalt concrete equal in thickness to the existing pavement but not less than three inches (3") in depth. The asphalt concrete shall be Type B asphalt concrete conforming to the requirements of Section 4, "Asphalt Paving and Surfacing," of these Standard Specifications. Asphalt concrete shall be placed by a paving machine unless otherwise approved by the Engineer.

At the option of the Contractor, the temporary surfacing may be used as an integral part of the permanent pavement section provided that the following requirements are satisfied:

1. The compaction requirements for backfill and subgrade are met, as determined by testing. The Contractor shall bear the cost of exposing the aggregate base, subgrade or backfill as necessary for the Engineer to conduct tests.

2. The existing pavement along the limits of the excavation is neatly sawcut.

3. The base rock is installed as part of the temporary surfacing and is equal in depth to the existing pavement structural section, but is not less than twelve inches (12") in depth.

4. Cut-back asphalt shall not be used in the temporary surfacing.

5. A one and one half inch (1 1/2") minimum asphalt concrete overlay (Type B, medium, 1/2" maximum aggregate) shall be installed over the existing temporary surfacing in no less than thirty (30) days and no more than sixty (60) days.

6. The combined depth of the asphalt concrete installed as part of the temporary surfacing and the one-inch (1") minimum overlay for permanent surfacing shall be equal to or greater in depth than the existing asphalt concrete pavement.

If any of the above requirements are not met, the Contractor shall remove the temporary surfacing to limits specified by the Engineer and replace it with permanent surfacing as necessary to fulfill the above-stated permanent surfacing specifications.

Permanent surfacing shall extend twelve inches (12") beyond neatly cut lines in the existing pavement as shown in the Standard Plans.

8-03.14 Utility Easements and Rights of Ways

Whenever the trench lies within property controlled by agencies such as the Southern Pacific Railroad, State of California, Santa Clara County, San Francisco Water Department, AT&T, Caltrans, Comcast or Pacific Gas and Electric Company, the trench backfill and resurfacing shall comply with the requirements of these agencies as well as with the requirements of these Standard Specifications. If permits must be obtained or bonds posted before entering these right-of-ways, the Contractor shall obtain and pay for such permits and bonds.

3-04 TESTING

Backfill shall have a relative compaction as specified and as determined by Test Method No. California 216.

Testing shall be done per Caltrans Construction Manual 6-109, one test for every 2500 tons or every 1500 cubic yards and shall be conducted on each lift.

The Contractor shall be responsible for protecting the aggregate subbase and base after they have been placed and compacted. The Contractor will not be allowed any additional compensation for the recompaction or retesting of the aggregate subbase or base due to the Contractor's failure to place the successive asphalt concrete pavement or other materials within a reasonable time period as determined by the Engineer.