

DEPARTMENT OF TECHNOLOGY ORDER NO. 1

REQUIREMENTS IMPLEMENTING SAN FRANCISCO'S "DIG ONCE" ORDINANCE

SECTION 1: PURPOSES OF ORDER

This Order implements Public Works Code sections 2.4.14, 2.4.95 and 2.4.96, as adopted by Board of Supervisors in Ordinance No. 220-14, by establishing the Department of Technology Requirements authorized in Section 2.4.96.

SECTION 2: DEFINITIONS

A. Use of Defined Terms.

Unless the context otherwise specifies or requires, when capitalized the terms defined in this Section shall mean the following for all purposes of this Order:

1. "Applicant" means an entity that intends to submit an application to DPW for a Project.
2. "Approval Number" means a number generated by DT through the Dig Once List that indicates that DT has approved the Dig Once Plans for a Project. Approval Numbers will begin with a Y.
3. "City Applicant" means a City department that intends to submit an application to DPW for a Project.
4. "Conduit" means a pipe or tube through which water, waste water, or gas are conveyed or which is used to protect electrical or communications cables.
5. "Confirmation Number" means a number generated by DT through the Dig Once List that indicates that DT has reviewed a Project and made a determination to participate. Confirmation Numbers will begin with a C.
6. "Day" means any calendar day. For the purposes hereof, the time in which an act is to be performed shall be computed by excluding the first Day and including the last. For the purposes hereof, if the time in which an act is to be performed falls on a Day that is not a business Day the time for performance shall be extended to the following business Day.

7. "Dedicated Trench" means a trench dedicated to the placement of Standard City Communications Infrastructure.
8. "Dig Once Coordinator" means the person designated by the Executive Director of DT to administer DT's participation in the Dig Once program.
9. "Dig Once Contact" means a person or persons designated by an Applicant as their principal contact for Dig Once related communications.
10. "Dig Once List" means a list of Projects that DT has expressed interest in participating in.
11. "Dig Once Plans" means plans submitted by Applicants that include City Communications Infrastructure conforming to the Standard City Communications Infrastructure Specifications.
12. "DPW" means the Department of Public Works.
13. "DT" means the Department of Technology.
14. "Exemption Incremental Cost" will be the difference between Applicant's costs for the Project with the items necessary to install City Communications Infrastructure and Applicant's costs without it.
15. "Order" means this Department of Technology Order No. 1, Regulations Implementing San Francisco's "Dig Once" Ordinance.
16. "Permit" means an excavation permit issued by DPW under Article 2.4 of the Public Works Code.
17. "Permit Application" means an application for a permit under Article 2.4 of the Public Works Code.
18. "Previously Planned Project" means a Project entered in ROWMS by an Applicant before March 31, 2016.
19. "Private Applicant" means an entity other than a City department that intends to submit an application to DPW for a Project.
20. "Project" means an excavation that includes the installation of one or more Conduits of more than 900 linear feet. "Project" shall not include emergency excavations or directional boring regardless of the length of the excavation or boring.
21. "Refusal Number" means a number generated by DT through the Dig Once List that indicates that DT has reviewed a Project and made a determination not to participate. Refusal Numbers will begin with an N.
22. "ROWMS" means DPW's on line Right-of-Way Management System for utility coordination. At the time of this publication, this system is the Acela Right of Way Management, which is also known as "Envista."

23. "Shared Trench" means a trench constructed for another non-communications Project that will also contain City Communications Infrastructure.
24. "Shared Communications Trench" means a trench constructed for another communications Project that will also contain City Communications Infrastructure.

B. Defined Terms Used in the Public Works Code.

Any of the capitalized terms used in this Order that are not identified above shall have the same meaning as set forth in Public Works Code Section 2.4.4.

SECTION 3: DT PARTICIPATION CRITERIA

- A. Under Public Works Code § 2.4.95(b), DT should elect to participate in Projects only when DT determines that participation is "both financially feasible and consistent with the City's long-term goals to add City communications infrastructure to the proposed excavation project."
- B. To determine whether DT's participation in a particular Project is consistent with the City's goals, DT will consider whether:
 1. The length of the Project. In particular, DT will look for Projects that will result in a long continuous route offering DT a wide range of potential uses in the future.
 2. The proximity of the Project to current to or planned City facilities and/or community anchor locations requiring service (i.e. health clinics, hospitals, areas of economic development).
 3. The presence of existing City Communications Infrastructure in the vicinity of the Project.
- C. To determine whether DT's participation in a particular Project is financially feasible, DT will consider:
 1. Whether physical constraints (bridges, freeway underpasses, underground utility districts) would make it unlikely that there are cost-effective alternatives for DT to install City Communications Infrastructure in the vicinity if needed in the future.
 2. Whether DT has any partners or customers willing to lease access to the City Communications Infrastructure installed in the Project so as to defray DT's costs.
 3. The cost of alternative routes, such as placement on utility poles, compared to the cost of serving a facility or area using City Communications Infrastructure installed in the Project.

4. Any budgetary constraints to DT's participation.
- D. Regardless of any findings made by DT under Sections 3.B and 3.C, DT may decline to participate in a Project if Applicant demonstrates to DT that DT's participation in the Project would cause Applicant to do one or more of the following:
1. Delay a Project that involves Applicant's installation of critical infrastructure;
 2. Incur costs that render the Project financially infeasible; or
 3. Assume undue risks that DT's continued use of City Communications Infrastructure would compromise Applicant's maintenance of its facilities in the Project.

SECTION 4: NOTICE REQUIREMENTS AND DT PARTICIPATION

- A. As soon as practical, Applicant shall notify DT of a Project by entering the Project into ROWMS or by e-mail. This initial notice should include a map showing the proposed route for the Project, the anticipated starting and ending dates, contact information. Entry of supporting material in the ROWMS satisfies this condition.
- B. The Dig Once Coordinator will confirm whether, based on the factors contained in Section 3, whether DT intends to participate in a Project. Within 30 days of the close of each quarter, DT will publish a Dig Once List that will identify a Confirmation Number or Refusal Number for each Project.
- C. For all City Applicant Projects where DT has confirmed its intent to participate, DT, the Applicant and DPW will arrange to utilize DPW to perform design and engineering services necessary to prepare Dig Once Plans before the Applicant submits the Permit Application to DPW. DPW will estimate the cost of participating in the Project.
- D. For all Private Applicant Projects where DT has confirmed its intent to participate, Applicant will provide DT with Dig Once Plans before submitting the Permit Application to DPW. DT encourages Private Applicant to provide DT with the Dig Once Plans as early as possible, but Applicant must do so at least 14 Days before submitting the Permit Application.
- E. If a Private Applicant is seeking Exemption Incremental Costs, the Applicant should submit an estimate of its Exception Incremental Cost and supporting documentation including bid results along with Dig Once Plans.
- F. Within 7 Days of receiving the Dig Once Plans from a Private Applicant, the Dig Once Coordinator will notify Applicant whether the Dig Once Plans meet

the Standard City Communications Infrastructure Specifications by providing Applicant with an Approval Number to be included in the Permit Application.

SECTION 5: QUARTERLY MEETINGS

- A. DT will conduct quarterly meetings to coordinate DT's participation in Projects. Dig Once Contacts must attend quarterly meetings.
- B. During these quarterly meetings, Applicants can notify DT of a Project, which notice can take the place of the formal notice procedures set forth in Section 4.
- C. Within 30 Days of receiving notice during a quarterly meeting, the Dig Once Coordinator will confirm whether DT will or will not participate in a Project by entering a Confirmation Number or Refusal Number in the Dig Once List.
- D. Applicants may also use the quarterly meetings to provide DT with the required Dig Once Plans and, if applicable, an estimate of its Exception Incremental Cost and supporting documentation including bid results.
- E. Within 30 Days of receiving the Dig Once Plans during a quarterly meeting, the Dig Once Coordinator will confirm that the Dig Once Plans meet the Standard City Communications Specifications by providing Applicant with an Approval Number to be included in the Permit Application.
- F. DT will review the Dig Once List at each quarterly meeting.

SECTION 6: PERMIT APPLICATIONS AND APPROVALS

- A. Applicant may submit a Permit Application to DPW only if it has notified DT of a Project through the procedures established in Section 4 and 5.
- B. Concurrent with its Permit Application, Applicant will notify the Dig Once Coordinator that it has applied for a Permit and will either supply to DT a copy of its final Dig Once Plans or certify to DT that those plans have not changed
- C. DT will notify Applicant and DPW if the Dig Once Coordinator determines that Applicant has not complied with notice requirements of this Order, or that the Dig Once Plans do not include City Communications Infrastructure that meets the Standard City Communications Infrastructure Specifications.
- D. Upon receipt of such notice from DT, DPW will deny the Permit.
- E. If DPW has denied a Permit for failure to comply with the requirements of this Order, the Applicant may reapply for the Permit as soon as Applicant complies with those requirements.

Section 7: Standard City Communications Infrastructure Specifications

The Standard City Communications Infrastructure Specifications are:

- A. Four 2-inch Conduits, minimum HDPE SDR 11, each of a separate color or unique striping to simplify identification of Conduits within vaults and between vaults, in the event Conduit must be accessed or repaired at intermediate points. Conduits shall be fastened together with spacers at 5-foot intervals, maintaining a minimum separation of $\frac{3}{4}$ -inch between conduits.
- B. Composite vaults having dimensions of 30" x 48" x 36" (W x L x D) placed in the sidewalk or available green space within the City right-of-way, as close to the curb or gutter as possible.
- C. Vaults spaced at intervals of 600 feet or less, typically in the area described in B. near the intersection of a City block.
- D. Sweeping Conduit bends shall be used to allow cable to be pulled without exceeding pull-tension thresholds when placing high-count fiber cables (e.g. 864-count). Unsupported conduit bends shall have a minimum bend radius of 48-inches, and bends utilizing manufactured elbows shall have a minimum radius of 36-inches (45-degree elbow maximum).
- E. Conduits placed in the same trench directly above Applicant's communications or electrical infrastructure, or where this is not possible, placed with minimum horizontal offset.
- F. Conduits placed parallel to water or sewer lines will be placed with a horizontal offset of at least 18" whether or not in the same trench.
- G. Further detail is presented in the typical drawings presented in Appendix A. Applicants should refer to the notes as well as the illustrations in Appendix A. Appendix A includes Figure 1 showing a typical configuration for a Dedicated Trench; Figure 2 showing a typical configuration of a Shared Gas or Electric Trench; Figure 3 showing a typical configuration for a Shared Communications Trench; Figure 4 showing a typical configuration for communications conduit placed in parallel to water and sewer lines; and Figure 5 showing the vertical profile of a typical vault installation. These specifications are intended to provide a general case, not to address all Project specific circumstances.
- H. Deviations from the Standard Specifications may be approved by the Dig Once Coordinator.

SECTION 8: INCREMENTAL COST

- A. Applicant may request compensation for the Incremental Cost of DT's participation in the Project.

- B. DT will compensate an Applicant according to the schedule set forth in Appendix B or the Exemption Incremental Cost described in Section 9. The Incremental Cost will be calculated by multiplying the per foot cost in Appendix B by the length of the Conduit run. The per foot Incremental Cost includes design, engineering, trenching, installation of conduit, placement of vaults, and all other associated items in the appropriate table in Appendix B. Table 1 is for a Dedicated Trench and Table 2 is for a Shared Trench or Shared Communication Trench.
- C. Applicants may request compensation for the scoping and design related costs associated with a Project for which they prepare Dig Once Plans pursuant to Section 4, even if DT does not participate in the Project.
- D. DT will compensate City Applicants by establishing a direct payment or work order sufficient to pay for DT's share of the cost to scope, design and participate in a Project. To the extent that DPW performs scoping, design and construction management on behalf of City departments, DPW will be compensated for these costs.
- E. In order for a Private Applicant to receive compensation, installation of City Communications Infrastructure must pass inspection by DT and Applicant must provide documentation including as-built drawings of all City Communications Infrastructure.
- F. DT will compensate a Private Applicant for its Incremental Cost or Exemption Incremental Cost within 30 Days after DT has accepted City Communications Infrastructure from Applicant as set forth in Section 10.

SECTION 9: EXEMPTION INCREMENTAL COST

- A. Applicant may submit a request in writing to recover its Exemption Incremental Cost. This request shall contain Applicant's detailed design and the itemized bid pricing, and shall specify how Applicant determined the costs attributable to installing City Communications Infrastructure. The itemized bid will include separately identified item(s) necessary to install City Communications Infrastructure.
- B. In order to enable DT to determine whether its participation in the Project is financially feasible, Applicant should submit a request for an Exemption Incremental Cost along with its submission of the Dig Once Plans.
- C. DT may approve a request for Exemption Incremental Cost if Applicant demonstrates that the actual cost, based on a clearly identified cost element, such as a bid item that clearly identifies the installation of communications conduit, will require Applicant to incur costs in excess of the Incremental Cost.

- D. Upon receipt of a request for an Exemption Incremental Cost, the Dig Once Coordinator will evaluate the request and make a determination whether the request complies with the requirements of this Order. In making this determination, the Dig Once Coordinator may agree to compensate Applicant for some or all of the costs identified in the request for an Exemption Incremental Cost.
- E. The Dig Once Coordinator will notify Applicant within 7 Days whether the Dig Once Coordinator will approve the request for an Exemption Incremental Cost and, if so, what portion or portions of Applicant's Exemption Incremental Cost will be reimbursed. If the Dig Once Coordinator does not approve the request, the notice shall specify the reasons for the refusal to approve Applicant's Exemption Incremental Cost.
- F. The Dig Once Coordinator's refusal to approve a request for an Exemption Incremental Cost shall not excuse Applicant's compliance with the requirements of this Order.
- G. If the Dig Once Coordinator refuses to approve a request for an Exemption Incremental Cost in its entirety, Applicant may request that the Director of DT review its request. This request must be made within 3 Days of the Dig Once Coordinator's determination. The Director's decision whether to approve all or part of the request for an Exemption Incremental Cost shall be final.

SECTION 10: DT ACCEPTANCE OF CITY COMMUNICATIONS INFRASTRUCTURE

- A. Applicant will notify the Dig Once Coordinator at least 48 hours in advance of the date and time that City Communications Infrastructure will be ready for DT inspection.
- B. The Dig Once Coordinator will notify Applicant within 24 hours after inspection whether the City Communications Infrastructure meets the Standard City Communications Infrastructure Specifications. If DT does not notify Applicant of any deficiencies within 24 hours or does not perform an inspection, DT will have waived its opportunity to inspect City Communications Infrastructure.
- C. Upon completion of the Project, Applicant shall provide DT with as-built drawings that include scale plans of the completed Project for inclusion in ROWMS and City databases. These drawings shall contain:
 - 1. Vertical and horizontal position of Conduits and vaults;
 - 2. GPS coordinates for DT's manholes;
 - 3. Edge-of-curb offset measurement every 50 feet; and
 - 4. Conduit colors, diameters, and materials.
- D. DT will notify Applicant in writing whether DT has accepted the City Communications Infrastructure from Applicant. DT may refuse to accept City

Communications Infrastructure only if DT finds that it does not meet the Standard City Communications Infrastructure Specifications.

- E. Once DT has accepted the City Communications Infrastructure from Applicant, DT will assume sole responsibility for the operation, use, and maintenance of the accepted City Communications Infrastructure.

SECTION 11: PREVIOUSLY PLANNED PROJECTS

- A. The Dig Once Coordinator will review all Previously Planned Projects that have been entered into the ROWMS but have not been permitted by DPW.
- B. The Dig Once Coordinator will notify Applicants and DPW whether DT intends to participate in any of those Previously Planned Projects which have a start date in the ROWMS prior to April 1, 2016 through the Dig Once List. If DT does not enter a Confirmation Number or Refusal Number by that date, DT will have been deemed to have elected not to participate in the Project.
- C. For those Previously Planned Projects in which DT has interest in participating, DT will discuss these projects at its first Quarterly meeting with the Applicant.
- D. The Dig Once Coordinator will review the Dig Once Plans for conformity with the Standard City Communications Infrastructure Specifications.
- E. The Dig Once Coordinator will confirm that the Dig Once Plans meet the Standard City Communications Specifications by providing Applicant with an Approval Number to be included in the Permit Application.

Approved:

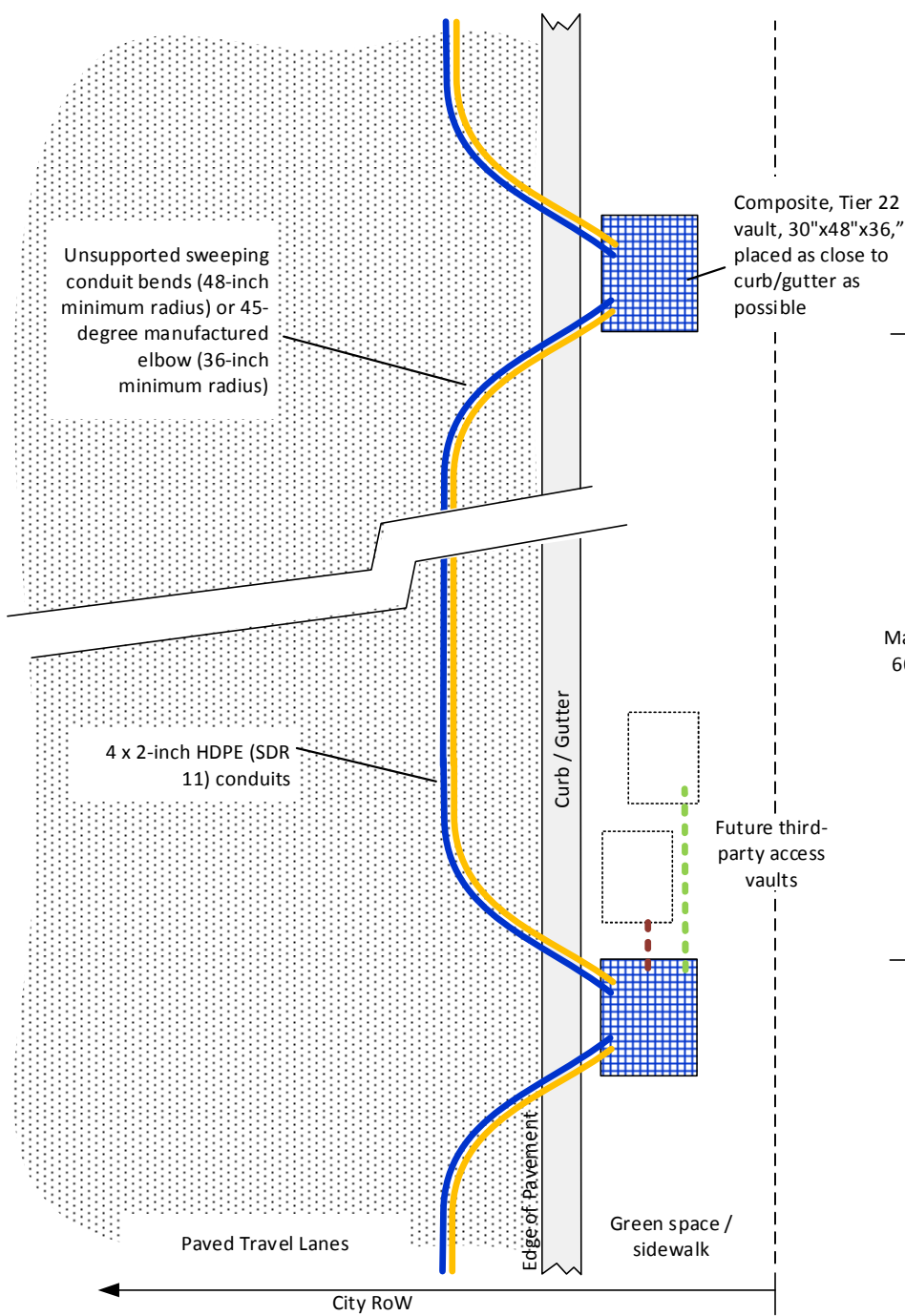
Miguel A. Gamiño Jr.
Chief Information Officer and
Executive Director, Department of Technology

Dated: _____, 2015

APPENDIX A: TYPICAL DRAWINGS

FIGURE 1: TYPICAL CONFIGURATION FOR CONDUIT IN A DEDICATED TRENCH

Conduit and Vault Horizontal Layout

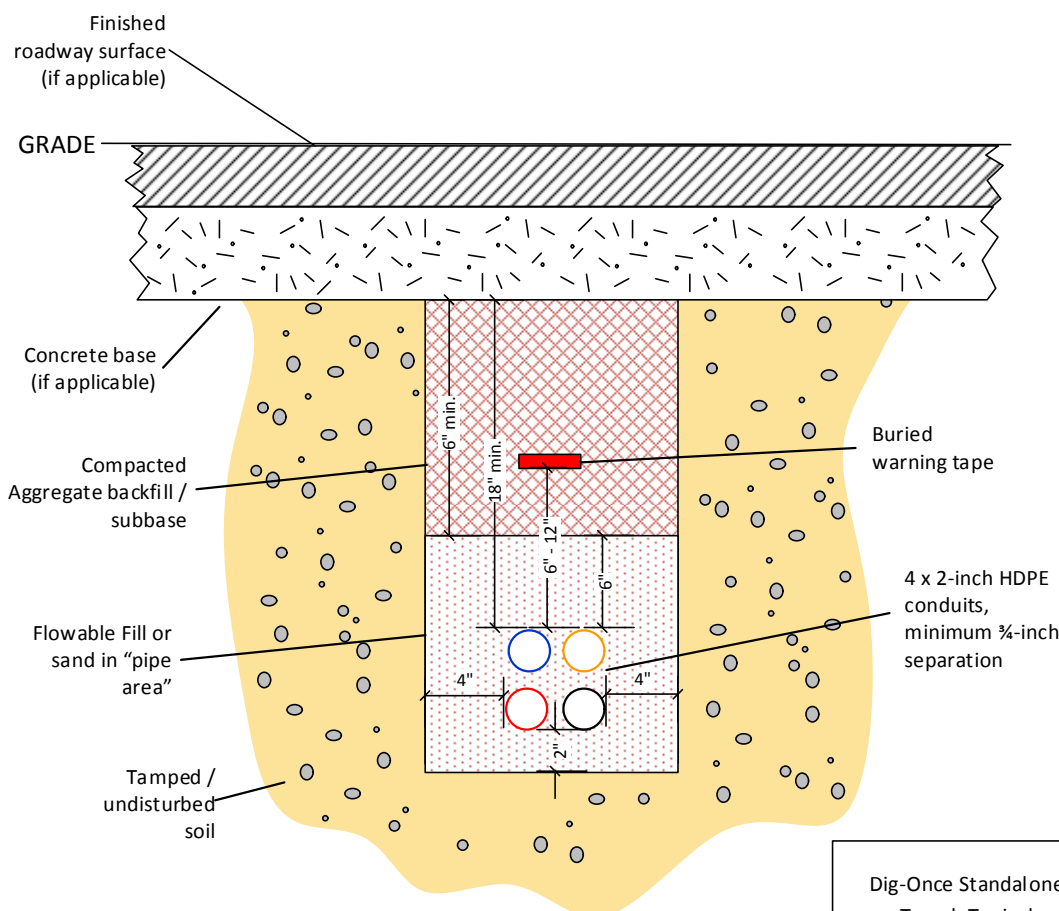


INSTALLATION AND CONSTRUCTION NOTES:

1. City communications conduit shall consist of four (4) 2-inch HDPE (SDR 11) flexible duct, with pre-installed mule tape. Each conduit shall be a different color or be uniquely striped for easy identification. Conduits shall be fastened together with spacers at 5-foot intervals, maintaining a minimum separation of 3/4-inch between each conduit.
2. All conduit couplers and fittings shall be installed to be water-tight. Conduits shall be sealed with an endcap or blank duct plug upon installation.
3. An electrical ground rod shall be installed in all vaults. Ground rods shall be comprised of 13-mil copper-clad steel, 5/8-inch diameter, 10-foot length, and tested to have an electrical resistance to ground of 25 ohms or less.
4. A 10 AWG insulated tracer wire shall be installed in one conduit in each conduit bank. Tracer wires shall consist of a solid, Copper Clad Steel (CCS) conductor and blue insulation. Insulation shall be HDPE or HMWPE). Tracer wires shall be electrically bonded to the ground rod in each vault using a suitable clamp.
5. Vaults shall be of a composite, straight-walled construction, UL-listed to ANSI 77-2010. Vaults and lids shall be Tier 22 load-rated. Vaults shall have external dimension of approximately 30"x 48"x 36" (WxLxD). Vault lids shall be etched with the words, "City of San Francisco Fiber Optics"
6. Vaults shall be placed in the City right-of-way immediately outside of the paved surface/vehicular traffic lanes, as close to the curb/gutter as possible.
7. Vaults shall be placed at roadway intersections, spaced a maximum of 600 feet. Adjacent vaults shall be separated by no more than two roadway crossings.
8. Conduit shall be placed with a minimum of 18-inches of cover below grade, or a minimum of 18-inches below the concrete base where located under paved roadway surfaces. Where feasible, conduit shall be placed with a maximum of 48-inch cover below grade.
9. Conduit shall be placed with sweeping bends from the roadway to each vault location having a minimum bend radius of 48-inches. If using manufactured elbows, bends shall utilize 45-degree elbows with a 36-inch minimum bend radius.
10. Conduit shall enter vaults from the sidewall through openings created per manufacturer instructions to retain the associated load rating. Conduits shall protrude beyond the interior wall of the vault by a minimum of 1-inch, and no more than 3-inches.
11. Trench backfill in the pipe area shall be flowable fill or sand.
12. Trench backfill within a minimum of 6-inches of the concrete base shall be Class 2 Aggregate Base and compacted to 95-percent maximum dry density per ASTM D-1557 or AASHTO T-180.
13. A 4-inch red colored warning tape (Terra Tape or accepted equal) shall be placed between 6-inches and 12-inches above the top of the conduit for the entire length of the trench.

Maximum
600 feet

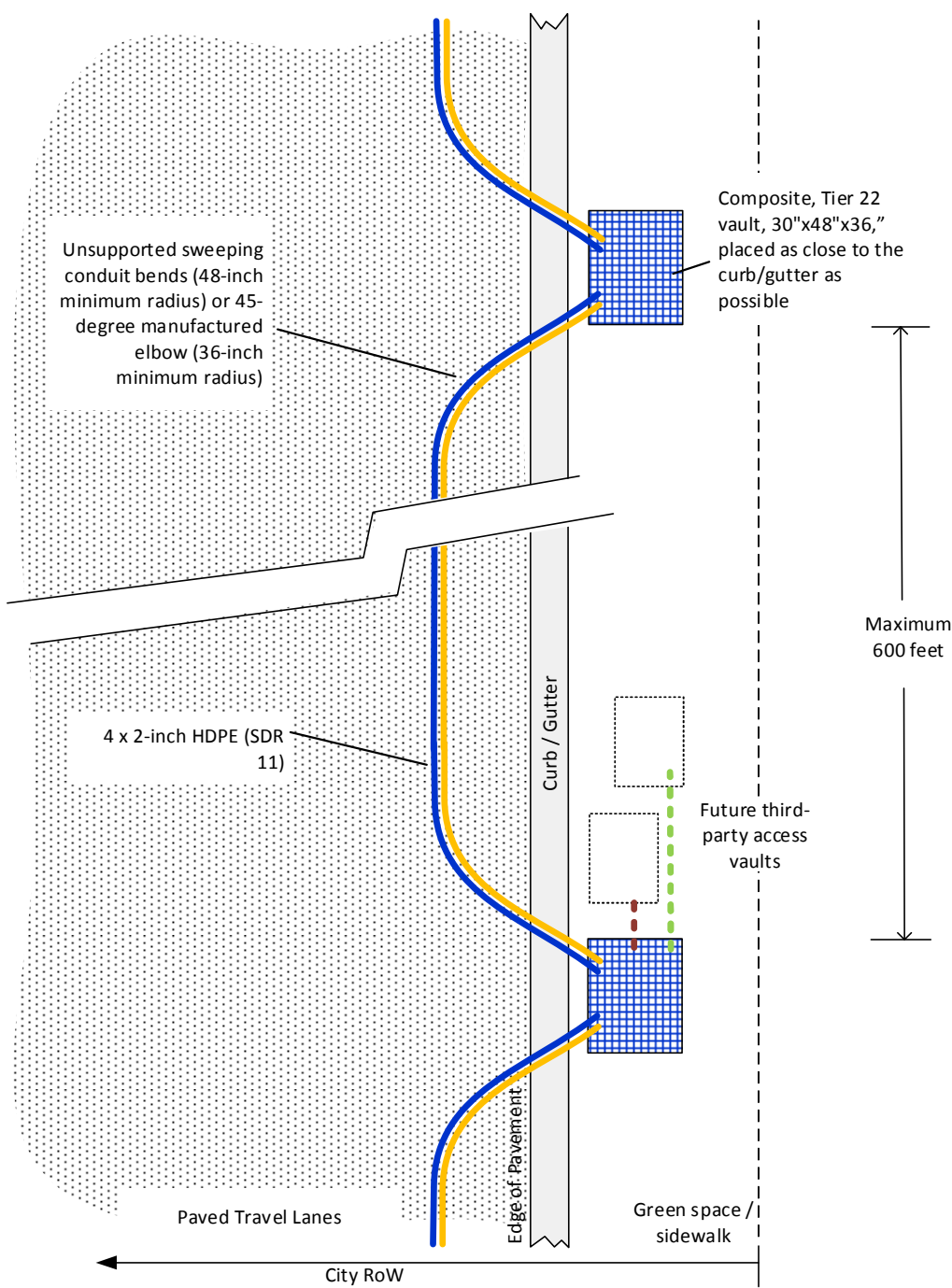
Trench Details



Dig-Once Standalone Trench Typical Configuration	City and County of San Francisco, California		
	SIZE 11"x17"	FSCM NO	DWG NO
	SCALE Not to scale	SHEET	REV 9
			1 OF 5

FIGURE 2: TYPICAL CONFIGURATION FOR CONDUIT IN SHARED TRENCH

Conduit and Vault Horizontal Layout

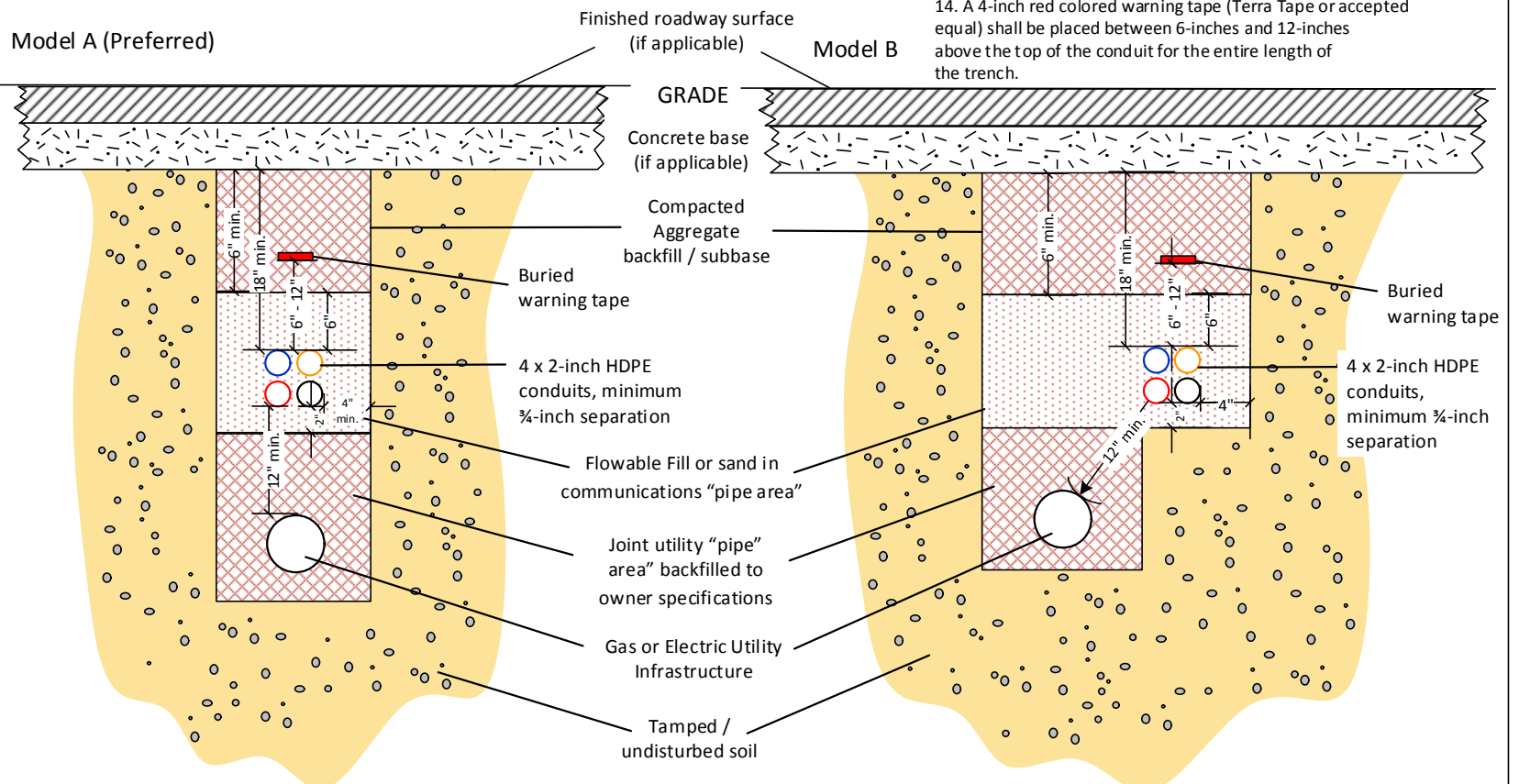


INSTALLATION AND CONSTRUCTION NOTES:

1. City communications conduit shall consist of four (4) 2-inch HDPE (SDR 11) flexible duct, with pre-installed mule tape. Each conduit shall be a different color or be uniquely striped for easy identification. Conduits shall be fastened together with spacers at 5-foot intervals, maintaining a minimum separation of ¼-inch between each conduit.
2. All conduit couplers and fittings shall be installed to be water-tight. Conduits shall be sealed with an endcap or blank duct plug upon installation.
3. An electrical ground rod shall be installed in all vaults. Ground rods shall be comprised of 13-mil copper-clad steel, 5/8-inch diameter, 10-foot length, and tested to have an electrical resistance to ground of 25 ohms or less.
4. A 10 AWG insulated tracer wire shall be installed in one conduit in each conduit bank. Tracer wires shall consist of a solid, Copper Clad Steel (CCS) conductor and blue insulation. Insulation shall be HDPE or HMWPE. Tracer wires shall be electrically bonded to the ground rod in each vault using a suitable clamp.
5. Vaults shall be of a composite, straight-walled construction, UL-listed to ANSI 77-2010. Vaults and lids shall be Tier 22 load-rated. Vaults shall have external dimension of approximately 30" x 48" x 36" (WxD). Vault lids shall be etched with the words, "City of San Francisco Fiber Optics"
6. Vaults shall be placed in the City right-of-way immediately outside of the paved surface/vehicular traffic lanes, as close to the curb/gutter as possible.
7. Vaults shall be placed at roadway intersections, spaced a maximum of 600 feet. Adjacent vaults shall be separated by no more than two roadway crossings.
8. Conduit shall be placed with a minimum of 18-inches of cover below grade, or a minimum of 18-inches below the concrete base where located under paved roadway surfaces. Where feasible, conduit shall be placed with a maximum of 48-inch cover below grade.
9. Conduit shall be placed with sweeping bends from the roadway to each vault location having a minimum bend radius of 48-inches. If using manufactured elbows, bends shall utilize 45-degree elbows with a 36-inch minimum bend radius..
10. Conduit shall enter vaults from the sidewall through openings created per manufacturer instructions to retain the associated load rating. Conduits shall protrude beyond the interior wall of the vault by a minimum of 1-inch, and no more than 3-inches.
11. Trench backfill in the communications conduit area shall be flowable fill or sand. Trench area surrounding joint utility pipe backfilled per utility owner specifications.
12. Trench backfill within a minimum of 6-inches of the concrete base shall be Class 2 Aggregate Base and compacted to 95-percent maximum dry density per ASTM D-1557 or AASHTO T-180.
13. City communications conduit shall maintain 12-inches of clearance radially from other utilities, unless otherwise agreed upon by the City and the applicable utility owner.
14. A 4-inch red colored warning tape (Terra Tape or accepted equal) shall be placed between 6-inches and 12-inches above the top of the conduit for the entire length of the trench.

Maximum
600 feet

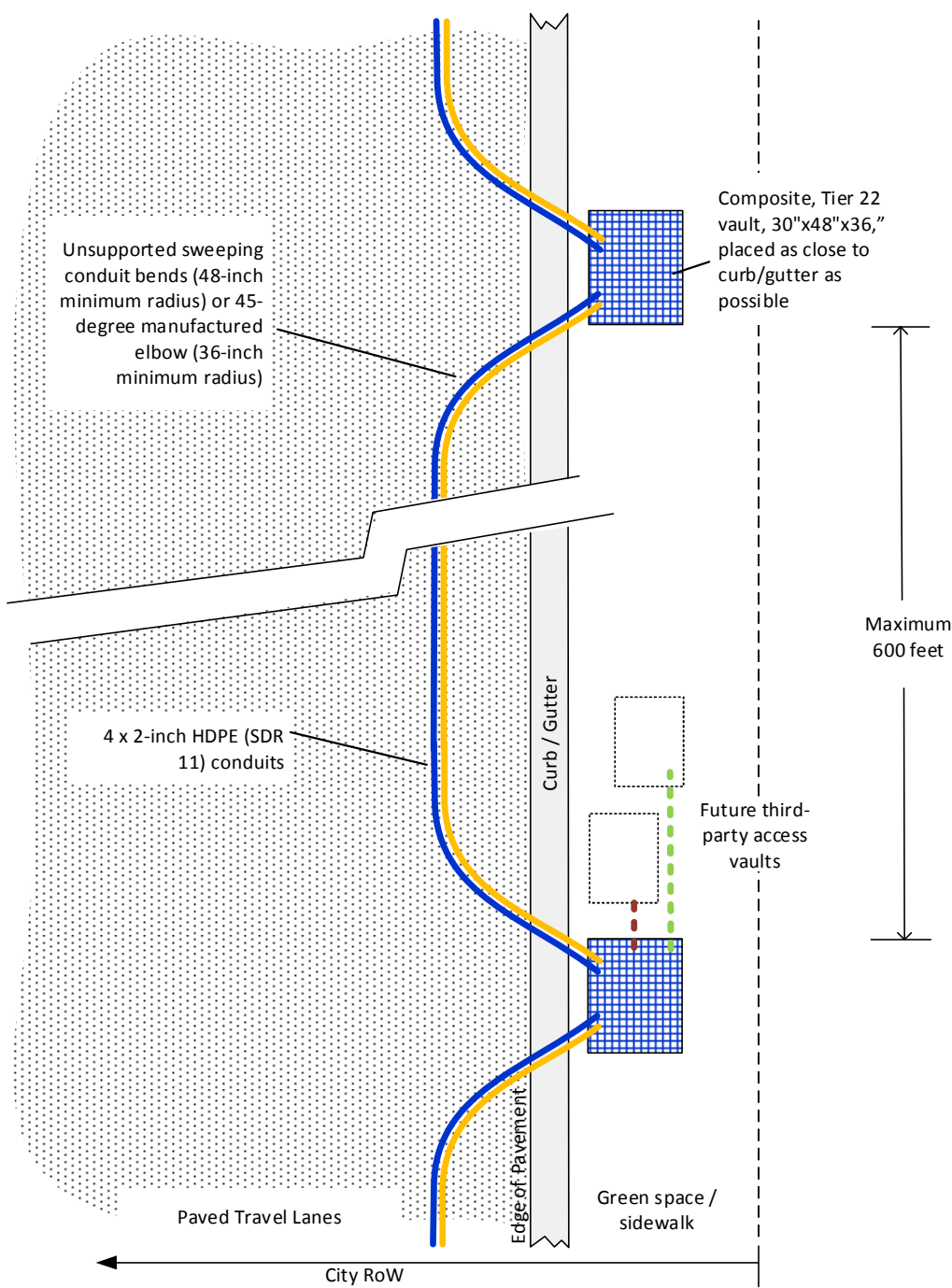
Trench Details



Dig-Once Joint Trench Typical Configuration – Gas / Electric	City and County of San Francisco, California			
	SIZE 11"x17"	FSCM NO	DWG NO	REV 9
	SCALE Not to scale		SHEET 2 OF 5	

FIGURE 3: TYPICAL CONFIGURATION FOR CONDUIT IN SHARED COMMUNICATIONS TRENCH

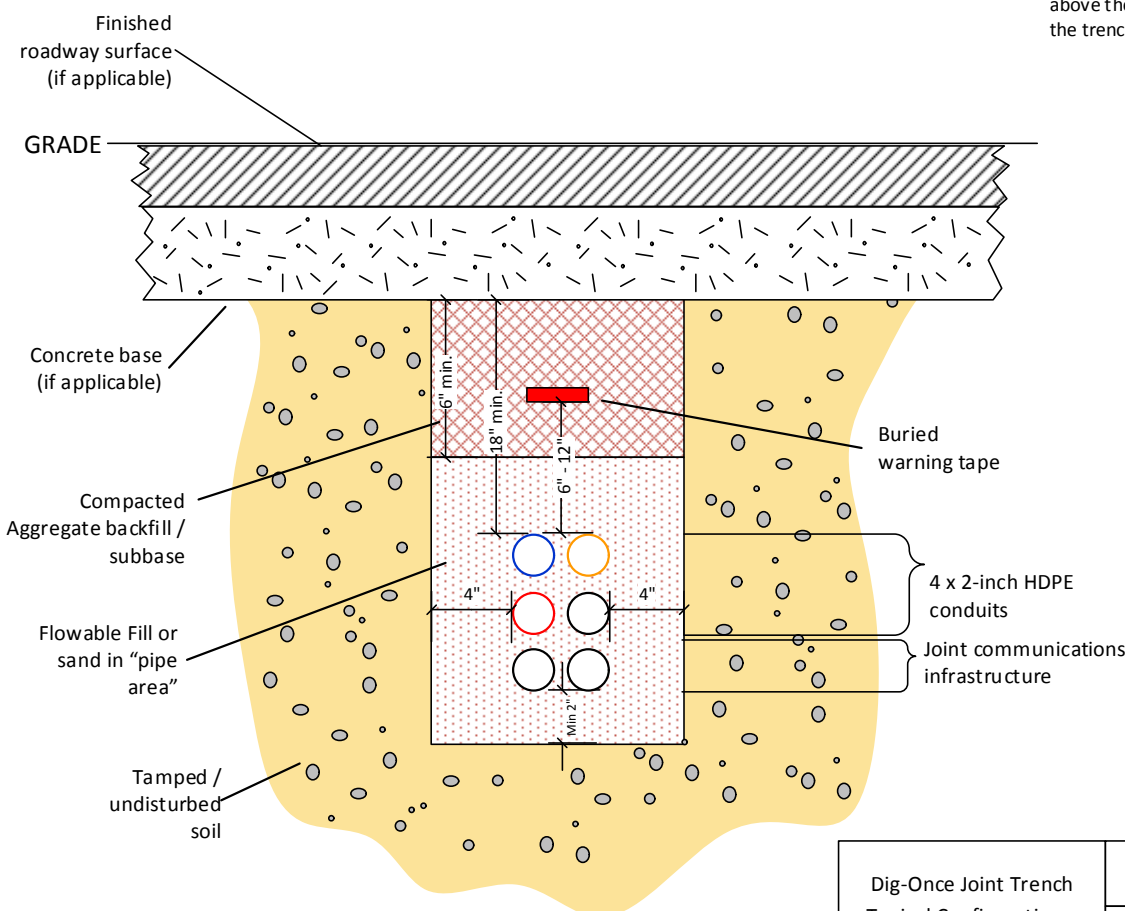
Conduit and Vault Horizontal Layout



INSTALLATION AND CONSTRUCTION NOTES:

1. City communications conduit shall consist of four (4) 2-inch HDPE (SDR 11) flexible duct, with pre-installed mule tape. Each conduit shall be a different color or be uniquely striped for easy identification. Conduits shall be fastened together with spacers at 5-foot intervals, maintaining a minimum separation of ¼-inch between each conduit.
2. All conduit couplers and fittings shall be installed to be water-tight. Conduits shall be sealed with an endcap or blank duct plug upon installation.
3. An electrical ground rod shall be installed in all vaults. Ground rods shall be comprised of 13-mil copper-clad steel, 5/8-inch diameter, 10-foot length, and tested to have an electrical resistance to ground of 25 ohms or less.
4. A 10 AWG insulated tracer wire shall be installed in one conduit in each conduit bank. Tracer wires shall consist of a solid, Copper Clad Steel (CCS) conductor and blue insulation. Insulation shall be HDPE or HMWPE). Tracer wires shall be electrically bonded to the ground rod in each vault using a suitable clamp.
5. Vaults shall be of a composite, straight-walled construction, UL-listed to ANSI 77-2010. Vaults and lids shall be Tier 22 load-rated. Vaults shall have external dimension of approximately 30"x 48"x 36" (WxLxD). Vault lids shall be etched with the words, "City of San Francisco Fiber Optics"
6. Vaults shall be placed in the City right-of-way immediately outside of the paved surface/vehicular traffic lanes, as close to the curb/gutter as possible.
7. Vaults shall be placed at roadway intersections, spaced a maximum of 600 feet. Adjacent vaults shall be separated by no more than two roadway crossings.
8. Conduit shall be placed with a minimum of 18-inches of cover below grade. Where feasible, conduit shall be placed with a maximum of 48-inch cover below grade.
9. Conduit shall be placed with sweeping bends from the roadway to each vault location having a minimum bend radius of 48-inches. If using manufactured elbows, bends shall utilize 45-degree elbows with a 36-inch minimum bend radius..
10. Conduit shall enter vaults from the sidewall through openings created per manufacturer instructions to retain the associated load rating. Conduits shall protrude beyond the interior wall of the vault by a minimum of 1-inch, and no more than 3-inches.
11. Trench backfill in the communications conduit area shall be flowable fill or sand.
12. Trench backfill within a minimum of 6-inches of the concrete base shall be Class 2 Aggregate Base and compacted to 95-percent maximum dry density per ASTM D-1557 or AASHTO T-180.
13. City communications conduit may be placed in a common bank with communications conduit owned by the joint trench owner with no additional clearances except as required for optional conduit bank spacers.
14. A 4-inch red colored warning tape (Terra Tape or accepted equal) shall be placed between 6-inches and 12-inches above the top of the conduit for the entire length of the trench.

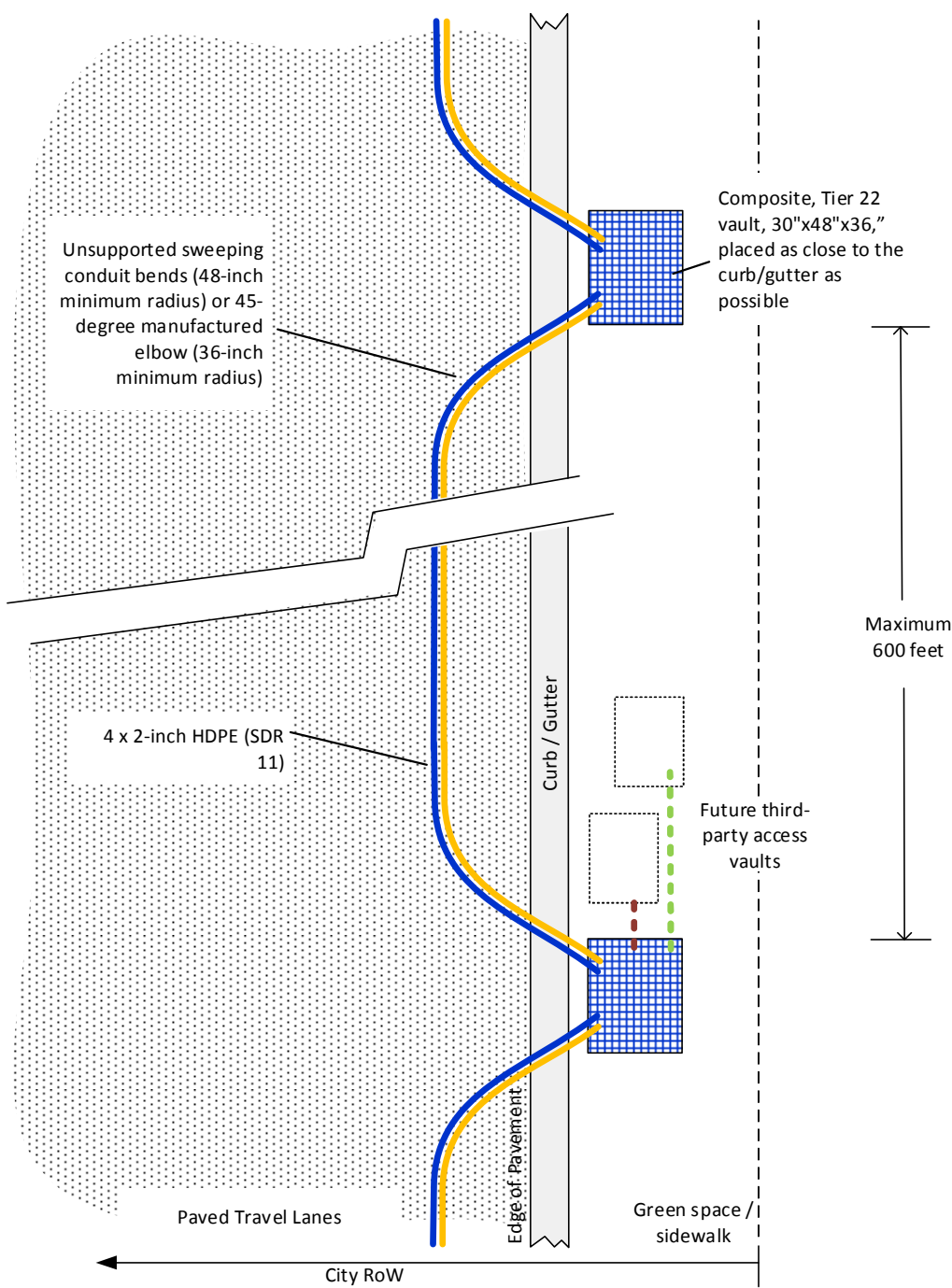
Trench Details



Dig-Once Joint Trench Typical Configuration – Communications Only	City and County of San Francisco, California			
	SIZE 11"x17"	FSCM NO	DWG NO	REV 9
	SCALE Not to scale		SHEET 3 OF 5	

FIGURE 4: TYPICAL CONFIGURATION FOR CONDUIT PARALLEL TO WATER OR SEWER LINES

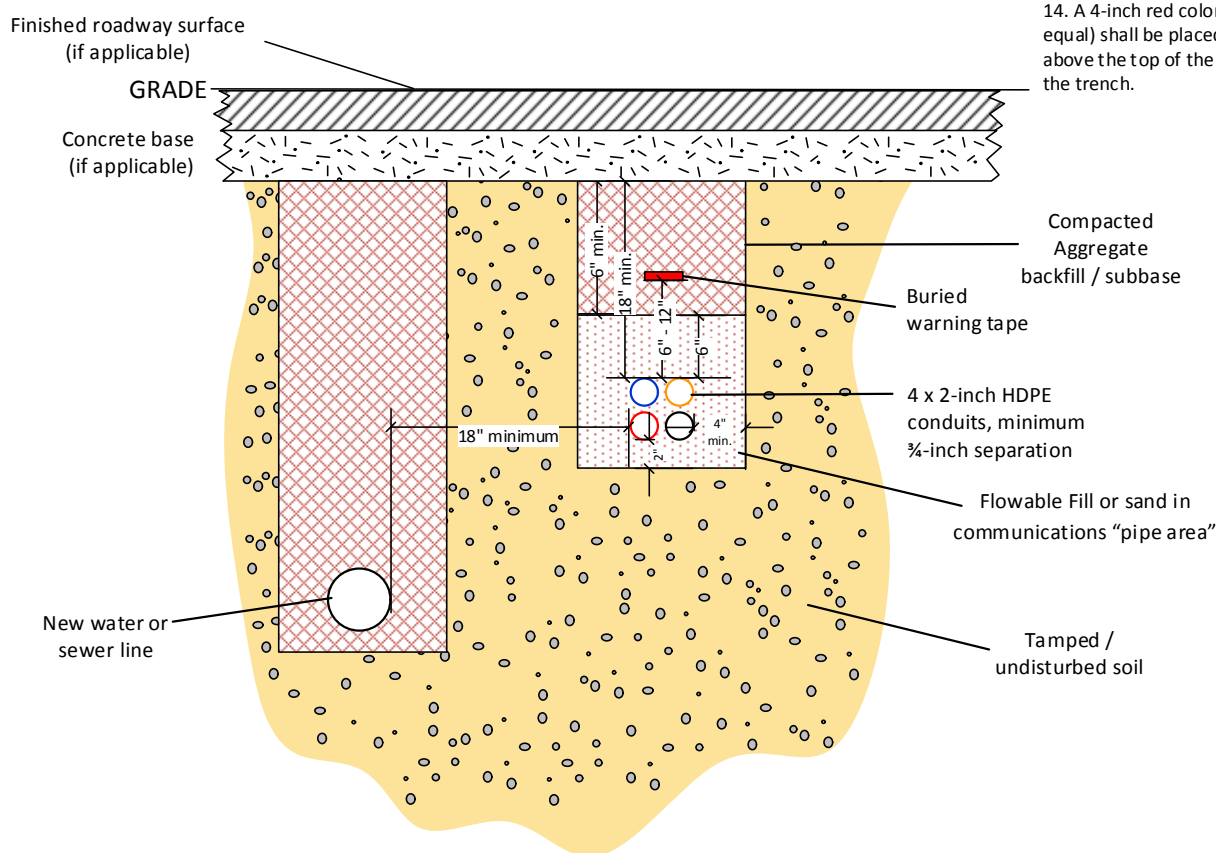
Conduit and Vault Horizontal Layout



INSTALLATION AND CONSTRUCTION NOTES:

1. City communications conduit shall consist of four (4) 2-inch HDPE (SDR 11) flexible duct, with pre-installed mule tape. Each conduit shall be a different color or be uniquely striped for easy identification. Conduits shall be fastened together with spacers at 5-foot intervals, maintaining a minimum separation of 3/4-inch between each conduit.
2. All conduit couplers and fittings shall be installed to be water-tight. Conduits shall be sealed with an endcap or blank duct plug upon installation.
3. An electrical ground rod shall be installed in all vaults. Ground rods shall be comprised of 13-mil copper-clad steel, 5/8-inch diameter, 10-foot length, and tested to have an electrical resistance to ground of 25 ohms or less.
4. A 10 AWG insulated tracer wire shall be installed in one conduit in each conduit bank. Tracer wires shall consist of a solid, Copper Clad Steel (CCS) conductor and blue insulation. Insulation shall be HDPE or HMWPE. Tracer wires shall be electrically bonded to the ground rod in each vault using a suitable clamp.
5. Vaults shall be of a composite, straight-walled construction, UL-listed to ANSI 77-2010. Vaults and lids shall be Tier 22 load-rated. Vaults shall have external dimension of approximately 30" x 48" x 36" (WxLxD). Vault lids shall be etched with the words, "City of San Francisco Fiber Optics"
6. Vaults shall be placed in the City right-of-way immediately outside of the paved surface/vehicular traffic lanes, as close to the curb/gutter as possible.
7. Vaults shall be placed at roadway intersections, spaced a maximum of 600 feet. Adjacent vaults shall be separated by no more than two roadway crossings.
8. Conduit shall be placed with a minimum of 18-inches of cover below grade, or a minimum of 18-inches below the concrete base where located under paved roadway surfaces. Where feasible, conduit shall be placed with a maximum of 48-inch cover below grade.
9. Conduit shall be placed with sweeping bends from the roadway to each vault location having a minimum bend radius of 48-inches. If using manufactured elbows, bends shall utilize 45-degree elbows with a 36-inch minimum bend radius..
10. Conduit shall enter vaults from the sidewall through openings created per manufacturer instructions to retain the associated load rating. Conduits shall protrude beyond the interior wall of the vault by a minimum of 1-inch, and no more than 3-inches.
11. Trench backfill in the communications conduit area shall be flowable fill or sand. Trench area surrounding joint utility pipe backfilled per utility owner specifications.
12. Trench backfill within a minimum of 6-inches of the concrete base shall be Class 2 Aggregate Base and compacted to 95-percent maximum dry density per ASTM D-1557 or AASHTO T-180.
13. City communications conduit shall maintain 18-inches of horizontal clearance radially from water and sewer utilities, unless otherwise agreed upon by the City and the applicable utility owner.
14. A 4-inch red colored warning tape (Terra Tape or accepted equal) shall be placed between 6-inches and 12-inches above the top of the conduit for the entire length of the trench.

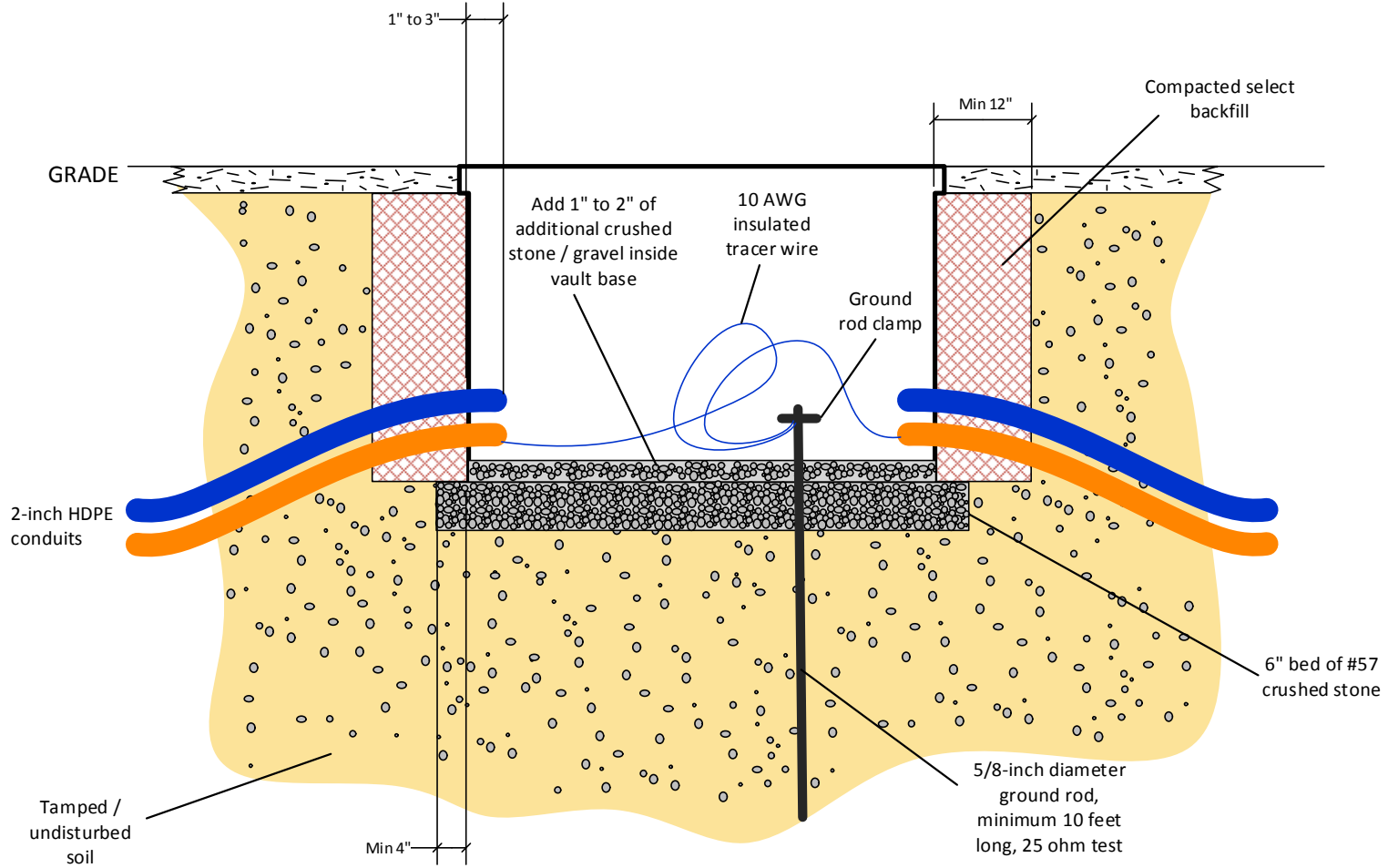
Trench Details



Dig-Once Joint Construction – Water / Sewer	City and County of San Francisco, California			
	SIZE 11"x17"	FSCM NO	DWG NO	REV 9
	SCALE Not to scale		SHEET 4 OF 5	

FIGURE 5: VERTICAL PROFILE FOR TYPICAL VAULT INSTALLATION

Typical Vault Installation



INSTALLATION AND CONSTRUCTION NOTES:

1. An electrical ground rod shall be installed in all vaults. Ground rods shall be comprised of 13-mil copper-clad steel, 5/8-inch diameter, minimum 10-foot length, and tested to have an electrical resistance to ground of 25 ohms or less.
2. Vaults shall be of a composite, straight-walled construction, UL-listed to ANSI 77-2010. Vaults and lids shall be Tier 22 load-rated. Vaults shall have external dimension of approximately 30"x 48"x 36" (WxLxD). Vault lids shall be etched with the words, "City of San Francisco Fiber Optics"
3. Conduit shall enter vaults from the sidewall through openings created per manufacturer instructions to retain the associated load rating. Conduits shall protrude beyond the interior wall of the vault by a minimum of 1-inch, and no more than 3-inches.
4. Vaults shall be installed flush with grade on a 6-inch bed of #57 crushed stone or gravel. An additional 1-inch to 2-inches of stone shall be placed inside the base of the vault.
5. A minimum of 12-inches of select, compacted backfill must surround the vault on all sides. Backfill must not contain large rocks or chunks, and there should be no voids between the vault sidewalls and the native surrounding soil.

Dig-Once Joint Trench Typical vault Elevation	City and County of San Francisco, California		
	SIZE 11"x17"	FSCM NO	DWG NO
SCALE	Not to scale	SHEET	REV 8
		1 OF 5	

APPENDIX B: INCREMENTAL COST CALCULATIONS

Table 1: Dedicated Trench, no roadway restoration					
		Average vault spacing (FT):		300	
		Total conduits per bank:		4	
Labor					
Item	Unit	Unit Price	Qty per Mile	Cost Per Street Mile	Cost Per Street Foot
Trench and installation of single 2" conduit <i>(includes standard backfill, installation of a tracer wire, and installation of all necessary conduit couplings and fittings)</i>	LF	\$ 8.45	5,808	\$ 49,077.60	\$ 9.30
Installation of a 2" conduit in an existing trench <i>(no additional excavation required)</i>	LF	\$ 1.58	17,424	\$ 27,442.80	\$ 5.20
Installation of a 30"x48"x36" vault	EA	\$ 303.44	17.60	\$ 5,340.50	\$ 1.01
Installation of a ground rod	EA	\$ 65.94	17.60	\$ 1,160.50	\$ 0.22
Remove and replace sidewalk <i>(assumes removal and repair of four (4) 3'x3' sidewalk flags)</i>	SF	\$ 10.40	457.60	\$ 4,759.04	\$ 0.90
Remove and replace curb <i>(assumes removal of 6 linear feet of curb adjacent to vault)</i>	LF	\$ 25.00	105.60	\$ 2,640.00	\$ 0.50
Labor Subtotals:				\$ 90,420.44	\$ 17.13
Material					
Item	Unit	Unit Price	Qty per Mile	Cost Per Street Mile	Cost Per Street Foot
2" HDPE conduit, SDR 11 <i>(includes all fittings and couplings)</i>	LF	\$ 0.87	23,232	\$ 20,211.84	\$ 3.83
Vault, Tier 22, 30"x48"x36"	EA	\$ 770.52	17.60	\$ 13,561.15	\$ 2.57
Tracer wire, insulated, 10 AWG	LF	\$ 0.34	5,280.00	\$ 1,795.20	\$ 0.34
Warning tape, orange, 3-inch width	LF	\$ 0.35	5,280.00	\$ 1,848.00	\$ 0.35
Ground rod, 13 mil copper-clad steel (RUS listed), 5/8" diameter, 8' length, including clamp	EA	\$ 22.20	17.60	\$ 390.72	\$ 0.07
Material Subtotals:				\$ 37,806.91	\$ 7.16
				Cost Per Street Mile	Cost Per Street Foot
Materials and Labor:				\$ 128,227.35	\$ 24.29
Engineering:				\$ 25,645.47	\$ 4.86
Total:				\$ 153,872.82	\$ 29.14

Table 2: Shared trench, no roadway restoration					
Average vault spacing (FT):		300			
Total conduits per bank:		4			
Labor					
Item	Unit	Unit Price	Qty per Mile	Cost Per Street Mile	Cost Per Street Foot
Installation of a 2" conduit in an existing trench <i>(no additional excavation required - includes installation of a tracer wire, and installation of all necessary conduit couplings and fittings)</i>	LF	\$ 1.58	23,232	\$ 36,590.40	\$ 6.93
Installation of a 30"x48"x36" vault	EA	\$ 303.44	17.60	\$ 5,340.50	\$ 1.01
Installation of a ground rod	EA	\$ 65.94	17.60	\$ 1,160.50	\$ 0.22
Remove and replace sidewalk <i>(assumes removal and repair of four (4) 3'x3' sidewalk flags)</i>	SF	\$ 10.40	457.60	\$ 4,759.04	\$ 0.90
Remove and replace curb <i>(assumes removal of 6 linear feet of curb adjacent to vault)</i>	LF	\$ 25.00	105.60	\$ 2,640.00	\$ 0.50
Labor Subtotals:				\$ 50,490.44	\$ 9.56
Material					
Item	Unit	Unit Price	Qty per Mile	Cost Per Street Mile	Cost Per Street Foot
2" HDPE conduit, SDR 11 <i>(includes all fittings and couplings)</i>	LF	\$ 0.87	23,232	\$ 20,211.84	\$ 3.83
Vault, Tier 22, 30"x48"x36"	EA	\$ 770.52	17.60	\$ 13,561.15	\$ 2.57
Tracer wire, insulated, 10 AWG	LF	\$ 0.34	5,280.00	\$ 1,795.20	\$ 0.34
Warning tape, orange, 3-inch width	LF	\$ 0.35	5,280.00	\$ 1,848.00	\$ 0.35
Ground rod, 13 mil copper-clad steel (RUS listed), 5/8" diameter, 8' length, including clamp	EA	\$ 22.20	17.60	\$ 390.72	\$ 0.07
Material Subtotals:				\$ 37,806.91	\$ 7.16
				Cost Per Street Mile	Cost Per Street Foot
Materials and Labor:				\$ 88,297.35	\$ 16.72
Engineering:				\$ 17,659.47	\$ 3.34
Total:				\$ 105,956.82	\$ 20.07