Southern California Edison
Presidential Substation Project A.08-12-023

DATA REQUEST SET Presidential ED-05

To: ENERGY DIVISION
Prepared by: Steve K. Alford
Title: Manager - TPD-L&E
Dated: 11/22/2010

Question 01:

Alternatives

Construction Methodology: Provide general construction methodologies required for undergrounding a single circuit 66 kV subtransmission line. Please provide the following information:

- General trench construction methodology: depth and width, cut and fill balance, and construction duration (any temporary nighttime lighting?).
- Trench location – in roadway or adjacent? *Along Read Road between Moorpark Road and Sunset Valley Road.*
- General installation requirements – vaults, splicing, etc.
- General tree removal requirements (what are the requirements that trigger tree removal?)
- If constructed, would telecommunications lines be installed underground with subtransmission or overhead with 16 kV?
- Describe any preliminarily known feasibility constraints.

Response to Question 01:

General trench construction methodology: depth and width, cut and fill balance, and construction duration (any temporary nighttime lighting?):

The following general trench construction methodology is typical of 66 kV underground construction where telecommunication facilities are not included in the duct bank with the 66 kV.

Trenching: A trench approximately 24-inch wide by 72-inch deep would be required to place the 66 kV subtransmission lines underground. This depth is required to meet the minimum 36 inches of cover above the duct bank. Trenching may be performed by using the following general steps, including but not limited to: mark the location and applicable underground utilities, lay out trench line, saw cut asphalt or concrete pavement as necessary, dig to appropriate depth with a backhoe or similar equipment, and install duct bank. Once the duct bank has been installed, the trench would be backfilled with a two-sack sand slurry mix. Excavated materials would be disposed of at an approved disposal facility in accordance with all applicable laws. Should groundwater be encountered, it would be pumped into a tank and disposed of at an approved disposal facility. The trench for underground construction would be widened and shored where appropriate to meet California Occupation and Safety Health Administration requirements. Trenching would be staged so that open trench lengths would not exceed that which is required to install the duct banks. Where needed, open trench sections would have steel plates placed over them in order to maintain vehicular and pedestrian traffic. Provisions for emergency vehicle access would be arranged with local jurisdictions in advance of construction activities.

Duct Bank Installation: As trenching for the underground 66 kV subtransmission line is completed, SCE would begin to install the underground duct bank. Collectively, the duct bank is comprised of cable conduit, spacers, ground wire, and concrete encasement. The duct bank typically consists of six 5-inch diameter polyvinyl chloride (PVC) conduits fully encased with a minimum of 3 inches of concrete all around. Typical 66 kV subtransmission duct bank installations would accommodate six cables.

It is not anticipated that nighttime work would be scheduled for this project, unless required by a local government agency, therefore SCE anticipates no need for temporary nighttime lighting.

Trench location – in roadway or adjacent? Along Read Road between Moorpark Road and Sunset Valley Road:

In this specific location, the trench would be in the roadway on the north side of the road centerline, assuming that all utility as-built information is complete and accurate. Existing utilities would prevent SCE from placing the trench adjacent to the roadway.

General installation requirements – vaults, splicing, etc. :

Vault Installation: Vaults are below-grade concrete enclosures where the duct banks terminate. The vaults are constructed of prefabricated steel-reinforced concrete and designed to withstand heavy truck traffic loading. The inside dimensions of the underground vaults are approximately 10 feet wide by 20 feet long with an inside height of 9.5 feet. Installation of each vault would typically take place over a one-week period depending on soil and site conditions. The installation of each vault typically requires the excavation of a hole of approximately 12.5 feet wide, 22.5 feet long, and 13.5 feet deep. The outside dimensions of each vault are approximately 11.5 feet wide, 21.5 feet long, and 11.5 feet tall. Vaults are set to a depth so that the main body is a minimum of 18 inches below the surface. The only surface exposure would be a 4 foot by 5 foot opening to provide access into the vault.

Vault pits are excavated and shored, and a minimum of 6 inches of mechanically compacted aggregate base is placed to cover the entire bottom of each pit, followed by delivery and installation of the vaults. Once the vaults are set, grade rings and the vault castings would be added and set to match the existing grade. The excavated areas are backfilled with a sand slurry mix to a point just below the top of the vault roof. Excavated materials, if suitable, are used to backfill the remainder of the excavation and any excess spoils are disposed of at an approved disposal facility in accordance with all applicable laws. Finally, the excavated areas are restored as required. Initially, the vaults are used as pulling locations to pull cable through the conduits. After the cable is installed, the vaults are utilized to splice the cables together. During operation, the vaults provide access to the underground cables for maintenance, inspections, and repairs.

Cable Pulling and Splicing: Following vault and duct bank installation, SCE would typically pull the electrical cables through the duct banks, splice the cable segments at each vault, and terminate cables at the transition structures where the subtransmission line would transition from underground to overhead. To pull the cables through the duct banks, a cable reel is placed at one end of the conduit segment, and a pulling rig is placed at the opposite end. The cable from the cable reel is attached to a rope in the duct bank, and the rope linked to the pulling rig, which pulls the rope and the attached cable through the duct banks. A lubricant is typically applied as the cable enters the ducts to decrease friction and facilitate travel through the PVC conduits. Each electrical cable for the 66 kV subtransmission line is typically pulled through the individual conduits in the duct bank at a rate of two to three cables between structures each day. After cable pulling is completed, the electrical cables are spliced together in each vault. A splice crew then conducts splicing operations at each vault location and continues until all splicing is completed.

Transition Structure (TSP Riser Pole) Construction: At each end of an underground 66 kV section, the cables typically rise out of the ground at transition structures (TSP riser poles), which accommodate the transition from underground to overhead subtransmission lines. The TSP riser poles support overhead conductor, underground cable, cable terminations, lightning arresters, and dead-end hardware for overhead conductors.

General tree removal requirements (what are the requirements that trigger tree removal?):

Typically, SCE attempts to avoid the removal of trees by siting project trench locations where they do not interfere with tree drip lines. Where the installation of underground facilities may pose a threat to existing trees, SCE will coordinate with local jurisdictions and have an evaluation performed by a certified arborist to determine the potential impact and feasibility of installing underground facilities adjacent to the trees. It may be determined that by utilizing other than standard construction methods, such as hand digging around the roots and/or tunneling under the root structure, it may be possible to the install the underground facilities and not threaten or damage the existing trees.

If constructed, would telecommunications lines be installed underground with subtransmission or overhead with 16 kV?

Telecommunications would follow the overhead distribution facilities as discussed in SCE's response to CPUC Data Request Set 5, Question 3.

Describe any preliminarily known feasibility constraints:

For Read Road between Moorpark Road and Sunset Valley Road, SCE is aware of underground telephone, fiber optic cable, gas; and 12-inch and 54-inch water lines. SCE assumes that no utilities have easements within the franchise and that SCE is only required to maintain clearance of 12 inches from other utilities per CPUC General Order (G.O.) 128 (Rules for Construction of Underground Electric Supply and Communications Systems). SCE subtransmission facilities must be located at least 10 feet from any other heat source, and SCE is not aware of any other underground utilities in this area that would be considered a heat source. (Note that if any other entities have existing easements within the public right of way, SCE would need to conform to the terms of the existing easements that could include requiring SCE to install its new underground conduits outside of the limits of the existing easements, or obtain consent from the entity holding the easement to install conduits within their easement.)

Question 02:

Alternatives

Construction Methodology: Provide general construction methodologies required for undergrounding a double circuit 66 kV subtransmission line. Please provide the following information:

- General trench construction methodology: depth and width, cut and fill balance, and construction duration (any temporary nighttime lighting?)
- Trench location – in roadway or adjacent? *Along Read Road between Sunset Valley Road and SR 23.*
- General installation requirements – vaults, splicing, etc.
- General Tree removal requirements (what are the requirements that trigger tree removal?)
- Describe the required separation distance between the two circuits (vertically or horizontally), or would two separate trenches be required.
- If constructed, would telecommunication lines be installed underground with the subtransmission or overhead with 16 kV?
- Describe any preliminarily known feasibility constraints.

Response to Question 02:

General trench construction methodology: depth and width, cut and fill balance, and construction duration (any temporary nighttime lighting?):

Please see SCE's response to CPUC Data Request Set 5, Question 1

Trench location – in roadway or adjacent? Along Read Road between Sunset Valley Road and SR 23:

In this specific location, the trench location would be mostly in the roadway on the north side of the road centerline, assuming that all underground utility as-built information is complete and accurate. Where practical, and if there are no other utility conflicts, terrain or vegetation issues, SCE would install the trench adjacent to the roadway in the public right-of-way to reduce trench costs, but this is not feasible for the entire route.

General installation requirements – vaults, splicing, etc.:

Please see SCE's response to CPUC Data Request Set 5, Question 1. Please note, however, that separate vaults would be required for each circuit to maintain worker safety and reliability.

General tree removal requirements (what are the requirements that trigger tree removal?)

Please see response to CPUC Data Request Set 5, Question 1.

Describe the required separation distance between the two circuits (vertically or horizontally), or would two separate trenches be required?

There are no additional separation requirements beyond those discussed above within a single duct bank. Six 5-inch conduits are typically installed in a single duct bank, which consists of two ducts wide by 3 ducts deep, and all conduits would be filled with cable. Normally, the circuits are installed parallel to each other in a vertical configuration.

If constructed, would telecommunications lines be installed underground with subtransmission or overhead with 16 kV?

Telecommunications would follow the overhead distribution facilities as discussed in SCE's response to CPUC Data Request Set 5, Question 3.

Describe any preliminarily known feasibility constraints:

For Read Road between Sunset Valley Road and SR 23, SCE is aware of underground telephone, fiber optic cable, gas; and 12-inch and 54-inch water lines. SCE assumes that no utilities have easements within the franchise and that SCE is only required to maintain clearance of 12 inches from other utilities per CPUC General Order (G.O.) 128 (Rules for Construction of Underground Electric Supply and Communications Systems). SCE subtransmission facilities must be located at least 10 feet from any other heat source, and SCE is not aware of any other underground utilities in this area that would be considered a heat source. (Note that if any other entities have existing easements within the public right of way, SCE would need to conform to the terms of the existing easements that could include requiring SCE to install its new underground conduits outside of the limits of the existing easements, or obtain consent from the entity holding the easement to install conduits within their easement.)

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To: ENERGY DIVISION
Prepared by: Jack Haggenmiller
Title: Field Engineering Project Manager
Dated: 11/22/2010

Question 03:

Alternatives

Along Read Road from Moorpark Road to West of SR 23, if the 66 kV circuits were installed underground and the 16 kV line was left overhead what changes to the 16 kV line would be required such as:

- Pole replacement?
- Pole height?
- Pole type (single versus double circuit, lightweight, tubular steel, dead-end, etc.)?
- Or – would the existing poles and lines be left in place?
- Would the telecommunication lines be underground with the 66 kV, or overhead with the 16 kV?
- Describe any differences between the single circuit 66 kV portion and the double circuit 66 kV portion as they relate to the overhead 16 kV distribution described above.

Response to Question 03:

Along Read Road from Moorpark Road to West of SR 23, if the 66 kV subtransmission lines were installed underground and the 16 kV distribution circuit was left overhead, minimal changes to the 16 kV distribution circuit would be required. The 16 kV distribution circuit would remain intact except that the existing automatic recloser, (a protective, sectionalizing device) on an existing wood distribution pole on Read Road near Moorpark Road would be removed (along with the related apparatus) and the existing switch (which is a different piece of equipment than the automatic recloser) on the same pole would be replaced with a new Omnirupter switch which needs to be installed to maintain 16 kV distribution circuit sectionalizing capability. Independent of any new telecommunication facilities, there are no anticipated pole replacements and, therefore no changes to pole heights or types. The existing wood poles and conductors would be left in place.

Telecommunication fiber optic cable required for the Proposed Project would be installed on the existing wood 16 kV distribution poles along Read Road from Moorpark Road to West of SR 23 where it does not already exist. It is anticipated that the new telecommunication cable would be installed on the existing wood distribution poles in the communication space. A wind loading study would need to be performed on the existing wood poles to verify if the telecommunication cable can be accommodated. If not, certain poles may need to be replaced. If a wood distribution pole is required to be replaced to accommodate the new telecommunication cable, it is anticipated that the replacement pole would be the same height and type as the existing wood pole, providing that there is enough space on the pole to install the new telecommunications conductor while maintaining CPUC GO-95 clearances. However, if there is an issue with CPUC GO-95 clearances, then a five foot taller wood pole would likely be required.

If the 66 kV portion of the subtransmission line route was either single circuit or double circuit along Read Road from Moorpark Road to West of SR 23, SCE anticipates keeping virtually (minus automatic recloser, switch, and associated equipment) all of the existing 16 kV distribution facilities overhead in place.

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To: ENERGY DIVISION
Prepared by: Steven K. Alford
Title: Manager - TPD-L&E
Dated: 11/22/2010

Question 04:

Alternatives

In general, describe the requirements/feasibility for undergrounding both the 66 kV and 16kV underground

- Trench depth and width
- What is the separation distance required between the two and would it require two separate trenches or just one.
- Trenching methodology
- General installation requirements
- Tree removal requirements (what are the requirements that trigger tree removal?)
- Would the telecommunication lines be located underground with the subtransmission and distribution lines? If not describe the facilities necessary for installing the telecommunications lines.
- Describe any preliminarily known feasibility constraints.

Response to Question 04:

Trench depth and width:

Please see SCE's response to CPUC Data Request Set 5, Question 1 for typical 66 kV trench depth and width. For undergrounding the 16 kV, please refer to SCE's response to CPUC Data Request Set 4, Question 1(redlined Proponents Environmental Assessment revisions submitted by SCE as part of the Design Update) for typical trench depth and width, and the General installation requirements section below (approximately 24-inches wide by 45-inches deep).

What is the separation distance required between the two and would it require two separate trenches or just one.

SCE requires separate trenches for distribution and sub-transmission facilities. Trenches must be separated by 10 feet to prevent loss of capacity to carry load (ampacity) in the cables due to heat.

Trenching methodology:

Please see SCE's response to CPUC Data Request Set 5, Question 1 for the 66 kV trenching methodology. For undergrounding the 16 kV, please refer to the general methodology described in the CPUC Data Request Set 4, Question 1 (redlined Proponents Environmental Assessment revisions submitted by SCE as part of the Design Update) and the General installation requirements section below**.** However, please note the methodology in the redlined Proponents Environmental Assessment revisions submitted by SCE as part of the Design Update is project-specific and includes additional detail not relevant to this question.

General installation requirements

Please refer to CPUC Data Request Set 5, Question 1 for the 66 kV general installation requirements. For undergrounding the 16 kV, please refer to the general installation requirements described in the redlined Proponents Environmental Assessment revisions submitted by SCE as part of the Design Update, and SCE's response to CPUC Data Request Set 1, Question 2 . However, please note the general installation requirements in the redlined Proponents Environmental Assessment revisions submitted by SCE as part of the Design Update, and SCE's response to CPUC Data Request, Set 1, Question 2 may include additional detail not relevant to this question. Namely, instead along Read Road, 6-foot x 12-foot distribution vaults would likely mostly be used with an adjacent 3-foot x 5-foot pull box for telecommunications at each vault location. In addition, SCE would likely require that the existing overhead distribution transformers be replaced with pad mounted transformers installed on pads and connected to the vaults using a single 4-inch conduit to each pad.

The civil construction work required to install the 16 kV distribution underground substructure of four 5-inch conduits in a concrete semi-encased duct bank would typically involve using a backhoe with a 24-inch bucket to excavate an approximate 24-inch trench approximately 45 inches deep. Shields or trench shoring may then be temporarily installed for safety to brace the walls of the trench. Four 5-inch conduits would then be installed using spacers to create a duct bank consisting of two columns of two stacked 5-inch conduits apiece. Any temporary shoring would be removed. The conduits would then be semi-encased in concrete with a minimum encasement of 3 inches on all sides except the bottom. After the concrete encasement has hardened, the trench would be backfilled with 1.5 sack sand slurry (which is a mix of sand and water with 1.5 bags of cement added with no aggregate per yard) in accordance with the minimum permit requirements as required by the local jurisdiction (e.g. the city) in which the trench is located. Later, the job would be finished as the street would be repaved in accordance with the city’s permit requirements.

Please refer to the attached page (CD 120) from SCE’s Distribution Underground Construction Standards to see the conduit bank requirements for typical duct bank block diagrams.

The details regarding typical construction methodology used to install a 7-foot x 18-foot x 8-foot distribution vault (inside dimensions) in the street are as follows: A contractor would use a backhoe with a 36-inch bucket to excavate a hole approximately 9 feet x 20 feet x 11.5 feet in size for a 7-foot x 18-foot vault with 36 inches of necking from flow line gutter. The size of the hole allows for a minimum of 6 inches of ¾-inch crushed rock from wall to wall for the base of the hole and a minimum of 6 inches clearance around the outside wall of the vault to the wall of the excavation. Shields or trench shoring are then temporarily installed for safety to brace the walls of the trench.

The 6 inches of ¾-inch crushed rock is then dumped, compacted, and leveled on the floor of the hole wall to wall. Shields or trench shoring are then removed. Using the boom on the delivery truck from the vault manufacturer, the bottom half of the vault is lowered in place and checked to assure it is level. Then the top half is lowered and placed atop the bottom half, with the seam sealed with mastic, a sealant to keep the vault seams from leaking. The depth of the vault is then verified from the top of the roof of the vault to the flow line gutter grade. Eighteen inches of necking is then installed on the 6-inch collar atop the roof of the vault. All seams are sealed with mastic to keep the structure watertight.

The 12-inch vault cover and frame is then set and adjusted to grade and the seam is grouted with non-shrink grout. One point five sack sand slurry (which is a mix of sand and water with 1.5 bags of cement added with no aggregate per yard) is then poured around the vault and over the top 6-inches, meaning the sand slurry is going to be 6 inches high when placed on top of the vault. This amounts to approximately 18 tons (approximately 1 cement truck load equals 10 tons) of slurry for this size vault. The rest of the excavation is then back-filled with minimum 1.5 sack sand slurry or the minimum requirements as required by the local jurisdiction (e.g. the city) in which the vault is to be located. The contractor would then excavate and install the vent pipes running to the designed location with a backhoe creating approximately another 6 yards of haul-off dirt. Such vent pipes would be installed for the purposes of providing ventilation to cool any distribution transformers that may ultimately be installed inside the vault. The vent pipe conduits are then encased and after the encasement hardens, the trench is backfilled with 1.5 sack sand slurry. To finish, the contractor would then repave the street in accordance with the city's permit requirements.

After the civil work of installing the duct bank, vaults, and vent pipes has been completed, SCE’s electrical contractor or SCE's cable crews would arrive at a later date to pull in three single conductor 1000 kcmil Aluminum Jacketed Concentric Neutral (JCN) cables per circuit run in one of the 5-inch conduits in the duct bank. To accomplish this, a router (cable pulling truck) would set up at every other vault to pull cable both ways. At opposite ends of every other vault, cable carousels would be set up to feed cable both ways. Other distribution crews typically would install the vault grounds, rack the cables, install any switches, any transformers and any other necessary equipment, and make the appropriate cable splices and terminations. Switching would be performed to put the new equipment into service. Lane closures and traffic control permits are often required for such cable installations by the appropriate local, county or state agency.

Tree removal requirements (what are the requirements that trigger tree removal?)

Please see SCE's response to CPUC Data Request Set 5, Question 1.

Would the telecommunication lines be located underground with the subtransmission and distribution lines? If not describe the facilities necessary for installing the telecommunications lines.

Yes, because SCE telecommunications typically follows distribution, in this scenario, SCE telecommunications conduits and cables would be placed underground in the distribution trench and separate structures would be installed for the telecommunications facilities.

Describe any preliminarily known feasibility constraints:

SCE is aware of underground telephone, fiber optic cable, gas; and 12-inch and 54-inch water lines. SCE assumes that no utilities have easements within the franchise and that SCE is only required to maintain clearance of 12 inches from other utilities per CPUC General Order (G.O.) 128 (Rules for Construction of Underground Electric Supply and Communications Systems). SCE subtransmission facilities must be located at least 10 feet from any other heat source, and SCE is not aware of any other underground utilities in this area that would be considered a heat source. (Note that if any other entities have existing easements within the public right of way, SCE would need to conform to the terms of the existing easements that could include requiring SCE to install its new underground conduits outside of the limits of the existing easements, or obtain consent from the entity holding the easement to install conduits within their easement. **This could seriously impact SCE's ability to install two separate trenches 10' apart.**)

Terrain issues, oak tree drip lines and other large tree roots may prohibit SCE from being able to underground both 66 kV and 16 kV between Sunset Valley Road and the west side of SR 23. There is a section of the public right-of-way where the road narrows due to a steep incline on the south side of the road, and a steep drop off on the north side of the road. In this section, the existing underground utilities are closer together than in other locations. Due to this constriction, it may not be possible for SCE to underground both distribution and transmission in this section of the roadway because SCE would not be able to maintain the 10 foot separation between distribution and sub-transmission facilities. SCE looked at the possibility of placing facilities in private property to overcome this issue, but it is not practical to install the system in private property on the south side of Read Road due to the terrain, private improvements, and trees. It is not practical to install the system on the north side of the street in private property because the underground system would not be accessible from the existing roadway and underground conduits and structures might need to be placed in the agricultural fields. Normal farming operations may not be compatible with installation of adjacent underground utilities because SCE backfills trenches with slurry to 12 inches below grade. Farming activities have the potential to excavate in conflict with SCE's facilities. Irrigation used in farming operations may result in excessive drainage into SCE vaults. Furthermore, pesticides used may corrode cables while also posing a potential hazard to utility workers. In addition, any future land improvements could result in significant changes in grade that could require these facilities to be relocated in the future.

SCE does not normally design underground systems within the drip line of oak trees. There are several oak trees on both sides of the road, in various locations that could prohibit SCE from placing both distribution and subtransmission conduit systems 10 feet apart. Also, there are other oak trees in this area where the drip line does not impact the trench routes, but it is impossible to know if these trees will grow large enough to create problems at the time the ducts would be installed.

There is also a portion of roadway on the north side of Read Road just east of Sunset Valley Road where there are extremely tall pine trees. An evaluation by an arborist would need to be done to determine if a trench near these trees would cause damage. If a trench cannot be placed on the north side of the roadway, SCE would not be able to maintain the required 10-foot separation between subtransmission and distribution facilities.

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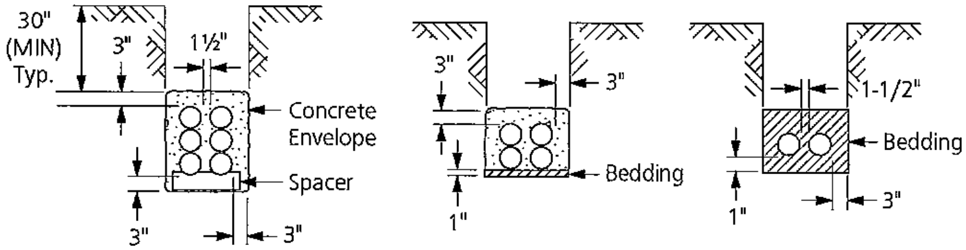
CD 120 Conduit Bank Requirements

Scope CD 120.1 Conduit Bank Requirements

Figure CD–4: Typical Conduit Bank Sections (Mainline and Commercial/Industrial)

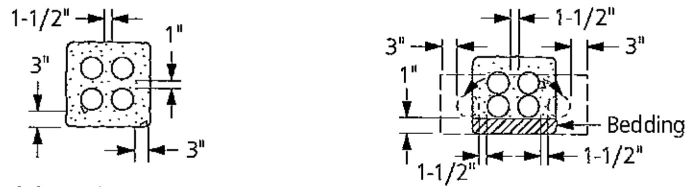


Full Encasement
More than 4 conduits
(base spacer required)

Semi-Encasement
3 or 4 conduits

Direct Burial

Special Conduit Formations



Conduit Bank Terminations
Minimum separations required between all types of conduit at conduit entrances to substructures

Conduit Rolling
Used only when specified or sanctioned for ducts to occupy minimum vertical space and maintain required cover.

Notes:

1. Spacing and concrete coverage as shown is minimum.
2. Spacers, when required, will be as recommended by the conduit manufacturer and approved by the company and will be placed at the intervals shown in Table CD–2. Vertical spacers and base spacers will be manufactured from rigid noncompressable type materials. Use temporary means to maintain horizontal conduit spacing at these intervals until backfill bedding or encasement is placed.

Table CD–2: Horizontal Conduit Spacing Intervals

Conduit Size	2"	3"	3-1/2"	4"	5"	6"
Spacing with Encasement	10'	10'		10'		
Spacing with Nonencasement	10'	8'		6'		

3. Base spacers are required on all banks of more than four conduits.
4. The conduit will be of an approved make and manufacture as set forth in drawing CD 115 (page CD–19), CD 115 (page CD–21), and CD 115 (page CD–22).
5. Types:
   A. "EB" (Type I) for encased and semi-cased installations;
   B. "DB" (Type II) for direct burial;
   C. "SCH. 40" Rigid PVC for inside bore casings.
6. For general conduit bank, concrete, and trenching requirements, see CD 100 (page CD–1).
7. Install neutral wire only when specified on working drawing.
8. Concrete encasement will be kept uniform. Excessive amounts of concrete will be avoided.
9. Bedding will be in accordance with CD 100 (page CD–3), Paragraph 6.1.