SPECIAL PROVISIONS

FOR

STOCKTON CITY HALL PARKING LOT

City of Stockton Project No.: E016015-A

Prepared for
City of Stockton

Dated November 21, 2023

CITY PROJECT NO. E016015-A

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

REGISTERED CIVIL ENGINEER

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DIVISION I GENERAL PROVISIONS

SECTION 1 - SPECIFICATIONS AND PLANS

1-1.01 Specifications

The work described herein shall be done in accordance with the current City of Stockton, Department of Public Works Standard Specifications and Plans, and the latest Editions of the State of California, Department of Transportation Standard Specifications and Standard Plans, California MUTCD, as referenced therein, and in accordance with the following Special Provisions. To the extent the California Department of Transportation Standard Specifications implement the STATE CONTRACT ACT, (or certain provisions of the Public Contracts code which are inapplicable to charter cities) they shall not be applicable.

In case of conflict or discrepancy between any of the Contract Documents, the order of documents listed below shall be the order of precedence, with the first item listed having the highest precedence.

1. Contract Change Order (changes last in time are first in precedence)
2. Addenda to Contract Agreement
3. Contract Agreement
4. Permits
5. Notice Inviting Bids and Instructions to Bidders
6. Addendums and Letters of Clarification
7. Special Provisions
8. Project Drawings
9. City of Stockton Standard Specifications
10. City of Stockton Standard Drawings
11. Caltrans Standard Specifications
12. Caltrans Standard Plans

Should it appear that the work to be done or any of the matters relative thereto are not sufficiently detailed or explained in these specifications, the special provisions, or the plans, the contractor shall apply to the Engineer in writing for such further explanations as may be necessary and shall conform to them as part of the contract. In the event of any doubt or question arising respecting the true meaning of these specifications, the special provisions or the plans, reference shall be made to the Engineer, whose decision thereon shall be final.

1-1.02 Plans

The bidder's attention is directed to the provisions in Section 1-1.03 “Definitions”, of the Standard Specifications and Section 1-1.07 “Definitions”, of the Caltrans Specifications.

1-1.03 Terms and Definitions

Wherever in the Standard Specifications, Special Provisions, Notice to Contractors, Proposal, Contract, or other contract documents the following terms are used, the intent and meaning shall be interpreted as follows:

City or Owner -	City of Stockton
Director -	Director of Public Works, City of Stockton
Standard Specifications -	Current City of Stockton, Standard Plans and Specifications, inclusive of all current revisions, and amendments, unless otherwise stated.
Caltrans Specifications -	State of California, Department of Transportation, Current Standard Plans and Specifications, inclusive of all current revisions, and amendments, unless otherwise stated.
Laboratory -	City of Stockton Department of Public Works Laboratory or consultant's laboratory
Department -	Department of Public Works, City of Stockton
Engineer -	City Engineer, City of Stockton, acting either directly or through properly authorized Engineer agents and consultants
California MUTCD	Latest edition of California Manual on Uniform Traffic Control Devices (MUTCD), and any amendments and revisions thereto.
Working Day	defined as any eight-hour day, except as follows: Saturday, Sunday, and City recognized holidays.

SECTION 2 – BIDDING AND BID PROTESTS

Refer to the Instructions to Bidders and Section 2, “Bidding” of the Standard Specification.

In case of Bid protests, attention is directed to the provisions in Section 2-1.51, “Bid Protests” of the Standard Specifications. The party filing the protest must have submitted a bid for the work. A subcontractor of a bidder may not submit a bid protest.

A copy of bid protests is to be sent to the following address:

Attention: Joshua Lewis
City of Stockton
Public Works Department
22 E. Weber Avenue, Room 301
Stockton, CA 95202

SECTION 3 – CONTRACT AWARD AND EXECUTION

The bidder's attention is directed to the provisions in Section 3, "Contract Award and Execution," of the Standard Specifications and these Special Provisions.

Bidders and subcontractors are required to be available the day of bid opening to answer questions.

The award of the contract, if it be awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed.

If the City awards the Contract, the award is made to the lowest responsible bidder within 90 days after the day of the bid opening.

SECTION 4 – SCOPE OF WORK

Attention is directed to the provisions in Section 4, “Scope of Work” of the Caltrans Specifications, Standard Specification, and these Special Provisions.

At no time shall construction begin without receiving notice that the contract has been approved by the City Attorney or an authorized representative. The Contractor shall follow the sequence of construction and progress of work as specified in Section 10-1.01, "Order of Work", of these Special Provisions.

The Contractor shall diligently prosecute all work items to completion.

Full compensation for any additional costs occasioned by compliance with the provisions in this section shall be considered as included in the prices paid for the various contract items of work, and no additional work compensation will be allowed, therefore.

Bidders will be required to carefully examine these special provisions and attachments to judge for themselves as to the nature of the work to be done and the general conditions relative thereto and the submission of a proposal hereunder shall be considered prima-facie evidence that the bidder has made the necessary investigation and is satisfied with respect to the conditions to be encountered, the character, quantity and quality of the work performed. For work to be completed, contractors are advised to visit and review the job site prior to the submission of their bid. Bids not presented on the City forms shall be cause for considering the bid as non-responsive.

Bidders must be thoroughly competent and capable of satisfactorily performing the work covered by the proposal, and when requested shall furnish such statements relative to previous experience on similar work, the plan or procedure proposed, and the organization and the equipment available for the contemplated work, and any other as may be deemed necessary by the City Engineer in determining such competence and capability.

It shall be understood that the Contractor shall be required to perform and complete the proposed work in a thorough and diligent manner, and to furnish and provide in connection therewith all necessary labor, tools, implements, equipment, materials and supplies. The Contractor is responsible to take all necessary precautions and use best practices in the industry to perform all work require completing the project.

4-1.01 Differing Site Conditions (23 CFR 635.109)

Attention is directed to the provisions in Section 4-1.06, "Differing Site Conditions," of the Caltrans Specifications and the Standard Specifications. Contractor shall notify the Engineer if he/she finds physical conditions differing materially from contract documents.

4-1.02 Changes and Extra Work

Attention is directed to the provisions in Section 4-1.05A “Changes and Extra Work” of the Standard Specifications and these Special Provisions.

SECTION 5 – CONTROL OF WORK

Attention is directed to the Instruction to Bidders, provisions in Section 5 “Control Work” of the Caltrans Specifications, Standard Specification and these special provisions.

5-1.01 Contract Components

Attention is directed to the provisions in Section 5-1.02,” Contract Components" of the Standard Specifications. If a discrepancy found or confusion arises, submit a Request for Information (RFI).

5-1.02 BLANK

5-1.03 BLANK

5-1.04 Coordination With Other Entities

5-1.04A Permits

The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work. The Environmental Quality Act (Public Resources Code, Sections 21000 to 21176, inclusive) may be applicable to permits, licenses, and other authorizations which the Contractor must obtain from local agencies in connection with performing the work of the contract. The Contractor shall comply with the provisions of those statutes in obtaining the permits, licenses and other authorizations and they shall be obtained in sufficient time to prevent delays to the work. If the City has obtained permits, licenses or other authorizations, applicable to the work, in conformance with the requirements in the Environmental Quality Act, the Contractor shall comply with the provisions of those permits, licenses and other authorizations. The following is a non-inclusive list of the required permits and/or licenses:

- Contractor’s License. At a minimum the Contractor shall possess at the time of bid and maintain throughout the duration of the contract, a valid California Class A or C-10 Contractor License.
- Business License. Contractor shall possess prior to the execution of the contract and maintain throughout the duration of the contract, a valid City of Stockton business license.
- City of Stockton Encroachment Permit (Contractor pays)
- State’s Water Resources Control Board Stormwater Construction General Permit (Contractor pays)
  - Storm Water Pollution Prevention Plan
  - Notice of Intent (NOI)
  - Notice of Termination (NOT)

5-1.05 Submittals

The following is a list of anticipated submittals for the project. The list is provided to aid the Contractor in determining the scope of work, but is not intended to be all inclusive and additional submittals may be required:

1) Baseline Progress Schedule (Critical Path Method)
2) Storm water Pollution Prevention Plan
3) Approved Notice of Intent from State Water Resources Control Board
4) Pre-construction survey
5) Temporary Traffic Control (includes Pedestrian Detour Plan)
6) Contractor Safety Plan
7) Portland Cement Concrete Mix Design
8) Staging Agreement with private property owners (if applicable)
9) City of Stockton Encroachment Permit
10) City's Construction and Demolition Debris Recycling Report
11) List of submittals
12) Product submittals
13) Lead Compliance Plan
14) A Schedule of Values

The Contractor shall transmit each submittal to the Engineer for review and approval with the submittal form approved by the Engineer. Submittals shall be sequentially numbered on the submittal form. Resubmittals shall be identified with the original number and a sequential resubmittal suffix letter. The original submittal shall be numbered X. The first resubmittal shall be numbered X-a and so on. Identify on the form the date of the submittal, Contractor, Subcontractor, or supplier; pertinent drawing and detail number, and/or special provision number, as appropriate. The Contractor shall sign the form certifying that review, approval, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and contract documents. Any incomplete submittals will be returned for resubmittal.

Schedule submittals to expedite the Project, and deliver to Engineer at the Engineer's office, see Section 10-1.01, "Order of Work," of these Special Provisions.

For each submittal for review, allow 15 calendar days excluding delivery time to and from the Contractor.

Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

When revised for resubmission, identify all changes made since previous submission.

Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

Submittals not requested either in the Contract Documents or in writing from the Engineer will not be recognized or processed.

Within 10 calendar days after Notice of Award submit a complete list of all submittals to be submitted and the dates when they will be submitted. **All submittals shall be submitted within 30 calendar days from the date the Notice of Award; otherwise project working days will commence, with or without issuance of the Notice to Proceed**.

Wherever called for in the Contract Documents, or where required by the Engineer, the Contractor shall furnish to the Engineer for review, 1 set, plus one reproducible copy, of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items. Whenever the Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state of California, unless otherwise directed.

Normally, a separate submittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multi-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Engineer.

Except as may otherwise be indicated herein, the Engineer will return prints of each submittal to the Contractor with their comments noted on the submittal. The Contractor shall make complete and acceptable submittals to the Engineer by the second submission of a submittal item. The City reserves the right to withhold monies due to the Contractor to cover additional costs of the Engineer's review beyond the second submittal.

If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN", formal revision and resubmission of said submittal will not be required.

If a submittal is returned to the Contractor marked "MAKE CORRECTIONS NOTED", formal revision and resubmission of said submittal will not be required.

5-1.06 Job Site Appearance

Attention is directed to Section 4-1.13 "Cleanup" of the Caltrans Specifications, Section 5-1.31 "Job Site Appearance" of the Standard Specifications, and these Special Provisions.

The Contractor shall maintain a neat appearance to the work.

Broken concrete and debris developed during clearing and grubbing shall be disposed of concurrently with its removal. Contractor shall pay to the City of Stockton the sum of Two Hundred Fifty Dollars ($250) for every calendar day where debris has remained on the job site overnight.

Full compensation for conforming to the provisions in this section shall be considered as included in the prices paid for the various contract items of work involved, and no additional

compensation will be allowed, therefore.

5-1.07 Staging Area

Attention is directed to Section 5-1.36E, "Use of Private property," of the Standard Specification and these Special Provisions. The street right-of-way shall be used only for activities that are necessary to perform the required work. The Contractor shall not occupy the right-of-way or allow others to occupy the right-of-way for material storage or other purposes that are not necessary to perform the required work.

5-1.08 Construction Staking

Section 5-1.26, "Construction Surveys", of the Standard Specifications is deleted, and replaced with the following:

1. The Contractor shall be responsible for all construction survey stakes necessary to construct the project in accordance with the lines, grades, sections, stage construction/traffic handling, and traffic signalization, pavement delineation plan described in the plans and specifications.

2. Contractor shall be responsible referencing all existing monumentation within the limits of the project prior to removal of any existing monuments. Monument referencing shall be reviewed and approved by the engineer prior to commencing of the work.

3. The Contractor shall employ a Land Surveyor registered in the State of California or an appropriately registered Civil Engineer to perform such survey work. All stakes and marks set by the Contractor's Land Surveyor or Civil Engineer shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged, they will be promptly replaced, at the direction of the Engineer at no additional cost to the City. Copies of all field notes and cut sheets shall be provided to the City at no additional cost to the City.

Full compensation for conforming to the provisions in this section shall be considered as included in prices paid for the various contract items of work involved, and no additional compensation will be allowed, therefore.

5-1.9 Increased or Decreased Quantities

The City reserves the right to make such alterations, deviations, additions to, or omissions from the plans and specifications, including the right to increase or decrease the quantity of any item or portion of the work or to omit any item or portion of the work, as may be deemed by the Engineer to be necessary or advisable and to require such extra work as may be determined by the Engineer to be required for the proper completion or construction of the whole work contemplated, without adjustment in the unit price as bid.

Attention is directed to Section 4-1.02, “Changes and Extra Work,” of these Special Provisions. Any such changes will be set forth in a contract change order, which will specify the work to be done in connection with the change made, adjustment of contract time, if any, and the basis of compensation for such work. A contract change order will not become effective until

approved by the City Manager and / or City Council.

5-1.10 Stop Notice Withholds

Section 9-1.16E(4) “Stop Notice Withholds” of the Caltrans Specifications is amended to read as follows:

> "The City of Stockton, by and through the Department of Public Works, may at its option and at any time retain out of any amounts due the Contractor, sums sufficient to cover claims, filed pursuant to Section 3179 et seq. of the Code of Civil Procedures."

5-1.11 Rights in Land

All work, equipment parking, or any other activity associated with the project shall be confined to the project limits within the street rights-of-way. The Contractor's use of any other property exclusively in connection with this project shall be by a written agreement between the property owner and the Contractor. A certified copy of any such agreement shall be furnished to the Engineer prior to the use of such property by the Contractor.

Full compensation for conforming to the provisions in this section shall be considered as included in prices paid for the various contract items of work involved, and no additional compensation will be allowed, therefore.

5-1.12 As-Built/Record Drawings

The Contractor shall maintain a complete set of drawings on-site for the purpose of keeping up to date all field modifications. This plan set shall be available for review by the project Inspector and the Engineer. These plans shall be provided to the Inspector after the completion of construction at the Post-Construction Meeting and prior to the final payment. All revisions, modifications, and/or changes shall be marked clearly. Notes and dimensions shall be in red and be clear and legible. These plans will be used by the Engineer to mark up the original plan sheets with the revisions made during construction.

A list shall be maintained of any trees removed during the course of construction by the Contractor or his Subcontractor, identifying the location, size, and species (common name). This list shall be submitted at the Post-Construction Meeting.

Full compensation for furnishing the As Built/Record Drawings shall be considered included in the prices paid for the various bid items of work, and no additional compensation will be considered therefore.

5-1.13 Notice of Potential Claim

The Contractor shall not be entitled to the payment of any additional compensation for any cause, or for the happening of any event, thing, or occurrence, including any act or failure to act, by the Engineer, unless he has given the Engineer due written notice of potential claim as hereinafter specified. However, compliance with this section shall not be a prerequisite for matters within the scope of the protest provisions under “Changes” or “Time of Completion” or within the notice provisions in “Liquidated Damages”. The written notice of potential claim shall set forth the items and reasons which the Contractor believes to be eligible for additional compensation, the description of work, the nature of the additional costs and the total amount

of the potential claim. If based on an act or failure to act by the Engineer, written notice for potential claim must be given to the Engineer prior to the Contractor commencing work. In all other cases, written notice for potential claims must be given to the Engineer within 15 days after the happening of the event, thing or occurrence giving rise to the potential claim.

It is the intention of this Section that potential differences between the parties of this Contract be brought to the attention of the Engineer at the earliest possible time so that appropriate action may be taken, and settlement may be reached. The Contractor hereby agrees that he shall have no right to additional compensation for any claim that may be based on any act or failure to act by the Engineer or any event, thing, or occurrence for which no written notice of potential claim was filed.

5-1.14 Records

The Contractor shall maintain cost accounting records for the contract pertaining to, and in such a manner as to provide a clear distinction between, the following 6 categories of costs of work during the life of the contract:

A. Direct costs of contract item work.
B. Direct costs of changes in character in conformance with Sections 4-1.05B and 9-1.15, "Work-Character Changes," of the Caltrans Specifications.
C. Direct costs of extra work in conformance with Section 4-1.02, "Changes and Extra Work," of these Special Provisions.
D. Direct costs of work not required by the contract and performed for others.
E. Direct costs of work performed under a notice of potential claim in conformance with the provisions in Section 5-1.43, "Potential Claims and Dispute Resolution," of the Caltrans Specifications.
F. Indirect costs of overhead.

Cost accounting records shall include the information specified for daily extra work reports in Section 5-1.27, "Records," of the Caltrans Specifications. The requirements for furnishing the Engineer completed daily extra work reports shall only apply to work paid for on a force account basis.

The cost accounting records for the contract shall be maintained separately from other contracts, during the life of the contract, and for a period of not less than 3 years after the date of acceptance of the contract. If the Contractor intends to file claims against the Department, the Contractor shall keep the cost accounting records specified above until complete resolution of all claims has been reached.

5-1.15 Noncompliant and Unauthorized Work

Attention is directed to Section 5-1.30, "Noncompliant and Unauthorized Work," of Caltrans Specifications.

5-1.16 Property and Facility Preservation

Attention is directed to Section 5-1.36, "Property and Facility Preservation," of Caltrans Specifications and these Special Provisions. Due care shall be exercised to avoid injury to existing highway improvements or facilities, utility facilities, adjacent property, and roadside

trees shrubs and other plants that are not to be removed. Roadside trees, shrubs and other plants that are not to be removed, and pole lines, fences, signs, markers and monuments, buildings and structures, conduits, pipelines under or above ground, sewer and water lines, all highway facilities and any other improvements or facilities within or adjacent to the highway shall be protected from injury or damage, and if ordered by the Engineer, the Contractor shall provide and install suitable safeguards, approved by the Engineer, to protect the objects from injury or damage. If the objects are injured or damaged by reason of the Contractor's operations, the objects shall be replaced or restored at the Contractor's expense.

The facilities shall be replaced or restored to a condition as good as when the Contractor entered upon the work, or as good as required by the specifications accompanying the contract, if any of the objects are a part of the work being performed under the contract. The Engineer may make or cause to be made those temporary repairs that are necessary to restore to service any damaged highway facility. The cost of the repairs shall be borne by the Contractor and may be deducted from any moneys due or to become due to the Contractor under the contract. The fact that any underground facility is not shown upon the plans shall not relieve the Contractor of the responsibility under this Section of these Special Provisions. It shall be the Contractor's responsibility, pursuant thereto, to ascertain the location of those underground improvements or facilities which may be subject to damage by reason of the Contractor's operations.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in protecting or repairing property as specified in this Section shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefor.

5-1.17 Pre-construction Survey

Attention is directed to Section 5-1.36D, “Survey Monuments” of the Caltrans Specifications and these Special Provisions. The Contractor shall perform a pre-construction survey of all existing structures, pavements, and other aboveground facilities within the project limits prior to beginning any work, noting their condition by means of photographs and video tapes supplemented by written documentation, where applicable.

Color photographs shall be taken with a digital camera at locations that are appropriate to show pre-existing conditions. Each photograph shall show the date and time the photograph was taken and clearly labeled showing the location, viewing direction, and any special features noted. Digital files of each photograph and a copy of videotapes shall be submitted to the Engineer.

Preserving and Perpetuating Survey Monuments

The contractor shall exercise due caution and shall carefully preserve bench marks, control points, reference points and all survey monuments, and shall bear all expenses for replacement and/or error caused by his/her unnecessary loss or disturbance. The contractor shall consult with a licensed land surveyor or civil engineer licensed to practice land surveying in California prior to beginning construction to ensure that any preconstruction corner records,

as required by the State of California Professional Land Surveyor' ACT have been filed with the County Surveyor, pursuant to Section 8771(a-f) of the California Business and Profession Code.

Action by:	Action:
Contractor's Land Surveyor	1. Identifies existing survey monuments. 2. Lists all existing survey monuments. 3. Ties out / performs construction staking of survey monuments. 4. Indicates survey monuments on construction plans.
	5. Files all pre-construction Corner Records or Records of Survey with San Joaquin County. The Corner Records or Record of Survey will show monuments within the area of construction reasonably subject to removal or disturbance not shown on a recent record document (recent record document is a filed survey map or corner record document completed with acceptable modern survey methods that includes survey ties from monuments within the construction area to monuments outside of the construction area). 6. Submits copies of pre-construction Corner Records or Records of Survey filed with San Joaquin County to City Engineer/Project Manager
Contractor	7. Preserves/perpetuates all survey monumentation during construction, including, but not limited to, those listed. 8. Restores survey monuments disturbed by construction.
Contractor's Land Surveyor,	9. Files all post-construction Corner Records and Records of Survey with San Joaquin County for all monuments disturbed during construction 10. Submits copies of Corner Records or Records of Survey filed with San Joaquin County to City Engineer/Project Manager.

Monuments set shall be sufficient in number and durability and efficiently placed so as not to be readily disturbed, to assure, together with monuments already existing, the perpetuation or facile reestablishment of any point or line of the survey.

When monuments exist that control the location of subdivisions, tracts, boundaries, roads, streets, or highways, or provide horizontal or vertical survey control, the monuments shall be located and referenced by or under the direction of a licensed land surveyor or registered civil engineer prior to the time when any streets, highways, other rights-of-way, or easements are improved, constructed, reconstructed, maintained, resurfaced, or relocated, and a corner record or record of survey of the references shall be filed with the county surveyor. They shall

be reset in the surface of the new construction, a suitable monument box placed thereon, or permanent witness monuments set to perpetuate their location if any monument could be destroyed, damaged, covered, or otherwise obliterated, and a corner record or record of survey filed with the county surveyor prior to the recording of a certificate of completion for the project. Sufficient controlling monuments shall be retained or replaced in their original positions to enable property, right-of-way and easement lines, property corners, and subdivision and tract boundaries to be reestablished without devious surveys necessarily originating on monuments differing from those that currently control the area. It shall be the responsibility of the governmental agency or others performing construction work to provide for the monumentation required by this section. It shall be the duty of every land surveyor or civil engineer to cooperate with the governmental agency in matters of maps, field notes, and other pertinent records. Monuments set to mark the limiting lines of highways, roads, streets or right-of-way or easement lines shall not be deemed adequate for this purpose unless specifically noted on the corner record or record of survey of the improvement works with direct ties in bearing or azimuth and distance between these and other monuments of record.

The decision to file either the required corner record or a record of survey pursuant to subdivision shall be at the election of the licensed land surveyor or registered civil engineer submitting the document.

Full compensation for pre-construction survey shall be included in the contract price for the various items of work involved, and no additional compensation will be allowed therefore.

5-1.18 Cooperation

Should construction be under way by other forces or by other contractors within or adjacent to the limits of the work specified or should work of any other nature be under way by other forces within or adjacent to those limits, the Contractor shall cooperate with all the other contractors or other forces to the end that any delay or hindrance to their work will be avoided. The right is reserved to perform other or additional work at or near the site (including material sources) at any time, by the use of other forces. When 2 or more contractors are employed on related or adjacent work, or obtain materials from the same material source, as provided in Section 6, "Control of Materials" of the Caltrans Specifications, each shall conduct their operations in such a manner as not to cause any unnecessary delay or hindrance to the other. Each contractor shall be responsible to the other for all damage to work, to persons or property caused to the other by their operations, and for loss caused the other due to unnecessary delays or failure to finish the work within the time specified for completion.

The Contractor shall protect from damage any utility facilities that are to remain in place, be installed, relocated, adjusted, or otherwise rearranged.

The Contractor should note that the following utility companies and other agencies maintain facilities within the project area and may have forces in the project area or adjacent thereto:

- PG&E
- AT&T and other phone companies
- City of Stockton Municipal Utilities Department
- Comcast Cable Company

- California Water Service Company

The Contractor shall verify the horizontal and vertical locations of all existing utilities prior to start of construction. The Contractor shall be responsible for the repair and replacement of these or any other facilities damaged during construction. A minimum of forty-eight (48) hours or two (2) working days prior to beginning construction, the Contractor shall notify Underground Services Alert (USA), telephone (800) 227-2600, to have existing facilities marked in the field.

Installation and/or relocation of the aforementioned utilities and other agencies' facilities will require coordination with the Contractor's operations. The Contractor shall make necessary arrangements with the utility company and other agencies through the Engineer, and shall submit a schedule of work, verified by a representative of the utility company or other agency, to the Engineer. The Contractor shall notify the Engineer in writing one (1) month and again one (1) week prior to preparing the site for the utility relocation work or work to be done by other agencies.

The Contractor shall take care to avoid working in any area of the project, which may conflict with the work underway by the utility companies. The Contractor's construction schedule shall be prepared to avoid utility work.

The Contractor shall cooperate completely with all utility companies having facilities within the project area.

Attention is directed to the possible existence of underground facilities not known to the City or in a location different from that which is shown on the plans or in these Special Provisions. The Contractor shall take steps to ascertain the exact location of all underground facilities prior to doing work that may damage such facilities or interfere with their service.

Payment for complying with this Special Provision shall be included in the various items of work, and no additional compensation will be allowed therefore.

SECTION 6 – CONTROL OF MATERIALS

Attention is directed to the provisions in Section 6, "Control of Materials," of the Standard Specifications, and these Special Provisions.

6-1-01 BLANK

6-1-02 Furnished Materials

There are no City Furnished Materials for this project.

6-1-03 BLANK

6-1.04 BLANK

6-1.05 Quality Assurance Program

Refer to Instruction to Bidders.

6-1.06 Testing

Testing of materials and work shall conform to the provisions in Section 6, "Control of Materials" of the Caltrans Specifications and these special provisions. Whenever the provisions of Section 6 of the Caltrans Standard Specifications refer to tests or testing, it shall mean tests to assure the quality and to determine the acceptability of the materials and work. Contractor's attention is directed to the City's Quality Assurance Program in Instructions to Bidder Package.

The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Department and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the engineer.

6-1.07 Pre-qualified and Tested Signing and Delineation Material

The California Department of Transportation maintains the list of Prequalified and Tested signing and delineation materials and products. Approval of pre-qualified and tested products and materials shall not preclude the Engineer from sampling and testing any of the signing and delineation materials or products at any time.

None of the listed signing and delineation materials and products shall be used in the work unless such material or product is listed on the California Department of Transportation's List of Approved Traffic Products. A Certificate of Compliance shall be furnished as specified in Section 6, "Control of Materials", of the Caltrans Specifications for signing and delineation materials and products. Said certificate shall also certify that the signing and delineation material or product conforms to the pre-qualified testing and approval of the California Department of Transportation, Division of Traffic Operations, and was manufactured in accordance with the approved quality control program.

For those categories of materials included on the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included on the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products will be considered for addition to said approved pre-qualified and tested list if the manufacturer of the material or product submits to the Division of Traffic Operations of the California Department of Transportation a sample of the material or product. The sample shall be sufficient to permit performance of all required tests. Approval of such materials or products will be dependent upon a determination as to compliance with the Specifications and any test the California Department of Transportation may elect to perform. The list of approved pre-qualified and tested signing and delineation materials and products can be found at the California Department of Transportation Web Site:

https://dot.ca.gov/-/media/dot-media/programs/engineering/documents/mets/signing-and-delineation-materials-a11y.pdf

SECTION 7 – LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

7-1.01 General

Attention is directed to Section 7 “Legal Relations and Responsibility to the Public” of the Caltrans Specifications, Standard Specifications, and these Special Provisions.

7-1.02 Maintaining Public Convenience and Safety

Attention is directed to Sections 7-1.03, "Public Convenience", 7-1.04, "Public Safety", and Section 12, "Temporary Traffic Control", of the Caltrans Specifications. Attention is also directed to Part 6 of the California MUTCD and Sections 7-1.03, "Public Convenience", 7-1.04, "Public Safety", of Standard Specifications, and Section 12-1.01, “Maintaining Traffic” of these Special Provisions. Nothing in these Special Provisions shall be construed as relieving the Contractor from his responsibility as provided in said sections and Part 6 of the California MUTCD.

7-1.03 Trench Safety

Attention is directed to Sections 7-1.02K(6)(b), "Excavation Safety” of the Standard Specifications and these Special Provisions.

If required, the Contractor shall furnish all labor, equipment, and materials required to design, construct, and remove all shoring, lagging, cribbing, piling, and/or other types of support for the wall of any open excavation required for the construction of this project.

In making excavations for the project, the Contractor shall be fully responsible for providing and installing adequate sheeting, shoring, and bracing, as may be necessary as a precaution against slides or cave-ins and to fully protect all existing improvements of any kind from damage.

The Contractor shall be solely responsible for any damages which may result from his failure to provide adequate shoring to support the excavations under any or all the conditions of loading which may exist, or which may arise during the construction project. Nothing herein shall be deemed to allow the use of shoring, sloping, or protective system less effective than that required by the Construction Safety Orders of the Division of Industrial Safety.

Full compensation for conforming to the provisions in this section shall be included in the prices paid for various bid items, and no additional compensation will be made, therefore.

7-1.04 Public Convenience

Contractor's attention is directed to the Section 12-1.01 “Maintaining Traffic” of these Special Provisions, Section 7-1.03 “Public Convenience” of the Standard Specifications, and these Special Provisions.

The Contractor shall notify San Joaquin Regional Transit District (SJRTD) a minimum of five (5) working days prior to beginning work. The Contractor shall coordinate with SJRTD if any bus stops and bus routes are affected.

The Contractor shall inform the City Fire Department, City Police Department, City Traffic Department, Municipal Utilities Department (MUD), and all affected utilities no later than three (3) working days before work is to begin.

The Contractor shall provide the City with the name and telephone number (business, home and mobile) of three (3) representatives available always during the duration of the contract. Said names and telephone numbers shall be provided to the City of Stockton Public Works, Fire, and Police Departments.

The Contractor shall circulate printed form letters, approved by the Engineer, explaining the project to be done and the length of time inconvenience will be caused by the project and deliver same to the residents and businesses to be affected at least three (3) working days before work is to commence on their street. In addition, the Contractor shall provide temporary "No Parking" signs posted three (3) working days in advance of the work. Such signs shall be placed no further than fifty (50) feet apart. The additional "No Parking" signs shall be removed upon completion of the work and the opening of the street to traffic. It shall be the Contractor's responsibility to remove any vehicles obstructing his operations.

Full compensation for conforming to the provisions in this section shall be included in the prices paid for various bid items, and no additional compensation will be made, therefore.

7-1.05 Public Safety

Contractor's attention is directed to the Section 12-1.01 “Maintaining Traffic” of these Special Provisions, Section 7-1.04 “Public Safety” of the Standard Specifications, and these Special Provisions. Nothing in the specifications voids the contractor’s public safety responsibilities.

All safety devices, their maintenance, and use shall conform to the latest requirements of OSHA and shall conform to the applicable provisions of the Part 6 "Temporary Traffic Control"**,** of the **California MUTCD**. It shall be the complete responsibility of the Contractor to protect persons from injury and to avoid property damage. Adequate barricades, construction signs, flashers, and other such safety devices, as required, shall be placed, and maintained during the progress of the construction work, until the project is completed. Whenever required, flaggers shall be provided to control traffic.

The Contractor shall provide for the proper routing of vehicles and pedestrian traffic in a manner that will hold congestion and delay of such traffic to practicable minimum by furnishing, installing, and maintaining all necessary temporary signs, barricades, and other devices and facilities, as approved by the City Traffic Engineer. As the work progresses, the Contractor shall relocate, subject to the City Traffic Engineer's approval, such devices, and facilities as necessary to maintain proper routing. The Contractor shall notify the City Traffic Engineer a minimum of three (3) working days prior to the relocation of any traffic control devices.

When work is not in progress on a trench or other excavation that requires closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Full compensation for furnishing, installing, moving, and removing of all necessary traffic control devices including, but not limited to, signing, striping, barricades, and flagging shall be included in the bid item for "Traffic Control System", as shown on the bid schedule, and no additional compensation will be allowed therefor.

7-1.06 Indemnification and Insurance

Attention is directed to Section 7-1.05 “Indemnification” and Section 7-1.06, “Insurance” of the Standard Specifications, and Instruction to Bidders for this project.

Indemnification and Insurance shall conform to an Exhibit, which is attached to this project bid package and incorporated by this reference.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved, and no additional compensation will be allowed, therefore.

7-1.07 BLANK

7-1.08 Lead Compliance Plan

Attention is directed to Section 7-1.02K(6)(j)(ii) “Lead Compliance Plan, of the Caltrans Specifications.

A lead compliance plan for worker health and safety must be prepared by a Certified Industrial Hygienist (CIH) and must be submitted and implemented prior to the start of construction activities. This plan is needed in order to comply with California Occupational Safety and Health Administration (Cal OSHA) regulations addressing aerially deposited lead for projects involving soil disturbance, and to minimize worker exposure to lead chromate or lead while handling paint and thermoplastic residue.

Allow 7 days for the Engineer’s review. Obtain authorization for the plan before starting any activity that presents the potential for lead exposure.

The plan shall include items listed in 8 CA of Regs § 1532.1(e)(2)(B). Obtain authorization for the plan before starting any activity that presents the potential for lead exposure. Contractor shall provide a safety training program to employees who have no prior training, including City employees. The safety training program shall comply with 8 CA Code of Regs § 1532.1 and the provided lead compliance plan. Contractor shall submit copies of air monitoring or job site inspection reports made by or under the direction of the CIH under 8 CA Code of Regs § 1532.1 within 10 days after the date of monitoring or inspection.

Supply personal protective equipment, training, and washing facilities required by your lead compliance plan for five City employees.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved, and no additional compensation will be allowed, therefore.

SECTION 8 – PROSECUTION AND PROGRESS

Attention is directed to the provisions in Section 8 of the Standard Specifications, and these Special Provisions.

8-1.01 Time of Completion

Attention is directed to the provisions in Sections 8-1.05A, "Time", and 8-1.07, “Delay” of the Standard Specifications, and these Special Provisions.

The contract for the performance of the work and the furnishing of materials shall be executed within ten (10) days after the approval thereof by the City Attorney. The City will issue the Notice to Proceed following execution of the contract.

Submittals shall be delivered to the Engineer within thirty (30) calendar days of execution of contract. Contract shall not start any work on the job site until the Engineer approves the submittals. Refer to section 5-1.05, “Submittals” of these Special Provisions. The Contractor shall only enter the jobsite prior to approval of the above submittals for purposes of measuring field dimensions and locating utilities.

The Contractor shall diligently prosecute the contract work to completion within <u>one hundred (100)</u> working days. The days to finish the punch list, provided by the City, are included in the Original Working Days.

Notice to Proceed will not be issued until all complete submittals have been reviewed at least once. Correction indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements. The Engineer’s review of Contractor Shop Drawing submittals shall not relieve the contractor of the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for any misfits due to error in Contractor submittals. The Contractor shall be responsible for the dimension and the design of adequate connections and details.

Prior to Notice to Proceed, the Contractor shall indicate in writing when all the traffic signal hardware and equipment, which makes the traffic signal and communication system operational, will be delivered to the project site. Based on the indicated delivery date, the date to commence the work will be issued by the City. If by any unforeseen action, the established delivery date cannot be made, the Contractor shall provide the City with a letter from the manufacturer indicating the reason why the delivery date cannot be met. The letter shall also indicate the revised delivery date. The City reserves the right to either accept the reason or to reject it. A letter from vendor is not acceptable.

Should the Contractor choose to work on a Saturday, Sunday, or on a holiday recognized by the labor unions, the Contractor shall reimburse the City of Stockton the actual cost of engineering, inspection, testing, superintendent, and/or other overhead expenses, which are directly chargeable to the contract. Should such work be undertaken at the request of the City, reimbursement will not be required.

8-1.02 Liquidated Damages

Attention is directed to the provisions in Section 8-1.10, "Liquidated Damages", of the Caltrans Specifications, Standard Specifications, and these Special Provisions.

The Contractor shall pay liquidated damages to the City of Stockton in the amount of $4,800 (forty-eight hundred dollars) per day for each and every calendar day that the work, with the exception of the maintenance period, remains incomplete after the expiration of the contract working days specified in these Special Provisions.

Full compensation for any costs required to comply with the provisions in this section shall be considered to be included in the prices paid for the various contract items of work, and no additional compensation will be allowed therefore.

8-1.03 Progress Schedule

GENERAL

Summary

Comply with Section 8-1.02, “Schedule," of the Caltrans Specifications, except you must:

1. Use computer software to prepare the schedule
2. Furnish compatible software for the Engineer's exclusive possession and use

The Contractor is responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

Definitions

contract completion date: The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer as specified in Section 8-1.05, "Time," of the Caltrans Specifications.

data date: The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."

float: The difference between the earliest and latest allowable start or finish times for an activity.

milestone: An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.

near critical path: A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.

time-scaled network diagram: A graphic depiction of a Critical Path Method (CPM) schedule comprised of activity bars with relationships for each activity represented by arrows. The tail of each arrow connects to the activity bar for the predecessor and points to the successor.

total float: The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.

Submittals

General Requirements

Submit to the Engineer baseline, monthly updated, and final updated schedules, each consistent in all respects with the time and order of work requirements of the contract. Perform work in the sequence indicated on the current accepted schedule.

Each schedule must show:

1. Calculations using critical path method to determine controlling activities.
2. Duration activities less than 20 working days.
3. Each required constraint. Constraints other than those required by the special provisions may be included only if authorized.

The Engineer's review and acceptance of schedules does not waive any contract requirements and does not relieve the Contractor of any obligation or responsibility for submitting complete and accurate information. Correct rejected schedules and resubmit them within 7 days of notification by the Engineer, at which time a new review period of 7 days will begin.

Errors or omissions on schedules do not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either you or the Engineer discovers that any aspect of the schedule has an error or omission, the Contractor must correct it on the next updated schedule.

Baseline Schedule

Submit to the Engineer a baseline schedule within 20 days of approval of the contract. Allow 20 days for the Engineer's review after the baseline schedule and all support data are submitted. Beginning the week the baseline schedule is first submitted, meet with the Engineer weekly to discuss and resolve schedule issues until the baseline schedule is accepted. The baseline schedule must include the entire scope of work and must show how the Contractor is plans to complete all work contemplated. Multiple critical paths and near-critical paths must be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities must be critical or near critical, unless otherwise authorized by the Engineer. The baseline schedule must not extend beyond the number of working days originally provided in these special provisions.

Updated Schedule

Submit an updated schedule and meet with the Engineer to review contract progress on or before the 1st day of each month, beginning one month after the baseline schedule is accepted. Allow 15 days for the Engineer's review after the updated schedule and all support data are submitted, except that the review period will not start until any previous month's required schedule is accepted. Updated schedules that are not accepted or rejected within the review period are considered accepted by the Engineer.
The updated schedule must show:

1. Data date of the 21st day of the month or other date established by the Engineer
2. Changes from approved revised schedules

Final Updated Schedule

Submit a final updated schedule with actual start and finish dates for the activities within 30 days after completion of contract work. Provide a written certificate with this submittal signed by the Contractor's project manager or an officer of the company stating, "To my knowledge and belief, the enclosed final updated schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

8-1.04 Federal Lobbying Restrictions

Refer to Instructions to Bidders.

8-1.05 Pre-Construction Meeting

The City of Stockton Public Works Department will schedule a pre-construction meeting with the Contractor following award of the contract and prior to commencing work (Contact 209-937-8411). The City will issue the Notice to Proceed following execution of the Contract. This meeting will be held in the City of Stockton, Public Works Department.

8-1.06 Post-Construction Meeting

The Contractor shall attend a post-construction meeting that will be arranged by the Public Works Department (Contact 209-937-8055) after completion of work and prior to acceptance and final payment. The project Design Engineer and the project Inspector will also attend this meeting. The purpose of the meeting will be to discuss the project and any related issues that can help improve future Public Works construction projects. This meeting will be held in the City of Stockton, Public Works Department.

SECTION 9 – PAYMENT

All measurements and payments for this work shall conform to all applicable provisions on Section 9, "Measurement and Payment" of the Standard Specifications, Instructions to Bidders, and these special provisions.

No partial payment will be made for any materials that are furnished on hand, but not yet installed or incorporated in the work. The work to be performed consists of furnishing all labor, materials, tools, transportation, supplies, equipment, appurtenances, fuel, and power, unless specifically excepted, necessary, or required to provide complete operating roadways, as

further delineated on the plans and described in these Special Provisions.

All other work as may be necessary as indicated on the plans, in the specifications, and as required by the Engineer.

Upon completion of all of the work included herein, including approved contract change orders as appropriate, the Contractor may request that the Engineer file a Notice of Completion for the purposes of relief of maintenance and release of retention.

All materials designated to be removed shall become the property of the Contractor, unless otherwise noted, and shall be disposed in accordance with local, State, and Federal laws and ordinances.

Full compensation for disposal of materials and performing the work in these Special Provisions shall be included in the prices paid for the various contract items of work, and no additional compensation will be allowed therefore.

9-1.01 Schedule of Values

Submit a schedule of values within 15 days after Contract approval. Value schedules for each lump sum bid item shall be prepared and submitted to the Engineer as set forth in Section 9-1, "Lump Sum Contracts", of the Standard Specifications and Section 9-1.16B, “Schedule of Values,” of the Caltrans Specifications. Unless otherwise approved by the Engineer, materials on hand, but not incorporated into the work, shall not be included for measurement or for purposes of payment.

9-1.02 Description of Work

The work to be performed consists of furnishing all labor, materials, tools, transportation, supplies, equipment, appurtenances, fuel, and power, unless specifically excepted, necessary, or required to install complete operating roadways, as further delineated on the plans and described in these Special Provisions.

The work shall include, but not be limited to, the following:

Base Bid

1. Mobilization
    a. By lump sum. All costs connected with mobilization of Contractor’s operations as described in Section 9 of the Caltrans Specifications will be paid for at the Contract price as described in Section 9 of the Caltrans Specifications.

2. Erosion Control
    a. By lump sum. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the plans, described in Section 13 and 21 of the Caltrans Standard Specifications and these Special Provisions. This includes but not limited to the development of the SWPPP.

3. Traffic Control System
    a. By lump sum. Includes designing, providing, erecting, and maintaining traffic control and signage as indicated on the plans, described in Section 12 of the Caltrans Standard Specifications, the California MUTCD, these Special Provisions and City of Sunnyvale TTC Guidelines. Also, includes performing all the work related to safe management of pedestrian, bicycle and vehicular traffic during construction of the project, including but not limited to preparing the Traffic Control Plans, and officers directing traffic for traffic control.

4. Sawcut
    a. By the linear foot. Includes providing all the labor, material, tools, equipment, and incidentals for sawcutting asphalt concrete and concrete as indicated on the Plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

5. Offsite Tree Removal
    a. By the unit. Includes providing all labor, materials, tools equipment, refuse disposal fees, and incidentals for doing all the work involved in tree removal, complete in place, including excavation, stump removal, disposal, and tree trimming, as indicated on the plans, described in Sections 14 and 17 of the Caltrans Standard Specifications and these Special Provisions.

6. Clearing, Grubbing & Gravel Removal
    a. By the square foot. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the plans, described in Sections 15&17 of the Caltrans Standard Specifications, and described in these Special Provisions. Also includes cutting, removing, and sealing roots encountered during this operation and modifications to existing irrigation.

7. Demolition: Concrete
    a. By the square foot. Includes excavating, removing, off-hauling, and disposing of existing concrete, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

8. Demolition: Concrete Tube
    a. By the unit. Includes excavating, removing, off-hauling, and disposing of existing concrete, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

9. Demolition: Asphalt
    a. By the square foot. Includes excavating, removing, off-hauling, and disposing of existing asphalt, stones, road base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

10. Demolition: 6” Curb & Gutter
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing concrete curb and gutter, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

11. Demolition: Striping by Grinding
    a. By the linear foot. Includes providing all the labor, material, tools, equipment, and incidentals for removing roadway striping as indicated on the Plans, described in the Caltrans Standard Specifications, and described in these Special Provisions.

12. Demolition: Bollard
    a. By the unit. Includes excavating, removing, off-hauling, and disposing of existing bollard, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

13. Demolition: Fence Chainlink
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing fence, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

14. Demolition: Sign
    a. By the unit. Includes providing all the labor, material, tools, equipment, and incidentals for removing and disposing existing signs as indicated on the Plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.
15. Relocate: Sign
    a. By the unit. Includes providing all the labor, material, tools, equipment, and incidentals for relocating existing signs as indicated on the Plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

16. Demolition: Trees
    a. By the unit. Includes providing all labor, materials, tools equipment, refuse disposal fees, and incidentals for doing all the work involved in tree removal, complete in place, including excavation, stump removal, disposal, and tree trimming, as indicated on the plans, described in Sections 14 and 17 of the Caltrans Standard Specifications and these Special Provisions.

17. Demolition: Storm Drain Catch Basin
    a. By the unit. Includes excavating, removing, off-hauling, and disposing of existing storm drain catch basin, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

18. Demolition: Storm Drain Pipe
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing storm drain pipe, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

19. Abandon: Storm Drain Pipe
    a. By the lump sum. Includes excavating, removing, off-hauling, and disposing of existing storm drain pipe as needed to accommodate proposed improvements, removing stones, base, subgrade soils, and debris, compacting and finishing subgrade, filling pipe to be abandoned with sand and capping ends, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

20. Demolition: Water Meter
    a. By the unit. Includes excavating, removing, off-hauling, and disposing of existing water meter, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

21. Cap End of Domestic Water
    a. By the lump sum. Includes providing all labor and materials to provide water cap at end of pipe and excavating, removing, off-hauling, and disposing of existing water service pipe, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

22. Earthwork (Export)
    a. By cubic yard. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions.

23. Staking
    a. By lump sum. The Contractor shall provide construction staking as needed to accurately construct the project improvements as described in Section 5 of the Caltrans Standard Specifications and these Special Provisions. Any additional staking needed for construction not included in this specification section shall be the responsibility of the Contractor and shall be included in the Bid Item List as a lump sum cost.

24. Storm Drain Overflow Inlet
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions.

25. Storm Drain Clean Out
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions.

26. Storm Drain Bubble Up
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions

27. Type 2 Storm Drain Catch Basin Inlet
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions

28. Storm Drain Connection
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions

29. 12” Storm Drain Line

a. By the linear foot. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions.

30. 6” Storm Drain Line (Perforated Pipe)
    a. By the linear foot. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans and described in these Special Provisions.

31. Adjust to Grade Storm Drain Manhole
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, and equipment to adjust the existing rim of the existing manhole, including, but not limited to, excavation, adjusting the vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

32. Adjust to Grade Sanitary Sewer Manhole
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, and equipment to adjust the existing rim of the existing manhole, including, but not limited to, excavation, adjusting the vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

33. Adjust to Grade Monitoring Well Frame
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, and equipment to adjust the existing frame of the existing monitoring well to grade, including, but not limited to, excavation, adjusting the well frame, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

34. Install Traffic Rated Monitoring Well Lid
    a. By the unit. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

35. Adjust to Grade Monitoring Well Utility Vault
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, and equipment to adjust the existing frame of the existing monitoring well to grade, including, but not limited to, excavation, adjusting the utility vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail,

as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

36. Install Traffic Rated Monitoring Well Vault Lid
    b. By the unit. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

37. Adjust to Grade PG&E Utility Vault
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, coordination with utility owner and equipment to relocate or adjust the existing vault of the existing utility, including, but not limited to, excavation, adjusting the vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

38. Adjust to Grade Utility Box
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, coordination with utility owner and equipment to relocate or adjust the existing box of the existing utility, including, but not limited to, excavation, adjusting the vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

39. Underground Cable Pedestal in Box at Grade
    a. By the unit. The contract unit price paid shall constitute the full compensation for furnishing all labor, materials, tools, coordination with utility owner and equipment to underground the existing cable pedestal in a new underground cable box at grade. This work shall in include, but is not limited to, excavation, adjusting the vault, backfilling, surface restoration, and all incidentals, complete in place, as shown on the plans and Standard Detail, as specified in these specifications, described in Section 15 of the Caltrans Standard Specifications, and as directed by the Engineer.

40. 6” Water Valve
    a. By the unit. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

41. Fire Hydrant
    a. By the unit. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

42. Fire Water Connection
    a. By unit. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

43. 6” Fire Water Line
    a. By the linear foot. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

44. 1.5” Irrigation Connection, Pipe, Meter, Backflow & Stub
    a. By lump sum. Includes full compensation for furnishing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions, these Technical Provisions and as directed by the Engineer.

Base Bid Site Paving

45. Paving: Vehicular Asphalt
    a. By the square foot. Includes placing hot mix asphalt (leveling) supplying and placing asphalt binder; supplying, preparing, placing, and compacting class II aggregate base; supplying, preparing, and placing Tensar Geogrid (or approved equal); scarifying and compacting subgrade; supplying, preparing, placing and compacting asphalt concrete; and constructing the asphalt concrete, aggregate base and subgrade to the elevations, thickness and locations as indicated on the Plans, described in Section 39 of the Caltrans Standard Specifications, and described in these Special Provisions.

46. Paving: Asphalt Deeplift
    a. By the square foot. Includes placing hot mix asphalt (leveling) supplying and placing asphalt binder, supplying, preparing, placing and compacting asphalt concrete and constructing to the elevations, thickness and locations as indicated on the Plans, described in Section 39 of the Caltrans Standard Specifications, and described in these Special Provisions.

47. Paving: Pedestrian Concrete
    a. By the square foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

48. Paving: Vehicular Concrete
    a. By the square foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

49. 3” Gravel
    a. By the square foot. Includes supplying gravel to the site, compacting subgrade, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, and described in these Special Provisions.

50. Finished Grading
    a. By the square foot. Includes grading the subgrade in preparation of the finished grade sections, as well as excavating, and removing waste materials from the site, as indicated on the Plans, described in Section15 of the Caltrans Standard Specifications, and described in these Special Provisions.

51. Truncated Domes
    a. By the square foot. Includes full compensation for furnishing all labor, tools, equipment and incidentals for furnishing the materials, complete in place, as indicated on the drawings, described in the 2019 CBC Chapter 11B-705.1 and these Special Provisions.

52. 6” Curb
    a. By the linear foot. Includes supplying concrete to the site, compacting subgrade and aggreg ate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

53. 6” Curb and Gutter
    a. By the linear foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on

the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

54. 7’ CMU Wall
    a. By the linear foot. Includes supplying concrete, concrete blocks, grout, rebar, and other materials necessary for construction of CMU wall to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

55. Valley Gutter
    a. By the linear foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

56. Curb Cut/Opening
    a. By the unit. Includes supplying concrete to the site, compacting subgrade and aggregate base, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

57. Accessible Ramp
    a. By the unit. Includes providing and placing and compacting aggregate base, supplying concrete to the site, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specifications, and described in these Special Provisions.

58. Bike Rack
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing a bike rack, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

59. Bioretention Area Section
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

60. Signs
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing a sign post as necessary, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

61. Pedestrian Barricade
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and doing all the work involved in furnishing and installing pedestrian barricade with signs, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

62. Security Fence
    a. By the linear foot. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and doing all the work involved in furnishing and installing security fence, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

63. Pedestrian Guardrail
    a. By the linear foot. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing pedestrian guardrail, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

64. Vehicle Gate with Knox Box
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing Vehicle Gate with Knox Box, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

65. Pedestrian Gate
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing pedestrian gate, complete in place, complying with the California Building Code, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

66. Cantilever Roll Gate System
    a. By the lump sum. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing cantilever roll gate system, complete in place, complying with the California Building Code, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

67. 4’ Wheel Stop
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing a 4’ Wheel Stop, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer.

68. Rectangular Rapid Flashing Beacon Assembly
    a. By the unit. Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and doing all the work involved in furnishing and installing a rectangular rapid flashing beacon assembly with signs on each side, complete in place, as shown on the plans, as specified in the Standard Specifications, these Technical Provisions and as directed by the Engineer

69. High Visibility Thermoplastic Crosswalk Striping
    a. By lump sum. Includes cleaning surface, providing and installing marker at the locations indicated on the Plans, described in Section 84 of the City Standard Specifications, and described in these Special Provisions.

70. Parking Lot Striping
    a. By lump sum. Includes cleaning surface, painting curbs, painting parking lot striping, and roadway arrows, legends and markings at the locations indicated on the Plans within the parking lot and as described in Section 84 of the Caltrans Standard Specifications and described in these Special Provisions.

71. Road Striping
    a. By lump sum. Includes cleaning surface, painting curbs, and providing roadway thermoplastic stripe, thermoplastic markings and installing markers at the locations indicated on the Plans, described in Section 84 of the Caltrans Standard Specifications, and described in these Special Provisions.

72. AC Dike
    a. By the linear foot. Includes placing hot mix asphalt (forming) supplying and placing asphalt binder, supplying, preparing, placing and compacting asphalt concrete and constructing to the elevations, thickness and locations as indicated on the Plans, described in Section 39 of the Caltrans Standard Specifications, and described in these Special Provisions.

73. Irrigation Controller Assembly
    a. By the unit. Includes providing all labor, materials, tools equipment,

excavation, and incidentals including but not limited to modular controller(s), backflow device(s), valves, and pipes, as indicated on the Plans, and described in these Special Provisions

74. Drip Irrigation
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals included but not limited to dripline, pipes, mesh tubes, drip system operation indicator(s), valve cap(s) and bubblers, as indicated on the Plans, and described in these Special Provisions

75. Spray Irrigation
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals including but not limited to shrub rotators, mesh tube, wide flow drip control kit(s), high flow control zone kit(s), valve cap(s), air relief valve(s), valve(s), as indicated on the Plans, and described in these Special Provisions

Base Bid Planting

76. Soil Amendments
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

77. Finish Grading
    a. By the square foot. Includes full compensation for providing all labor, materials, tools, equipment, and incidentals necessary for grading the subgrade in preparation of the finished grade sections, as well as excavating, removing, and disposing waste materials from the site, as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications and these Special Provisions.

78. Install Trees (15 Gal) w/Root Barrier
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

79. Install Shrubs (5 Gal)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

80. Install Shrubs (1 Gal)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions.

81. Install Shrub (Plug)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

82. SOD
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

83. Bark Mulch (3” Layer)
    a. By the cubic yard. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

84. Decomposed Granite Fines Mulch (4” Layer)
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

85. Landscape Maintenance (1 Year)
    a. By lump sum. Includes furnishing all labor, material, tools, equipment, excavation and services required to maintain the landscape in a healthy and attractive condition for a period of 1 year (365 days) as well as fertilization, watering, insect and disease control, weed control, weekly trash removal, mulching, re-staking trees, tightening of guys, resetting plants to proper grades or upright position, and restoration of watering basins, and other incidentals as indicated on the Plans, and described in these Special Provisions

86. Pedestal “HP” Installed
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the installation of the pedestal for the pad, grounding, conduit, and conductors, and described in these Special Provisions..

87. Vehicle Entry
    a. By the uniteach(4). Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the trenching, pullboxes, grounding, conduit, cabling, inductive loops and conductors, and described in these Special Provisions. As well as all access control hardware and programming for gate control.

88. Pedestrian Entry
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, for the trenching, pullboxes, grounding, conduit, cabling and conductors, and described in these Special Provisions. As well as all access control hardware and

programming for gate control.

89. Connection to City Hall
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the trenching, pullboxes, conduit, and fiber optic cable with related terminations, and described in these Special Provisions

90. PV Pathways
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the trenching, pullboxes, and conduit, and described in these Special Provisions

91. EV Pathways
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the installation of both electrical panels, breakers, support system, trenching, pullboxes, grounding, conduit, and conductors, and described in these Special Provisions

92. On-Site Lighting
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the luminaires, poles, foundation, trenching, pullboxes, grounding, conduit and conductors, and described in these Special Provisions

93. Off-Site Lighting
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the luminaires, poles, foundation, trenching, grounding, pullboxes, fusing, conduit and conductors, and described in these Special Provisions

94. Cameras & Infrastructure
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the trenching, conduit, cabling, electronics/camera, and programming, and described in these Special Provisions

Alt Bid

1. Mobilization
    a. By lump sum. All costs connected with mobilization of Contractor’s operations as described in Section 9 of the Caltrans Specifications will be paid for at the Contract price as described in Section 9 of the Caltrans Specifications.

2. Erosion Control
    a. By lump sum. Includes providing all labor, materials, tools equipment, and

incidentals as indicated on the plans, described in Section 13 and 21 of the Caltrans Standard Specifications and these Special Provisions. This includes but not limited to the development of the SWPPP.

3. Clearing, Grubbing & Gravel Removal
    a. By the square foot. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the plans, described in Sections 15&17 of the Caltrans Standard Specifications, and described in these Special Provisions. Also includes cutting, removing, and sealing roots encountered during this operation and modifications to existing irrigation.

4. Demolition: Concrete
    a. By the square foot. Includes saw-cutting, excavating, removing, off-hauling, and disposing of existing concrete, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

5. Demolition: 6” Curb
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing concrete curb and gutter, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

6. Demolition: Trench Drain
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing trench drain, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

7. Demolition: Fence
    a. By the linear foot. Includes excavating, removing, off-hauling, and disposing of existing fence, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

8. Demolition: Building
    a. By lump sum. Includes excavating, removing, off-hauling, and disposing of existing building, stones, base, subgrade soils, and debris, compacting and finishing subgrade, loading and removing waste materials from the site and performing the work as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

9. Earthwork (Export)
    a. By cubic yard. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions.

10. Staking
    a. By lump sum. The Contractor shall provide construction staking as needed to accurately construct the project improvements as described in Section 5 of the Caltrans Standard Specifications and these Special Provisions. Any additional staking needed for construction not included in this specification section shall be the responsibility of the Contractor and shall be included in the Bid Item List as a lump sum cost.

11. Storm Drain Clean Out
    a. By the unit. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

12. 6” Storm Drain Line (Perforated Pipe)
    a. By the linear foot. Includes providing all labor, materials, tools equipment, and incidentals as indicated on the Plans, described in Section 15 of the Caltrans Standard Specifications, and described in these Special Provisions.

13. Paving: Vehicular Asphalt
    a. By the square foot. Includes placing hot mix asphalt (leveling) supplying and placing asphalt binder; supplying, preparing, placing, and compacting class II aggregate base; supplying, preparing, and placing Tensar Geogrid (or approved equal); scarifying and compacting subgrade; supplying, preparing, placing and compacting asphalt concrete; and constructing the asphalt concrete, aggregate base and subgrade to the elevations, thickness and locations as indicated on the Plans, described in Section 39 of the Caltrans Standard Specifications, and described in these Special Provisions.

14. Finished Grading
    a. By the square foot. Includes grading the subgrade in preparation of the finished grade sections, as well as excavating, and removing waste materials from the site, as indicated on the Plans, described in Section15 of the Caltrans Standard Specifications, and described in these Special Provisions.

15. 6” Curb
    a. By the linear foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

16. 6” Curb and Gutter
    a. By the linear foot. Includes supplying concrete to the site, compacting subgrade and aggregate base, scarifying subgrade, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

17. Curb Cut/Opening
    a. By the unit. Includes supplying concrete to the site, compacting subgrade and aggregate base, forming, reinforcing, placing concrete, removing forms, curing, finishing, loading and removing waste materials from the site, and constructing the facilities as indicated on the Plans, described in Section 73 of the Caltrans Standard Specification, and described in these Special Provisions.

18. Bioretention Area Section
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

19. Striping
    a. By lump sum. Includes cleaning surface, painting curbs, painting parking lot striping, and providing roadway thermoplastic strip markings and installing marker at the locations indicated on the Plans, described in Section 84 of the Caltrans Standard Specifications, and described in these Special Provisions.

20. Drip Irrigation
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals included but not limited to dripline, pipes, mesh tubes, drip system operation indicator(s), valve cap(s) and bubblers, as indicated on the Plans, and described in these Special Provisions

21. Spray Irrigation
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals including but not limited to shrub rotators, mesh tube, wide flow drip control kit(s), high flow control zone kit(s), valve cap(s),

air relief valve(s), valve(s), as indicated on the Plans, and described in these Special Provisions

22. Soil Amendments
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

23. Finish Grading
    a. By the square foot. Includes full compensation for providing all labor, materials, tools, equipment, and incidentals necessary for grading the subgrade in preparation of the finished grade sections, as well as excavating, removing, and disposing waste materials from the site, as indicated on the plans, described in Section 15 of the Caltrans Standard Specifications and these Special Provisions.

24. Install Shrub (15 Gal)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

25. Install Shrub (5 Gal)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

26. Install Shrub (1 Gal)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

27. Install Shrub (Plug)
    a. By the unit. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

28. SOD
    a. By the square foot. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

29. Bark Mulch (3” Layer)
    a. By the cubic yard. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans, and described in these Special Provisions

30. Landscape Maintenance (1 Year)
    b. By lump sum. Includes furnishing all labor, material, tools, equipment, excavation and services required to maintain the landscape in a healthy and attractive condition for a period of 1 year (365 days) as well as fertilization, watering, insect and disease control, weed control, weekly trash removal, mulching, re-staking trees, tightening of guys, resetting plants to proper grades or upright position, and restoration of watering basins, and other incidentals as indicated on the Plans, and described in these Special Provisions

31. Lighting
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the Plans for the luminaires, poles, foundation, trenching, pullboxes, grounding, conduit and conductors within the alternative bid location, and described in these Special Provisions

32. CCTV
    a. By lump sum. Includes providing all labor, materials, tools equipment, excavation, and incidentals as indicated on the for the trenching, conduit, cabling, electronics/camera, and programming, and described in these Special Provisions

9-1.03 Quantities

The **following** estimate of the quantities of work to be done and materials to be furnished are **approximate only**, and are intended as a basis for the comparison of bids. The City does not expressly or by implications agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work without increase or decrease in the unit price bid or to omit portions of the work that may be deemed necessary or expedient by the Engineer.

ITEM NO.	BASE BID	UNITS	ESTIMATED QUANTITY
1	MOBILIZATION	LS	1
2	EROSION CONTROL	LS	1
3	TRAFFIC CONTROL SYSTEM	LS	1
4	SAWCUT	LF	635
5	OFFSITE TREE REMOVAL	EA	5
6	CLEARING, GRUBBING & GRAVEL REMOVAL	SF	161,876
7	DEMOLITION: CONCRETE	SF	2,789
8	DEMOLITOIN: CONCRETE TUBE	EA	1
9	DEMOLITION: ASPHALT	SF	725
10	DEMOLITION: 6" CURB & GUTTER	LF	287
11	DEMOLITION: STRIPING BY GRINDING	LF	1,607
12	DEMOLITION: BOLLARD	EA	25
13	DEMOLITION: FENCE CHAINLINK	LF	1,687
14	DEMOLITION: SIGN	EA	2
15	RELOCATE: SIGN	EA	1
16	DEMOLITION: TREES	EA	11
17	DEMOLITION: STORM DRAIN CATCH BASIN	EA	1
18	DEMOLITON: STORM DRAIN PIPE	LF	45
19	ABANDON: STORM DRAIN PIPE	LS	1
20	DEMOLITON: WATER METER	EA	1
21	CAP END OF DOMESTIC WATER	LS	1
22	EARTHWORK (EXPORT)	CY	4,718
23	STAKING	LS	1
24	STORM DRAIN OVERFLOW INLET	EA	4

ITEM NO.	BASE BID	UNITS	ESTIMATED QUANTITY
25	STORM DRAIN CLEAN OUT	EA	9
26	STORM DRAIN BUBBLE UP	EA	5
27	TYPE 2 STORM DRAIN CATCH BASIN INLET	EA	1
28	STORM DRAIN CONNECTION	EA	2
29	12" STORM DRAIN LINE	LF	436
30	6" STORM DRAIN LINE (PERFORATED PIPE)	LF	784
31	ADJUST TO GRADE STORM DRAIN MANHOLE	EA	1
32	ADJUST TO GRADE SANITARY SEWER MANHOLE	EA	2
33	ADJUST TO GRADE MONITORING WELL FRAME	EA	15
34	INSTALL TRAFFIC RATED MONITORING WELL LID	EA	12
35	ADJUST TO GRADE MONITORING WELL UTILITY VAULT	EA	4
36	INSTALL TRAFFIC RATED MONITORING WELL VAULT LID	EA	2
37	ADJUST TO GRADE PG&E UTILITY VAULT	EA	1
38	ADJUST TO GRADE UTILITY BOX	EA	1
39	UNDERGROUND CABLE PEDESTIL IN BOX AT GRADE	EA	1
40	6" WATER VALVE	EA	1
41	FIRE HYDRANT	EA	1
42	FIRE WATER CONNECTION	EA	1
43	6" FIRE WATER LINE	LF	12
44	1.5" IRRIGATION CONNECTION, PIPE, METER, BACKFLOW & STUB	LS	1
45	PAVING: VEHICULAR ASPHALT	SF	104973
46	PAVING: ASPHALT DEEPLIFT	SF	732
47	PAVING: PEDESTRIAN CONCRETE	SF	3305
48	PAVING: VEHICULAR CONCRETE	SF	4704

ITEM NO.	BASE BID	UNITS	ESTIMATED QUANTITY
49	3" GRAVEL	SF	20418
50	FINISHED GRADING	SF	142773
51	TRUNCATED DOMES	SF	252
52	6" CURB	LF	2918
53	6" CURB AND GUTTER	LF	1222
54	7' CMU WALL	LF	543
55	VALLEY GUTTER	LF	36
56	CURB CUT/OPENING	EA	25
57	ACCESSIBLE RAMP	EA	2
58	BIKE RACK	EA	17
59	BIORETENTION AREA SECTION	SF	8641
60	SIGNS	EA	32
61	PEDESTRAIN BARRICADE	EA	2
62	SECURITY FENCE	LF	830
63	PEDESTRAIN GUARDRAIL	LF	47
64	VEHICLE GATE WITH KNOX BOX	EA	2
65	PEDESTRIAN GATE	EA	4
66	CANTILEVER ROLL GATE SYSTEM	LS	1
67	4' WHEEL STOP	EA	52
68	RECTANGULAR RAPID FLASHING BEACON ASSEMBLY	EA	2
69	HIGH VISIBILITY THERMOPLASTIC CROSSWALK STRIPING	LS	1
70	PARKING LOT STRIPING	LS	1
71	ROAD STRIPING	LS	1
72	AC DIKE	LF	3

ITEM NO.	BASE BID	UNITS	ESTIMATED QUANTITY
73	IRRIGATION CONTROLLER ASSEMBLY	EA	1
74	DRIP IRRIGATION	SF	14,194
75	SPRAY IRRIGATION	SF	13,737
76	SOIL AMENDMENTS	SF	27,337
77	FINISH GRADING	SF	27,337
78	INSTALL TREES (15 GAL) W/ROOT BARRIER	EA	85
79	INSTALL SHRUB (5 GAL)	EA	322
80	INSTALL SHRUB (1 GAL)	EA	878
81	INSTALL SHRUB (PLUG)	EA	268
82	SOD	SF	6,194
83	BARK MULCH (3" LAYER)	CY	141
84	DECOMPOSED GRANITE FINES MULCH (4" LAYER)	SF	405
85	LANDSCAPE MAINTENANCE (1 YEAR)	LS	1
86	PEDESTAL "HP" INSTALLED	LS	1
87	VEHICLE ENTRY	LS	1
88	PEDESTRIAN ENTRY	LS	1
89	CONNECTION TO CITY HALL	LS	1
90	PV PATHWAYS	LS	1
91	EV PATHWAYS	LS	1
92	ON-SITE LIGHTING	LS	1
93	OFF-SITE LIGHTING	LS	1
94	CAMERAS & INFRASTRUCTURE	LS	1

ITEM NO.	ALT BID	UNITS	ESTIMATED QUANTITY
1	MOBILIZATION	LS	1
2	EROSION CONTROL	LS	1
3	CLEARING, GRUBBING & GRAVEL REMOVAL	SF	20733
4	DEMOLITION: CONCRETE	SF	1507
5	DEMOLITION: 6" CURB	LF	213
6	DEMOLITION: TRENCH DRAIN	LF	127
7	DEMOLITION: FENCE	LF	213
8	DEMOLITION: BUILDING	LS	1
9	EARTHWORK (EXPORT)	CY	668
10	STAKING	LS	1
11	STORM DRAIN CLEAN OUT	EA	3
12	6" STORM DRAIN LINE (PERFORATED PIPE)	LF	144
13	PAVING: VEHICULAR ASPHALT	SF	12,447
14	FINISHED GRADING	SF	14,600
15	6" CURB	LF	545
16	6" CURB & GUTTER	LF	162
17	CURB CUT/OPENING	EA	3
18	BIORETENTION AREA SECTION	SF	2,153
19	STRIPING	LS	1
20	DRIP IRRIGATION	SF	7,422
21	SPRAY IRRIGATION	SF	6,511
22	SOIL AMENDMENTS	SF	9,214
23	FINISH GRADING	SF	9,214
24	INSTALL SHRUB (15 GAL)	EA	26

ITEM NO.	ALT BID	UNITS	ESTIMATED QUANTITY
25	INSTALL SHRUB (5 GAL)	EA	78
26	INSTALL SHRUB (1 GAL)	EA	391
27	INSTALL SHRUB (PLUG)	EA	84
28	SOD	SF	1,225
29	BARK MULCH (3" LAYER)	CY	73
30	LANDSCAPE MAINTENANCE (1 YEAR)	LS	1
31	LIGHTING	LS	1
32	CCTV	LS	1

Each bidder shall bid each item on the Base Bid Schedule. Failure to bid an item shall be just cause for considering the bid as non-responsive. The City reserves the right to include or delete any Schedule or portion thereof, or to reject all bids.

Official bid documents, including plans and specifications are available online at http://www.stocktongov.com/services/business/bidflash/pw.html?dept=Public_Works**.** All bids submitted for this project, must conform to the requirements of the official bid documents, including plans and specifications.

9-1.04 Unsatisfactory Progress

If the number of working days charged to the contract exceeds 75 percent of the working days in the current time of completion and the percent working days elapsed exceeds the percent work completed by more than 15 percentage points, the City will withhold 10 percent of the amount due on the current monthly estimate.

The percent working days elapsed will be determined from the number of working days charged to the contract divided by the number of contract working days in the current time of completion, expressed as a percentage. The number of contract working days in the current time of completion shall consist of the original contract working days increased or decreased by time adjustments approved by the Engineer.

The percent work completed will be determined by the Engineer from the sum of payments made to date plus the amount due on the current monthly estimate, divided by the current total estimated value of the work, expressed as a percentage.

When the percent of working days elapsed minus the percent of work completed is less than or equal to 15 percentage points, the funds withheld shall be returned to the Contractor with the next monthly progress payment.

Funds kept or withheld from payment, due to the failure of the Contractor to comply with the provisions of the contract, will not be subject to the requirements of Public Contract Code 7107 or to the payment of interest pursuant to Public Contract Code Section 10261.5.

9-1.05 Mobilization

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site.

Full compensation for mobilization shall be considered as included in the lump sum price paid for Mobilization, and no additional compensation will be allowed therefore.

DIVISION II GENERAL CONSTRUCTION

SECTION 10 – GENERAL CONSTRUCTION

10-1.01 Order of Work

The order of work shall conform to the Contractor's approved project schedule described in Section 8-1.03, "Progress Schedule", of these Special Provisions.

Contractor's attention is directed to the Public Safety, Public Convenience, and Maintaining Traffic sections of these Special Provisions. Nothing in this section shall be construed as to relieve the Contractor of his/her responsibility to stage the work in a manner which complies with the requirements of these sections.

All permits and approvals as may be required for this project shall be secured or ordered immediately after award of the contract or their acquisition timing determined, such that the same is not a cause for delay. The cost of the permits shall be included in the total bid costs.

At those locations exposed to public traffic where guard railings or barriers are to be constructed, reconstructed, or removed and replaced, the Contractor shall schedule operations so that at the end of each working day there shall be no post holes open nor shall there be any railing or barrier posts installed without the blocks and rail elements assembled and mounted thereon.

Before obliterating any pavement delineation (traffic stripes, pavement markings, and pavement markers) that is to be replaced on the same alignment and location, as determined by the Engineer, the pavement delineation shall be referenced by the Contractor, with a sufficient number of control points to reestablish the alignment and location of the new pavement delineation. The references shall include the limits or changes in striping pattern, including one- and 2-way barrier lines, limit lines, crosswalks and other pavement markings.

The Contractor shall stage and sequence the work as follows:

1. The Resident Engineer shall coordinate with SJCOG on performing pre-construction bird survey 30 days prior to start of construction, if required.

2. The contractor orders all items required, after all submittals are approved by the Engineer, for this project which may have long lead times to assure that their acquisition is not the cause for any delays. These items may include, but are not limited to, traffic signal equipment, street lighting, and related appurtenances. The Contractor shall furnish the Engineer with statements from the vendors that the orders for said equipment has been received and accepted by said vendors. These statements shall be furnished within ten (10) working days of the Notice to Proceed date.

3. Obtain all necessary permits.

4. Prior to the start of construction, the Contractor shall submit to the Engineer for approval a detailed “Traffic Control Plan” which also addresses pedestrian detours. The Traffic Control Plan shall be prepared in accordance with the provisions in Section 12-1.01,” Maintaining Traffic” of these special provisions.

5. Traffic signal and lighting standards and other above ground electrical equipment shall not be installed until the Contractor has received delivery of all electrical materials.

6. Prior to the start of construction, the Contractor shall verify the location and depth of all existing utilities and underground facilities within the project limits. The Contractor shall notify the Engineer of any discrepancies between the conditions in the field and the plans.

7. Portions of existing concrete curbs, gutters and sidewalks that are removed shall be replaced within 10 working days after removal.

8. Street lighting, traffic signals, including fiber system shall be maintained at all times.

9. The Contractor shall develop and implement a Storm Water Pollution Prevention Plan (SWPPP), which specifies Best Management Practices (BMPs) that will prevent all construction pollutants from contacting storm water and with the intent of keeping all products of erosion from moving off site into receiving waters. The Contractor shall inspect and maintain all BMPs.

10. Upon award of the Construction Contract by Stockton’s City Council (Notice of Award) the Contractor shall prepare all project submittals for City review as set forth in Section 5-1.05, “Submittals” of these Special Provisions.

11. Refer to the plans for additional staging requirements

At the end of each working day if a difference in excess of 2 inches exists between the elevation of the existing pavement and the elevation of excavations within 4 feet of the traveled way, material shall be placed and compacted against the vertical cuts adjacent to the traveled way. During excavation operations, native material may be used for this purpose; however, once placing of the topsoil commences, topsoil material shall be used. The material shall be placed to the level of the elevation of the top of existing pavement and tapered at a slope of 1:4 (vertical:horizontal) or flatter to the bottom of the excavation.

Minor deviations from these requirements may be allowed by the Engineer, if in the opinion of the Engineer, the prosecution of the contract will be better served and the work expedited. Any Contractor request for such deviations shall not be adopted without the Engineer's prior written approval.

Full compensation for conforming to such requirements will be considered as included in the prices paid for the various contract items of work, and no additional compensation will be allowed therefore.

10-1.02 Alternative Equipment

The City reserves the right to order discontinuance of any equipment in use. This will be determined at the discretion of the Engineer on the basis that the use of said equipment would prohibit obtaining the best possible end result.

Additional installation equipment may be requested by the Engineer for the above reason. Failure to comply with the Engineer's request concerning equipment use or removal will be deemed sufficient cause for shutting down all work until the requirements are met. Days lost for this type of shutdown will be charged as working days.

10-1.03 Inspections

All work under this contract shall be under the control and inspection of the City Engineer or his appointed representative. The Contractor shall notify of the Public Works Department, at (209) 937-8381, three (3) working days in advance of any construction.

10-1.04 Obstructions

Attention is directed to Section 5-1.36,”Property and Facility Preservation” of Caltrans Specifications, Sections 7-1.05, "Indemnification” and Section 7-1.06, “ Insurance”, of the Standard Specifications and Section 15, "Existing Facilities", of the Caltrans Specifications and these Special Provisions.

The Contractor's attention is directed to the existence of certain underground facilities that may require special precautions be taken by the Contractor to protect the health, safety, and welfare of workers and of the public. Facilities requiring special precautions include, but are not limited to, conductors of petroleum products, oxygen, chlorine, and toxic or flammable gases, natural gas in pipelines six (6) inches or greater in diameter, or pipelines operating at pressures greater than 415 KPa (gage); underground electric supply system conductors or cables with potential to ground of more than 300 V, either directly buried or in duct or conduit, which do not have concentric grounded or other effectively grounded metal shields on sheaths.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least two (2) working days, but not more than fourteen (14) calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire, or other structure. Regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert – Northern California (USA)	(811) 227-2600 (800) 227-2600
South Shore Utility Coordinating Council (DICS)	(800)-541-3447

Relocations or repairs necessitated because of existing facilities, which are not shown on the plans or are shown at substantially different locations than existing, may be paid as extra work in accordance with Section 4-1.02, “Changes and Extra Work”, of the these Special Provisions, but only if the Engineer rules that the Contractor exercised due diligence in his operation. Due diligence may be determined by the Engineer by reviewing surface and subsurface conditions that were existing prior to exposing the facility and determining the absence of any signs sufficient to warn a diligent Contractor of the possible existence of a facility in the area.

Immediately upon encountering unknown existing facilities, the Contractor shall notify the Engineer in writing of the situation, request coverage of the work as extra work, and aid the Engineer in determining due diligence. Failure to do so may result in forfeiture of any rights to receive extra work compensation under Section 8-1.07, "Delay", of the Standard Specifications. Should the Contractor stop work, no compensation will be made for any "down time" prior to written notifications being received by the Engineer or his representative.

Delays due to encountering unexpected facilities shall be determined and compensated in accordance with the provisions of Section 8-1.07, "Delay", of the Standard Specifications, and as herein modified. Delays due to encountering unexpected facilities shall be compensated as additional contract working days to the contractor. Contractor shall submit a written request to the Engineer requesting time extension due to the delay. No other compensation is allowed.

Payment for complying with this Special Provision shall be included in the various items of work, and no additional compensation will be allowed therefore.

10-1.05 System Outage Request, City of Stockton Facilities

Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities may require the temporary outage or bypass of treatment processes, equipment, utilities, or other facilities. In addition to the Construction Schedule required under these Special Provisions, the Contractor shall submit a System Outage Request (SOR) and a detailed outage plan and time schedule for all construction activities, which will make it necessary to remove a tank, pipeline, channel, electrical circuit, control circuit, equipment, structure, road, or other facilities from service.

The SOR and outage plan shall be submitted to the Engineer and other affected utilities for review and acceptance a minimum of two (2) weeks in advance of the time that such outage

is needed. The outage plan shall be coordinated with the construction schedule specified in these Special Provisions and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the Contractor's method for preventing bypassing of other facilities; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation, or alarms required to maintain control, monitoring, and alarms for the affected facilities; and the labor, plant, and equipment which the Contractor shall provide in order to ensure proper operation.

In addition, the outage plan shall describe the Contractor's contingency plan that shall be initiated in the event that his temporary facilities fail, or it becomes apparent that the time constraints described in the approved outage plan cannot be met. The contingency plan shall conform to all specified outage requirements. All costs for preparing and implementing both the outage and contingency plans shall be borne by the Contractor with no additional compensation therefore.

The Contractor shall provide, Monday through Friday, at least three (3) working days prior to the actual shutdown, written confirmation of the shutdown date and time, or written notification that the schedule for performing the work has changed, or revisions to the outage plan are required.

Operations of the City's facilities and utilities are critical to the public health and safety of the citizens of Stockton. Sufficient facilities to serve the needs and demands of the City shall remain in service at all times. The City and/or affected utility owner shall be the sole judge of its needs and the facilities that must remain in service to provide adequate service.

The Contractor shall coordinate and cooperate with the City and utilities to establish the Contractor's schedule for work at the entire project facilities. The approved project schedule shall be subject to change, as it pertains to site work and shutdowns, when required by the City/utilities to accommodate unforeseen or emergency situations in the operation of the affected facilities.

Payment for complying with this Special Provision shall be included in the various other items of work, and no additional compensation will be allowed therefore.

10-1.06 Directional Boring

Contractor’s attention is directed to the provisions in Section 77-1.09, “Conduit” of these Special Provisions and Sections 86-1.02B, “Conduit and Accessories” and 87-1.03B, “Conduit Installation” of the Caltrans Specifications for the installation of signal and ITS conduits. Should the contractor desire to use other type(s) of conduit such as HDPE for the ITS conduits then the Contractor should submit the material specifications for the proposed conduit to the Engineer for his review and approval. Contractor’s attention is also directed to the provisions in Section 5-1.05 “Submittals” of these Special Provisions.

Directional Boring under railroad tracks shall be a minimum of 3'-6" below the railroad ties. No trenching will be allowed within the railroad right of way. The Contractor shall comply with all requirements set forth by the CPUC and other rail authority.

A. General

1. Quality Assurance
The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

2. Submittals

a. WORK PLAN: Prior to beginning work, the Contractor must submit to the Engineer a general work plan outlining the procedure and schedule to be used to execute the project. Plan should document the thoughtful planning required to successfully complete the project.

b. EQUIPMENT: The Contractor shall submit specifications on directional boring equipment to be used to ensure that the equipment will be adequate to complete the project. Spares inventory shall be included.

c. MATERIAL: Specifications on material to be used shall be submitted to the Engineer. Material shall include the conduit, fittings and any other item which is to be an installed component of the project. Contractor’s attention is directed to the provisions in Section 6-1.04, “Buy America requirements” of these Special Provisions for purchase of the signal and ITS conduits.

d. PERSONNEL: Documentation of training and relevant experience of personnel shall be submitted.

B. Equipment Requirements

1. General
The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bore and pullback the conduit, a boring fluid mixing and delivery system of sufficient capacity to successfully complete the boring, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2. Boring System

a. BORING RIG: The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill conduit into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the directional boring. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. The hydraulic system shall be free of leaks. The rig shall have a system to monitor and record

maximum pull-back pressure during pull-back operations. The rig shall be grounded during boring and pull-back operations. Sufficient spares shall be kept on hand for any break-downs which can be reasonably anticipated.

b. BORE HEAD: The bore head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and boring fluid jets.

3. Guidance System

The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

C. Operations

1. General

The Engineer must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Inspector is present at the job site and agrees that proper preparations for the operation have been made. The Inspector’s approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. The conduit shall be installed below the minimum depth of 24" unless directed otherwise by the Engineer.

2. Boring Procedure

a. SITE PREPARATION: Prior to any alterations to the work site, the Contractor shall photograph or video tape the entire work area, including entry and exit points. One copy of which shall be given to the Engineer and one copy shall remain with the Contractor for a period of one year following the completion of the project.

The work site, as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. The Contractor shall confine all activities to designated work areas.

b. BORE PATH SURVEY: The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on the drawings. If the Contractor is using a magnetic guidance system, the drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

c. ENVIRONMENTAL PROTECTION: The Contractor shall protect all boring operation areas and any drainage or other area designated for such protection by contract documents and/or state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place. The Contractor shall adhere to all applicable environmental regulations.

d. UTILITY LOCATES: the Contactor shall notify all companies with underground utilities in the work area via the state or local "one-call" to obtain utility locates. Once the utilities have been located the Contractor shall physically identify the exact location of the utilities by vacuum or hand excavation, when possible, in order to determine the

actual location and path of any underground utilities which might be within 4 feet of the bore path. The Contractor shall not commence boring operations until the location of all underground utilities within the work area have been verified.

e. SAFETY: The Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to the Engineer.

f. CONDUIT: Conduit shall be connected together in one length prior to pull-back operations, if space permits.
The Contractor's attention is called to the fact that extreme care will be required when placing the conduit so as to permit the installation of the conduit to the alignment and depth, as shown on the Plans and these Special Provisions. Variations from theoretical grade of the conduit at the time of completion of boring shall not exceed one percent of the distance from the bore pit point.

g. PILOT HOLE: Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'.

h. BORE PIT: Where ground conditions at the face of the bore pit are such that sloughing or caving of ground is likely to occur at the face of the excavation upon commencement thereof, the face of the pit shall be made stable so that an excessive void is not carried with the face of the excavation for the length of the casing or conduit. This may be accomplished by solid sheathing at the portal of the bore pit, or excavating and backfilling the face of the bore pit with cohesive material.

i. REAMING: Upon successful completion of pilot hole, the Contractor shall ream bore hole to a minimum of 25% greater than outside diameter of conduit using the appropriate tools. The Contractor shall not attempt to ream at one time more than the boring equipment are designed to safely handle.

j. PULL-BACK: After successfully reaming the bore hole to the required diameter, the Contractor shall pull the conduit through the bore hole. In front of the conduit shall be a swivel. Once pull-back operations have commenced, operations must continue without interruption until conduit is completely pulled into the bore hole. During pull-back operations the Contractor shall not apply more than the maximum safe conduit pull pressure at any time.

In the event that conduit becomes stuck, the Contractor shall cease pulling operations to allow any potential hydro-lock to subside and shall commence pulling operations. If conduit remains stuck, the Contractor shall notify the Engineer. The Engineer and the Contractor shall discuss options and then work shall proceed accordingly.

k. EXCAVATED MATERIAL: In general, excavated material shall be removed from the conduit as boring progresses and no accumulation of excavated material within the conduit will be permitted. Should appreciable loss of ground occur in installations where

the face of the excavation is accessible, the voids shall be backpacked promptly to the extent practicable with an approved soil cement.

3. Site Restoration
Following boring operations, the Contractor shall de-mobilize equipment and restore the work site to its original condition. All excavations shall be backfilled and compacted according to the City of Stockton requirements.

4. Record Keeping, As-Builts
The Contractor shall maintain a daily project log of boring operations and a guidance system log with a copy given to the Engineer at the completion of the project. As-built drawings shall be certified as to accuracy by the Contractor.

D. Payment

Full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved with installing conduits by directional boring methods, including, but not be limited to, excavating, backfilling and compacting the boring and receiving pits, boring and tunneling, removing and replacing concrete sidewalk, as shown on the Plans, as set forth in these Special Provisions, and as directed by the Engineer will be considered as included in the contract prices paid for various items of work requiring installation of conduit, and no additional compensation will be allowed therefore.

10-1.07 Sheeting and Shoring

Attention is directed to the Section 10-1.02E, “Excavation” of the Caltrans Specifications. Excavations shall be adequately shored and braced so that the earth will not slide, move, or settle, and so that all existing improvements of any kind will be fully protected from damage.

Attention is called to Article 6 of "Construction Safety Orders" of the California Division of Industrial Safety, which applies to all open excavations made in the earth's surface, including trenches.

Trenches over five (5) feet in depth requires a permit from California Division of Industrial Safety and shall be evaluated for stability prior to personnel entering the trench. Where trenches are deeper than five (5) feet, the Contractor shall comply with the California Occupational Safety and Health Administration (CAL OSHA) requirements pertaining to trench safety.

The Contractor shall furnish, install, and maintain such sheet piling, timbering, lagging, and bracing as indicated on the standard drawings or any additional precautions not specifically set forth as necessary to support the sides of the trench. The protection of adjacent structures from movement of the ground and the elimination of the element of danger to life, property, or to existing improvements is the intent of this requirement.

Additional supports requested by the Engineer shall in no way relieve the Contractor of his responsibility for the sufficiency of his precautions.

All such piling, timbering, lagging, and bracing shall, unless otherwise required by the Engineer, be removed during backfilling in such a manner as to prevent any movement of the ground or damage to the piping or other structures.

Full compensation for complying with these provisions shall be included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefore.

10-1.08 Surface Restoration

Surface restoration shall consist of restoring all areas within the limits of work to their original existing condition prior to construction or to the condition shown on the plans or specified in the Specifications.

The Contractor shall restore all paved areas, such as driveways, curb and gutter, sidewalk, roadway surfaces, ditches, etc., landscaped areas, and all other improvements disturbed or damaged by his operations.

Payment for the restoration of damaged areas, for which specific bid items are not provided, shall be included in the prices paid for various items of work and no additional compensation will be allowed therefore.

SECTION 11 – BLANK

SECTION 12 – TEMPORARY TRAFFIC CONTROL

Attention is directed to Part 6 of the California MUTCD, and Sections 12, "Temporary Traffic Control", of the Caltrans Specifications, Standard Specifications, and these Special Provisions.

12-1.01 Maintaining Traffic

Attention is directed to Part 6 of the California MUTCD, Sections 7-1.03, "Public Convenience", 7-1.04, "Public Safety", Section 12-4 “Maintaining Traffic”, of the Caltrans Specifications, and Section 10-1.01, "Order of Work", of these Special Provisions. Nothing in these Special Provisions shall be construed as relieving the Contractor from the responsibilities specified in these sections.

The Contractor shall furnish, and maintain in good working order, all barricades and flashers, and provide flaggers as necessary to protect pedestrians, bicyclists, and vehicular traffic. The Contractor shall furnish and maintain all barricades, flashers, and any detour signs twenty-four (24) hours a day, including covering or removing signs during non-construction hours.

The Contractor shall provide adequate and continuous ingress and egress for all adjacent properties; except for the limited period of time it is necessary to perform work at a specific property. The Contractor shall diligently prosecute all work directly impacting businesses to completion. The Contractor shall coordinate limited closures with tenants or owners, as required by these Special Provisions, and as directed by the Engineer. The Contractor shall cover signal heads with traffic jackets, signs and other traffic control devices that may conflict with any detours.

The Contractor shall submit to the City Engineer a detailed "Traffic Control Plan" for review

and approval. The "Traffic Control Plan" shall be submitted no later than ten (10) working days following the Notice to Proceed date and at least 3 working days prior to commencing any work which requires implementation of any component of the "Traffic Control Plan". The plan shall be approved by the Engineer prior to its implementation by the Contractor.

The "Traffic Control Plan" shall conform to the typical traffic control details included in the Caltrans Standard Plans, Part 6 of the California MUTCD, and the requirements of Section 12-1.02, "Traffic Control System for Lane Closure", of these Special Provisions. The Traffic Control Plan shall include, but not be limited to, detailed requirements for the following:

- Traffic control devices, including signs and markings.
- Construction routes, phasing and/or staging of both the roadway and sidewalk areas.
- Employee, Customer, and Business/Delivery access to adjacent property.
- Emergency vehicles access.
- Bus, refuse collection, and mail delivery access.
- Any parking zones to be removed on a temporary basis.
- Pedestrian and bicyclist access.

The Traffic Control Plan shall consider the impacts of changes in traffic volumes and capacities related to the construction activities, and their impact on vehicular and bicycle traffic and pedestrian operations, on roadway pavements, including provisions to restore construction-damaged pavements.

Traffic Lane and Sidewalk Closures
Lanes and sidewalks may be closed only as indicated in the Section 12, of these Special Provisions. Except for work required under Section 7-1.03 “Public Convenience” and Section 7-1.04, “Public Safety” of the Standard Specifications, work that interferes with public traffic shall be performed only as indicated. Traffic lane and sidewalk closures shall conform to the following requirements:

Work within the Lincoln Street and Weber Avenue requiring lane closure(s) shall be done on weekends (Friday 6:00 pm to Monday 6:00 am). Work warranting lane closure shall include, but is not limited to the following:

- **Installing new curb and gutter within the public right of way.**
- **Installation of underground wet utilities within the public right of way.**
- **Installing new driveways and accessible curb ramps within the public right of way.**
- **Installing public roadway signage within the public right of way.**
- **Installing electrical utilities within the public right of way.**

Lane closure, a maximum of one lane in each direction of travel, not less than twelve (12) feet wide, shall be permitted only between the hours of 9:00 a.m. and 3:30 p.m. Any lane closures other than specified shall be approved by the Engineer.

Standard working hours shall be 7:00 am to 5:00 pm for setup only. Standard working hours **outside of setup** shall be 9:00 a.m. to 5:00 p.m. Any extended working hours require

the approval of the Engineer.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders, including any section closed to public traffic.

Adequate ingress and egress shall be maintained throughout the project limits for fire, police, and other emergency vehicles. The Contractor shall provide adequate ingress and egress for residences, property owners, and abutting business owners to their respective properties except when performing work at their specific locations.

Also, the Contractor shall provide adequate signing, barricades and flashers or portable flashing beacons, flaggers, and other equipment and personnel necessary to adequately control and direct traffic in a safe manner. The Contractor shall maintain all barricades, flashers and detour signs twenty-four (24) hours a day, including covering signs during non-construction hours. The Contractor shall also provide the City with the names and telephone numbers of three (3) representatives available at all times.

Except as otherwise allowed by the Engineer, “long term” and temporary closures shall be removed and the full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress during the working period or successive working periods.

The contractor shall provide for pedestrian and wheelchair access to at least one (1) intersection corner within each block and the abutting sidewalk facilities along each block, at all times. Simultaneous closure of both intersection corners to pedestrian traffic within the same block is not allowed.

The contractor shall maintain at least one (1) north/south crosswalk and one (1) east/west crosswalk open to pedestrian and wheelchair access, where exists, at each intersection at all times.

Whenever Contractor's vehicles or equipment are parked within six (6) feet of a traffic lane, the area shall be closed with fluorescent traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment and along the edge of the traffic lane at twenty-five (25) foot intervals to a point not less than twenty-five (25) feet past the last vehicle or piece of equipment. A minimum of nine (9) cones or portable delineators shall be used for the taper. A W20-1 (Road Work Ahead) sign shall be mounted on a portable sign stand with flags. The sign shall be placed where directed by the Engineer.

Temporary Pedestrian Access Routes
Attention is directed to Section 12-4.04, “Temporary Pedestrian Access Routes” of the updated Caltrans Specification and these Special Provisions.

When a pedestrian circulation path is temporarily closed by construction, alterations, maintenance operations, or other conditions, contractor shall submit a work plan for a temporary pedestrian access route complying with Caltrans Specification Section 12-4.04A(3) and sections 6D.01, 6D.02, and 6G.05 of the MUTCD, and State Standard plans T30, T31, T32, T33, and T34 shall be provided. The work plan must Be sealed and signed by

an engineer who is registered as a civil engineer in the State

Whenever possible work should be done in a manner that does not create a need to detour pedestrians from existing pedestrian routes. Extra distance and additional pedestrian street crossings add complexity to a trip and increase exposure of risk to accidents. The alternate pedestrian routes shall be accessible and detectable, including warning pedestrians who are blind or have low vision about sidewalk closures. Proximity-actuated audible signs are a preferred means to warn pedestrians who are blind or have low vision about sidewalk closures.

The surface shall be skid-resistant and free of irregularities. Pedestrian walkways shall be maintained in good condition, and shall be suitable for wheelchair use. Walkways shall be kept clear of obstructions.

The Contractor shall cause the least possible disruption to the affected properties and restore suitable pedestrian access immediately following completion of the active work in progress.

At least one (1) continuous walkway along one (1) side of the street shall be available at all times. At locations where work is actively in progress, the pedestrian walkway within a single block may be temporarily closed at one (1) end of the block along one (1) side of the street. Pedestrians shall be rerouted to the walkway on the opposite side of the street.

Minor deviations from the requirements of this section, which do not significantly change the cost of the work, may be permitted upon the written request of the Contractor if, in the opinion of the Engineer, public traffic will be better served and the work expedited. These deviations shall not be adopted by the Contractor until the Engineer has approved them in writing. All other modifications will be made by contract change order.

12-1.02 Traffic Control System for Lane Closure

A traffic control system shall consist of closing traffic lanes in accordance with the details shown on the plans, the provisions of Section 12, "Temporary Traffic Control", of the Caltrans Specifications, and Standard Specifications, and these Special Provisions.
The provisions in this section will not relieve the Contractor from the responsibility to provide additional devices or take the measures that may be necessary to comply with the provisions in Section 7-1.04, "Public Safety", of the Standard Specifications and these Special Provisions.

During traffic striping operations and pavement marker placement operations using bituminous adhesive, traffic shall be controlled, at the option of the Contractor, with either stationary or moving type lane closures. During all other operations, traffic shall be controlled with stationary type lane closures. The Contractor's attention is directed to the provisions in Sections 84-2.03, "Construction", of the Caltrans Specifications.

If any component in the traffic control system is displaced, or ceases to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the component to its original condition or replace the component, and shall restore the component to its original location.

When lane closures are made for work periods only, at the end of each work period, all

components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations, approved by the Engineer, within the limits of the highway right-of-way.

Each vehicle used to place, maintain, and remove components of a traffic control system shall be equipped with a Type II flashing arrow sign, which shall be in operation when the vehicle is being used for placing, maintaining, or removing the components. Vehicles equipped with Type II flashing arrow signs not involved in placing, maintaining, or removing the components when operated within a stationary type lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on the vehicles which are doing the placing, maintaining, and removing of components of a traffic control system, and shall be in place before a lane closure requiring its use is completed.

The Contractor shall pay fully the cost of furnishing all flaggers, including transporting flaggers, to provide for passage of public traffic.

Attention is directed to Part 6 of the California MUTCD. Nothing in these Special Provisions shall be construed as relieving the Contractor from his responsibility as provided in Part 6 of California MUTCD.

Full compensation for furnishing all labor (including flagging costs), materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in lane closures, including placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system, as shown on the plans, as specified in the Caltrans Specifications and these Special Provisions, and as directed by the Engineer, shall be included in the lump sum price paid for “Traffic Control System”, and no additional work compensation will be allowed therefor.

Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary.

12-1.03 Type K Temporary Railing

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle, or storage area when the following conditions exist:

A. Excavations - the near edge of the excavation is twelve (12) feet or less from the edge of the lane, except:

    1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
    2. Excavations less than one (1) foot deep.
    3. Trenches less than one (1) foot wide for irrigation pipe or electrical conduit, or excavations less than one (1) foot in diameter.
    4. Excavations parallel to the lane for the purpose of pavement widening or

reconstruction.
5. Excavations in side slopes, where the slope is steeper than 1:4 (vertical:horizontal).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles - the work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.

C. Storage Areas - material or equipment is stored within twelve (12) feet of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these Special Provisions.

The approach end of temporary railing, installed in conformance with the provisions in this section, "Public Safety", and in Section 7-1.04, "Public Safety", of the Caltrans Specification, shall be offset a minimum of fifteen (15) feet from the edge of an open traffic lane. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than one (1) foot transversely to ten (10) feet longitudinally with respect to the edge of the traffic lane.

If the fifteen (15) feet minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Temporary Railing shall conform to the provisions in Section 12-3.20, "Type K Temporary Railing", of the Caltrans Specifications. Temporary Railing, conforming to the details shown on Caltrans Standard Plan T3A and T3B, may be used.

12-1.04 Temporary Pavement Delineation

Temporary pavement delineation shall be furnished, placed, maintained, and removed in conformance with the provisions in Section 12-6 “Temporary Pavement Delineation” of the Caltrans Specifications and these Special Provisions. Nothing in these Special Provisions shall be construed as reducing the minimum standards specified in the California MUTCD or as relieving the contractor from the responsibilities specified in Section 7-1.04, “Public Safety”, of the Caltrans Specifications, Standard Specifications, and these Special Provisions. Whenever the work causes obliteration of existing pavement delineation, temporary or permanent pavement delineation shall be in place prior to opening the traveled way to public traffic. Laneline or centerline pavement delineation shall be provided at all times for traveled ways open to public traffic.

The Contractor shall perform the work necessary to establish the alignment of temporary pavement delineation, including required lines or marks. Surfaces to receive temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation shall not be applied over existing pavement delineation or other temporary

pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation.

Temporary pavement markers, including underlying adhesive and removable traffic tapes which are applied to the final layer of surfacing or existing pavement to remain in place or which conflicts with a subsequent or new traffic pattern for the area, shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

12-1.05 BLANK

12-1.06 Maintaining Existing and Temporary Electrical Systems

Maintaining existing electrical systems and communication systems shall conform to the provisions of Section 87, “Electrical Systems," of the Caltrans Specifications and these Special Provisions. Existing traffic signal systems and communication systems shall be kept in effective operation for the benefit of the traveling public during the progress of the work, except when shut down is permitted. The traffic signal shutdowns shall be limited to the hours of 9:00 a.m. to 3:30 p.m., and shall be permitted only during the switch over from existing to new controller operation, unless prior approval is obtained from the Engineer. Contractor required to obtain authorization at least three (3) working days before interrupting communication between an existing system and the traffic management center (TMC).

Temporary standards with signal equipment may be required during the construction of the new installation. The Contractor shall provide temporary equipment if deemed necessary by the Contractor or Engineer. The cost of the temporary systems shall be included in the lump sum price paid for the various contract items of work involved and no additional compensation shall be allowed therefor.

12-1.07 Barricades and Channelizers

Barricades shall be furnished, placed and maintained at the locations shown on the approved Traffic Control Plan (TCP), specified in Part 6 of the California MUTCD, in the Standard Specifications or in these Special Provisions or where designated by the Engineer. Barricades shall conform to the provisions in Section 12, "Temporary Traffic Control," of the Standard Specifications and these Special Provisions.

Attention is directed to Section 6-1.07 "Pre-qualified and Tested Signing and Delineation Material" of these special provisions regarding retroreflective sheeting for barricades.

Channelizers shall conform to the provisions in Section 12, "Temporary Traffic Control," of the Caltrans Specifications, Standard Specifications, and these special provisions.

Channelizers shall conform to the provisions in Section 6-1.07 "Pre-qualified and Tested Signing and Delineation Material" of these Special Provisions.

At the time of completion of the project, certain channelizers shall be left in place as determined by the Engineer.

When no longer required for the work as determined by the Engineer, channelizers (except channelizers to be left in place) and underlying adhesive used to cement the channelizer bases to the pavement shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

12-1.08 Payment

Full compensation for all work under Section 12,"Temporary Traffic Control", shall be considered as included in the lump sum price paid for "Traffic Control System", and no additional work compensation will be allowed therefore.

SECTION 13 – WATER POLLUTION CONTROL

13-1.01 General

Attention is directed to Sections 13, "Water pollution Control", of the Caltrans Specifications, these Special Provisions, and as directed by the Engineer.

The Contractor shall develop and implement a Storm Water Pollution Prevention Plan (SWPPP), which specifies Best Management Practices (BMPs) that will prevent all construction pollutants from contacting storm water and with the intent of keeping all products of erosion from moving off site into receiving waters. The Contractor shall inspect and maintain all BMPs.

Full compensation for water pollution control shall be considered as included in the prices paid for various items of work, and no additional compensation will be allowed therefore.

SECTION 14 – ENVIRONMENTAL STEWARDSHIP

Attention is directed to Sections 14, "Environmental Stewardship", of the Caltrans Specifications, these Special Provisions, and as directed by the Engineer.

14-1.01 Construction Site Waste Materials Management

Removal of existing traffic stripes and marking shall be per Caltrans Specifications Section 84-9, "Existing Markings".

Where grinding or other methods approved by the Engineer are used to remove thermoplastic traffic stripes and pavement markings, the removed residue, including dust, shall be tested for lead and chromium content. If the thermoplastic grindings are found to be hazardous, the materials shall be disposed of at a Class 1 facility.

Residue from removing traffic stripes and pavement markings which contains lead from the paint or thermoplastic. The average lead concentrations are less than 1,000 mg/kg total lead and 5 mg/L soluble lead. This residue:

1. Is a nonhazardous waste
2. Does not contain heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs
3. Is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii) “Lead Compliance Plan”, of the Caltrans Specifications.

Earth Material Containing Lead
This section includes specifications for handling, removing, and disposing of earth material containing lead.

Submit a lead compliance plan.

If earth material is disposed of:

1. Disclose the lead concentration of the earth material to the receiving property owner when obtaining authorization for disposal on the property
2. Obtain the receiving property owner's acknowledgment of lead concentration disclosure in the written authorization for disposal
3. You are responsible for any additional sampling and analysis required by the receiving property owner

If you choose to dispose of earth material at a commercial landfill:

1. Transport it to a Class III or Class II landfill appropriately permitted to receive the material
2. You are responsible for identifying the appropriately permitted landfill to receive the earth material and for all associated trucking and disposal costs, including any additional sampling and analysis required by the receiving landfill

Soil Handling
Excess soils must be handled as potential hazardous waste, or the excess soils must be tested for concentrations of lead prior to disposal.

Contaminated Soil
Identify contaminated soil from spills or leaks by noticing discoloration, odors, or differences in soil properties. Soil with evidence of contamination must be sampled and tested by a laboratory certified by Environmental Laboratory Accreditation Program (ELAP).

If levels of contamination are found to be hazardous, handle and dispose of the soil as hazardous waste.

Prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:

1. Berms
2. Cofferdams
3. Grout curtains
4. Freeze walls
5. Concrete seal course

If water mixes with contaminated soil and becomes contaminated, sample and test the water using a laboratory certified by ELAP. If levels of contamination are found to be hazardous, handle and dispose of the water as hazardous waste.

Upon completion of underground facilities and backfilling of the trenches in each portion of the work, the sub-grade shall be prepared by compacting to a relative compaction of not less than ninety-five (95) percent for a minimum depth of zero point five (0.5) feet below the grading plane (sub-grade plane) for a total width of the area to be paved.

All portland cement concrete flatwork shall be saw-cut a minimum of 3-1/2 inches deep prior to removal. All monolithic portland cement concrete shall be saw-cut a minimum of 8 inches deep prior to removal.

Existing asphalt concrete sections to be removed shall be neatly saw cut two and one-half (2-1/2) inches deep and excavated to a depth of fifteen (15) inches. The vertical edges of the pavement shall be neatly trimmed. All debris shall be removed. The top six inches of the sub-grade shall be compacted to 90% of the maximum density at near optimum moisture content.

Payment
Full compensation for disposing, transporting, testing and preparation of lead compliance plan handling material contaminated, or potentially contaminated with aerially deposited lead, except as otherwise provided, shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

Payment for handling, removal, transporting, and disposal of pavement residue that is a nonhazardous waste is included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

14-1.02 Air Pollution Control

Attention is directed to Section 14-9.02 “Air Pollution Control” of the Caltrans Specifications.

Comply with air pollution control rules, regulations, ordinances, and statutes that apply to work performed under the contract, including air pollution control rules, regulations, ordinances, and statures provided in government code 11017 (Pub Cont Code 10231).

Do not burn material to be disposed of.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved, and no additional compensation will be allowed therefor.

14-1.03 Dust Control, Apply Water, Site Maintenance, and Cleanup

Dust control shall conform to any requirements set forth in the San Joaquin Valley Air Pollution Control District Construction Notification Form, the provisions in Section 14-9, “Air Quality” of the Caltrans Specifications, and these Special Provisions. Use of water except for recycled, reclaimed, or other non-potable water for the purpose of dust control or other construction uses

unless for health or safety purposes is prohibited. All dust control operations shall be performed by the Contractor at the time, location and in the amount ordered by the Engineer. The application of either water or dust palliative shall be under the control of the Engineer at all times." Watering shall conform to the provisions of Section 13 "Water Pollution Control" of the Caltrans Specifications and these Special Provisions. Attention is also directed to Section 18 “Dust Palliatives” of the Caltrans Specifications and these Special Provisions.

During construction, the Contractor shall remove all rubbish and debris as it is generated. Upon completion of the work, the Contractor shall remove all equipment, debris, and shall leave the site in a neat, clean condition all to the satisfaction of the Engineer. A permit shall be obtained from the Municipal Utilities Department, or California Water Service, as applicable, for construction water obtained from City hydrants. This permit shall be approved by the City of Stockton Fire Department.

The Contractor shall conduct and cause all working forces at the site to maintain the site in a neat, orderly manner throughout the construction operations. The work shall be conducted in a manner that will control the dust. When ordered to provide dust control, the Contractor shall use water to reduce the dusty conditions all to the satisfaction of the Engineer. During construction, the Contractor shall remove all rubbish and debris as it is generated. The Contractor shall pay to the City of Stockton the sum of Two Hundred Fifty Dollars **($250)** for every calendar day where debris has remained on the job site overnight. Upon completion of the work, the Contractor shall remove all equipment and debris, and shall leave the site in a neat, clean condition all to the satisfaction of the Engineer.

14-1.04 Sound Control Requirements

The Contractor's attention is directed to Section 14-8.02 “Noise Control” of the Caltrans Specifications and the project specific equipment noise control measures listed in Table 8.1 below. Nothing in the Caltrans Specifications or these Special Provisions voids the Contractor’s public safety responsibilities or relieves the Contractor from the responsibility to comply with other ordinances regulating noise level.

The Contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without the muffler.

To minimize the construction impacts to residents, the Contractor is encouraged to select the bore method (directional drilling) over conventional trenching to install new conduits.

The noise level requirement shall apply to the equipment on the job or related to the job, including, but not limited to, trucks, transit mixers, or transient equipment that may or may not be owned by the Contractor. All equipment shall have sound-control devices that are no less effective than those provided on the original equipment. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

Project Specific Equipment Noise Control

Table 8-1 summarizes noise levels produced by construction equipment that is commonly used on roadway construction projects. Construction equipment is expected to generate noise levels ranging from 70 to 90 dB at a distance of 50 feet, and noise produced by construction equipment would be reduced over distance at a rate of about 6 dB per doubling of distance. The noise levels generated by the boring machine would be lower than any equipment listed in the table.

Table 8-1. Construction Equipment Noise

Equipment	Maximum Noise Level (dBA at 50 feet)
Scrapers	89
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Concrete Pump	82

Source: Federal Transit Administration 1995.

Further, implementing the following measures would minimize the temporary noise impacts from construction:

All equipment shall have sound-control devices that are no less effective than those provided on the original equipment. No equipment shall have an unmuffled exhaust.

As directed by the Engineer, the contractor shall implement appropriate additional noise mitigation measures as warranted. These could include, but are not specifically limited to, changing the location of stationary construction equipment, turning off idling equipment, rescheduling construction activity, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources. Furthermore, construction activities shall be limited to the time period between 9:00 a.m. and 5:00 p.m.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for the various contract items of work involved, and no additional compensation will be allowed therefore.

14-1.05 Supplied Biologist will be done by others

General

This work includes providing a biologist to conduct one preconstruction survey of the study area and other activities to protect regulated species that may be harmed during construction activities. Attention is also directed to the provisions in Section 14-6.03D “Contractor-Supplied Biologist” of the Caltrans Special Provisions.

14-1.06 Cultural Resources

If cultural materials are discovered during construction, including human remains, do not

disturb the resources and immediately stop all work within a 60-foot radius of the discovery and within any nearby area suspected to overlie the discovery. Immediately notify all appropriate parties including the Caltrans District 10 Local Assistance archaeologist, the Local Assistance Engineer (DLAE), and the County Coroner if human remains are found. Do not move cultural materials or take them from the job site. Do not resume work within the discovery area until authorized. Additional protocols for human remains are given in the State Health and Safety Code Section §7050.5 and §5097.98.

Full compensation for doing all the work involved in trench excavation, water control and dewatering, bedding and backfilling, placement of temporary paving, and cultural resources shall be considered as included in the contract prices paid for the various items of work and no additional compensation will be made therefore.

SECTION 15 – EXISTING FACILITIES

15-1.01 Existing Facilities

Contractor attention is directed to requirements of Section 5-1.16, “Property and Facility Preservation” of these Special provisions, and 7-1.05, "Indemnification” and 7-1.06 “Insurance", of the Caltrans Specifications.

The work shall be performed in connection with various existing highway facilities (i.e., traffic signals and streetlights, storm drain pipe, catch basins, sidewalk drains, roadway pavement, roadside signs, utility boxes, trees, fences, etc.) shall conform to the provisions in Section 15, "Existing Facilities", of the Caltrans Specifications and these Special Provisions.

All traffic control signs shall be maintained. If relocation is necessary to facilitate the construction, the Contractor shall notify the Public Works Department, at (209) 937-8381, three (3) working days prior to said relocation, and request for approval as to where sign is to be temporarily relocated. Full compensation for performing such removal and reinstallation shall be considered as included in the various items of work and no additional compensation will be allowed therefore.

Fire hydrants, water valves, curb-stop boxes, and other utility facilities shall be unobstructed and accessible during the construction period.

Should the Contractor desire to have any alterations made in any utility or other improvement for Contractor's own convenience in order to facilitate Contractor's construction operations and for Contractor's sole benefit, Contractor shall make all necessary arrangements with the owners and bear all expense in connection therewith.

Removed highway facilities that are not to be salvaged shall become the property of the Contractor and shall be disposed of according to these special provisions, Section 15 “Existing Facilities” of Caltrans specifications, and as indicated on the plans.

Items of work under this section, "Existing Facilities", for which specific bid items are not provided, shall be considered as included in the prices paid for the various items of work of the bid schedule, and no additional compensation will be provided therefore.

Any contract adjustment that may be warranted due to differing site conditions will be made in accordance with the provisions of Section 4-1.02, "Changes and Extra Work", of these Special Provision.

Relocations or repairs necessitated because of existing facilities which are not shown on the plans, or are shown at substantially different locations than shown may be paid as extra work in accordance with Section 4-1.02, “Changes and Extra Work”, of these Special Provisions, but only if the Engineer rules that the Contractor exercised due diligence in his operation. Due diligence may be determined by the Engineer by reviewing surface and subsurface conditions that were existing prior to exposing the facility, and determining the absence of any signs sufficient to warn a diligent Contractor of the possible existence of a facility in the area.

Utility Facilities
Attention is directed to the possible existence of underground utilities not known to the City or in a location different from that which is shown on the plans or in these Special Provisions. The Contractor shall take steps to ascertain the exact location of such facilities prior to doing any work that may damage such facilities or interfere with their service.

Remove Existing Concrete
Existing concrete sidewalk, gutter, curb and gutter, driveways, wheelchair ramps, and other concrete surfacing, where shown on the plans to be removed, shall be removed and disposed of. Concrete removal includes removal of any steel embedded in the concrete. Sawcut concrete ramps, walks, curbs, and gutters to be removed at the nearest joint or scoreline, at the locations indicated on the plans, and as designated by the Engineer.

Remove Existing Pavement
Asphalt concrete pavement and aggregate base shall be removed by saw-cutting and excavation or cold planing to the lines, depths, and dimensions indicated on the plans and/or as directed by the Engineer.

Roadside Signs
Unless otherwise shown on the plans, the Contractor shall maintain existing roadside signs in place. The Contractor shall replace or repair all signs damaged by his operations and under this contract by using new material. Such material shall be a replacement of the original in regards to type of sign, posts, and construction. Relocation of the existing signs shall be done the same day the sign is removed from its original location.

At the Contractor's option, existing signs may be temporarily removed in order to facilitate the Contractor's construction of other improvements included under this contract. Any sign which is removed or damaged by the Contractor's shall be reinstalled at its original location using new unistrut posts in conformance with the Standard Specifications. Existing steel pipe sign posts shall be salvaged as directed by the Engineer. Each roadside sign shall be reinstalled on the same day that the sign is removed.

All new non-mast arm mounted signs shall have High Intensity Prismatic (HIP) reflective sheeting (reflectivity; ASTM type III) and covered with anti-graffiti film. The anti-graffiti film shall be transparent overlay for use on signs. The reflective sheeting and anti-

graffiti film shall be from same manufacturer and guaranteed for the same number years.

Full compensation for any temporary removal and reinstallation of roadside signs and removing existing concrete and pavement shall be considered included in the lump sum price paid for "Traffic Control System", and no additional compensation will be allowed therefor.

SECTION 16 – BLANK

SECTION 21 –RECTANGULAR RAPID FLASHING BEACON

21-1 GENERAL

This section includes specifications for constructing a solar-powered and/or AC-powered rectangular rapid flashing beacon system.

Each unit shall consist of a self-contained solar engine that houses the energy management system (EMS), on-board user interface, wireless communications. The batteries and solar panel shall be housed together in one compact enclosure. Each unit shall include bi-directional lightbars with optional side emitting pedestrian confirmation light(s). The system shall meet or exceed all provisions of the MUTCD, Including interim approval IA-21. The system shall include the roadside signage at the crosswalk as shown on the plans. Six (6)-wire audible ADA Accessible Pedestrian push buttons system (APS) with audible controller shall be included as part of the system at the locations shown on the plans to activate the flashing lightbars.

Submittals

The Contractor must submit, as one package, RRFB product data and manufacturer's

instructions including:

1) Pole and Foundation

2) Accessible Pedestrian Signal (APS)

3) Solar and Battery System

4) Solar Power Report

5) Light bars

6) Signages

7) Warranty Information

21-2 MATERIALS

Poles shall be 16' Type 1-B Standard complying with Caltrans Standard Plan ES-7B or City Standard Type 15 Street Light Pole. Pole type shall be installed in accordance with the plans.

Mechanical Specifications

The solar engine shall be constructed from aluminum. The Solar panel shall be integrated to the solar engine. All batteries and electronics shall be mounted in the solar engine, with no external control cabinet or battery cabinet required. A hinged lid shall provide access to the interior of the engine. The solar engine shall be vented to provide cooling of the battery and electronic system. The system shall have a wireless range of 1000 feet and battery design life of +5years. The solar engine shall be supplied with a fixed tilt angle of 60 degrees and shall be able to be oriented south with no additional mounting hardware. The lightbar housing shall be constructed from aluminum and shall have the approximate dimensions: 24” L x 1.5” D x 4.5” H (61.0 cm L x 3.8 cm D x 11.4 cm H).The lightbar shall be mounted to the pole using a separate bracket assembly to facilitate mounting two lightbars back-to-back (bi-directional) and to allow the lightbar to pivot. The lightbar shall be able to pivot by approximately 40 degrees in order to aim the lightbar independent of the wire hole location on the pole. The lightbar bracket shall be constructed from galvanized steel and shall have both banding and bolting mounting options and shall be able to be mounted to all specified pole types.

The lightbar assembly shall open for access to and wiring connections to the LED indicators. LED indicators shall be IP67 rated enclosures. Mounting 4” to 4.5” Diameter Round Post Mount. The solar engine and lightbar assemblies shall be furnished with mounting hardware for mounting to standard 4” to 4.5” Diameter Round Poles.

Configuration

The solar engine shall house an on-board user interface that provides on-site configuration adjustment, system status and fault notification, and system activation information.
The flash duration shall be adjustable in-the-field to one second increments.
The system shall provide configurable nighttime intensity settings and shall be able to enable and disable low ambient light dimming.
Flash duration and other in-the-field adjustable settings shall be automatically broadcast to all units in the system, except channel selection which shall be configured on each unit.

Solar / Battery System

The solar engine shall include one 30-watt minimum solar panel no larger than the footprint of the housing and shall have a hinged top to provide access to the on-board user interface and batteries. The solar engine shall house 36 Ahr battery system. Batteries shall be readily available from multiple suppliers and non-proprietary. Solar panel and battery system shall be 12 Volt DC.

Operational Specifications

The intensity of the yellow indications shall meet the minimum specifications of the Society of Automotive Engineers (SAE) standard J595 Class I intensity by 2.5 to 3x when used as recommended. The color of the yellow indications shall meet the specifications of SAE standard J578 (Color Specification).

The solar engine shall have the capability to activate other solar engines by wireless communications within 1000 feet. The solar engine shall have unique channels that can be configured on-site to avoid activation of nearby systems. The system shall be dimmable during low ambient light conditions using a light sensor.

Qualifications

The product shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements. The product shall be Buy American compliant. Manufacturer shall provide a minimum of **5-Year** Limited Warranty. Manufacturer must be ISO 9001 certified.

Rectangular Rapid Flasher (RRFB) Accessible Pedestrian Signal (APS)

APS shall be a 6-wire pushbutton type system and shall conform to the latest applicable provisions of the California MUTCD, and these Special Provisions. The APS shall be from the same manufacturer of RRFB and shall be furnish and installed as one package.

A. The housing for the unit shall be 9”x12” and made of 356 Aluminum heat-treated to meet Spec. T-6. It shall be of a telescoping, vandal-proof design. The color shall be **yellow**. Adaptors may be required to install pushbutton housing and the sign plate. The PPB shall be installed right side up.

B. Each APS shall connect to a control unit located inside its associated RRFB housing. The Push Button Stations (PBS) shall provide information and cues upon pedestrian actuation via an audible message saying, **“CROSS STREET WITH CAUTION, VEHICLES MAY NOT STOP,”** and cease operation at a predetermined time, after the pedestrian clears the crosswalk. The voice messaging shall be programmed in the APS button via manufacturer's suggested app. All sounds shall emanate from the back of the unit. The weather-proof speaker shall be protected by a vandal resistant screen. The speaker volume shall be adjusted to accommodate the lowest ambient background noise. A sunlight visible red LED latches “ON” to confirm the button has been pushed. PBS shall include frame, sign, ADA compliant push button and mounting hardware.

   By interfacing with the Control Unit that is installed in the unit control box, the PBS shall provide the following standard features.

   - Confirmation of button push via latching LED, and sound.
   - Shall have Bluetooth5 configuration interface.
   - Standard voice messaging in English.
   - Button with directional arrow.
   - Standard City of Stockton locating tone.
   - All sounds automatically adjust to ambient over 60dB range.
   - All sounds shall be synchronized/
   - Extended button push shall turn on and/or boost volumes.

C. The button shall be located within five (5) feet of the crosswalk line and mounted at a height of 42” above the finished grade.

D. The pedestrian instruction sign shall be R10-25 and installed with security screws. The security screws shall be stainless steel, button head socket cap screws #8 diameter, 3/8 inch in length and 32 threads per inch. The socket shall be 3/32 inch Allen. The sign shall be integral with each pedestrian pushbutton.

E. The duration of a predetermined period of operation of the RRFB following each actuation should be based on the MUTCD procedure for timing of pedestrian clearance times for pedestrian signals.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing APS shall be considered as included in the contract lump sum prices paid for RRFB system and no additional compensation will be allowed therefor.

SECTION 84 – MARKINGS

84-1.01 Traffic Stripes, Pavement Markings, and Pavement Markers

Traffic stripes, including crosswalks, shall be placed as shown on the plans, and must comply with the California MUTCD, as modified herein, and as directed by the Engineer. All pavement **traffic stripes**, crosswalks shall be installed with hot applied thermoplastic pavement material. The width and patterns of striping lines shall conform to the striping details shown in Figures 3A-101 (CA) through 3A-113 (CA) in the California MUTCD.

Pavement markings shall be placed as shown on the plans, and must comply with Caltrans Specifications, as modified herein, Caltrans Standard Plans A24A through A24E, and as directed by the Engineer. All pavement markings shall be installed with hot applied thermoplastic pavement.

The thermoplastic material shall be free of lead and chromium and conform to State Specification PTH-02ALKYD (for markings) and PTH-02SPRAY (for stripes). Thermoplastic material shall be applied to the pavement at a minimum thickness of 0.090 inches for new long lines (4 inches stripes and 8 inches stripes in width) and 0.100 inches for all legends and arrows. The crosswalk lines and limit lines shall be installed at a minimum thickness of 0.125 inches.

A double extruded thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 2 traffic stripes.

A double sprayable thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 1 traffic stripe.

If the contractor chooses to install stripes by using a cart (extruded) rather than a striping vehicle, all striping shall be applied to the pavement at a minimum thickness of 0.090 inches. Glass beads shall conform to State Specification in Sections 84-2.02D, 84-2.02E, and 84-2-03C(2)e. Thermoplastic pavement markings and stripes shall be free of runs, bubbles, craters, drag marks, stretch marks, and debris.

Use appropriate installation procedures according to manufacturer. If pavement markings are applied to existing surface over existing painted legends (arrows and crosswalks), existing pavement legends (arrows and sidewalks) shall be removed before thermoplastic material is applied. For either material, pavement shall be preheated to remove all residual moisture prior to installation.

At intersections where existing pavement is removed and replaced, Contractor shall install new crosswalk control points for the City to review and approve.

Configuration of traffic stripes, and crosswalks shall conform to the detail and methods as set forth in the latest issue of the California MUTCD, unless specifically modified on the plans.

Configuration of pavement markings shall conform to the detail and methods as set forth in the Caltrans Specifications, unless specifically modified on the plans.

All existing traffic stripes and pavement markings shall be removed where shown on the plans, where the existing striping conflicts with proposed striping, and as designated by the Engineer.

Existing pavement markers, including underlying adhesive, when no longer required for traffic lane delineation, as directed by the Engineer, shall be removed and disposed of.

Removal of traffic stripes and pavement markings, or the removal of objectionable material, shall be performed using methods approved in advance by the Engineer. All resulting residue and dust shall be removed immediately from the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation. **The removal of yellow paint and thermoplastic material shall include testing for lead prior to disposal of the material. Disposal of materials containing lead shall conform to state approved practices**. The removal of yellow paint and thermoplastic material shall also conform to the provisions in Section 14-1.01 “Construction Site Waste Materials Management” of these special provisions.

The Contractor shall place control points for the Engineer to review and approve. No additional "cat tracks" shall be placed until control points are approved by the Engineer. The Contractor shall obtain approval from the Engineer on all striping cat tracks prior to final application and striping and markers.

The Contractor shall place and remove any temporary striping required for routing traffic through the project area.

All thermoplastic shall be provided by the Contractor. Manufacturer and specifications shall be submitted for approval and shall conform to the specifications contained herein. All thermoplastic supplied shall conform to the local air pollution regulations. Traffic line markings shall be reflectorized conforming to the Caltrans Specifications, Section 84-2,”Traffic Stripes and Pavement Markings”.

Existing surface which is to receive the thermoplastic material shall be mechanically wire brushed to remove all dirt and contaminants. Thermoplastic material shall be applied only to

the dry pavement surfaces and only when the pavement surface temperature is above fifty (50**°F**) degrees Fahrenheit. Thermoplastic shall be applied only on a thoroughly dry surface and during periods of favorable weather.

The Contractor shall make all necessary conform striping as required. The completed stripes and markings shall be sharp and clear with clean, well-defined edges.

Any damage by the elements to the newly stripe or marking due to the failure of any Contractor to protect his work shall be repaired by him at no additional cost. Any over-spray or tracking of fresh thermoplastic material onto unpainted surfacing shall be removed by any methods to the satisfaction of the Engineer.

On one-way streets and median-divided streets, the side of the retroreflective raised pavement markers that is visible to traffic proceeding in the wrong direction shall be red (Type C). The other retroreflective side shall be white or yellow as per the detail. This section is applicable to Details 9, 10, 12, 13, 25, 25A, 26 and 27 in the California MUTCD.

Blue Raised Pavement Markers shall be installed after any surface treatment (overlay, micro-surfacing, chip-seal, cape-seal, etc.) solely for aiding in locating fire hydrants. Typical marker locations are shown on Figure 3B-102 (CA) of the California MUTCD.

(1) *Two-Way Streets*—Markers should be placed 6 inches from the edge of painted centerline on the side nearest the fire hydrant. If the street has no centerline, the marker should be placed 6 inches from the approximate center of the roadway on the side nearest the hydrant.

(2) *Streets with Left Turn Lane at Intersection*—Markers should be placed 6 inches from the edge of painted white channelizing line on the side nearest the hydrant.

(3) *Streets with Continuous Two-Way Turn Lane*—Markers should be placed 6 inches from the edge of the painted yellow barrier line on the side nearest the fire hydrant.

(4) *One-way streets and median-divided streets*—Markers should be placed 6 inches from the edge of lane line on the side nearest the fire hydrant (at least 12’ from curb or edge of traveled way).

The noise level created by the combined grinding activities must not exceed 86 dBA when measured at a distance of 50 feet at right angles to the direction of travel.

Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing traffic stripes, painted curbs, pavement markings, pavement markers and legends, including any necessary cat tracks, dribble lines, and layout work, placement, removal, and disposal of any and all conflicting striping and pavement markers, complete in place, as shown on the plans, as specified in the Caltrans Specifications and these Special Provisions, and as directed by the Engineer shall be considered as included in various prices paid and no additional compensation will be allowed therefor.

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

SUMMARY

A. SECTION INCLUDES:

1. Work required to demolish, modify, salvage, relocate, dispose, and convert existing structures, pavements, utilities, fencing, and miscellaneous items as required for the construction of the improvements as shown on the Drawings and as specified.

2. Protect all on-site personnel and the public at all areas of demolition.

3. Complete erosion and dust control measures as specified in Section 31 25 13.

4. Protect, support, and maintain adjoining structure, utilities, site work facilities, and miscellaneous items surrounding the demolition work from damage or harmful effects.

5. In accordance with all applicable state and local laws, properly dispose of all hazardous materials as required, obtain EPA generator number from the OWNER, and prepare safety plans.

6. Selective site demolition to provide all new underground utilities and utility connections, including all on-site and off-site paving & site improvement removal; all excavation and trenching; and all paving and site improvement restoration work. Utility paths are shown diagrammatically on Plans, and it is the Contractor's responsibility to determine the actual routes.

B. RELATED SECTIONS. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 01 10 00 – Summary.

2. Section 01 40 00 – Quality Requirements.

3. Section 01 50 00 – Temporary Facilities and Controls.

1.2 SELECTIVE SITE DEMOLITION WORK

A. Selective demolition work includes, but is not limited to:

1. General site work: Asphalt and concrete paving and slabs, fencing, storm drainage structures, sidewalks, curbs, gutters, concrete walls and slabs, signs, bollards, utilities, irrigation systems, and landscaping. Demolition of existing site work structures that conflict with the new Work shown on the Drawings.

2. Partial demolition of pavements to allow new work to connect, for conduit penetrations, or otherwise modify existing structures.

1.3 PROTECTION

A. Maintain free and safe passage for all on-site personnel at all times.

B. Prevent movement or settlement of structures or surrounding areas to demolition work. Provide bracing, shoring, and debris barriers as required and assume responsibility for the safety and support of affected structures.

C. Protect existing finishes, equipment, and adjacent work which remains from damage. Cut finish surfaces such as masonry, tile, plaster, wood, gypsum wallboard, concrete, or metals by methods which will terminate or join work in a straight line at an appropriate point of division.

D. Protect existing vegetation, landscaping, and irrigation systems to remain.

E. Cease operations and notify the ENGINEER immediately if the safety of any structure or utility appears to be endangered. Take additional precautions to properly support such structure(s) and do not resume demolition operations until safety is restored.

F. Utility locations shown on the Drawings are approximate and may vary from where they are shown. The CONTRACTOR shall contact Underground Service Alert (800-642-2444) and obtain field marking to determine the exact locations of utilities owned by agencies. Record, preserve and protect the field markings.

G. Blasting and the use of explosives shall not be permitted for any demolition work.

H. Promptly repair any damage caused to facilities or landscaping by demolition operations as directed by the ENGINEER and at no additional cost to the OWNER. The minimum quality of repair shall be equal to that which existed prior to the start of the CONTRACTOR’s work.

1.4 SCHEDULING

A. Schedule all demolition work to meet the requirements of Section 01 32 00 and minimize disruption to the work of OWNER staff and the public. Exercise due concern and procedures for maintaining plant operation and diligently direct all activities towards maintaining continuous operation of the existing plant and minimizing operation inconvenience.

1.5 CONDITION OF STRUCTURES

A. Conditions existing at the structures and areas to be demolished at the time of the bid period shall be maintained by the OWNER insofar as practical. Minor variations in small piping, electrical equipment, and miscellaneous materials shall be expected by the CONTRACTOR and this work shall be completed at no additional cost to the OWNER.

1.6 DISPOSAL OF MATERIAL REMOVED BY DEMOLITION WORK

A. All materials removed by demolition work shall become the property of the CONTRACTOR as soon as actual demolition is initiated. The CONTRACTOR shall remove demolition materials as soon as possible but in no case shall store materials removed by demolition on the project site longer than 5 working days. Demolition materials other than concrete and soil shall be properly contained in covered waste disposal bins. Concrete and soil shall be tightly stockpiled until removal.

1.7 SUBMITTALS

A. All submittals shall be in accordance with Section 01 33 00.

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under Division 26.

2. Division 26 when referenced refers to the following Sections:

a. Section 260500 Basic Electrical Materials and Methods

b. Section 260526 Grounding and Bonding for Electrical Systems

c. Section 260519 Conductors and Cables

d. Section 260533 Raceway and Boxes

B. Related work under this section

1. Labor and materials required to furnish and install the electrical systems in a complete and operational fashion.

2. Carpentry, masonry, steel and concrete materials and labor required for construction of proper stands, bases and supports for electrical materials and equipment.

3. Excavating, pumping and backfilling required for installation.

4. Repair of damage to the premises resulting from construction activities under this Section to City's satisfaction.

5. Removal of work debris from construction activities to City's satisfaction.

6. Testing and cleaning of equipment installed.

C. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall

govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations

   a. Title 8 –Industrial Relations; Section 1 –Department of Industrial Relations

      1) Chapter 3.2 -California Occupational Safety and Health Regulations (CAL/OSHA)

   b. Chapter 4 –Section of Industrial Safety

      1) Subchapter 4 -Construction Safety Orders (CSO)

   c. Subchapter 5 -Electrical Safety Orders (ESO)

   d. Title 24 –California Building Standards

      1) Part 1 -Building Standards Administrative Code

   e. Part 2 -California Building Code (CBC); International Building Code (IBC) with California amendments

   f. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

   g. Part 4 -California Mechanical Code (MEC); IAPMO Uniform Mechanical Code (UMC) with California amendments

   h. Part 5 -California Plumbing Code; IAPMO Uniform Plumbing Code (UPC) with California amendments

   i. Part 6 -California Energy Code

   j. Part 7 -California Elevator Safety Construction Code

   k. Part 9 -California Fire Code; International Fire Code (IFC) with California amendments

   l. Part 12 -California Reference Standards Code

2. CPUC –California Public Utilities Commission

    a. GO-95; Rules for Overhead Electric Line Construction

    b. GO-128; Rules for Construction of Underground Electric Supply and Communication Systems

3. IEEE –Institute of Electrical and Electronic Engineers

    a. C2; National Electrical Safety Code (NESC)

4. NECA –National Electrical Contractors Association

    a. 1; Standard Practices for Good Workmanship in Electrical Contracting

    b. 4090; Manual of Labor Units

5. All applicable local municipal codes and ordinances.

6. Applicable rules and regulations of local utility companies.

1.3 SUBMITTALS

A. Product Data

a. Refer to Division 1.

B. Closeout Submittal

1. Furnish three complete sets of maintenance and operating instructions bound in a binder and indexed to City. Start compiling data upon approval of materials and equipment. Final inspection will not be made until Engineer approves binders. Refer also to Division 1 for additional requirements.

2. Provide one of each tool required for proper equipment operation and maintenance provided under this Division. All tools shall be delivered to the City at project completion.

3. Provide two keys to City for each lock furnished under Division 26.

4. As-Built Drawings

    a. Refer to Division 1.

1.4 SUBSTITUTIONS

A. Refer to Division 1.

1.5 CHANGE ORDER PROPOSALS

A. Refer to Division 1.

1.6 QUALITY ASSURANCE

A. References to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to bid submittal. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work and materials shall be in full accordance with the latest rules and regulations of applicable state of local laws or regulations and standards of following:

1. National Fire Protection Association (NFPA)
2. California Electrical Code (CEC)
3. California Occupational Safety Health Act (Cal-OSHA)
4. California State Fire Marshall (CSFM)
5. California Code of Regulations (CCR)
6. Electrical Safety Orders, CAC Title 8 (ESO)
7. California Public Utilities Commissions, General Order 95 (GO-95)
8. Applicable rules and regulations of local utility companies.
9. NECA 1-2006, Standard Practices for Good Workmanship in Electrical Contracting

C. All electrical equipment and material furnished under Division 26 shall conform to all CEC requirements and bear the Underwriters' Laboratories (UL) label where applicable.

D. Nothing in the Construction Documents shall be construed to permit work not conforming to these Codes. Whenever the indicated material, workmanship, arrangement, or construction is of high quality or capacity than that required by the above rules and regulations, the Construction Documents shall take precedence. Should there be any direct conflict between the rules and regulations and Construction Documents, the rules shall govern.

E. All electrical equipment and material furnished under this Division shall conform to NEMA and ASTM standards, CEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

F. All electrical work shall conform to manufacturer's written instruction, and the NECA Standard Practices for Good Workmanship in Electrical Contracting and all published recommended practices at the time of project. The Contractor shall use the requirements within the Specifications whenever they exceed NECA guidelines.

G. Follow manufacturer's direction where these directions cover points not included with the Construction Documents.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, shipping, handling, and unloading

1. Damage to the equipment delivered to the site or in transit to the job shall be the responsibility of the Electrical Contractor.

2. Equipment and material delivery of shall be scheduled as required for timely, expeditious progress of work.

B. Storage and protection of job equipment is the responsibility of the Contractor.

1.8 PROJECT CONDITIONS

A. Discrepancies

1. In the event of discrepancies with the Contract Documents, Engineer shall be notified with sufficient time as stated within Division 1 to allow the issuing of an addendum prior to the bid opening.

2. If time does not permit notification of clarification of discrepancies prior to the bid opening, the following shall apply:

a. The drawings govern in matters of quantity and specifications govern in matters of quality.

b. In the event of conflict within the drawings and specifications involving quantities or quality, the greater quantity or higher quality shall apply. Such discrepancies shall be noted and clarified within the contractor's bid. No additional allowances will be made because of errors, ambiguities or omissions which reasonably should have been discovered during the bid preparation.

B. Verify all power and communication utilities' requirements prior to commencement of any utility work. Make proper adjustments to the construction to satisfy the serving utility.

C. Information shown relative to services is based upon available records and data but shall be regarded as approximate only. Make minor deviations found necessary to conform to actual locations and conditions without extra cost. Verify locations and elevations of utilities prior to commencement of excavation for new underground installation.

D. Exercise extreme care in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations. Contact all utility companies to obtain exact locations prior to commencement of construction.

E. The electrical plans indicate the general layout and arrangement; the field conditions shall determine exact locations. Field verifies all conditions and modify as required to satisfy design intent. Maintain all required working clearances.

F. Fees, permits and utility services

1. Obtain and pay for all permits and service charges required for the installation of this work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Arrange for all utility connections and pay charges incurred including excess service charges if any.

2. Extra charges imposed by the electrical and communication utility companies shall be included in the bid, if available. Unless otherwise stated, these charges will be assumed to include in the bid.

G. Provide and maintain temporary construction power. The General Contractor will pay for electric energy charges. Should the Electrical Contractor be the prime contractor, the Electrical Contractor shall pay for energy charges unless negotiated with City.

1.9 SEQUENCING

A. Coordinate work within phasing plans as provided by the City.

1.10 WARRANTY

A. Refer to Division 1.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Materials mentioned herein or on Drawings require that the items be provided and of quality noted or an approved equal. All materials shall be new, full weight, standard in all respects and in first-class condition. Insofar as possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.

B. Trade names or catalog numbers stated herein indicts grade or quality of material desired. Materials, where applicable, shall UL have labeled and in accordance with NEMA standards.

C. Dimensions, sizes, and capacities shown are a minimum. Do not make changes without written permission of Engineer

2.2 CONCRETE

A. All concrete work shall comply with all applicable requirements of CalTrans Standard Specifications, which is 3,000 psi at 28 days.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Construction Documents and Site; be familiar with types of construction where electrical installation is involved. Note carefully other sections of Specifications with their individual cross- references, standard details, etc.

B. Any electrical work or materials shown either in Construction Documents, but not mentioned herein, or vice versa, shall be executed the same as if mentioned herein, in a workmanlike manner in accordance with all published NECA Standards of Installation.

C. Coordinate work with other crafts to avoid conflicts and check all outlet locations with drawings and specifications. Make minor adjustments without additional cost to City.

D. Engineer will make clarifications and rulings concerning any obvious discrepancies or omissions in work prior and after bidding. Perform all work involved in correcting obvious errors or omissions after award of contract as directed by Engineer at Contractor's expense.

E. Examine site dimensions and locations against Drawings and become informed of all conditions under which work is to be done before submitting proposals. No allowance will be made for extra expense due to error.

F. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial) but shall be followed as closely as possible. Construction Documents are for assistance and guidance, and exact locations, distance, levels, etc., will be governed by construction; accept same with this understanding.

G. Horsepower of motors or wattage of equipment indicated in Construction Documents is estimated horsepower or wattage requirement of equipment furnished under other sections of Specifications. Size all feeders (conduit and wiring), motor starters, overload protection and circuit breakers to suit horsepower of motors or wattage of equipment furnished under various sections of specifications. However, in no case shall feeders and branch circuits (conduit and wiring) and circuit breakers be of smaller capacities or sizes than those indicated on Drawings or specified, unless approved in writing by Engineer.

3.2 PREPARATION

A. Seal all exterior wall penetrations in an approved watertight manner and to the satisfaction of Engineer and City.

B. Channels, joiners, hangers, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of 120 hours when subjected to a standard salt spray cabinet test, or shall be hot dipped galvanized

3.3 INSTALLATION

A. Equipment identification

1. Properly identify panelboards, remote control switches, push buttons, terminal boxes, etc. with a descriptive nameplate. Make nameplate with 3/32” laminated plastic with black background and white letters. Machine engraved letters 1/8” high for equipment in device box(es) and 1/4” high for panelboards, terminal cabinets, or larger items. Punched strip type nameplates and cardholders in any form are not acceptable. Fasten nameplates with oval head machine screws, tapped into front cover/panel.

B. Working spaces

1. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders and CEC 110.26. In general, provide 78” of headroom and 30” wide minimum clear workspace in front of panelboards and controls. In addition to the above, provide the

following minimum working clearances:

a. 0V – 150V (line-to-ground) provide 36” minimum clear distance.

b. 151V – 600V (line-to-ground) provide 42” minimum clear distance.

C. Equipment supports

1. Anchor all electrical equipment to structure. Support systems shall be adequate to withstand seismic forces per CBC.

D. Excavating and backfilling

1. Excavate and backfill as required for installation of Work. Restore all surfaces, roadways, walks, curbs, walls existing underground installations, etc., cut by installations to original condition in an acceptable manner. Maintain all warning signs, barricades, flares and lanterns as required by ESO and local ordinances.

2. Dig trenches straight and true to line and grade, with bottom clear of any rock points. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of pipe crown shall per Drawings.

E. Forming, cutting, and patching

1. In new construction, General Contractor shall provide any special forming, recesses, chased, etc., and provide wood blocking, backing and grounds as necessary for the proper installation of electrical work. Be responsible for notifying General Contractor that such provision is necessary; layout work and check to see that it suits his requirements.

a. Provide metal backing plates, anchor plates and such that are required for anchorage of electrical work under Division 26; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

2. Be responsible for proper placement of pipe sleeves, hangers, inserts and supports for this Work.

F. Concrete work

1. Provide concrete work related solely to electrical work. Concrete work, including forming and reinforcing steel installed for all electrical work.

3.4 REPAIR/RESTORATION

A. Cutting, patching, and repairing of existing construction to permit installation of work under Division 26 is the responsibility of Contractor. Repair or replace all damage to existing work in kind to City's satisfaction.

B. Obtain Engineer's approval prior to performing any cutting or patching of concrete, masonry, wood, or steel structure within building.

3.5 FIELD QUALITY CONTROL

A. Inspection of work

1. Working parts shall be readily accessible for inspection, repair, and renewal. The right is reserved to make reasonable changes in equipment location shown on Drawings prior to rough in without additional costs to the City.

2. During construction all work will be subject to observation by the Engineer and his representatives. Assist in ascertaining any information that maybe required.

3. Do not allow or cause any work installed hereunder to be covered up or enclosed before it has been inspected and approved. Should any work be enclosed or covered prior to approval, uncover work, and after it has been inspected and approved, restore work of all others to the condition in which it was found at the time of cutting, all without additional costs to City.

B. Furnish all testing equipment as maybe required.

C. Test all wiring and connections for continuity and grounds; where such tests indicate faulty insulation or other defects, locate, repair and re-test.

D. Check rotation of all motors and correct if necessary.

3.6 CLEANING

A. Repair or replace all broken, damaged or otherwise defective parts without additional cost to City and leave entire work in a condition satisfactory to Engineer. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work; leave systems and equipment in satisfactory operating condition.

B. Clean out and remove from the site all surplus materials and debris resulting from this work; this includes surplus excavated materials.

3.7 DEMONSTRATION

A. At project completion, Contractor shall allot a period of not less than 8 hours for instruction of operating and maintenance personnel in the use of all systems installed under this Division.

This time is in addition to any instruction time stated in the Specifications of other sections for other equipment (i.e., fire alarm, security, intercom, etc.). All personnel shall be instructed at one time, the Contractor shall make all necessary arrangements with manufacturer's representatives as may be required. Contractor, if any, for the above services shall pay all costs.

3.8 PROTECTION

A. In performance of work, protect work of other trades as well as work under this Division from damage.

B. Protect electrical equipment, stored and installed, from dust, water or other damage.

END OF SECTION

SECTION 26 05 19
CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes

1. Provide all labor, materials, and equipment necessary for the installation of all conductors and cables under this Section related to lighting, power, mechanical, control and signal systems.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ASTM -American Society for Testing and Materials

a. B3; Standard Specification for Soft or Annealed Copper Wire

b. B8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

c. B787/B787M; Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation

d. D1000; Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

2. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. UL -Underwriters Laboratories, Inc.

    a. UL 83; Thermoplastic-Insulated Wire and Cables

    b. UL 486A 486B; Wire Connectors

    c. UL 486C; Splicing Wire Connectors

    d. UL 486D; Standard for Insulated Wire Connector Systems For Underground Use Or In Damp Or Wet Locations

    e. UL 486E; Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

    f. UL 493; Thermoplastic-Insulated Underground Feeders and Branch Circuit Cables

    g. UL 510; Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

    h. UL 854; Service-Entrance Cables

4. NEMA –National Electrical Manufacturer's Association

    a. WC 70-1999; Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy

5. IEEE –Institute of Electrical and Electronic Engineers

    a. 82; Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors

1.3 DELIVERY

A. Wire shall be in original unbroken package. Obtain approval of Inspector or Engineer before installation of wires.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Conductor material

1. Provide annealed copper for all wire, conductor, and cable of not less than 98% conductivity.

2. Wire #8 AWG and larger shall be stranded.

3. Wire #10 AWG and smaller shall be solid.

B. Insulation material

1. All insulated wire, conductor and cable shall be 600 Vac rated.

2. Feeder and branch circuits larger than #6 AWG shall be type THW, XHHW or THHN/THWN.

3. Feeder and branch circuits #6 AWG and smaller shall be type TW, THW, XHHW or THHN/THWN.

4. Control circuits shall be type THW or THHN/THWN.

5. Wires shall bear the UL label, be color-coded, and marked with gauge, type and manufacturer's name on 24" centers.

2.2 FLEXIBLE CORDS AND CABLES

A. Provide flexible cords and cables of size, type and arrangement as indicated on Drawings.

B. Type S flexible cords and cable shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full sized green insulated grounding conductor with an outer rubber or neoprene jacket.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as a integral connector component or an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s).

2.3 WIRE CONNECTIONS AND TERMINATIONS

A. Electrical spring wire connectors

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross- sectional steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.

2. Self-striping pigtail and tap U-contact connectors are not acceptable.

B. Compression type terminating lugs

1. Provide tin-plated copper high compression type lugs for installation with hand or hydraulic crimping tools as directed by manufacturer. Notch or single point type crimps are not acceptable.

2. Two-hole, long barrel lugs shall be provided for size #4/O AWG and larger wire where terminated to bus bars. Use minimum of three crimps per lug where possible.

C. Splicing and insulating tape

1. Provide black, UV resistant, self-extinguishing, 7 mil thick vinyl general purpose electrical tape per UL 510 and ASTM D1000. 3M Scotch 33 or equal.

D. Insulating putty

1. Provide pads or rolls of non-corrosive, self-fusing, 125 mil thick rubber putty with PVC backing sheet per UL 510 and ASTM D1000. 3M Scotchfil or equal.

E. Insulating resin

1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. 3M Scothcast 4 or equal.

2. Use resin with thermal and diaelectric properties equal to the cable's insulating properties.

F. Terminal strips

1. Provide box type terminal strips in the required quantities plus 25% spare. Install in continuous rows.

2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.

3. Identify all terminals strips and circuits.

G. Crimp type connectors

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support.

2. Fasten crimp type connectors or terminals using a crimping tool recommended by the manufacturer.

3. Provide insulated overlap splices with tinned seamless electrolytic copper-brazed barrel with funnel wire entry and insulation support.

4. Provide insulated butt splices with tinned seamless electrolytic copper-brazed barrel with center stop, funnel wire entry and insulation support.

H. Cable ties

1. Provide harnessing and point-to-point wire bundling with nylon cable ties. Install using tool supplied by manufacturer as required.

I. Wire lubricating compound

1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.

2. Shall not be used on wire for isolated type electrical power systems.

J. Bolt termination hardware

1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE Grade 5; or silicon bronze alloy ASTM B-9954 Type B.

2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.

3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, conforming to ANSI B27.2. SAE or narrow series shall be used.

4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.

5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:

a. 1/4” bolt – 125 A

b. 5/16” bolt – 175 A

c. 3/8” bolt – 225 A

d. 1/2” bolt – 300 A

e. 5/8” bolt – 375 A

f. 3/4” bolt – 450 A

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.2 INSTALLATION

A. All wire, conductor, and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient conditions.

B. Feeders and branch circuits in wet locations shall be rated 75°C minimum.

C. Feeders and branch circuits in dry locations shall be rated 90°C minimum.

D. Minimum conductor size

1. #12 AWG copper for all power and lighting branch circuits.

2. #14 AWG copper for all line voltage signal and control wiring, unless otherwise indicated.

3. Aluminum conductors may be substituted on the basis of equal performance for sizes greater than #10 AWG with the approval of Engineer.

E. Remove and replace conductors under the following conditions at no additional costs to the City:

1. Installed within wrong specified conduit or raceway.

2. Damaged during installation.

3. Of insufficient length to facilitate proper splice of conductors

3.3 WIRING METHODS

A. Install wires and cable in accordance with manufacturer's written instructions, as shown on Drawings and as specified herein.

B. Install all single conductors within raceway system, unless otherwise indicated.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all aspects.

D. Provide adequate length of conductors within electrical enclosures and neatly train to termination points with no excess. Terminate such that there is no bare conductor at the terminal.

E. Splice cables and wires only in junction boxes, outlet boxes, pull boxes, manholes or handholes.

F. Group and bundle with tie wrap each neutral with its associated phase conductors where more than one neutral conductor is present within a conduit.

G. Install cable supports for all vertical feeders in accordance with CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

H. Seal cable where exiting a conduit from an exterior underground raceway with a non-hardening compound (i.e., duct seal or equal).

I. Provide UL listed factory fabricated, solder-less metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal or greater than the conductor or cable being terminated.

J. Stranded wire shall be terminated using fittings, lugs or devices listed for the application. Under no circumstances shall stranded wire be terminated solely by wrapping it around a screw or bolt.

K. Flexible cords and cables supplied as part of a pre-manufactured assembly shall be installed according to manufacturer's published instructions.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway after interior of building has been physically protected from weather, and all mechanical work likely to injure conductors has been completed.

B. Pull all conductors into raceway at the same time.

C. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

D. Completely mandrel all underground or concrete encased conduits prior to installation.

E. Completely and thoroughly swab raceway system prior to installation

F. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors smaller than #1 AWG.

G. Wire pulling

1. Provide installation equipment that will prevent cutting or abrasion of insulation during installation.

2. Maximum pull tension shall not exceed manufacturer's recommended value during installation for cable being measured with tension dynometer.

3. Use rope made of non-metallic material for pulling.

4. Attach pulling lines by means of either woven basket grips or pulling eyes attached directly to the conductors.

5. Pull multiple conductors simultaneously within same conduit.

3.5 WIRE SPLICES, JOINTS, AND TERMINATIONS

A. Join and terminate wire, conductors, and cables in accordance with UL 486, CEC and manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full conductor ampacity without perceptible temperature rise, and shall be made mechanically and electrically secure.

D. Terminate wires in terminal cabinets using terminal strips, unless otherwise indicated.

E. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere within panel or cabinet.

F. Encapsulate splices in wet locations using specified insulating resin kits.

G. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as feed conductor with at least 6 inches of tail, all neatly packed within box.

H. Where conductors are to be connected to metallic surfaces, coated surfaces shall be cleaned to base metal surface before installing connector. Remove lacquer coating of conduits where ground clamps are to be installed.

I. Branch circuits (#10 AWG and smaller) connectors shall comply with 2.01.D.2 and 2.01.D.2 above.

J. Branch circuits (#8 AWG and larger)

1. Join or tap conductors using insulated mechanical compression taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over-wrapped with two half- lapped layers of vinyl insulating tape starting and ending at the middle of joint.

2. Terminate conductors using mechanical compression lugs in accordance with manufacturer's recommendation or as specified elsewhere.

3. Field installed compression connectors for 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.

4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature.

K. Termination hardware assemblies

1. Al/Cu lugs connected to aluminum plated or copper bus shall be secured with steel bolt, flat washer (two per bolt), Belleville washer and nut.

2. Copper lugs connected to copper bus shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.

3. The crown of Belleville washers shall be under the nut.

4. Bolt assemblies shall be torque to manufacturer's recommendations. Where manufacturer recommendation is not obtainable, the following shall be used:

a. 1/4" -20 bolt at 80 inch-pound torque

b. 5/16" -18 bolt at 180 inch-pound torque

c. 3/8" -20 bolt at 20 inch-pound torque

d. 1/2" -20 bolt at 40 inch-pound torque

e. 5/8" -20 bolt at 55 inch-pound torque

f. 3/4" -20 bolt at 158 inch-pound torque

3.6 IDENTIFICATION

A. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

B. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

C. In manholes, pullboxes and handholes provide tags of embossed brass type with cable type and voltage rating. Attach tags to cable with slip-free plastic cable lacing units.

D. Color coding

1. For 120/208 Volt (or 120/240 Volt), 1 phase, 3 wire systems:

   a. Phase A – Black

   b. Phase B – Red

   c. Neutral – White

   d. Ground – Green

2. For 120/208 Volt, 3 phase, 4 wire systems:

   a. Phase A – Black

   b. Phase B – Red

   c. Phase C – Blue

   d. Neutral – White

   e. Ground – Green

3. For 277/480 Volt, 3 phase, 4 wire systems:

   a. Phase A – Brown

   b. Phase B – Orange

   c. Phase C – Yellow

   d. Neutral – Gray

   e. Ground – Green

4. Switch leg individually installed shall be the same color as the branch circuit to which they originate, unless otherwise indicated.

5. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.7 FIELD QUALITY CONTROL

A. Supply labor, materials and test equipment required to perform continuity and ground tests.

B. Electrical testing

1. Perform feeder and branch circuit insulation test after installation and prior to connection to device.

2. Tests shall be performed by 600 Vdc megger for a continuous 10 seconds from phase-to-phase and phase-to-ground.

3. Torque test conductor connections and terminations for conformance to Specifications.

4. If any failure is detected, locate failure, determine cause and replace or repair cable to Engineer's satisfaction at no additional costs.

5. Furnish test results in type written report form for review by Engineer.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials, and equipment necessary to complete the installation required for the item specified under this Section, including but not limited to power system grounding

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code (CEC); NFPA 70 National Electrical Code (NEC) with California amendments

2. IEEE –Institute of Electrical and Electronic Engineers

a. 142; Recommend Practices for Grounding of Industrial and Commercial Power Systems

3. NFPA –National Fire Protection Association

a. 780; Lightning Protection Code

4. UL –Underwriters Laboratories, Inc.

a. 467; Grounding and Bonding Equipment

1.3 SYSTEM DESCRIPTION

A. This Section provides for the grounding and bonding of all electrical and communication apparatus, machinery, appliances, components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.

B. Ground the electrical service system neutral at service entrance equipment as shown on the Drawings.

C. Ground each separately derived system, as defined in CEC 250.5 (D) and on the Drawings, unless specifically noted otherwise.

D. Except as otherwise indicated, the complete electrical installation including the neutral conductor, equipment and metallic raceways, boxes and cabinets shall be completely and effectively grounded in accordance with all CEC requirements, whether or not such connections are specifically shown or specified.

1.4 SUBMITTALS

A. Submit manufacturer's data for equipment and materials specified within this Section in accordance to Section 16050.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.1 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND)

A. #3/O AWG minimum bare stranded copper conductor.

2.2 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum ¾" diameter by 10'-0" length, sectional type with copper alloy couplings and carbon steel driving stud; Weaver, Cadweld or equal.

2.3 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with 150°C molded plastic insulated throat and

lay-in ground lug; OZ/Gedney BLG, Thomas & Betts #TIGB series or equal.

2.4 CONNECTION TO PIPE

A. Cable to pipe connections; OZ/Gedney G-100B series, Thomas & Betts #290X series or equal.

2.5 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.6 BONDING JUMPERS

A. OZ/Gedney Type BJ, Thomas & Betts #3840 series or equal.

2.7 GROUND CONDUCTOR

A. Ground conductor shall be code size UL labeled, Type THWN insulated copper wire, green in color.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Grounding electrodes

1. Concrete encased grounding electrode (Ufer ground)

a. Provide a #3/O AWG minimum bare copper conductor encased along the bottom of concrete foundation, footing or trench which is in direct contact with the earth and where there is no impervious waterproofing membrane between the footing and soil. The electrode shall extend through a horizontal length of 30’ minimum and shall be encased in not less than 2” or more than 5” of concrete separating it from surrounding soil. The electrode shall emerge from the concrete slab through a protective non- metallic sleeve and shall be extended to BGB or as shown on Drawings.

2. Supplementary grounding electrode (ground ring, grid and driven rod)

a. Provide as shown driven ground rod(s). Interconnect ground rod with structural steel and adjacent rods with code size bare copper conductor. Ground rods shall be space no less than 6’-0” on centers

from any other electrode or electrodes of another electrical system.

B. Grounding electrode conductor

1. Provide grounding electrode conductors per CEC Table 250-94 or as shown on Drawings, whichever is greater.

C. Equipment Bonding/Grounding

1. Provide a code sized copper ground conductor, whether indicated or noted on the drawings, in each of the following:

   a. All power distribution conduits and ducts

   b. Distribution feeders

   c. Motor and equipment branch circuits

   d. Device branch circuits

2. Provide a separate grounding bus at distribution panelboards, loadcenters, switchboards and motor control centers. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35V above ground.

3. Metallic conduits terminating in concentric, eccentric or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.

4. Provide bonding jumpers across expansion and deflection coupling in conduit runs, pipe connections to water meters and metallic cold water dielectric couplings.

5. Provide ground wire in flexible conduit connected at each end via grounding bushing.

6. Provide bonding jumpers across all cable tray joints.

7. Bond each end of metallic conduit longer than 36” in length to grounding conductor using a #6 AWG pigtail.

3.2 FIELD QUALITY CONTROL

A. Contractor using test equipment expressly designed for that purpose shall perform all ground resistance tests in conformance with IEEE guidelines. Contractor shall submit typewritten records of measured resistance values

to City for review and approval prior to energizing the system.

B. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required to comply with the following resistance limits:

1. Resistance from ground bus to ground electrode and to earth shall not exceed 5 ohms unless otherwise noted.

2. Resistance from the farthest panelboard, loadcenter, switchboard or motor control center ground bus to the ground electrode and to earth shall not exceed 20 ohms maximum.

C. Inspection

1. The City or Inspector prior to encasement, burial or concealment thereto shall review the grounding electrode and connections.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES

PART 1 -GENERAL

1.1 SUMMARY

A. Section includes:

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to electrical conduits; outlet, junction and pull boxes; and related supports.

B. Related sections:

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

   a. 260526 – Grounding and Bonding for Electrical Systems

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute

   a. C33.91; Specification for Rigid PVC Conduit

   b. C80.1; Specification Rigid Steel Conduit, Zinc-Coated

   c. C80.3; Specification for Electrical Metallic Tubing, Zinc-Coated

   d. C80.6; Intermediate Metal Conduit (IMC), Zinc-Coated

2. CCR –California Code of Regulations, Title 24

   a. Part 2 -California Building Code (CBC); International Building Code (IBC) with California amendments

b. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. NECA –National Electrical Contractors Association

   a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT)

   b. 111, Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)

4. NEMA –National Electrical Manufacturer's Association

   a. FB 1; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

   b. FB 2.10; Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)

   c. FB 2.20; Selection and Installation Guidelines For Fittings for Use With Flexible Electrical Conduit and Cable

   d. OS 1; Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

   e. OS 3; Selection and Installation Guidelines for Electrical Outlet Boxes

   f. RN 1; Polyvinyl-Choride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing

   g. TC 2; Electrical Plastic Tubing and Conduit

   h. TC 3; PVC Fittings for Use with Rigid PVC Conduit and Tubing

   i. TC 14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

5. OSHPD Anchorage Pre-approvals

   a. OPA-0003; Superstrut Seismic Restraint System

   b. OPA-0114; B-Line Seismic Restraints

   c. OPA-0120; Unistrut Seismic Bracing System

   d. OPA-0242; Power-Strut Seismic Bracing System

6. UL –Underwriter's Laboratories, Inc.

a. 1; Standard for Flexible Metal Conduit

b. 6; Rigid Metal Electrical Conduit

c. 360; Standard for Liquid-Tight Flexible Steel Conduit

d. 514A; Metallic Outlet Boxes, Electrical

e. 514B; Fittings for Conduit and Outlet Boxes

f. 651; Schedule 40 & 80 PVC Conduit

g. 797; Electrical Metallic Tubing

h. 1242; Intermediate Metal Conduit

i. 1684; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.3 SYSTEM DESCRIPTION

A. Furnish, assemble, erect, install, connect and test all electrical conduits and related raceway apparatus required and specified to form a complete installation.

1.4 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 16050.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the NECA installation guidelines unless otherwise indicated within this Section

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits and Fittings

1. Rigid steel conduit (RMC)

a. Conduit: Standard weight, mild steel pipe, and zinc coated on both inside

and outside by a hot dipping or shearardizing process manufactured in accordance with UL 6 and ANSI C80.1 specifications.

b. Fittings (couplings, elbows, bends, etc.):

1) Shall be steel or malleable iron.

2) Coupling and unions shall be threaded type, assembled with anti-corrosion, conductive and anti-seize compound at joints made absolutely tight to exclude water.

c. Bushings:

1) Insulating bushings: Threaded polypropylene or thermosetting phenolic rated at 150°C minimum.

2) Insulating grounding bushing: Threaded cast body with insulating throat and steel “lay- in” ground lug.

3) Insulating metallic bushing: Threaded cast body with plastic insulated throat rated at 150°C minimum.

2. Coated rigid steel conduit (CRMC)

a. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant. The coating thickness shall be a minimum of 40mil.

b. Fittings (couplings, elbows, bends, etc.)

c. Equivalent to RMC above with bonded coating same as conduit.

d. The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter or 1 1/2” whichever is smaller.

e. Bushing equivalent to RMC above.

3. Intermediate metallic conduit(IMC)

a. Conduit: Intermediate weight, mild steel pipe, meeting the same requirements for finish and material as rigid steel conduit manufactured in accordance with UL 1242 and ANSI C80.6 specifications.

b. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.

c. Bushing equivalent to RMC above.

4. Electrical metallic tubing (EMT)

    a. Conduit: Cold rolled steel tubing with zinc coating on outside and protective enamel on inside manufactured in accordance with UL 797 and ANSI C80.3 specifications.

    b. Couplings: Steel or malleable iron with compression type fastener via a nut.

    c. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.

5. Rigid non-metallic conduit (PVC)

    a. Conduit: PVC composed Schedule 40, 90°C manufactured in accordance with NEMA TC 2 and UL 651 specifications.

    b. Fittings: Molded PVC, slip on solvent welded type in accordance to NEMA TC 3.

6. Reinforced thermosetting resin conduit (RTRC)

    a. Conduit: Fiber impregnated with a cured thermosetting resin compound in accordance with NEMA TC 14 and UL1684.

    b. Fittings: Molded resin with glass reinforcement manufactured in the same process as the conduit bonded with an epoxy adhesive.

7. Flexible metallic conduit (FMC)

    a. Conduit: Continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 1.

    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.

8. Liquidtight flexible metallic conduit (LFMC)

    a. Conduit: PVC coated, continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 360.

    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.

9. Miscellaneous Fittings and Products

    a. Conduit sealing bushings: Steel or cast malleable iron body and

pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Supplied with neoprene sealing rings between body and PVC sleeve.

b. Watertight cable terminators: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel screws and zinc plated cast iron locking collar.

c. Watertight cable/cord connectors: Liquidtight steel or cast malleable iron body with sealing neoprene bushing and stainless steel retaining ring.

d. Expansion fittings: Multi-piece unit of hot dip galvanized malleable iron or steel body and outside pressure bussing design to allow a maximum of 4” movement (2” in either direction). Furnish with external braid tinned copper bonding jumper. UL listed for both wet and dry locations.

e. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve, internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling to provide minimum of 3/4” movement and 30 degrees deflection from normal. UL listed for both wet and dry locations.

f. Conduit bodies: Raintight, malleable iron, hot-dip galvanized body with threaded hubs, stamped steel cover, stainless steel screws and neoprene gasket.

g. Other couplings, connectors and fittings shall be equal in quality, material and construction to items specified herein.

B. Boxes:

1. Outlet boxes

a. Standard: Galvanized one-piece of welded pressed steel type in accordance with NEMA OS 1 and UL 514. Boxes shall not be less than 4” square and at least 1 1/2” deep.

b. Concrete: Galvanized steel, 4” octagon ring with mounting lug, backplate and adapter ring type in accordance with NEMA OS 1 and UL 514. Depth as required by application.

c. Masonry: Galvanized steel, 3.75” high gang box in accordance with NEMA OS 1 and UL 514.

d. Surface cast metal: Cast malleable iron body, surface mounted box with threaded hubs and mounting lugs as required in accordance with NEMA OS 1 and UL 514. Furnish with ground flange, steel cover and neoprene gasket.

2. Pull and junction boxes

a. Sheet metal boxes: Standard or concrete outlet box wherever possible; otherwise use 16 gauge galvanized sheet metal, NEMA 1 box sized per CEC with machine screwed cover.

b. Cast metal boxes: Install standard cast malleable iron outlet or device box when possible.

c. Flush mounted boxes: Install overlapping cover with flush head screws.

d. In-ground mounted pull holes/boxes: Install pre-cast concrete box, sized per Drawing or CEC with pre-cast or traffic rated lid.

C. Pull line/cord:

1. Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.2 PREPARATION

A. Conduit

1. Provide all necessary conduit fittings, connectors, bushings, etc. required to complete conduit installation to meet the CEC and intended application whether noted, shown or specified within.

2. Location of conduit runs shall be planned in advance of the installation and coordinated with other trades.

3. Where practical, install conduits in groups in parallel vertical or horizontal runs that avoid unnecessary offsets.

4. All conduits shall be parallel or at right angles to columns, beams and walls whether exposed or concealed.

5. Conduits shall not be placed closer than 12” to a flue, parallel to hot water, steam line or other heat sources; or 3” when crossing perpendicular to the above said lines when possible.

6. Install exposed conduit as high as practical to maintain adequate headroom. Notify City if headroom will be less than 102”.

7. Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.

8. The largest trade size conduit in concrete floors and walls shall not exceed 1/3 thickness or be spaced a less than three conduit diameters apart unless permitted by City. All conduits shall be installed in the center of slab or wall, and never between reinforcing steel and bottom of floor slab.

9. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.

10. When installing underground conduits to specified depth; depth shall be taken from finished grade as it will be at project completion. Should finish grade be above existing grade by an amount equal to or greater than specified depth, conduit shall be installed not less than 6” below existing grade.

11. Verify that information concerning finish grade is accurate, for should the underground run be less than the specified depth, Contractor may be required to re-install conduit to meet the required depth.

12. Unless otherwise specified, underground conduits shall be installed with top side not less than 24” below finished grade; this depth applies to all conduits outside of building foundations including those under walks, open corridors or paved areas.

13. Utility company service conduits installation depth shall be as directed by their respective specifications and requirements.

B. Boxes

1. Before locating outlet boxes, check Construction Documents for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment.

3.3 INSTALLATION

A. Conduit

1. Minimum conduit size shall be 3/4” unless otherwise indicated.

2. All conduit work shall be concealed unless otherwise indicated. Exposed conduits shall be permitted within unfinished rooms/spaces to facilitate installation.

3. Install conduit in complete runs prior to installing conductors or cables.

4. Make long radius conduits bends free from kink, indentations, or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends 1 1/4” size and larger shall be factory made ells or be made with a manufactured mechanical bender. Heating of steel conduit to facilitate bending or that damage galvanized coating will not be permitted.

5. Remove burrs and sharp edges at end of conduit with tapered reamer.

6. Protect and cover conduits during construction with metallic bushings and bushings “pennies” to seal exposed openings.

7. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten securely.

8. Install conduits shall that no traps to collect condensation exist.

9. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity.

10. Install pull cords/line within any spare or unused conduits of sufficient length to facilitate future cable installation.

11. Penetrations:

    a. Locate penetrations within structural members as shown on Drawings and as directed by City. Should it be necessary to notch any framing member, make such notching only at locations and in a manner as approved by City.

    b. Do not chase concrete or masonry to install conduit unless specifically approved by City.

    c. Cutting or holes

    d. Install sleeves for cast-in-place concrete floors and walls. After installing conduit through penetration, seal using dry-pack grouting compound (non-iron bearing, chloride free and non-shrinking) or fire

rated assembly if rated floor or wall. Use escutcheon plate on floor underside to contain compound as necessary.

e. Cut holes with a hole saw for penetrations through non-concrete or non-masonry members.

f. Provide chrome plated escutcheon plates at all publicly exposed wall, ceiling and floor penetrations.

g. Sealing

1) Non-rated penetration openings shall be packed with non-flammable insulating material and sealed with gypsum wallboard taping compound.

2) Fire rated penetration shall be sealed using a UL classified fire stop assembly suitable to maintain the equivalent fire rating prior to the penetration.

3) Use escutcheon plates to hold sealing or fire rated compound as necessary.

h. Waterproofing:

1) Make penetrations through any damp-proofed/waterproofed surfaces within damp/wet locations as such as to maintain integrity of surface.

2) Install specified watertight conduit entrance seals at all below grade wall and floor penetrations.

3) At roof penetrations furnish roof flashing, counter flashing and pitch-pockets compatible to roof assembly.

4) Where possible conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration’s exterior side.

5) Make penetrations through floors watertight with mastic, even when concealed within walls or furred spaces.

12. Supports:

a. Conduits shall be support and braced per OSHPD pre-approved anchorage systems when those methods are implemented and installed.

b. Sizes of rods and cross channels shall be capable of supporting 4

times and 5 times actual load, respectively. Anchorage shall support the combined weight of conduit, hanger and conductors.

c. Support individual horizontal conduit 1 1/2" and smaller by means of 2 hole straps or individual hangers.

d. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically design for that purpose for 1 1/2" conduits and larger.

e. Support multi-parallel horizontal conduits runs with trapeze type hangers consisting of 2 or more steel hanger rods, preformed cross channels, 'J' bolts, clamps, etc.

f. Support conduit to wood structures by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduits runs with galvanized Unistrut, Power-Strut or approved equal type supports anchored to wall. Where multi-floored conduits pass through floors, install riser clamps at each floor.

h. Maximum conduit support spacing shall be in accordance with NECA Standard of Installation:

i. Horizontal runs:

1) 3/4" and smaller at 60" on centers, unless building construction prohibits otherwise, then 84" on centers.

2) 1" and larger at 72" on centers, unless building construction prohibits otherwise or any other condition, then 120" on centers.

j. Vertical runs:

1) 3/4" and smaller @ 84" on centers.

2) 1" and 1 1/4" @ 96" on centers.

3) 1 1/2" and larger @ 120" on centers.

k. Any vertical condition such as shaftways and concealed locations for any sized conduit, 120" on centers.

l. Anchorage for RMC/IMC supports unless otherwise specified:

1) < 1” IMC/RMC = #10 bolt/screw.

2) 1” IMC/RMC = 1/4” bolt/screw.

3) 1 1/2” and 2” IMC/RMC = 3/8” bolt/screw.

4) 3” IMC/RMC, 4” EMT = 1/2” bolt/screw.

5) > 3”IMC/RMC = 5/8” bolt/screw.

m. Anchorage for EMT supports unless otherwise specified:

1) < 1 1/2” EMT = #10 bolt/screw.

2) 1 1/2” EMT = 1/4” bolt/screw.

3) 2, 2 1/2” and 3” EMT = 3/8” bolt/screw.

4) 4” EMT = 1/2” bolt/screw.

5) > 4”EMT = 5/8” bolt/screw.

B. Boxes:

1. Install boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

2. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.

3. Install plaster rings on all outlet boxes in stud walls or in furred, suspended, or exposed ceilings. Covers shall be of a depth suited for installation.

4. Provide gasketed cast metal cover plates where boxes are exposed in damp or wet locations

5. Install access door for boxes installed within concealed locations without access.

6. Install approved factory-made knockout seal where knockouts are not present.

7. Refer to Architectural interior elevations and details shown for exact mounting heights of all electrical outlets. In general, locate outlets as shown or specific and complies with Americans with Disabilities Act:

    a. Convenience outlets: +18”AFF or +6” above counter or splash.

    b. Local switches: +48”AFF or +6” above counter or splash.

    c. Telecommunication outlets: +18”AFF or +48”AFF for wall telephone or intercom device.

    d. Verify all mounting heights with Drawings, and where heights are not suited for construction or finish please consult City.

8. Use conduit bodies to facilitate pulling of conductor or cables or change conduit direction. Do not splice within conduit bodies.

9. Enclose pull box with additional rated gypsum board as necessary to maintain wall’s original fire rating.

10. Install galvanized steel cover plates on all open boxes within dry listed areas.

11. Install in-ground pull holes/boxes flush to grade finish at finished areas or 1” above finished landscaped grade. Seal all conduits terminating in pull hole/box watertight. Install and grout around bell ends where shown. Cover and lids shall be removable without damage to adjacent finish surfaces.

12. Support

    a. Accurately place boxes for finish, independently and securely supported by adequate blocking or manufacturer channel type heavy-duty box hangers for stud walls. Do not use nails to support boxes.

    b. Support boxes independent of conduit system.

    c. Mount boxes installed within ceilings to 16 gauge metal channel bars attached to main runners or joists.

    d. Support boxes within suspended acoustical tile ceilings directly from structure above when light fixture are to be installed from box.

    e. Use auxiliary plates, bar or clips and grouted in place for masonry, block or pour-in-place concrete construction.

3.4 APPLICATION

A. Conduit:

1. RMC/IMC suitable for all damp, dry and wet locations except when in contact with earth. IMC not suitable for hazardous locations as stated within CEC.

2. CRMC suitable for damp or wet locations, concealed within concrete or in contact with earth.

3. EMT suitable for exposed or concealed dry, interior locations.

4. PVC/RTRC suitable for beneath ground floor slab, except when penetrating, and direct earth burial. Do not run exposed within concrete walls or in floor slab unless indicated on Drawings or per City's permission.

5. FMC suitable for dry locations only for connections to motors, transformers, vibrating equipment/machinery, controllers, valves, switches and light fixtures in less than 6 foot lengths.

6. LFMC application same as FMC above but for damp or wet locations.

B. Termination and joints:

1. Use raceway fittings compatible with associated raceway and suitable for the location.

2. Raceways shall be joined using specified couplings or transitions where dissimilar raceway systems are joined.

3. Conduits shall be securely fastened to cabinets, boxes and gutters using (2) two locknuts and insulating bushing or specified insulated connector. Where joints cannot be made tight and terminations are subject to vibration, use bonding jumpers, bonding bushings, or wedges to provide electrical continuity of the raceway system. Use insulating bushings to protect conductors where subjected to vibration or dampness. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

4. Terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

5. Stub freestanding equipment conduits through concrete floors for connections with top of coupling set flush with finished floor. Install plugs to protect threads and entrance of debris.

6. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating within interior switchboard, panel, cabinet, or

gutters. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.

7. Where conduits enter building from below grade inject into filled raceways pre-formulated rigid 2 lbs. density polyurethane foam suitable for sealing against water, moisture, insects, and rodents.

8. Install expansion fitting or expansion/deflection couplings per manufacturer's recommendations where:

   a. Any conduit that crosses a building structure expansion joint; secure conduit on both sides to building structure and install expansion fitting at joint.

   b. Any conduit that crosses a concrete expansion joint; install expansion/deflection at joint.

   c. Any conduit greater than 1-1/4" is routed along roof top in runs greater than 100 feet; install expansion fittings every 100 feet.

   d. City may allow FMC or LFMC in lieu of expansion fitting or expansion/deflection couplings on conduits 2" and smaller within accessible locations upon further review and written consent.

C. Boxes:

1. Standard type suitable for all flush installations and all dry concealed locations.

2. Concrete type suitable for all flush concrete installations.

3. Masonry type suitable for all flush concrete and block installations.

4. Surface cast meta type suitable for all exposed damp and wet surface mounted locations, and dry surface mounted locations less than 96" from finished floor.

END OF SECTION

SECTION 26 22 00

DISTRIBUTION DRY-TYPE TRANSFORMERS (600VAC AND LESS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials, and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to transformers

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

a. 26 05 26 – Grounding and Bonding for Electrical Systems

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI - American National Standards Institute

a. C57; Distribution and Power Transformers, Guide for Loading Dry-Type

2. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. NECA –National Electrical Contractors Association

a. 409; Recommended Practices for Installing and Maintaining Dry-Type Transformers

4. NEMA –National Electrical Manufacturer's Association

    a. ST20; Dry Type Transformers for General Applications

    b. TP1; Guide for Determining Energy Efficiency for Distribution Transformers

    c. TP2; Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

    d. TP3; Standard for the Labeling of Distribution Transformer Efficiency

    e. TR1; Transformers, Regulators, and Reactors

5. UL -Underwriters Laboratories, Inc.

    a. 1561; Dry-Type General Purpose and Power Transformers

1.3 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Include outline and support point dimensions of enclosures and accessories; unit weights; voltage; kVA rating; impedance rating and characteristics; loss and efficiency data at 25%, 50%, 75% and 100% rated load; sound level, tap configurations; insulation system type; and rated temperature raised.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to NECA 409-2002, Recommended Practice for Installing and Maintaining Dry-Type Transformers.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store in a warm, dry location with uniform temperature. Protect unit if handled in inclement weather (i.e., rain, sleet, snow, etc.). Cover ventilating opening to keep out dust and foreign materials prior to startup.

B. Handle transformer using only lifting eyes and brackets provided for that purpose; see manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE

A. Manufacturers

1. Square D, Cutler-Hammer or approved equal.

B. Rating Information

1. All insulating materials are to exceed NEMA ST20 standards and be rated for 220^{O}C UL component recognized insulation system.

2. Capable of meeting daily overload requirements of ANSI C57.96.

3. Transformers 15kVA and larger shall be 150^{O}C temperature rise above 40^{O}C ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps.

4. The maximum temperature of the top of the enclosure shall not exceed 50^{O}C rise above a 40^{O}C ambient.

5. Sound levels shall be warranted by the manufacturer not to exceed NEMA ST20 requirements.

C. Construction

1. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.

2. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration- absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

3. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

4. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing,

followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use.

5. Manufacturer shall provide the optional accessories where required and noted on the Drawings:

    a. Weathershields for all models.

    b. Wall mounting brackets for 75kVA units and smaller.

    c. Ceiling mounting brackets for 150kVA units and smaller.

2.2 ENERGY EFFICIENT, GENERAL PURPOSE

A. Manufacturers

1. Square D, Cutler-Hammer or approved equal.

B. Rating Information

1. Same as General Purpose above except:

    a. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

C. Construction

1. Same as General Purpose above.

2.3 PREMIUM GRADE

A. Manufacturers

1. Square D, Cutler-Hammer or approved equal.

B. Rating Information

1. Same as General Purpose above except:

    a. Transformers 10kVA and larger shall have the following temperature rise above 40^{o}C ambient capable of maintaining a continuous load without exceeding a 150^{o}C rise in a 40^{o}C ambient:

        1) 115^{o}C rise with 115% rated load.

2) 80^{O}C rise with 130% rated load.

b. The maximum temperature of the top of the enclosure shall not exceed 35^{O}C rise above a 40^{O}C ambient.

C. Construction

1. Same as General Purpose above.

2.4 NON-LINEAR

A. Manufacturers

1. Square D, Cutler-Hammer or approved equal.

B. Rating Information

1. Same as General Purpose above except:

a. Neither the primary nor the secondary temperature shall exceed 220^{O}C at any point in the coils while carrying their full rating of non-sinusoidal load. Transformers are to be UL listed and as defined as the sum of fundamental and harmonic $I_h(pu)^2h^2$ per UL 1561. Transformers evaluated by the UL K-Factor evaluation shall be listed for either 115^{O}C or 80^{O}C average temperature rise as noted on the Drawings. K-Factor listed transformers rated at 150^{O}C rise shall not be acceptable.

b. K-Factor rated transformers shall have an impedance range of 3% to 5%, and shall have a minimum reactance of 2% in order to help reduce neutral current when supplying loads with large amounts of third harmonic current.

C. Construction

1. Same as General Purpose above except:

a. Transformers shall be supplied with quality, full width electrostatic shields resulting in a maximum effective coupling capacitance between primary and secondary of 33 picofarads. With transformers connected under normal, loaded operating conditions, the attenuation of line noise and transients shall equal or exceed the following limits:

1) Common Mode: 0 to 1.5kHz - 120dB; 1.5kHz to 10kHz - 90dB; 10kHz to 100kHz - 65dB; 100kHz to 1MHz - 40dB

2) Transverse Mode: 1.5kHz to 10kHz - 52dB; 10kHz to 100kHz - 30dB; 100kHz to 1MHz- 30dB

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine transformer to provide adequate clearances for installation.

B. Check that concrete pads are level and free of irregularities for floor mounted installations.

C. Begin work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Read and follow manufacturer's bulletin included with unit prior to installation.

B. Installation shall conform to NECA 409 where not specified under this Division.

C. Transformers not specifically designed for wall mounting, shall be spaced a minimum of 6" from adjacent walls, ceiling and all other equipment.

D. Mount to resist seismic forces and brace to 0.56g. Submit calculations and mounting details for review and approval.

E. Terminations

1. Provide all transformers with lugs for both primary and secondary conductors shown on Drawings. Connect lug to termination point with appropriate size bolt, nut and washers.

2. Use flexible conduit indoors in dry locations or liquid-tight flexible conduit in damp/wet locations for primary and secondary connections to transformer case when less than 48" in length. Connection shall be to enclosure's side panels only unless fed directly below from ground mounted installation or as shown on Drawings.

F. Grounding

1. Provide a dual rated four-barrel solderless grounding lug with a 5/8"-11 threaded hole. Drill transformer enclosure with 11/16" bit and attach lug to enclosure using a torque bolt and T&B Dragon Tooth transition washer with the following connections:

a. Primary feeder ground

b. Secondary feeder ground

c. Grounding electrode per CEC/NEC 250-30.

d. Main bond jumper to neutral (when present)

3.3 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages, and make appropriate tap adjustments to within 2% of rated voltage

3.4 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials, and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to switchboards and large distribution panels.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

a. 26 05 26 – Grounding and Bonding for Electrical Systems

b. 26 28 11 – Overcurrent Protection Devices

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI - American National Standards Institute

a. C12.16; Solid State Electricity Metering

b. C57.13; Instrument Transformers

2. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. Federal Specification

a. W-C-37; Circuit Breakers, Molded Case, Branch Circuit and Service

4. NECA –National Electrical Contractors Association

    a. 400, Recommended Practice for Installing and Maintaining Switchboards

5. NEMA –National Electrical Manufacturer's Association

    a. AB 1; Molded Case Circuit Breakers and Molded Case Switches

    b. KS; Fused and Non-fused Switches

    c. PB 2; Deadfront Distribution Switchboards, File E8681

    d. PB 2.1; Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less

    e. PB 2.2; Application Guide for Ground Fault Protective Devices for Equipment

6. UL -Underwriters Laboratories, Inc.

    a. UL 50; Cabinets and Boxes

    b. UL 98; Enclosed and Dead Front Switches

    c. UL 489; Molded Case Circuit Breakers

    d. UL 891; Dead-Front Switchboards

    e. UL 943; Ground Fault Circuit Interrupters

    f. UL 977; Fused Power Circuit Devices

1.3 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Shop Drawings shall indicate front and side enclosure elevations with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; equipment schedule; and switchboard instrument details.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

C. Installation shall conform to NECA 400-1998, Recommended Practice for Installing and Maintaining Switchboards unless otherwise specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D, Cutler-Hammer or approved equal.

2.2 MATERIAL

A. General

1. Utility Metering Compartment: The utility current transformer compartment shall be connected for hot sequence metering. The compartment shall comply with EUSERC and/or the local utility company specifications.

2. Switchboards shall be rated with a minimum short circuit current rating at listed voltage as shown on Drawings.

3. All unused spaces provided, unless otherwise specified, shall be fully bussed and equipped for future devices, including all appropriate connectors and

mounting hardware.

4. Enclosure shall be of NEMA type shown on Drawings.

5. Sections shall be aligned front and rear.

6. Sections shall be aligned front and rear.

7. The switchboard frame shall be of formed steel rigidly bolted together to support all cover plates, bussing and component devices during shipment and installation.

8. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.

9. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre- treatment.

10. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.

11. Top and bottom conduit areas shall be clearly indicated on shop drawings.

12. Provide 1” high by 3” wide engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.

13. Bus Composition shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

14. Bus Connections shall be bolted with Grade 5 bolts and conical spring washers.

15. Ground Bus shall be sized per CEC/NEC and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.

16. Square-D I-Line or equivalent distribution bussing with the following characteristics where so noted on Drawings.

    a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly, facilitating ease of installation of future

devices.

b. The interior shall have three bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus., providing side-by-side mounting of breakers.

c. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.

d. Line-side circuit breaker connections are to be jaw type, whereby clamping forces are increased under faulted conditions.

e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

B. Incoming main devices shall of type and accessories as shown on Drawings.

1. Circuit Breakers

a. Circuit breaker shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.

2. Fusible Switches

a. Single main group mounted through 800 A.

b. Fusible main switch shall be group mounted plug-on with mechanical restraint. No additional hardware shall be required to mount the fusible switch into the switchboard.

c. Switch shall have dual cover interlocks designed to prevent the opening of the cover when the switch is ON. The cover interlock shall prevent the switch from being turned ON with the cover open. Interlock may be manually overridden for testing purposes. Switch cover shall include a means by which the cover can be padlocked in the closed position. The operating handle shall feature positive lock-off means by providing provisions for (3) 0.375” padlocks.

d. Load side fusible switch connections shall be jaw type.

3. Incoming Lug Only (Distribution only, non-service entrance)

a. Incoming conductors shall terminate at lug landing pads rated per Drawings.

b. All lugs shall be UL Listed to accept solid and/or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the NEC.

c. Provide compression type lugs to accommodate the conductor shown on the associated drawings.

C. Distribution section devices shall of type and accessories as shown on Drawings.

1. Group mounted or individually mounted as shown on Drawings.

2. All circuit breakers shall be installed in a twin mount configuration where allowed by the manufacturer with prepared space unless otherwise noted.

3. All distribution circuit breakers shall be thermal-magnetic molded case, unless otherwise noted on Drawings.

4. Circuit breaker shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine switchboard to provide adequate clearances for installation.

B. Check that concrete pads are level and free of irregularities.

C. Begin work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in location shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1. Anchor to resist seismic forces as indicated on Drawings and in accordance with OSHPD's anchorage requirements. Provide all testing and inspections requirements by inspecting authority.

B. Installation shall conform to NECA 400 where not specified under this Division.

C. Tighten accessible bus connection and mechanical fasteners after placing switchboard.

3.3 FIELD QUALITY CONTROL

A. Obtain the services of an independent testing company who shall provide quality control and adjustments as well as tests.

B. Inspect complete installation for physical damage, proper alignment, anchorage and grounding prior to energizing.

C. Measure the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each at 1000Vdc; acceptable insulation resistance is 1 megaohm. Also, refer to manufacturer's specifications for specific testing procedures and values.

D. Check tightness of accessible bolted bus joints using a calibrated torque wrench per manufacturer's specifications.

E. Physically test key interlock systems to check for proper functionality.

F. Test ground fault systems by push-to-test button.

G. Check and set where required all protective device settings in accordance with approved coordination study settings and conduct ground fault acceptance tests.

3.4 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated by Engineer.

D. Main circuit breaker ground fault setting shall be per CEC/NEC 230-95(a).

3.5 CLEANING

A. Touch up scratched or marred surfaces to match original finish

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials, and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to wiring devices.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

   a. 26 05 26 – Grounding and Bonding for Electrical Systems

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. Federal Specification

   a. W-C-596; Connector, Electrical, Power, General Specification for

   b. W-S-896; Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification)

2. NEMA –National Electrical Manufacturer’s Association

   a. WD 1; General Color Requirements for Wiring Devices

   b. WD 6; Wiring Devices-Dimensional Requirements

3. UL -Underwriters Laboratories, Inc.

   a. 20; General-Use Snap Switches

b. 498; Standard for Attachment Plugs and Receptacles

c. 943; Standard for Ground-Fault Circuit-Interrupters

d. 1449; Standard for Transient Voltage Surge Suppressors

1.3 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Standards

1. At dedicated receptacle locations and as otherwise noted, use specification grade, NEMA 5- 20R configuration grounding type, rated 20A at 125/250Vac that conform to NEMA WD-6 and when possible Fed. Spec W-C-596.

B. Color

1. General purpose receptacle face shall be nylon; color shall be compatible with adjacent wall finish, unless otherwise indicated.

C. Receptacle types

1. Ground fault circuit interrupter (GFCI) duplex

a. Provide 20A, 125Vac receptacle consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5mA line-to-ground fault current in approximately 1/40th of a second per UL 943.

b. Provide visual device with trip indication, manual reset and test mechanisms per UL 943.

c. Device shall be capable of point of use and multi-outlet protection.

d. Use Cooper Wiring Devices #XGF20, Hubbell #GF53, or equal.

2.3 WALL PLATES

D. Exterior: die-cast copper-free aluminum, gasketed, raintight cover UL listed for exterior and wet locations while in use. Use Hubbell #WP8M (duplex), #WP26M (GFCI) or equal.

E. Screws shall match plate.

F. Tamper resistance receptacles shall have exposed screws of temper resistant type.

G. Individual, gangable wall plates are not acceptable where two or more devices are installed at one location.

PART 3 - EXECUTION

3.2 INSTALLATION

A. Comply with manufacturer's instructions regarding termination of conductors to wiring device.

END OF SECTION

SECTION 26 28 11

OVERCURRENT PROTECTION DEVICES

PART 1

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials, and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to overcurrent protection devices.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24

   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

2. Federal Specification

   a. W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service

3. NEMA –National Electrical Manufacturer’s Association

   a. AB 1; Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures

   b. PB 2.2; Application Guide for Ground Fault Protective Devices for Equipment

4. UL -Underwriters Laboratories, Inc.

a. 248; Low Voltage Fuses

b. 468; Wire Connectors

c. 508E; IEC Type "2" Coordination Short Circuit Tests

d. 489; Molded-Case Circuit Breakers and Circuit Breaker Enclosures

e. 943; Standard for Ground-Fault Circuit-Interrupters

1.3 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Production test of circuit breakers upon request of Engineer.

C. Submittal shall show the following information: circuit breaker numbering, circuit breaker type and short circuit rating, provisions for future circuit breakers, bussing, including neutral and ground, ratings and enclosure dimensions and trims.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

1.5 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

PART 2 - PRODUCTS

2.1 FUSES

A. All power distribution fuses shall be time-delay, high interrupting (200kAIC minimum) and current limiting type, unless otherwise indicated. All fuses shall be of same manufacturer and model.

1. Motor branch circuit fuses (0 – 600A): UL Class RK5 dual element, time delay type shall be size for UL 508E “Type 2” coordination for the motor controller. Coordinate fuse selection with motor starter overload relay heaters as required.

2. General purpose feeder fuses (0 – 600A): UL Class RK1 dual element, time delay type shall be size per Drawings.

B. Control and instrumentation fuses shall of type and rating as recommended by equipment manufacturer, suitable for fuse blocks or holders installation.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication.

4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker after installation.

5. Circuit breakers shall have an RMS interrupting capacity not less than shown on Drawings, or if not shown shall not be less than:

   a. 25kA for 480V systems

   b. 22kA for 240V (or less) systems

6. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.

7. Circuit breakers shall be equipped with UL Listed electrical accessories as noted on Drawing. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.

8. All circuit breakers shall be UL Listed for reverse connection without

restrictive line and load markings and be suitable for mounting in any position.

9. Circuit breakers shall be constructed with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs. Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating in the CEC.

10. All circuit breakers shall be capable of accepting bus connections.

B. Thermal-Magnetic Circuit Breakers

1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 40°C ambient temperature.

3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.

4. Provide equipment ground fault protection where shown on Drawing with the following features.

   a. Ground fault sensing system shall be modified zero sequence sensing type and not require any external power to trip the circuit breaker.

   b. The ground fault sensing system shall be suitable for use on grounded systems. The ground fault sensing system shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three- phase, four-wire systems.

   c. Ground fault pickup current setting and time delay shall be field adjustable. A switch shall be provided for setting ground fault pickup point. A means to seal the pickup and delay adjustments shall be provided.

   d. The ground fault sensing system shall include a ground fault memory circuit to sum the time increments of intermittent arcing ground faults above the pickup point.

   e. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.

f. Local visual ground fault trip indication shall be provided.

g. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.

C. Electronic Trip Circuit Breakers

1. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on Drawings.

2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80% (or 100% where noted on Drawings) of their ampere rating continuously.

4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

a. Instantaneous Pickup

b. Long Time Pickup

c. Long Time Delay

d. Short Time Pickup

e. Short Time Delay

f. Ground Fault Pickup (when specified with ground fault protection)

g. Ground Fault Delay (when specified with ground fault protection)

5. A means to seal the trip unit adjustments in accordance with CEC/NEC 240-6(b) shall be provided.

6. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

7. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. All current values shall be displayed in true RMS with 2% accuracy.

8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

9. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

10. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in true RMS with 2% accuracy.

11. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.

12. Equipment Ground Fault Protection shall be provided where noted on Drawings.

    a. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three- wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.

    b. A separate neutral current transformer shall be provided for three-phase, four-wire systems.

    c. Ground fault sensing system shall be residual sensing type.

    d. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.

    e. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.

f. Local visual trip indication for a ground fault trip occurrence shall be provided.

g. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.

13. Circuit breaker trip system shall be equipped with an externally accessible test port. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

2.3 INSULATED CASE CIRCUIT BREAKERS

A. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on Drawings.

B. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

C. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.

D. Circuit breakers shall have an RMS interrupting capacity not less than shown on Drawings, or if not shown shall not be less than:

1. 100kA for all frame sizes at 208V

2. 65kA for all 800A - 2,000A frames at 480V

3. 100kA for all 3,000A - 4,000A frames at 480V

E. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.

F. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.

a. Instantaneous Pickup

b. Long Time Pickup

c. Long Time Delay

d. Short Time Pickup

e. Short Time Delay

f. Ground Fault Pickup (when specified with ground fault protection)

g. Ground Fault Delay (when specified with ground fault protection)

G. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short-time withstand ratings shall be specified in RMS symmetrical amperes, as shown on the [drawings] [schedules].

H. A means to seal the rating plug and trip unit adjustments in accordance with CEC/NEC 240-6(b) shall be provided.

I. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

J. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. [Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection]. All current values shall be displayed in True RMS with 2% accuracy.

K. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

L. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

M. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence: CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN

N. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.

O. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.

P. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. [Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection]. All current values shall be displayed in True RMS with 2% accuracy.

Q. All circuit breakers shall be equipped with electrical accessories as noted on Drawings.

R. Provide the following interlocking capabilities:

1. cell door interlock

2. key interlock for main-tie-main

3. lock off

S. Circuit breaker trip system shall be equipped with an externally accessible test port. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

T. Equipment Ground Fault Protection shall be provided where noted on Drawings.

1. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four- wire systems.

2. A separate neutral current transformer shall be provided for three-phase, four-wire systems.

3. Ground fault sensing system shall be residual sensing type.

4. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.

5. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.

6. Local visual trip indication for a ground fault trip occurrence shall be provided.

7. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.

2.4 DRAWOUT INSULATED CASE CIRCUIT BREAKERS

A. Main circuit breaker shall meet the same requirements of insulated case circuit breakers and be individually drawout mounted where shown on Drawings.

B. Sturdy drawout rails shall be permanently attached to the sides of the breaker compartment and retract into the compartment when not in use.

C. When fully withdrawn, the circuit breaker shall permit access for inspection and testing. Circuit breaker(s) shall also be removable from the rails completely.

D. When the circuit breaker is in the Connected, Test, or Disconnected positions, or when the circuit breaker is removed from the compartment, the compartment door shall be able to be fully closed and secured.

E. A removable crank shall be supplied for racking the circuit breaker between the Connected, Test, or Disconnected positions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Notify Engineer no later than 10 working days for adjustable circuit breaker settings not shown within Drawings. Submit to Engineer the following information:

1. Panel, switchboard name/ID

2. Circuit breaker identifier (i.e., main circuit breaker, load served, etc.)

3. List of necessary settings (i.e., trip settings, time delays, etc.)

3.2 INSTALLATION

A. Install equipment and their accessories in to manufacturer’s instructions, pertinent Codes, and with recognized industry practices to insure device operates properly.

B. Tighten electrical connectors and terminals in accordance to manufacturer’s requirements. Where the manufacturer does not have published torque tightening values, comply with the requirements of UL 468.

3.3 FIELD QUALITY CONTROL

A. Check tightness of circuit breaker connections using a calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

B. Obtain the services of an independent testing company who shall provide quality control and adjustments as well as tests for

1. Check each circuit breaker above 100A on a 225A frame for long-time and short-time delay pickup and instantaneous pickup.

    a. Instantaneous pickup current shall be determined by 4 cycles or less.

    b. Perform timing test with 300% of breaker trip unit rated current.

    c. Adjust unit if required, so that the tripping characteristics are within the limits of the published time-current characteristic curves for that particular trip unit.

2. Test and calibrate ground fault protection trip and pickup time on 225A frame breakers and larger.

C. Physically test key interlock systems to check for proper functionality.

D. Check and set where required all protective device settings in accordance with approved coordination study settings and conduct ground fault acceptance tests.

3.4 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Adjust circuit breaker trip and time delay settings to values indicated as instructed by Engineer.

1. Check each circuit breaker above 100A, long-time and short-time delay pickup and instantaneous pickup. Instantaneous pickup current shall be determined by 4 cycles or less. Perform timing test with 300% of breaker trip unit rated current. Adjust unit if required, so that the tripping characteristics are within the limits of the published time-current characteristic curves for that particular trip unit.

2. Main circuit breaker ground fault setting shall be per CEC/NEC 230-95(a) or as directed by Engineer.

3.5 PROTECTION

A. When directed by Engineer provide physical means to “permanently fix” settings for rotary and DIP type switches with a thin coat of clear lacquer.

3.6 CLEANING

A. Remove marks, dirt and debris from installed equipment surfaces for “new like” appearance.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. Pole: Luminaire support structure, including tower used for large area illumination.

F. Standard: Same definition as "Pole" above.

1.3 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide light fixtures as indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USES ONLY" and include specific lamp type.

b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

e. ANSI ballast type (M98, M57, etc.) for HID luminaires.

f. CCT and CRI for all luminaires.

PART 3 - EXECUTION

3.1 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.2 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Do not install grounding electrode for each pole unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Do not install grounding electrode for each pole.

2. Install grounding conductor and conductor protector.

3. Ground metallic components of pole accessories and foundations.

END OF SECTION

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

a. Provide all labor, materials and equipment necessary to complete the installation required for the item specified under this Section, including but not limited to telecommunication system grounding.

B. Related sections

1. Where items specified in other Division 27 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 27 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

2. IEEE –Institute of Electrical and Electronic Engineers

a. 1100; Recommended Practices Powering and Grounding Electronic Equipment

3. NFPA –National Fire Protection Association

a. 780; Lightning Protection Code

4. TIA/EIA – Telecommunications Industry Association/Electronic Industries

Alliance

a. 607; Commercial Building Grounding and Bonding Requirements for Telecommunications

5. UL -Underwriters Laboratories, Inc.

a. 467; Grounding and Bonding Equipment

1.03 SYSTEM DESCRIPTION

A. This Section provides for the grounding and bonding of all electrical and communication apparatus, appliances, components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.

B. Except as otherwise indicated, the complete electrical installation including equipment and metallic raceways, boxes and cabinets shall be completely and effectively grounded in accordance with all Code requirements, whether or not such connections are specifically shown or specified.

C. Provide telecommunication system ground bus bars with each building main telecommunications equipment room or cabinet/rack location. Provide connection between the bus bar and main building reference ground bus, the ground bus of the panelboard serving power to telecommunication equipment, and all telecommunication conduit, cable trays, cable ladders and boxes.

1.04 SUBMITTALS

A. Submit manufacturer’s data for equipment and materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.01 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with 150□C molded plastic insulated throat and lay-in ground lug; OZ/Gedney BLG, Thomas & Betts #TIGB series or equal.

2.02 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPICES

A. Where required by the Drawings, grounding conductors shall be spliced

together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.03 BONDING JUMPERS

A. OZ/Gedney Type BJ, Thomas & Betts #3840 series or equal.

2.04 GROUND CONDUCTOR

A. Ground conductor shall be #6 AWG UL labeled, Type THWN insulated copper wire, green in color.

2.05 TELECOMMUNICATION MAIN GROUNDING BUS BAR (TMGB)

A. Provide grounding bus bar at telecommunication backboards, racks and cabinets of the following type:

1. Backboards 4'X8' and greater, floor mounted telecommunication equipment racks/cabinets larger than 60" height or wall mounted cabinets greater than 36"Wx36"H

    a. Provide 1 13.5"x2"x1/4" TK copper bus bar mounted on wall with insulating stand-offs at +96" AFF. Furnish complete with cast copper alloy body Thomas Betts Series 310 or equal lugs for connecting grounding conductors. Attach lugs to bus with appropriate size bronze bolt, flat washer and Belleville washer. All connections shall be torque, and all holes shall be drilled and tapped for single hole lugs. Provide 4 spare lugs with respective spaces.

2. Backboards less than 4'X8', floor/wall mounted telecommunication equipment racks/cabinet less than 60" or wall mounted cabinets less than 36"Wx36"H

    a. Provide an aluminum loadcenter ground kit with 14 terminals minimum, General Electric TGL2 or equal. A minimum of 3 terminals shall accommodate #6 AWG. Mount within enclosure or on backboard at +96" AFF.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Telecommunication system grounding

1. Bond all telecommunication conduit, cable tray, ladder rack, equipment racks and all other metallic telecommunication infrastructure components

to the nearest TMGB using a #6 AWG conductor.

2. Provide #6 AWG ground within ¾" conduit from each secondary backboard, cabinet, rack, etc. to the BGB.

3. Install #6 AWG grounding conductor in nonmetallic underground raceways containing only fiber optic cable.

4. Provide an engraved nameplate mechanically fastened to wall or enclosure adjacent to each TMGB. Nameplate shall be blue with ¼" high white lettering to read "TMGB-(name of enclosure or building)".

3.02 FIELD QUALITY CONTROL

A. Contractor using test equipment expressly designed for that purpose shall perform all ground resistance tests in conformance with IEEE Standard 1100. Contractor shall submit typewritten records of measured resistance values to Engineer for review and approval prior to energizing the system.

B. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required to comply with the following resistance limits:

1. Resistance from ground bus to ground electrode and to earth shall not exceed 5 ohms unless otherwise noted.

2. Resistance from the farthest panelboard, loadcenter, switchboard or motor control center ground bus to the ground electrode and to earth shall not exceed 20 ohms maximum.

C. Obtain and record ground resistance measurements (DC, 60Hz, 10MHz, 20MHz, 33 MHz, 66MHz and 100MHz) both from each TMGB to the ground electrode and from the ground electrode to earth.

D. Inspection

1. The Engineer or Inspector prior to encasement, burial or concealment thereto shall review the grounding electrode and connections.

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to electrical conduits; outlet, junction and pull boxes; and related supports.

B. Related sections

1. Where items specified in other Division 27 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

a. 27 05 26 – Grounding and Bonding for Electrical Systems

2. The requirements of this Section apply to all Division 27 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute

a. C33.91; Specification for Rigid PVC Conduit

b. C80.1; Specification Rigid Steel Conduit, Zinc-Coated

c. C80.3; Specification for Electrical Metallic Tubing, Zinc-Coated

d. C80.6; Intermediate Metal Conduit (IMC), Zinc-Coated

2. CCR –California Code of Regulations, Title 24

a. Part 2 -California Building Code (CBC); International Building Code (IBC) with California amendments

b. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. NECA –National Electrical Contractors Association

a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT)

b. 111, Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)

4. NEMA –National Electrical Manufacturer's Association

a. FB 1; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

b. FB 2.10; Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)

c. FB 2.20; Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable

d. OS 1; Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

e. OS 3; Selection and Installation Guidelines for Electrical Outlet Boxes

f. RN 1; Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.

g. TC 2; Electrical Plastic Tubing and Conduit

h. TC 3; PVC Fittings for Use with Rigid PVC Conduit and Tubing

i. TC 14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

5. OSHPD Anchorage Pre-approvals

a. OPA-0003; Superstrut Seismic Restraint System

b. OPA-0114; B-Line Seismic Restraints

c. OPA-0120; Unistrut Seismic Bracing System

d. OPA-0242; Power-Strut Seismic Bracing System

6. UL –Underwriter's Laboratories, Inc.

a. 1; Standard for Flexible Metal Conduit

b. 6; Rigid Metal Electrical Conduit

c. 360; Standard for Liquid-Tight Flexible Steel Conduit

d. 514A; Metallic Outlet Boxes, Electrical

e. 514B; Fittings for Conduit and Outlet Boxes

f. 651; Schedule 40 & 80 PVC Conduit

g. 797; Electrical Metallic Tubing

h. 1242; Intermediate Metal Conduit

i. 1684; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.3 SYSTEM DESCRIPTION

A. Furnish, assemble, erect, install, connect and test all electrical conduits and related raceway apparatus required and specified to form a complete installation.

1.4 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the NECA installation guidelines unless otherwise indicated within this Section

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits and Fittings

1. Rigid steel conduit (RMC)

a. Conduit: Standard weight, mild steel pipe, and zinc coated on both inside and outside by a hot dipping or shearardizing process manufactured in accordance with UL 6 and ANSI C80.1 specifications.

b. Fittings (couplings, elbows, bends, etc.)

1) Shall be steel or malleable iron.

2) Coupling and unions shall be threaded type, assembled with anti-corrosion, conductive and anti-seize compound at joints made absolutely tight to exclude water.

c. Bushings

1) Insulating bushings: Threaded polypropylene or thermosetting phenolic rated at 150□C minimum.

2) Insulating grounding bushing: Threaded cast body with insulating throat and steel “lay-in” ground lug.

3) Insulating metallic bushing: Threaded cast body with plastic insulated throat rated at 150□C minimum.

2. Coated rigid steel conduit (CRMC)

a. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant. The coating thickness shall be a minimum of 40mil.

b. Fittings (couplings, elbows, bends, etc.)

1) Equivalent to RMC above with bonded coating same as conduit.

2) The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter or 1 1/2” whichever is smaller.

c. Bushing equivalent to RMC above.

3. Intermediate metallic conduit(IMC)

a. Conduit: Intermediate weight, mild steel pipe, meeting the same

requirements for finish and material as rigid steel conduit manufactured in accordance with UL 1242 and ANSI C80.6 specifications.

b. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.

c. Bushing equivalent to RMC above.

4. Electrical metallic tubing (EMT)

   a. Conduit: Cold rolled steel tubing with zinc coating on outside and protective enamel on inside manufactured in accordance with UL 797 and ANSI C80.3 specifications.

   b. Couplings: Steel or malleable iron with compression type fastener via a nut.

   c. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

5. Rigid non-metallic conduit (PVC)

   a. Conduit: PVC composed Schedule 40, 90□C manufactured in accordance with NEMA TC 2 and UL 651 specifications.

   b. Fittings: Molded PVC, slip on solvent welded type in accordance to NEMA TC 3.

6. Reinforced thermosetting resin conduit (RTRC)

   a. Conduit: Fiber impregnated with a cured thermosetting resin compound in accordance with NEMA TC 14 and UL1684.

   b. Fittings: Molded resin with glass reinforcement manufactured in the same process as the conduit bonded with an epoxy adhesive.

7. Flexible metallic conduit (FMC)

   a. Conduit: Continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 1.

   b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

8. Liquidtight flexible metallic conduit (LFMC)

   a. Conduit: PVC coated, continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 360.

b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

9. Miscellaneous Fittings and Products

a. Conduit sealing bushings: Steel or cast malleable iron body and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Supplied with neoprene sealing rings between body and PVC sleeve.

b. Watertight cable terminators: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel screws and zinc plated cast iron locking collar.

c. Watertight cable/cord connectors: Liquidtight steel or cast malleable iron body with sealing neoprene bushing and stainless steel retaining ring.

d. Expansion fittings: Multi-piece unit of hot dip galvanized malleable iron or steel body and outside pressure bussing design to allow a maximum of 4” movement (2” in either direction). Furnish with external braid tinned copper bonding jumper. UL listed for both wet and dry locations.

e. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve, internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling to provide minimum of 3/4” movement and 30 degrees deflection from normal. UL listed for both wet and dry locations.

f. Conduit bodies: Raintight, malleable iron, hot-dip galvanized body with threaded hubs, stamped steel cover, stainless steel screws and neoprene gasket.

g. Other couplings, connectors and fittings shall be equal in quality, material and construction to items specified herein.

B. Boxes

1. Outlet boxes

a. Standard: Galvanized one-piece of welded pressed steel type in accordance with NEMA OS 1 and UL 514. Boxes shall not be less than 4” square and at least 1 1/2” deep.

b. Concrete: Galvanized steel, 4” octagon ring with mounting lug, backplate and adapter ring type in accordance with NEMA OS 1 and UL 514. Depth as required by application.

c. Masonry: Galvanized steel, 3.75” high gang box in accordance with NEMA OS 1 and UL 514.

d. Surface cast metal: Cast malleable iron body, surface mounted box with threaded hubs and mounting lugs as required in accordance with NEMA OS 1 and UL 514. Furnish with ground flange, steel cover and neoprene gasket.

2. Pull and junction boxes

a. Sheet metal boxes: Standard or concrete outlet box wherever possible; otherwise use 16 gauge galvanized sheet metal, NEMA 1 box sized per CEC with machine screwed cover.

b. Cast metal boxes: Install standard cast malleable iron outlet or device box when possible.

c. Flush mounted boxes: Install overlapping cover with flush head screws.

d. In-ground mounted pull holes/boxes: Install pre-cast concrete box, sized per Drawing or CEC with pre-cast or traffic rated lid.

3. Floor boxes

a. Floor boxes shall be adjustable, cast metal body with threaded conduit openings, adjustable rings, brass flange or Lexan ring and cover plate with threaded plug. Include provisions to accommodate surface mounted telephone or receptacle outlet, or flush floor mounted telephone or receptacle outlet where shown on Drawings.

C. Pull line/cord

1. Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification

tolerances. Do not commence with work until all conditions are made satisfactory.

3.2 PREPARATION

A. Conduit

1. Provide all necessary conduit fittings, connectors, bushings, etc. required to complete conduit installation to meet the CEC/NEC and intended application whether noted, shown or specified within.
2. Location of conduit runs shall be planned in advance of the installation and coordinated with other trades.
3. Where practical, install conduits in groups in parallel vertical or horizontal runs that avoid unnecessary offsets.
4. All conduits shall be parallel or at right angles to columns, beams and walls whether exposed or concealed.
5. Conduits shall not be placed closer than 12” to a flue, parallel to hot water, steam line or other heat sources; or 3” when crossing perpendicular to the above said lines when possible.
6. Install exposed conduit as high as practical to maintain adequate headroom. Notify Engineer if headroom will be less than 102”.
7. Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.
8. The largest trade size conduit in concrete floors and walls shall not exceed 1/3 thickness or be spaced a less than three conduit diameters apart unless permitted by Engineer. All conduits shall be installed in the center of slab or wall, and never between reinforcing steel and bottom of floor slab.
9. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.
10. When installing underground conduits to specified depth; depth shall be taken from finished grade as it will be at project completion. Should finish grade be above existing grade by an amount equal to or greater than specified depth, conduit shall be installed not less than 6” below existing grade.
11. Verify that information concerning finish grade is accurate, for should the

underground run be less than the specified depth, Contractor may be required to re-install conduit to meet the required depth.

12. Unless otherwise specified, underground conduits shall be installed with top side not less than 24” below finished grade; this depth applies to all conduits outside of building foundations including those under walks, open corridors or paved areas.

13. Utility company service conduits installation depth shall be as directed by their respective specifications and requirements.

B. Boxes

1. Before locating outlet boxes, check Construction Documents for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment.

2. Install all outlet boxes flush within walls, ceiling and floors except where installed within non-finished rooms, cabinetry, attic spaces or as indicated on Drawings.

3. Locate pull boxes and junction boxes within concealed, accessible locations where possible.

4. Do not install outlet boxes back-to-back with same stud space. Where shown back-to-back, offset as required, and fill void with sound dampening material where requested by Owner.

5. In fire rated walls separate boxes by 24” minimum and with stud member.

6. Adjust position of outlet boxes within masonry wall to accommodate course lines.

3.3 INSTALLATION

A. Conduit

1. Minimum conduit size shall be 3/4” unless otherwise indicated.

2. All conduit work shall be concealed unless otherwise indicated. Exposed conduits shall be permitted within unfinished rooms/spaces to facilitate installation.

3. Install conduit in complete runs prior to installing conductors or cables.

4. Make long radius conduits bends free from kink, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends 1 1/4" size and larger shall be factory made ells, or be made with a manufactured mechanical bender. Heating of steel conduit to facilitate bending or that damage galvanized coating will not be permitted.

5. Remove burrs and sharp edges at end of conduit with tapered reamer.

6. Protect and cover conduits during construction with metallic bushings and bushing "pennies" to seal exposed openings.

7. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten securely.

8. Install conduits shall that no traps to collect condensation exist.

9. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity.

10. Install pull cords/line within any spare or unused conduits of sufficient length to facilitate future cable installation.

11. Penetrations

    a. Locate penetrations within structural members as shown on Drawings and as directed by Architect or Engineer. Should it be necessary to notch any framing member, make such notching only at locations and in a manner as approved by Engineer.

    b. Do not chase concrete or masonry to install conduit unless specifically approved by Engineer.

    c. Cutting or holes

        1) Install sleeves for cast-in-place concrete floors and walls. After installing conduit through penetration, seal using dry-pack grouting compound (non-iron bearing, chloride free and non- shrinking) or fire rated assembly if rated floor or wall. Use escutcheon plate on floor underside to contain compound as necessary.

        2) Cut holes with a hole saw for penetrations through non-concrete or non-masonry members.

        3) Provide chrome plated escutcheon plates at all publicly exposed wall, ceiling and floor penetrations.

d. Sealing

1) Non-rated penetration openings shall be packed with non-flammable insulating material and sealed with gypsum wallboard taping compound.

2) Fire rated penetration shall be sealed using a UL classified fire stop assembly suitable to maintain the equivalent fire rating prior to the penetration.

3) Use escutcheon plates to hold sealing or fire rated compound as necessary.

e. Waterproofing

1) Make penetrations through any damp-proofed/waterproofed surfaces within damp/wet locations as such as to maintain integrity of surface.

2) Install specified watertight conduit entrance seals at all below grade wall and floor penetrations.

3) At roof penetrations furnish roof flashing, counter flashing and pitch-pockets compatible to roof assembly.

4) Where possible conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration’s exterior side.

5) Make penetrations through floors watertight with mastic, even when concealed within walls or furred spaces.

12. Supports

a. Conduits shall be support and braced per OSHPD pre-approved anchorage systems when those methods are implemented and installed.

b. Sizes of rods and cross channels shall be capable of supporting 4 times and 5 times actual load, respectively. Anchorage shall support the combined weight of conduit, hanger and conductors.

c. Support individual horizontal conduit 1 1/2” and smaller by means of 2 hole straps or individual hangers.

d. Galvanized iron hanger rods sizes 1/4” diameter and larger with spring steel fasteners, clips or clamps specifically design for that purpose for 1 1/2” conduits and larger.

e. Support multi-parallel horizontal conduits runs with trapeze type hangers consisting of 2 or more steel hanger rods, preformed cross channels, ‘J’ bolts, clamps, etc.

f. Support conduit to wood structures by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduits runs with galvanized Unistrut, Power-Strut or approved equal type supports anchored to wall. Where multi-floored conduits pass through floors, install riser clamps at each floor.

h. Maximum conduit support spacing shall be in accordance with NECA Standard of Installation:

1) Horizontal runs:

a) 3/4” and smaller at 60” on centers, unless building construction prohibits otherwise, then 84” on centers.

b) 1” and larger at 72” on centers, unless building construction prohibits otherwise or any other condition, then 120” on centers.

2) Vertical runs:

a) 3/4” and smaller @ 84” on centers.

b) 1” and 1 1/4” @ 96” on centers.

c) 1 1/2” and larger @ 120” on centers.

d) Any vertical condition such as shaftways and concealed locations for any sized conduit, 120” on centers.

i. Anchorage for RMC/IMC supports unless otherwise specified:

1) < 1” IMC/RMC = #10 bolt/screw.

2) 1” IMC/RMC = 1/4” bolt/screw.

3) 1 1/2” and 2” IMC/RMC = 3/8” bolt/screw.

4) 3” IMC/RMC, 4” EMT = 1/2” bolt/screw.

5) > 3” IMC/RMC = 5/8” bolt/screw.

j. Anchorage for EMT supports unless otherwise specified:

1) < 1 1/2” EMT = #10 bolt/screw.

2) 1 1/2” EMT = 1/4” bolt/screw.

3) 2, 2 1/2” and 3” EMT = 3/8” bolt/screw.

4) 4” EMT = 1/2” bolt/screw.

5) > 4” EMT = 5/8” bolt/screw.

B. Boxes

1. Install boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

2. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.

3. Install plaster rings on all outlet boxes in stud walls or in furred, suspended or exposed ceilings. Covers shall be of a depth suited for installation.

4. Provide gasketed cast metal cover plates where boxes are exposed in damp or wet locations

5. Install access door for boxes installed within concealed locations without access.

6. Install approved factory made knockout seal where knockouts are not present.

7. Refer to Architectural interior elevations and details shown for exact mounting heights of all electrical outlets. In general, locate outlets as shown or specific and complies with Americans with Disabilities Act:

a. Convenience outlets: +18”AFF or +6” above counter or splash.

b. Local switches: +48”AFF or +6” above counter or splash.

c. Telecommunication outlets: +18”AFF or +48”AFF for wall telephone or intercom device.

d. Verify all mounting heights with Architectural Drawings, and where heights are not suited for construction or finish please consult Engineer or Architect.

8. Use conduit bodies to facilitate pulling of conductor or cables or change conduit direction. Do not splice within conduit bodies.

9. Enclose pull box with additional rated gypsum board as necessary to maintain wall’s original fire rating.

10. Install galvanized steel coverplates on all open boxes within dry listed areas.

11. Install in-ground pull holes/boxes flush to grade finish at finished areas or 1” above finished landscaped grade. Seal all conduits terminating in pull hole/box watertight. Install and grout around bell ends where shown. Cover and lids shall be removable without damage to adjacent finish surfaces.

12. Support

a. Accurately place boxes for finish, independently and securely supported by adequate blocking or manufacturer channel type heavy-duty box hangers for stud walls. Do not use nails to support boxes.

b. Support boxes independent of conduit system.

c. Mount boxes installed within ceilings to 16 gauge metal channel bars attached to main runners or joists.

d. Support boxes within suspended acoustical tile ceilings directly from structure above when light fixture are to be installed from box.

e. Use auxiliary plates, bar or clips and grouted in place for masonry, block or pour-in-place concrete construction.

3.4 APPLICATION

A. Conduit

1. RMC/IMC suitable for all damp, dry and wet locations except when in contact with earth. IMC not suitable for hazardous locations as stated within

CEC/NEC.

2. CRMC suitable for damp or wet locations, concealed within concrete or in contact with earth.

3. EMT suitable for exposed or concealed dry, interior locations.

4. PVC/RTRC suitable for beneath ground floor slab, except when penetrating, and direct earth burial. Do not run exposed within concrete walls or in floor slab unless indicated on Drawings or per Engineer's permission.

5. FMC suitable for dry locations only for connections to motors, transformers, vibrating equipment/machinery, controllers, valves, switches and light fixtures in less than 6 foot lengths.

6. LFMC application same as FMC above but for damp or wet locations.

B. Termination and joints

1. Use raceway fittings compatible with associated raceway and suitable for the location.

2. Raceways shall be joined using specified couplings or transitions where dissimilar raceway systems are joined.

3. Conduits shall be securely fastened to cabinets, boxes and gutters using (2) two locknuts and insulating bushing or specified insulated connector. Where joints cannot be made tight and terminations are subject to vibration, use bonding jumpers, bonding bushings or wedges to provide electrical continuity of the raceway system. Use insulating bushings to protect conductors where subjected to vibration or dampness. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

4. Terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

5. Stub freestanding equipment conduits through concrete floors for connections with top of coupling set flush with finished floor. Install plugs to protect threads and entrance of debris.

6. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating within interior switchboard, panel, cabinet or gutters. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.

7. Where conduits enter building from below grade inject into filled raceways pre-formulated rigid 2 lbs. density polyurethane foam suitable for sealing against water, moisture, insects and rodents.

8. Install expansion fitting or expansion/deflection couplings per manufacturer's recommendations where:

   a. Any conduit that crosses a building structure expansion joint; secure conduit on both sides to building structure and install expansion fitting at joint.

   b. Any conduit that crosses a concrete expansion joint; install expansion/deflection at joint.

   c. Any conduit greater than 1-1/4" is routed along roof top in runs greater than 100 feet; install expansion fittings every 100 feet.

   d. Engineer may allow FMC or LFMC in lieu of expansion fitting or expansion/deflection couplings on conduits 2" and smaller within accessible locations upon further review and written consent.

C. Boxes

1. Standard type suitable for all flush installations and all dry concealed locations.

2. Concrete type suitable for all flush concrete installations.

3. Masonry type suitable for all flush concrete and block installations.

4. Surface cast meta type suitable for all exposed damp and wet surface mounted locations, and dry surface mounted locations less than 96" from finished floor

END OF SECTION

SECTION 28 05 26

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1-GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the item specified under this Section, including but not limited to telecommunication system grounding.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24

a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

2. IEEE –Institute of Electrical and Electronic Engineers

a. 1100; Recommended Practices Powering and Grounding Electronic Equipment

3. NFPA –National Fire Protection Association

a. 780; Lightning Protection Code

4. TIA/EIA – Telecommunications Industry Association/Electronic Industries

Alliance

a. 607; Commercial Building Grounding and Bonding Requirements for Telecommunications

5. UL -Underwriters Laboratories, Inc.

a. 467; Grounding and Bonding Equipment

1.03 SYSTEM DESCRIPTION

A. This Section provides for the grounding and bonding of all electrical and communication apparatus, appliances, components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.

B. Except as otherwise indicated, the complete electrical installation including equipment and metallic raceways, boxes and cabinets shall be completely and effectively grounded in accordance with all Code requirements, whether or not such connections are specifically shown or specified.

C. Provide telecommunication system ground bus bars with each building main telecommunications equipment room or cabinet/rack location. Provide connection between the bus bar and main building reference ground bus, the ground bus of the panelboard serving power to telecommunication equipment, and all telecommunication conduit, cable trays, cable ladders and boxes.

1.04 SUBMITTALS

A. Submit manufacturer’s data for equipment and materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.01 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with 150□C molded plastic insulated throat and lay-in ground lug; OZ/Gedney BLG, Thomas & Betts #TIGB series or equal.

2.02 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPICES

A. Where required by the Drawings, grounding conductors shall be spliced

together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.03 BONDING JUMPERS

A. OZ/Gedney Type BJ, Thomas & Betts #3840 series or equal.

2.04 GROUND CONDUCTOR

A. Ground conductor shall be #6 AWG UL labeled, Type THWN insulated copper wire, green in color.

2.05 TELECOMMUNICATION MAIN GROUNDING BUS BAR (TMGB)

A. Provide grounding bus bar at telecommunication backboards, racks and cabinets of the following type:

1. Backboards 4’X8’ and greater, floor mounted telecommunication equipment racks/cabinets larger than 60” height or wall mounted cabinets greater than 36”Wx36”H

a. Provide 1 13.5”x2”x1/4” TK copper bus bar mounted on wall with insulating stand-offs at +96” AFF. Furnish complete with cast copper alloy body Thomas Betts Series 310 or equal lugs for connecting grounding conductors. Attach lugs to bus with appropriate size bronze bolt, flat washer and Belleville washer. All connections shall be torque, and all holes shall be drilled and tapped for single hole lugs. Provide 4 spare lugs with respective spaces.

2. Backboards less than 4’X8’, floor/wall mounted telecommunication equipment racks/cabinet less than 60” or wall mounted cabinets less than 36”Wx36”H

a. Provide an aluminum loadcenter ground kit with 14 terminals minimum, General Electric TGL2 or equal. A minimum of 3 terminals shall accommodate #6 AWG. Mount within enclosure or on backboard at +96” AFF.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Telecommunication system grounding

1. Bond all telecommunication conduit, cable tray, ladder rack, equipment racks and all other metallic telecommunication infrastructure components

to the nearest TMGB using a #6 AWG conductor.

2. Provide #6 AWG ground within ¾" conduit from each secondary backboard, cabinet, rack, etc. to the BGB.

3. Install #6 AWG grounding conductor in nonmetallic underground raceways containing only fiber optic cable.

4. Provide an engraved nameplate mechanically fastened to wall or enclosure adjacent to each TMGB. Nameplate shall be blue with ¼" high white lettering to read "TMGB-(name of enclosure or building)".

3.02 FIELD QUALITY CONTROL

A. Contractor using test equipment expressly designed for that purpose shall perform all ground resistance tests in conformance with IEEE Standard 1100. Contractor shall submit typewritten records of measured resistance values to Engineer for review and approval prior to energizing the system.

B. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required to comply with the following resistance limits:

1. Resistance from ground bus to ground electrode and to earth shall not exceed 5 ohms unless otherwise noted.

2. Resistance from the farthest panelboard, loadcenter, switchboard or motor control center ground bus to the ground electrode and to earth shall not exceed 20 ohms maximum.

C. Obtain and record ground resistance measurements (DC, 60Hz, 10MHz, 20MHz, 33 MHz, 66MHz and 100MHz) both from each TMGB to the ground electrode and from the ground electrode to earth.

D. Inspection

1. The Engineer or Inspector prior to encasement, burial or concealment thereto shall review the grounding electrode and connections.

END OF SECTION

SECTION 28 05 33

PATHWAY FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to electrical conduits; outlet, junction and pull boxes; and related supports.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

   a. 26 05 26 – Grounding and Bonding for Electrical Systems

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute

   a. C33.91; Specification for Rigid PVC Conduit

   b. C80.1; Specification Rigid Steel Conduit, Zinc-Coated

   c. C80.3; Specification for Electrical Metallic Tubing, Zinc-Coated

   d. C80.6; Intermediate Metal Conduit (IMC), Zinc-Coated

2. CCR –California Code of Regulations, Title 24

   a. Part 2 -California Building Code (CBC); International Building Code (IBC)

with California amendments

b. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. NECA –National Electrical Contractors Association

   a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT)

   b. 111, Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)

4. NEMA –National Electrical Manufacturer's Association

   a. FB 1; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

   b. FB 2.10; Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)

   c. FB 2.20; Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable

   d. OS 1; Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

   e. OS 3; Selection and Installation Guidelines for Electrical Outlet Boxes

   f. RN 1; Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing

   g. TC 2; Electrical Plastic Tubing and Conduit

   h. TC 3; PVC Fittings for Use with Rigid PVC Conduit and Tubing

   i. TC 14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

5. OSHPD Anchorage Pre-approvals

   a. OPA-0003; Superstrut Seismic Restraint System

   b. OPA-0114; B-Line Seismic Restraints

   c. OPA-0120; Unistrut Seismic Bracing System

   d. OPA-0242; Power-Strut Seismic Bracing System

6. UL –Underwriter's Laboratories, Inc.

   a. 1; Standard for Flexible Metal Conduit

   b. 6; Rigid Metal Electrical Conduit

   c. 360; Standard for Liquid-Tight Flexible Steel Conduit

   d. 514A; Metallic Outlet Boxes, Electrical

   e. 514B; Fittings for Conduit and Outlet Boxes

   f. 651; Schedule 40 & 80 PVC Conduit

   g. 797; Electrical Metallic Tubing

   h. 1242; Intermediate Metal Conduit

   i. 1684; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.3 SYSTEM DESCRIPTION

A. Furnish, assemble, erect, install, connect and test all electrical conduits and related raceway apparatus required and specified to form a complete installation.

1.4 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the NECA installation guidelines unless otherwise indicated within this Section

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits and Fittings

   1. Rigid steel conduit (RMC)

a. Conduit: Standard weight, mild steel pipe, and zinc coated on both inside and outside by a hot dipping or shearardizing process manufactured in accordance with UL 6 and ANSI C80.1 specifications.

b. Fittings (couplings, elbows, bends, etc.)

1) Shall be steel or malleable iron.

2) Coupling and unions shall be threaded type, assembled with anti-corrosion, conductive and anti-seize compound at joints made absolutely tight to exclude water.

c. Bushings

1) Insulating bushings: Threaded polypropylene or thermosetting phenolic rated at 150□C minimum.

2) Insulating grounding bushing: Threaded cast body with insulating throat and steel “lay- in” ground lug.

3) Insulating metallic bushing: Threaded cast body with plastic insulated throat rated at 150□C minimum.

2. Coated rigid steel conduit (CRMC)

a. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant. The coating thickness shall be a minimum of 40mil.

b. Fittings (couplings, elbows, bends, etc.)

1) Equivalent to RMC above with bonded coating same as conduit.

2) The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter or 1 1/2” whichever is smaller.

c. Bushing equivalent to RMC above.

3. Intermediate metallic conduit(IMC)

a. Conduit: Intermediate weight, mild steel pipe, meeting the same requirements for finish and material as rigid steel conduit manufactured in accordance with UL 1242 and ANSI C80.6 specifications.

b. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.

c. Bushing equivalent to RMC above.

4. Electrical metallic tubing (EMT)

   a. Conduit: Cold rolled steel tubing with zinc coating on outside and protective enamel on inside manufactured in accordance with UL 797 and ANSI C80.3 specifications.

   b. Couplings: Steel or malleable iron with compression type fastener via a nut.

   c. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

5. Rigid non-metallic conduit (PVC)

   a. Conduit: PVC composed Schedule 40, 90□C manufactured in accordance with NEMA TC 2 and UL 651 specifications.

   b. Fittings: Molded PVC, slip on solvent welded type in accordance to NEMA TC 3.

6. Reinforced thermosetting resin conduit (RTRC)

   a. Conduit: Fiber impregnated with a cured thermosetting resin compound in accordance with NEMA TC 14 and UL1684.

   b. Fittings: Molded resin with glass reinforcement manufactured in the same process as the conduit bonded with an epoxy adhesive.

7. Flexible metallic conduit (FMC)

   a. Conduit: Continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 1.

   b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

8. Liquidtight flexible metallic conduit (LFMC)

   a. Conduit: PVC coated, continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 360.

   b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150□C minimum.

9. Miscellaneous Fittings and Products

a. Conduit sealing bushings: Steel or cast malleable iron body and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Supplied with neoprene sealing rings between body and PVC sleeve.

b. Watertight cable terminators: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel screws and zinc plated cast iron locking collar.

c. Watertight cable/cord connectors: Liquidtight steel or cast malleable iron body with sealing neoprene bushing and stainless steel retaining ring.

d. Expansion fittings: Multi-piece unit of hot dip galvanized malleable iron or steel body and outside pressure bussing design to allow a maximum of 4" movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. UL listed for both wet and dry locations.

e. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve, internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling to provide minimum of 3/4" movement and 30 degrees deflection from normal. UL listed for both wet and dry locations.

f. Conduit bodies: Raintight, malleable iron, hot-dip galvanized body with threaded hubs, stamped steel cover, stainless steel screws and neoprene gasket.

g. Other couplings, connectors and fittings shall be equal in quality, material and construction to items specified herein.

B. Boxes

1. Outlet boxes

a. Standard: Galvanized one-piece of welded pressed steel type in accordance with NEMA OS 1 and UL 514. Boxes shall not be less than 4" square and at least 1 1/2" deep.

b. Concrete: Galvanized steel, 4" octagon ring with mounting lug, backplate and adapter ring type in accordance with NEMA OS 1 and UL 514. Depth as required by application.

c. Masonry: Galvanized steel, 3.75" high gang box in accordance with NEMA OS 1 and UL 514.

d. Surface cast metal: Cast malleable iron body, surface mounted box with

threaded hubs and mounting lugs as required in accordance with NEMA OS 1 and UL 514. Furnish with ground flange, steel cover and neoprene gasket.

2. Pull and junction boxes

   a. Sheet metal boxes: Standard or concrete outlet box wherever possible; otherwise use 16 gauge galvanized sheet metal, NEMA 1 box sized per CEC with machine screwed cover.

   b. Cast metal boxes: Install standard cast malleable iron outlet or device box when possible.

   c. Flush mounted boxes: Install overlapping cover with flush head screws.

   d. In-ground mounted pull holes/boxes: Install pre-cast concrete box, sized per Drawing or CEC with pre-cast or traffic rated lid.

3. Floor boxes

   a. Floor boxes shall be adjustable, cast metal body with threaded conduit openings, adjustable rings, brass flange or Lexan ring and cover plate with threaded plug. Include provisions to accommodate surface mounted telephone or receptacle outlet, or flush floor mounted telephone or receptacle outlet where shown on Drawings.

C. Pull line/cord

1. Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.2 PREPARATION

A. Conduit

1. Provide all necessary conduit fittings, connectors, bushings, etc. required to complete conduit installation to meet the CEC/NEC and intended application whether noted, shown or specified within.

2. Location of conduit runs shall be planned in advance of the installation and

coordinated with other trades.

3. Where practical, install conduits in groups in parallel vertical or horizontal runs that avoid unnecessary offsets.

4. All conduits shall be parallel or at right angles to columns, beams and walls whether exposed or concealed.

5. Conduits shall not be placed closer than 12” to a flue, parallel to hot water, steam line or other heat sources; or 3” when crossing perpendicular to the above said lines when possible.

6. Install exposed conduit as high as practical to maintain adequate headroom. Notify Engineer if headroom will be less than 102”.

7. Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.

8. The largest trade size conduit in concrete floors and walls shall not exceed 1/3 thickness or be spaced a less than three conduit diameters apart unless permitted by Engineer. All conduits shall be installed in the center of slab or wall, and never between reinforcing steel and bottom of floor slab.

9. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.

10. When installing underground conduits to specified depth; depth shall be taken from finished grade as it will be at project completion. Should finish grade be above existing grade by an amount equal to or greater than specified depth, conduit shall be installed not less than 6” below existing grade.

11. Verify that information concerning finish grade is accurate, for should the underground run be less than the specified depth, Contractor may be required to re-install conduit to meet the required depth.

12. Unless otherwise specified, underground conduits shall be installed with top side not less than 24” below finished grade; this depth applies to all conduits outside of building foundations including those under walks, open corridors or paved areas.

13. Utility company service conduits installation depth shall be as directed by their respective specifications and requirements.

B. Boxes

1. Before locating outlet boxes, check Construction Documents for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment.

2. Install all outlet boxes flush within walls, ceiling and floors except where installed within non- finished rooms, cabinetry, attic spaces or as indicated on Drawings.

3. Locate pull boxes and junction boxes within concealed, accessible locations where possible.

4. Do not install outlet boxes back-to-back with same stud space. Where shown back-to-back, offset as required, and fill void with sound dampening material where requested by Owner.

5. In fire rated walls separate boxes by 24” minimum and with stud member.

6. Adjust position of outlet boxes within masonry wall to accommodate course lines.

3.3 INSTALLATION

A. Conduit

1. Minimum conduit size shall be 3/4” unless otherwise indicated.

2. All conduit work shall be concealed unless otherwise indicated. Exposed conduits shall be permitted within unfinished rooms/spaces to facilitate installation.

3. Install conduit in complete runs prior to installing conductors or cables.

4. Make long radius conduits bends free from kink, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends 1 1/4” size and larger shall be factory made ells, or be made with a manufactured mechanical bender. Heating of steel conduit to facilitate bending or that damage galvanized coating will not be permitted.

5. Remove burrs and sharp edges at end of conduit with tapered reamer.

6. Protect and cover conduits during construction with metallic bushings and bushing “pennies” to seal exposed openings.

7. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten securely.

8. Install conduits shall that no traps to collect condensation exist.

9. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity.

10. Install pull cords/line within any spare or unused conduits of sufficient length to facilitate future cable installation.

11. Penetrations

    a. Locate penetrations within structural members as shown on Drawings and as directed by Architect or Engineer. Should it be necessary to notch any framing member, make such notching only at locations and in a manner as approved by Engineer.

    b. Do not chase concrete or masonry to install conduit unless specifically approved by Engineer.

    c. Cutting or holes

        1) Install sleeves for cast-in-place concrete floors and walls. After installing conduit through penetration, seal using dry-pack grouting compound (non-iron bearing, chloride free and non-shrinking) or fire rated assembly if rated floor or wall. Use escutcheon plate on floor underside to contain compound as necessary.

        2) Cut holes with a hole saw for penetrations through non-concrete or non-masonry members.

        3) Provide chrome plated escutcheon plates at all publicly exposed wall, ceiling and floor penetrations.

    d. Sealing

        1) Non-rated penetration openings shall be packed with non-flammable insulating material and sealed with gypsum wallboard taping compound.

        2) Fire rated penetration shall be sealed using a UL classified fire stop assembly suitable to maintain the equivalent fire rating prior to the penetration.

        3) Use escutcheon plates to hold sealing or fire rated compound as necessary.

    e. Waterproofing

1) Make penetrations through any damp-proofed/waterproofed surfaces within damp/wet locations as such as to maintain integrity of surface.

2) Install specified watertight conduit entrance seals at all below grade wall and floor penetrations.

3) At roof penetrations furnish roof flashing, counter flashing and pitch-pockets compatible to roof assembly.

4) Where possible conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration's exterior side.

5) Make penetrations through floors watertight with mastic, even when concealed within walls or furred spaces.

12. Supports

a. Conduits shall be support and braced per OSHPD pre-approved anchorage systems when those methods are implemented and installed.

b. Sizes of rods and cross channels shall be capable of supporting 4 times and 5 times actual load, respectively. Anchorage shall support the combined weight of conduit, hanger and conductors.

c. Support individual horizontal conduit 1 1/2" and smaller by means of 2 hole straps or individual hangers.

d. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically design for that purpose for 1 1/2" conduits and larger.

e. Support multi-parallel horizontal conduits runs with trapeze type hangers consisting of 2 or more steel hanger rods, preformed cross channels, 'J' bolts, clamps, etc.

f. Support conduit to wood structures by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduits runs with galvanized Unistrut, Power-Strut or approved equal type supports anchored to wall. Where multi-floored conduits pass through floors, install riser clamps at each floor.

h. Maximum conduit support spacing shall be in accordance with NECA Standard of Installation:

1) Horizontal runs:

a) 3/4” and smaller at 60” on centers, unless building construction prohibits otherwise, then 84” on centers.

b) 1” and larger at 72” on centers, unless building construction prohibits otherwise or any other condition, then 120” on centers.

2) Vertical runs:

a) 3/4” and smaller @ 84” on centers.

b) 1” and 1 1/4” @ 96” on centers.

c) 1 1/2” and larger @ 120” on centers.

d) Any vertical condition such as shaftways and concealed locations for any sized conduit, 120” on centers.

i. Anchorage for RMC/IMC supports unless otherwise specified:

1) < 1” IMC/RMC = #10 bolt/screw.

2) 1” IMC/RMC = 1/4” bolt/screw.

3) 1 1/2” and 2” IMC/RMC = 3/8” bolt/screw.

4) 3” IMC/RMC, 4” EMT = 1/2” bolt/screw.

5) > 3” IMC/RMC = 5/8” bolt/screw.

j. Anchorage for EMT supports unless otherwise specified:

1) < 1 1/2” EMT = #10 bolt/screw.

2) 1 1/2” EMT = 1/4” bolt/screw.

3) 2, 2 1/2” and 3” EMT = 3/8” bolt/screw.

4) 4” EMT = 1/2” bolt/screw.

5) > 4” EMT = 5/8” bolt/screw.

B. Boxes

1. Install boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

2. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.

3. Install plaster rings on all outlet boxes in stud walls or in furred, suspended or exposed ceilings. Covers shall be of a depth suited for installation.

4. Provide gasketed cast metal cover plates where boxes are exposed in damp or wet locations

5. Install access door for boxes installed within concealed locations without access.

6. Install approved factory made knockout seal where knockouts are not present.

7. Refer to Architectural interior elevations and details shown for exact mounting heights of all electrical outlets. In general, locate outlets as shown or specific and complies with Americans with Disabilities Act:

   a. Convenience outlets: +18”AFF or +6” above counter or splash.

   b. Local switches: +48”AFF or +6” above counter or splash.

   c. Telecommunication outlets: +18”AFF or +48”AFF for wall telephone or intercom device.

   d. Verify all mounting heights with Architectural Drawings, and where heights are not suited for construction or finish please consult Engineer or Architect.

8. Use conduit bodies to facilitate pulling of conductor or cables or change conduit direction. Do not splice within conduit bodies.

9. Enclose pull box with additional rated gypsum board as necessary to maintain wall’s original fire rating.

10. Install galvanized steel coverplates on all open boxes within dry listed areas.

11. Install in-ground pull holes/boxes flush to grade finish at finished areas or 1” above finished landscaped grade. Seal all conduits terminating in pull

hole/box watertight. Install and grout around bell ends where shown. Cover and lids shall be removable without damage to adjacent finish surfaces.

12. Support

    a. Accurately place boxes for finish, independently and securely supported by adequate blocking or manufacturer channel type heavy-duty box hangers for stud walls. Do not use nails to support boxes.

    b. Support boxes independent of conduit system.

    c. Mount boxes installed within ceilings to 16 gauge metal channel bars attached to main runners or joists.

    d. Support boxes within suspended acoustical tile ceilings directly from structure above when light fixture are to be installed from box.

    e. Use auxiliary plates, bar or clips and grouted in place for masonry, block or pour-in-place concrete construction.

3.4 APPLICATION

A. Conduit

1. RMC/IMC suitable for all damp, dry and wet locations except when in contact with earth. IMC not suitable for hazardous locations as stated within CEC/NEC.

2. CRMC suitable for damp or wet locations, concealed within concrete or in contact with earth.

3. EMT suitable for exposed or concealed dry, interior locations.

4. PVC/RTRC suitable for beneath ground floor slab, except when penetrating, and direct earth burial. Do not run exposed within concrete walls or in floor slab unless indicated on Drawings or per Engineer’s permission.

5. FMC suitable for dry locations only for connections to motors, transformers, vibrating equipment/machinery, controllers, valves, switches and light fixtures in less than 6 foot lengths.

6. LFMC application same as FMC above but for damp or wet locations.

B. Termination and joints

1. Use raceway fittings compatible with associated raceway and suitable for the location.

2. Raceways shall be joined using specified couplings or transitions where dissimilar raceway systems are joined.

3. Conduits shall be securely fastened to cabinets, boxes and gutters using (2) two locknuts and insulating bushing or specified insulated connector. Where joints cannot be made tight and terminations are subject to vibration, use bonding jumpers, bonding bushings or wedges to provide electrical continuity of the raceway system. Use insulating bushings to protect conductors where subjected to vibration or dampness. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

4. Terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

5. Stub freestanding equipment conduits through concrete floors for connections with top of coupling set flush with finished floor. Install plugs to protect threads and entrance of debris.

6. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating within interior switchboard, panel, cabinet or gutters. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.

7. Where conduits enter building from below grade inject into filled raceways pre-formulated rigid 2 lbs. density polyurethane foam suitable for sealing against water, moisture, insects and rodents.

8. Install expansion fitting or expansion/deflection couplings per manufacturer's recommendations where:

    a. Any conduit that crosses a building structure expansion joint; secure conduit on both sides to building structure and install expansion fitting at joint.

    b. Any conduit that crosses a concrete expansion joint; install expansion/deflection at joint.

    c. Any conduit greater than 1-1/4" is routed along roof top in runs greater than 100 feet; install expansion fittings every 100 feet.

    d. Engineer may allow FMC or LFMC in lieu of expansion fitting or expansion/deflection couplings on conduits 2" and smaller within accessible locations upon further review and written consent.

C. Boxes

1. Standard type suitable for all flush installations and all dry concealed locations.

2. Concrete type suitable for all flush concrete installations.

3. Masonry type suitable for all flush concrete and block installations.

4. Surface cast meta type suitable for all exposed damp and wet surface mounted locations, and dry surface mounted locations less than 96” from finished floor

END OF SECTION

SECTION 31 21 13

SITE GRADING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Excavating, backfilling, preparing subgrades, and compacting the site to the elevations shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.

B. Related work: Documents affecting work of this Section include, but are not limited to, General Conditions, Supplementary Conditions, and Sections in Division 0, 1 and 2 of these Specifications and:

1. Section 01 21 00 – Allowances – Additional site grading work if required by proof rolling
2. Section 31 21 13 – Site Grading
3. Section 31 25 13 – Erosion Controls
4. Section 31 23 33 – Trenching and Backfilling
5. Storm Water Pollution Prevention Plan (SWPPP).
6. Construction Drawings.

1.2 QUALITY ASSURANCE

A. Use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

C. In addition to complying with requirements of governmental agencies having jurisdiction, the Contractor must comply with the directions of the Owner.

1.3 PRODUCT HANDLING

A. Comply with pertinent provisions of Division 0 and 1 of the specifications.

1.4 SUBMITTALS

A. If geotextile fabrics and/or geogrid are to be used, proposed material data sheets shall be sent to the Civil Engineer of Record before installation of fabric or grid.

B. Each type of plastic warning tape must be submitted.

1.5 DEFINITIONS

A. Backfill: Soil material or selected material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and backfill materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 6 inches in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2-3/8 inches in their greatest dimension to within 24 inches of proposed subgrade.

2. Fill material is subject to the approval of the Owner, Material removed from excavations or imported from off-site borrow areas must be free from roots and other deleterious matter.

3. Do not permit rocks with a dimension greater than 1 inch in the upper 12 inches of fill or embankment.

4. Cohesionless material used for structural backfill: Provide #57 crushed stone free from organic material and other foreign matter, and as approved by the Owner.

2.2 TOPSOIL

A. Where and if shown on the Drawings or as otherwise required, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoils, roots, heavy or stiff clay, stones larger than 2 inches in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter.

B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources.

2.3 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M288
2. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
4. Tear Strength: 56 lbf ; ASTM D 4533.
5. Puncture Strength: 56 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 40 sieve, max. ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491
8. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than fifty percent (50%); complying with AASHTO M 288 as well as the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288
2. Grab Tensile Strength: 247 lbf ; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf ; ASTM D 4632.
4. Tear Strength: 90 lbf ; ASTM D 4533.
5. Puncture Strength: 90 lbf ; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, max. ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Notify the Owner of conditions which may be detrimental to

timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PROCEDURES

A. Utilities:

1. Unless utility are to be removed, protect active utility lines.

2. If active utility lines are encountered, promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Contractor or Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Contractor and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the Contractor.

6. Notify The Owner's Site Manager not less than ten (10) days in advance if there are any proposed utility interruptions.

7. Do not proceed with utility interruptions without The Owner's Site Manager's written permission.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day, and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. Dewatering:

1. Remove all water, including rain water, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
2. Keep excavations and site construction area free from water.

D. Use means necessary to prevent dust from becoming a nuisance to the

public, to neighbors, and to other work on or near the site.

E. Maintain access to adjacent areas at all times.

3.3 EXCAVATING

This section covers excavation of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated and specified herein.

A. Satisfactory excavated materials:

1. Transport to and place in, fill or embankment areas within the limits of Work.

B. Unsatisfactory excavated materials:

1. Excavate to a distance below grade as directed by the Owner, and replace with satisfactory materials.

2. Include excavation of unsatisfactory materials, and replacement by satisfactory materials, as parts of the work of this Section.

C. Surplus materials:

1. Dispose of unsatisfactory excavated materials, and surplus satisfactory excavated material, away from the site at disposal areas.

D. Maintenance of drainage:

1. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

E. Ditches and gutters:

1. Cut accurately to the cross sections, grades, and elevations shown.

2. Maintain excavations free from detrimental quantities of leaves, sticks, trash, and other debris until completion of the Work.

3. Dispose of excavated materials as directed by the Contractor, except do not under any circumstance deposit materials less than 3'-0" from the edge of a ditch.

F. Unauthorized excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Owner.

2. Under footings, foundations, or retaining walls:

   a. Fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.
   b. When acceptable to the Owner, lean concrete fill may be used to bring bottom elevations to proper position.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the D/B.

G. Stability of excavations:

1. Slope sides of excavation to 1:1 or flatter, unless otherwise directed by the Owner.

2. Shore and brace where sloping is not possible because of space restrictions or stability of the materials being excavated.

3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

H. Shoring and bracing:

1. Provide materials for shoring and bracing as may be necessary for safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.

2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.

3. Carry shoring and bracing down as excavation progresses.

3.4 FILLING AND BACKFILLING

A. Backfill excavations as promptly as progress of the Work permits, but not until:

1. Acceptance of construction below finish grade:

2. Inspecting, testing, approving, and recording locations of underground utilities;

3. Concrete formwork is removed;

4. Shoring and bracing are removed, and voids have been backfilled with satisfactory materials;

5. Trash and debris have been removed; and

6. Horizontal bracing is in place on horizontally supported walls.

B. Ground surface preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from the ground surface prior to placement of fills.

2. Plow, strip, or break up surfaces steeper than one vertical to four horizontal, so that fill material will bond with existing surface.

3. Prepare the subgrade soils per the project geotechnical report.

C. Placing and compacting:

1. Place fill materials in layers not more than 8" (eight inches) in loose depth when using heavy compaction equipment and 4” (four inches) loose depth for material compacted using hand operated tampers.

2. Before compacting, moisten or aerate each layer as necessary to provide the moisture content as required by this specification.

3. Compact each layer to the required percentage of maximum density for the area.

4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.

5. Place backfill and fill materials evenly adjacent to structures, to required elevations.

6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

3.5 GRADING

A. General:

1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.

2. Smooth the finished surfaces within specified tolerance.

3. Compact with uniform levels or slopes between points where elevations

are shown on the Drawings, or between such points and existing grades.

4. Where a change of slope is indicated on the Drawings, construct a rolled transition section having a minimum radius of approximately 8'-0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.

3.6 COMPACTING

A. Control soil compaction during construction to provide the specified Standard Proctor Compaction for each area as determined according to ASTM D 698.

B. Provide not less than the following density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place, and as specified by the project geotechnical report , and as approved by the Owner.

1. Structures, Building Slabs, Pavements, and Steps:
   a. Per the project soils report.

2. Lawn and unpaved areas:
   a. Compact the top 8 inches of subgrade and each layer of fill material or backfill material to 85 percent of the soils maximum dry density as determined by the standard Proctor compaction test (ASTM D 698).

3. Walks:
   a. Per the project soils report.

4. Pavements:
   a. Per the project soils report.

C. Moisture control:

1. Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.

3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density

relation tests approved by the owners representative.

4. The moisture content of the fill material shall be no more than +2% of optimum moisture as determined by ASTM D698.

3.7 FIELD QUALITY CONTROL

A. The Contractor's quality control manager or designee shall inspect and approve subgrades and fill layers before subsequent construction is permitted thereon.

B. The Contractor will have at least the following compaction tests conducted to the approval of the owners representative:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 100 feet or less of trench length, but no fewer than 2 tests.

C. If, in the Owner 's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing under the provisions of Section 003132 of these Specifications.

3.8 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds;

2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

3.9 CERTIFICATION

A. Upon completion of this portion of the Work, and as a condition of its acceptance, the Contractor will secure a written report from the testing

agency certifying that the compaction requirements have been obtained. The report will state the area of fill or embankment, the compaction density obtained, and the type or classification of fill material placed.

3.10 EROSION CONTROL

A. BMP's (Best Management Practices) shall be placed at the locations shown on the Drawings.

B. Sediment deposited at BMP's shall be removed and properly disposed of when deemed necessary. When their usefulness has ended and the site is stabilized and re-vegetated, temporary BMP's shall be removed after any sediment trapped by them is removed and disposed of properly. Any area disturbed during removal of the temporary BMP's shall be re- graded then seeded and protected.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

1.2 RELATED SECTIONS

A. Section 31 25 13 Erosion Controls

B. Section 31 21 13 Site Grading

C. Section 02 41 13 Selective Site Demolition

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. CalTrans Standard Specifications.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in accordance with the established schedule.

C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the geotechnical engineer.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 3 inches in greatest dimension, and with not more than 15% of the rocks or lumps larger than 3 inches in their greatest dimension.

2. Fill material is subject to the approval of the geotechnical engineer, and is that material removed from excavations or imported from off-site borrow areas, predominantly non- expansive soil free from organics and other deleterious matter.

3. Do not permit rocks having a dimension greater than 1 inch in the upper 12 inches of fill.

4. Cohesionless material used for backfill: Provide sand free from organic material and other foreign matter, and as approved by the geotechnical engineer.

5. Where aggregate backfill is called for provide aggregate complying with requirements in Section 19-3 of the California Department of Transportation Standard Specification, Latest Edition.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected for the work subject to the approval of the Owner.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

A. Comply with pertinent provision of these specifications.

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.

2. Utility paths are shown diagrammatically on the Plans and it is the Contractor's responsibility to determine the actual routes. The Contractor shall promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the ENGINEER and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the Owner.

6. Notify The OWNER not less than ten days in advance if there are any proposed utility interruptions.

7. Do not proceed with utility interruptions without the OWNER'S written permission.

B. Protection of persons and property:

1. Barricade and maintain protection in open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. Dewatering:

1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.

2. Keep trenches and site construction area free from water.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.4 TRENCHING

A. Comply with pertinent provisions of these specifications, and the provisions of this Section.

B. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.

1. Prior to backfilling, remove all sheeting.

2. Do not permit sheeting to remain in the trenches.

C. Open cut:

1. Excavate for utilities by open cut.

2. If conditions at the site prevent such open cut, and if approved by the Owner, tunneling may be used.

3. Short sections of a trench may be tunneled if, in the opinion of the Owner, the conductor can be installed safely and backfill can be compacted properly into such tunnel.

4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the geotechnical engineer.
5. When the void is below the subgrade for the utility bedding, use suitable earth materials and compact to the relative density as directed by the geotechnical engineer.
6. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as directed by the geotechnical engineer and specified in these specifications.

7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

8. Excavating for appurtenances:

a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12 inches clear between outer surfaces

and the embankment or shoring that may be used to hold and protect the banks.

b. Over-depth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the geotechnical engineer, and at no additional cost to the Owner.

D. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.

E. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

F. Cover:

9. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade:

a. Areas subject to vehicular traffic:
1) Sanitary sewers: 36";
2) Storm drains: 24".

b. Areas not subject to vehicular traffic:
1) Sanitary sewers: 30";
2) Storm drains: 12".

c. All areas:
1) Water lines: 30";
2) Natural gas lines: 30";
3) Electrical cables: 42";
4) Electrical ducts: 36".

d. Concrete encased:
1) Pipe sleeves for water and gas lines: 24";
2) Sanitary sewers and storm drains: 12";
3) Electrical ducts: 24".

10. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long- radius rigid metal conduit riser, provided it will not interfere with the structural integrity of the slab or pavement.

11. Where the minimum cover is not provided, encase the pipes in concrete to 6 inches from outside diameter. Fill void between outside wall of utility and concrete with fine sand or other material approved by the

geotechnical engineer. Provide concrete with a minimum

twenty-eight (28) day compressive strength of 3500 psi. Place warning tape on top of concrete cap longitudinally with the buried utility.

3.5 BEDDING

A. Provide bedding as indicated on the Drawings.

3.6 BACKFILLING

A. General:

1. Compaction of trenches shall be according to the project drawings.

2. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent Sections of these Specifications.

3. Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with selected material approved by the geotechnical engineer.

4. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the geotechnical engineer.

5. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.

6. Should any of the Work be so enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 6 inch maximum thickness, and compact with suitable tampers to the density specified in the project drawings, until there is a cover of not less than 24 inches over sewers and 12 inches over other utility lines.

2. Take special care in backfilling and bedding operations to not damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 3 inches or 1/2 the layered thickness, whichever is smaller, in any dimension.

3.7 COMPACTION

A. Compact each layer of backfill material according to the project drawings.

3.8 TEST FOR DISPLACEMENT OF STORM AND SANITARY SEWERS

A. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.

B. Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.

C. If the illuminated interior of the pipe line shows poor alignment, displaced pipes, or any other defects, correct the defects to the specified conditions and at no additional cost to the Owner.

3.9 PIPE BORING AND JACKING

A. The Contractor may, at his option, install steel pipe casings, tongue-and-groove reinforced concrete pipes, and steel pipes under existing roads or pavements by boring and jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the geotechnical engineer.

3.10 TUNNELING OPERATIONS

A. The Contractor may, at his option, tunnel pipes into position using procedures approved by the geotechnical engineer and the governmental agencies having jurisdiction.

3.11 FIELD QUALITY CONTROL

A. The geotechnical engineer will inspect and approve open cuts and trenches before installation of utilities, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed.

2. Check backfilling for proper layer thickness and compaction.

3. Verify that compaction test results conform to the specified

requirements, and that at each compacted initial and final backfill layer, at least one (1) test for each 100 feet or less of trench length, but no fewer than two (2) tests are performed.

4. Assure that defective work is removed and properly replaced.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Work included: The work included in this Section includes all labor, materials, and equipment necessary to place temporary and permanent erosion and sediment control measures as detailed on the Drawings and specified herein. **Contractor shall be responsible for implementation of the Erosion Control Plans for the project. The Erosion Control Plan included in the project drawings can and shall be modified accordingly by the contractor throughout construction to comply with the State Water Resources Control Board Standards for construction.**

1.1 RELATED SECTIONS

A. Section 02 41 13 Selective Site Demolition

B. Section 31 21 13 Site Grading

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of these Specifications.

C. Referenced Standards

1. All work to be done in accordance with the City of Stockton Standard Specifications and Drawings, where conflicts occur between the City of Stockton Standard Specifications and Drawings and the specifications noted herein, the more stringent interpretation shall apply.

2. All work to be done in accordance with the State Water Resources Control Board Standards for Erosion and Sediment Control.

3. CalTrans Standard Specifications.

1.4 QUALITY ASSURANCE AND CONTROL

A. Use adequate numbers of skilled workers who are thoroughly trained and

experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

1.6 SUBMITTALS

A. Project Data:

1. Materials list of items proposed to be provided under this Section.

2. Specifications and other data needed to prove compliance with the specified requirements.

3. Weekly Inspection Reports, Before, During and Post Rain Event Inspection Reports and any other testing or inspection report required by the State Water Resources Control Board in compliance of their Standards. Please note that inspections must be done at a minimum of once a week and those reports kept on file at the job trailer. Do not mail to state or city offices. A copy of the reports and inspections should be attached to the SWPP Plan.

PART 2 – PRODUCTS

2.1 FOR EROSION AND SEDIMENT CONTROL

A. The primary erosion and sediment control measures implemented during the Mass Grading/Site Preparation phase of the project shall be inspected, maintained, and repaired in accordance with the Erosion Control Plan provided in the Civil Plans. Secondary measures such as Inlet Protection, dust control, erosion control blanket, temporary and permanent seeding shall be installed/applied as necessary. See Civil Plans for placement of BMP's and the Erosion Control Details for further information.

B. Inlet Protection as shown on the Erosion Control Plan provided in the Civil Plans.

PART 3 - EXECUTION

3.1 EROSION CONTROL PLAN IMPLEMENTATION

A. Review Civil Plans for Erosion Control Plan requirements.

3.2 EROSION CONTROL PLAN IMPLEMENTATION

A. Place erosion control and storm water pollution prevention measures in

accordance with the approved Contract Documents as construction proceeds and the appropriate phase is in progress for each measure.

B. Permanent erosion control measures shall be incorporated into the Project at the earliest practical time to minimize the need for temporary controls.

3.3 PERMANENT AND TEMPORARY SEEDING MEASURES

A. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

B. Slopes that erode easily or that will not be graded for a period of fourteen (14) days or more shall be temporarily seeded as work progresses with temporary seeding.

3.4 REMOVAL OF EROSION AND SEDIMENT CONTROL MEASURES

A. When site is ninety-five percent (95%) re-vegetated and stabilized with grasses, remove temporary sediment risers. Remove accumulated sediment and regrade area to original contours. Seed and protect with permanent grass seed mixture.

B. Remove drainage structure inlet protection.

C. Remove silt fence and temporary check dams. Seed and protect any disturbed areas with permanent grass seed mixture.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1-GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

1.2 RELATED SECTIONS

A. Section 32 12 16 Asphalt Paving

B. Section 32 13 13 Concrete Paving

C. Section 31 21 13 Site Grading

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. CalTrans Standard Specifications.

2. American Association of State Highway and Transportation Officials:

3. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

5. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Coarse Aggregate Fill Type according to CalTrans standards:

1. Basis of Measurement: By the square foot to elevations indicated on Drawings.

2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

B. Fine Aggregate Fill Type according to CalTrans standards:

1. Basis of Measurement: By the square foot to elevations indicated on Drawings.

2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.5 SUBMITTALS

A. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Caltrans standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fine Aggregate Sand: As specified in CalTrans standards.

B. Class 2 Aggregate Base: As specified in CalTrans standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and are dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re- compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Place aggregate in maximum 4 inch layers and roller compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch measured with 10 foot straight edge.

B. Maximum Variation From Thickness: 1/4 inch.

C. Maximum Variation From Elevation: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Compaction testing will be performed in accordance with ASTM D1556 and ASTM D698.

B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1-GENERAL

1.1 SECTION INCLUDES

A. Section Includes:

1. Asphaltic concrete paving, wearing, binder and base course.

2. Surface sealer.

3. Paving fabrics.

4. Aggregate subbase course.

1.2 RELATED SECTIONS

A. Section 32 11 23 Aggregate Base Course

B. Section 31 21 13 Site Grading

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. CalTrans Standard Specifications.

2. City of Stockton Standard Specifications

3. American Association of State Highway and Transportation Officials:

4. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.

5. AI MS-19 - Basic Asphalt Emulsion Manual.

6. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.

7. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

1.4 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Asphalt Pavement Mix (Base Course):

1. Basis of Measurement: By cubic yard.

2. Basis of Payment: Includes preparing base, primer, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.

B. Asphalt Pavement Mix (Wearing Course):

1. Basis of Measurement: By cubic yard.

2. Basis of Payment: Includes primer, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.

1.5 PERFORMANCE REQUIREMENTS

A. Paving: Designed for main street arteries.

1.6 SUBMITTALS

A. Product Data: Submit product information and mix design.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with California Department of Transportation Public Work's standards.

B. Mixing Plant: Conform to California Department of Transportation Public Work's standards.

C. Obtain materials from same source throughout.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: In accordance with Section 39 of California Department of Transportation Public Work's standards.

B. Aggregate for Base Course Mix: In accordance with California Department of Transportation Public Work's standards.

C. Aggregate for Wearing Course Mix: In accordance with California Department of Transportation Public Work's standards.

D. Tack Coat: In accordance with California Department of Transportation Public Work's standards.

E. Petromat 4598 or Mirapave RG4, Petrotack or Miratack all in accordance with CalTrans Section 88.

2.2 ASPHALT PAVING MIX

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: In accordance with California Department of Transportation Public Work's standards.

C. Wearing Course: In accordance with California Department of Transportation Public Work's standards.

2.3 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Verify gutter drainage grilles and frames, manhole frames, and are installed in correct position and elevation.

3.2 SUBBASE

A. Prepare subbase in accordance with California Department of Transportation standards.

3.3 PREPARATION – PRIMER

A. Apply primer in accordance with California Department of Transportation standards.

3.4 PREPARATION - TACK COAT

A. Apply tack coat in accordance with California Department of Transportation standards.

3.5 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with California Department of Transportation standards.

B. Place asphalt within twenty-four (24) hours of applying primer or tack coat.

C. Place asphalt wearing course as indicated on the Plans.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.6 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place wearing course within twenty-four (24) hours of placing and compacting binder course. When binder course is placed more than twenty-four (24) hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

B. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

C. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.7 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from Indicated Elevation: Within 1/4 inch.

3.8 PROTECTION OF FINISHED WORK

A. Immediately after placement, protect pavement from mechanical injury for forty-eight (48) hours or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1-GENERAL

1.1 SUMMARY

A. Section Includes: Cast-in-place concrete, Concrete Paving for roads, parking areas, and sidewalks, as well as curbs, gutters and valley gutters. The work will also cover cast in place retaining walls.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 32 11 23 – Aggregate Base Course.

2. Section 31 21 13 – Site Grading.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

7. ASTM C150 - Standard Specification for Portland Cement.

8. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.

9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed

Concrete by the Pressure Method.

12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C596 - Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

B. American Concrete Institute (ACI):

1. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
2. ACI 305R - Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 318 - Building Code Requirements for Structural Concrete.
5. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

A. Product Data: Submit to the Engineer, in accordance with Section 01 33 00, product data including the following:

1. Sources of cement, pozzolan, and aggregates.
2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature

considerations and conformity to ASTM standards.

5. High-range water-reducing admixture (superplasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix design for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. See also the required test reports and certifications listed below. Provide either (a) or (b) below for each mix design proposed.

    a. Compression test results for proposed mixes. Include standard deviation data for each proposed concrete mix based on statistical records.

    b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.

7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM C171 standard.

8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM C309 standard. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Quality Assurance/Control

1. Test Reports

    a. Fine aggregates - sieve analysis, physical properties, and deleterious substance.

    b. Coarse aggregates - sieve analysis, physical properties, and deleterious substances.

    c. Cements - chemical analysis and physical properties for each type.

    d. Pozzolans - chemical analysis and physical properties.

e. Proposed concrete mixes - compressive strength, slump, shrinkage, and air content.

2. Certifications

a. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

b. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.

c. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

3. Work Plans

a. Hot weather concreting.

1.4 QUALITY ASSURANCE

A. Reinforced concrete shall comply with ACI 318, ACI 350 and other stated requirements, codes and standards. The most stringent requirement of the codes, standards and this Section shall apply when conflicts exist.

B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.

C. Concrete meeting: A meeting will be held between the Engineer and the Contractor to review the detailed requirements of the Contractor's proposed concrete design mixes and to determine the procedures for producing proper concrete construction. The meeting shall be held no later than 30 days prior to the first concrete placement. All parties involved in concrete work shall attend the conference including the following:

1. Contractor’s superintendent and/or project manager;

2. Contractor's concrete supplier testing laboratory representative (optional as determined by the Engineer);

3. Concrete subcontractor;

4. Reinforcing steel subcontractor and detailer;

5. Concrete supplier;

6. Admixture manufacturer's representative(s).

Meeting discussion topics will include, but not be limited to: methods of hot and cold weather concrete placement, concrete placement during rainy weather, cleanliness of rebar before placement of concrete, concrete mix design(s) and source of concrete materials, concrete shrinkage for key structures, waterstop placement, use of admixtures, concrete curing methods, concrete finishes, grouts, and rebar submittals.

D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at no additional cost to the Owner.

E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at no additional cost to the Owner, make new acceptance tests of aggregates and establish new design mixes.

F. Testing of the following materials shall be furnished by Contractor to verify conformity with this Specification Section and the stated ASTM Standards.

1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.

4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.

5. Proposed concrete mix designs - compressive strength, slump, shrinkage, and air content.

G. Field testing and inspection services will be provided by the Owner. The cost of such work, except as specifically stated otherwise, will be paid by the Owner. The Contractor shall be responsible for the cleanup and disposal of testing waste at the project site. Testing of the following items shall be by the Owner to verify conformity with this Specification Section.

1. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, air content, and shrinkage.

2. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples and test

reports.

1.5 DELIVERY, STORAGE AND HANDLING

A. Cement: Store in watertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles in bunkers or other physical structures to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles in bunkers or other physical structures to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Pozzolan: Store in watertight buildings, bins or silos to provide protection from dampness and contamination.

F. Sheet Curing Materials: Store in watertight buildings or off the ground and under cover.

G. Liquid Curing Compounds: Store in closed containers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

1. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration required.

2. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

3. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic Portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used on any one structure. The following cement type(s) shall be used:

1. Class A and Class B Concrete - Type II with the equivalent alkalies, as defined in Table 2 of ASTM C150, limited to a maximum of a 0.60% (low-alkali cement).

2. Class D Concrete - Type II, low-alkali cement with fly ash resulting in C_3A being below 8 percent of total cementitious content.

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 32 13 13-1 herein.

E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

3. High-Range Water-Reducer (Superplasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

4. Admixtures causing retarded or accelerated setting of concrete shall not be

used without written approval from the Engineer. When allowed, the admixtures shall combine retarding or accelerating with water reducing or high range water reducing admixtures.

G. Pozzolan (Fly Ash). Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent maximum.

H. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.

I. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

2.2 MIXES

A. Measuring Materials

1. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water- reducer may also be added in the field.

2. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 and ACI 304R except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.

3. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

4. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

   a. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

   b. Inject multiple admixtures separately during the batching sequence.

B. Mix Design

1. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer and engaged by the Contractor at no additional cost to the Owner.

2. Select proportions of ingredients to meet the design strength and materials limits specified in Table 32 13 13-1 and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

3. The design mix shall be based on one of the following:

    a. Standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318.

    b. Trial mixtures developed by the design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory engaged by the Contractor and at no additional cost to the Owner.

    The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 32 13 13-1. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI318.

4. Entrained air, as measured by ASTM C231, shall be as shown in Table 32 13 13-1. If the air- entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.

5. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 32 13 13-1. If a high-range water-reducer (superplasticizer) is used, the slump indicated shall be that measured before superplasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.

6. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 32 13 13-1 CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Minimum Cementitious Content (4)
A	2500	C150 Type II	C33	57	440
B	3000	C150 Type II	C33	57	480
D	5000	C150 Type II	C33	57	560

Class	W/C Ratio (5)	Fly Ash	AE Range (6)(7)	WR (8)	HRWR (9)	Slump Range Inches
A	0.62 max.	15-20% (10)	3.5 to 5	Yes	No	1-4
B	0.54 max.	15-20% (10)	3.5 to 5	Yes	No	1-3
D	0.44 max.	15-20% (10)	3.5 to 5	Yes	(11)	3-5

NOTES:
(1) Minimum compressive strength in psi at 28 days
(2) ASTM designation
(3) Size Number in ASTM C33
(4) Cementitious content in lbs/cu yd
(5) W/C is Water-Cementitious ratio by weight
(6) AE is percent air-entrainment
(7) AE for concrete slabs may be less than 3 percent
(8) WR is water-reducer admixture
(9) HRWR is high-range water-reducer admixture
(10) Percentage of the total cement plus pozzolan content, by weight
(11) HRWR is required at walls taller than 20 feet and optional at others

C. Mixing and Transporting

1. Concrete shall be ready-mixed concrete. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions.

2. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

3. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be approved by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

4. All central plant and rolling stock equipment and methods shall comply with ACI 318, ACI 304R and ASTM C94.

5. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

6. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.

7. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete.

8. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer. Annotate each delivery ticket with the structure and component where the concrete was placed.

9. Temperature and Mixing Time Control

   a. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.

   b. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

   c. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.

   d. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 32 13 13-2.

TABLE 032 13 13-2

MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
Above 90 Degree F (32 Degree C) (Note 1)	60 minutes
80 to 90 Degree F (27 to 32 Degree C)	60 minutes
70 to 79 Degree F (21 to 26 Degree C)	60 minutes
40 to 69 Degree F (5 to 20 Degree C)	90 minutes

Note 1: In air temperatures above 90 degrees F, the temperature of concrete being placed shall not exceed 90 degrees F.

If an approved high-range water-reducer (superplasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

D. Concrete Appearance

1. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

    a. The gradation of aggregate.

    b. The proportion of fine and coarse aggregate.

    c. The percentage of entrained air, within the allowable limits.

2. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10-ft away, shall be pleasing in appearance, and at 20-ft shall show no visible defects.

2.3 SOURCE QUALITY CONTROL

A. Compression Tests: Provide testing of the proposed concrete mix or mixes

to demonstrate compliance with the specified design strength requirements in conformity with Section 2.02B.

B. Shrinkage Tests: Perform shrinkage tests on the design mix for Class D concrete. All specimens shall be cast in the laboratory. Concrete and not mortar specimens shall be used. The tests shall conform to ASTM C157 modified as follows:

1. Three 4”x4”x11” test specimens with 10” gage length shall be made.

2. Specimens shall be removed from molds at an age of 23±1 hours after trial batching, and placed immediately in water at 73°F±3° for at least 30 minutes.

3. Specimens shall be measured 30 minutes thereafter to determine the original length, and then submerged in saturated lime water at 73°F±3°.

4. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. The length at 7 days shall be made the base length for drying shrinkage calculations.

5. Specimens shall be stored in a humidity control room maintained at 73°F±3° and 50%±4% relative humidity for the remainder of the test.

6. Measurements to determine shrinkage expressed as a percentage of base length shall be made and reported separately for 7, 14, and 21 days of drying after 7 days of moist curing.

7. The average shrinkage at 21 days of air storage shall not exceed 0.040 percent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing

1. The class of concrete shall be per Table 32 13 13-3 or as shown on the Drawings. Place all concrete in accordance with the recommendations contained in ACI304R. Concrete shall not be placed when rainfall (or forecast rainfall) is sufficient to cause damage to the work. Concrete placement in progress shall be stopped when rainfall occurs unless the concrete is completely protected from rainfall damage. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have competent workers at the

location of the placement. Workers shall be able to ensure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.

4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only if it is a non-water containing structure, when made of galvanized metal or concrete, and only if prior approval from the Engineer has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

    a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.

    b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

    c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

    a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 4-ft and the maximum free fall of concrete shall not exceed 4-ft.

    b. A minimum of 48 hours shall have elapsed between casting of adjacent wall sections at a vertical construction joint.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc, shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.

2. All concrete shall be placed and compacted with mechanical vibrators. One vibrator shall be used for each 8 c.y. placed per hour. The type and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert and withdraw vibrators vertically at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not segregate concrete through overvibration. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8-in and thicker shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.

5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:

    a. Frequency returns to normal.

    b. Surface appears liquefied, flattened and glistening.

    c. Trapped air ceases to rise.

    d. Coarse aggregate has blended into surface, but has not disappeared.

C. Curing

1. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

2. Curing Methods

    a. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a

minimum of 7 days after placement. Curing methods to be used are as follows:

1) Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
2) Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
3) Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

b. Specified Applications of Curing Methods.

1) Slabs for Water Containment Structures: Water curing only.
2) Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
3) Structural Slabs (other than water containment): Water curing or liquid membrane curing.
4) Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
5) Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
6) Concrete Joints: Water cured or sheet material cured.

3. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

D. Cold Weather Concreting:

1. "Cold weather" is defined as a period when for more than 3 successive

days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.

2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12 hour intervals (minimum).

3. The Contractor shall discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.

4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

   a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g.: 5 days at an average 70 degrees F = 350 degree-days).

   b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

5. Salt, manure or other chemicals shall not be used for protection.

6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr.

2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R

and the additional requirements specified herein.

a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.

b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.

c. The Engineer may require the Contractor to immediately cover plastic concrete with sheet material.

3. The Contractor shall discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

F. Removal of Forms

1. Form and shoring removal shall conform to the requirements specified in these project specifications.

3.2 FIELD QUALITY CONTROL

A. The placing and curing of concrete shall be subject to the inspection of the Special Inspector at all times. The Contractor shall advise the Special Inspector of his/her readiness to proceed at least 2 working days prior to each concrete placement. The Special Inspector will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and tightness of formwork. No placement shall be made without the inspection and acceptance of the Special Inspector.

B. Sets of field control cylinder specimens will be taken by the Owner (or Inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of five cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth and fifth cylinders may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low. Compressive strength tests shall comply with ASTM C39.

2. When the average 28 day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed by the Contractor to achieve the required strengths.

C. The Contractor shall cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated and closed, wood or metal curing box for specimens, affording protection to the specimens against injury or loss through the Contractor's operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. The cleanup and disposal of test waste shall be the responsibility of the Contractor.

D. Slump tests will be made in the field by the Special Inspector immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. Slump test shall be taken for each set of test cylinders defined above. If the slump is outside the specified range, the concrete shall be rejected.

E. Air Content: Test for air content shall be made by the Special Inspector on fresh concrete samples. Air content test shall be taken for each set of test cylinders defined above. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

F. Shrinkage (for concrete in liquid-containing structures)

1. Field test specimens shall be handled and tested by the Special Inspector as specified in Paragraph 2.03B. A set of test cylinders shall be taken from the first batch of concrete and any initial batch thereafter in which the source of concrete ingredients has changed.

2. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

3. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the Owner, to achieve the specified shrinkage requirements. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

G. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.

H. The Contractor shall cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The Contractor shall repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

3.3 ADJUSTING

A. Failure to Meet Requirements

1. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 32 13 13-1, the Engineer shall have the right to require changes in the mix design to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such mix design changes and additional curing shall be at no additional cost to the Owner. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at no additional cost to the Owner. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

2. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at no additional cost to the Owner, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.

3. Should the 28-day strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

B. Patching and Repairs

1. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will require no patching.

2. Defective concrete as determined by the Engineer shall be repaired as specified in at no additional cost to the Owner.

3. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

4. Immediately after removal of forms, remove plugs and break off metal ties. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

5. When patching exposed surfaces, the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Do not damage or stain the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.4 SCHEDULE

A. The following (Table 32 13 13-3) are the general applications for the various concrete classes and design strengths:

TABLE 32 13 13-3 CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill, duct and pipe encasements, and thrust blocks

B	3,000	Concrete overlay slabs, pavements, sidewalk and curb
D	4,000	Retaining walls, footings, slabs on grade, suspended slab and beam systems, and all other structural concrete

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section Includes painted pavement markings, lines, and legends.

1.2 RELATED SECTIONS

A. Section 32 12 16 Asphalt Paving

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Caltrans State Standard Specifications, Latest Edition.

D. M.U.T.C.D California Supplement, Latest Edition

E. CBC - California Building Code, Latest Edition

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s printed product data on all coatings specified, including preparation and application instructions.

B. Samples:

1. Submit two paper chip samples, 3 inch by 5 in size illustrating range of colors and textures available for each surface finishing product scheduled.

2. Submit two painted samples, illustrating selected colors and textures for each color and system selected. Submit on white card stock, 8 inch by 10 inch in size.

C. Manufacturer’s Installation Instructions: Submit the manufacturer’s current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, special surface preparation procedures, and substrate conditions requiring special attention.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALIFICATIONS

A. Manufacturer Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Applicator: Company regularly engaged and specializing in the application of pavement markings, with minimum three (3) years documented experience.

C. Regulatory Requirements: Comply with applicable codes and regulations of cognizant governmental agencies having jurisdiction, including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provision.

D. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local regulations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions. Protect materials from adulteration by infiltration.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Perform the Work of this Section under environmental conditions no less stringent than those stipulated by the manufacturers of the materials used.

1. Take precautions necessary to avoid and mitigate the effects of wind drift in the application of liquid materials.

2. Do not apply marking paint when weather is foggy or rainy, or ambient temperatures are below 40 degrees F, nor when such conditions are anticipated during eight hours after application.

B. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.8 EXTRA MATERIALS

A. Supply one (1) gallon of each color, type, and surface texture of paint installed. Store where directed.

B. Label each container with color, type, texture, and room locations, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A.

1. Dunn-Edwards. Type: W801 Traffic Marking Paint

2. Frazee Industries, Inc. Type: 506 Traffic Line Paint

3. ICI Dulux. Type: 4800 Series Traffic Paint

B. Description: Dunn Edwards Vin-L-Stripe Traffic Marking Paint, W80l Series, epoxy modified acrylic latex based, specifically formulated for application to asphalt and concrete vehicular traffic surfaces. Provide paint certifiable by the manufacturer as being in accordance with the California Air Resources Board (CARB) rules in effect at the time of application.

1. mixed, quick drying and non-bleeding.

2. Color

a.	Text	White and Blue as shown on drawings.
b.	Parking divider stripes:	White.
c.	No parking zone markings:	Yellow.
d.	No parking curb:	Red.
e.	Accessible Zone markings:	White and Blue as shown on drawings.
f.	Crosswalk striping:	White.
g.	Directional arrows:	White.
h.	Driving lane dividers:	White.

3. Blue paint for the symbol of accessibility: Match color No. 15090 in Federal Standard 595A as specified in Section 2-1720 of CCR Title 24 Handicap Regulations (similar to Royal Blue).

2.2

A. d, self-contained paint machine capable of applying a straight line from 2 inches to 6 inches wide, with consistent coverage of a minimum of 150 square feet per gallon.

B. Calibration:

1. Line Measuring Device: Calibrate automatic line length gauges to maintain tolerance of plus or minus 25 feet per mile.

2. Guns: Calibrate to simultaneously apply paint binder at uniform rates as specified with an allowable tolerance of plus or minus 1 mil.

C. Equipment

1. application of crosswalks, intersections stop lines, legends and other miscellaneous items by walk behind stripers, hand spray or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive Work as instructed by product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

3.2 PREPARATION

A. Maintenance and Protection of Traffic:

1. Provide short term traffic control in accordance with these specifications.

2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.

3. Maintain travel lanes between 7: 00 AM to 9: 00 AM, and between 4: 00 PM and 6: 00 PM.

4. Maintain access to existing buildings and other properties requiring access.

B. Locate markings as shown on Drawings. Provide qualified technicians to supervise equipment and application of markings. Lay out markings using guidelines, templates and forms. Obtain verification from Architect for confirmation of lay out;

colors, and placement of markings.

C. Correct defects and clean surfaces affecting work of this section. Sand all gloss finishes to sheen. Remove existing coatings that are flaking or otherwise in unacceptable condition to receive paint Preparation or removal of coatings containing lead must be performed in accordance with all EPA and OSHA guidelines.

D. Concrete and Masonry Surfaces: Pressure wash to remove all dirt, loose mortar, scale, salts, alkalies, and other detrimental substances. Remove oils and grease with solution of trisodium phosphate; rinse well and allow to dry. Remove all plant growth, including all growth spores and spore residue where designated.

E. Asphalt Concrete: All surfaces must be cleaned free from grease, oil, dirt, mildew, stains and other contaminants that would cause adhesion problems. Remove loose, peeling or chalky paint by high- pressure washing or other appropriate methods. Surfaces must be completely dry before application.

1. Allow asphalt concrete to age for 30 days before starting pavement marking.

3.3 EXISTING WORK

A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

B. Clean and repair existing remaining or reinstalled lines and legends.

3.4 APPLICATION

A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.

B. Apply marking paint at rate of one gallon per 150 square feet (equivalent to approximately one gallon for 450 lineal feet of 4 inch wide stripe). Rate can increase to a maximum of 400 square feet per gallon based on conditions of surface to be coated.

C. Apply paint with mechanical equipment:

1. Provide uniform straight edges without overspray.

2. Uniform line width of 4 inches, unless otherwise noted on Drawings.

3. Provide hatching in accessible parking areas as required by Code.

4. Use single line striping between parking stalls.

5. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 13 mils.

6. Identify parking spaces with text where shown on drawings.

D. Accessibility Symbol: Apply international accessibility symbol on pavement surface in accordance with CCR Title 24 Section 1129B. The surface of each accessible parking space or stall shall have a surface identification duplicating the following scheme:

1. By outlining a profile view of a wheelchair with occupant in white on blue background. Locate profile view so that it is visible to a traffic enforcement office when vehicle is properly parked in the space. Size: 36 inches high by 36 inches wide.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Prior to applying, mix paint a sufficient length of time to thoroughly mix the pigment and vehicle together, and keep thoroughly agitated during its application.

G. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

H. Apply markings to indicated dimensions at indicated locations.

I. Prevent splattering and over spray when applying markings.

J. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free. When vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.

K. Collect and legally dispose of residues from painting operations.

3.5 PROTECTION OF FINISHED WORK

A. Do not permit traffic over the painted striping and pavement markers until the paint has cured.

3.6 APPLICATION TOLERANCES

A. Maximum Variation from Wet Film Thickness: 1 mil.

B. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

C. Maximum Variation from Specified Application Temperature: Plus or minus 5 degrees F.

3.7 PROTECTION OF FINISHED WORK

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry lime.

3.8 SCHEDULE OF COLORS

A. Stripes between standard parking stalls: White.

B. Stripes between accessible parking stalls: White.

C. No parking zones diagonal striping: White.

D. Accessible pedestrian crosswalks: White.

E. Accessible Parking Curb: Blue.

F. Direction Arrows: White.

G. NO PARKING stenciled letters: White and Blue as shown on drawings.

END OF SECTION

SECTION 32 31 19

SECURITY FENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Galvanized steel security fencing.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: In the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, and accessories.

C. Shop drawings: Showing location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain galvanized steel security fences and gates as complete units, including necessary erection accessories, fittings, and fastenings from a single source or manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to the compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

1. Master Halco, Inc.
2. Merchants Metals

3. AmeriStar
4. Monumental Iron Works

B. Fencing: AmeriStar “Montage plus ATF” as manufactured by Monumental Iron Works or approved equal. Fencing shall be the height as noted on drawings.

C. Finish: Black acrylic or powder top coat over epoxy or resin primer over zinc phosphate coating over hot dip applied by electrostatic spray process; 2.5 mils minimum thickness

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install security fencing in accordance with the manufacturer’s written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

1. Dimensions and Profile: As indicated on Drawings.
2. Concealed Concrete Footings: Stop footings a minimum of **2 inches (50 mm)** below grade to allow covering with surface material.

END OF SECTION

SECTION 32 84 00
PLANTING IRRIGATION

PART 1-GENERAL

1.1 SUMMARY DESCRIPTION

A. Scope of Work

1. Provide irrigation systems as shown on the Drawings and described herein.

B. Related Work

1. Section 01 23 00 Alternates

2. Division 26 Electrical: Power connection for controller.

1.2 SUBMITTALS

A. Material List

1. Complete manufacturer's technical data and installation instructions shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.

B. Record Drawings

1. The original record drawings shall be submitted to the Owner’s Representative for approval prior to making the controller chart. Refer to Section 01 78 39 Project Record Documents.

2. Drawings shall include dimensions from two permanent points of reference such as building corners, sidewalks, or road intersections for the location of the following items:

a. Connection to existing water lines.

b. Connection to existing electrical power and splice locations.

c. Relocated existing equipment.

d. Gate valves.

e. Routing of sprinkler pressure lines.

f. Sprinkler control valves.

g. Routing of control wiring.

h. Quick coupling valves.

i. Other related equipment as directed by the Owner’s

Representative.

C. Controller Charts

1. Controller charts shall be prepared by Contractor.

2. Provide one controller chart for each controller supplied.

3. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow when rolled up.

4. The chart shall be a reduced drawing of the actual as-built system and shall be readable when reduced.

5. The chart shall be a black line print and different colors shall be used to indicate the area of coverage for each station.

6. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 mils if required by Owner’s Representative.

7. As-built record drawings and controller charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals

1. Contractor shall prepare Operation and Maintenance Manuals in accordance with Section 01 78 00 Close-out Submittals.

a. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.

b. Catalog and parts sheets on all material and equipment installed under this contract (not necessary for campus standard irrigation equipment).

c. Guarantee statement.

d. Complete operating and maintenance instructions on all major equipment.

E. Equipment to be Furnished

1. Furnish the following tools:

a. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve provided on this project.

b. Two keys for each automatic controller.

c. Two quick coupler keys and matching hose swivels per project.

2. This equipment shall be furnished to Owner before final inspection can occur. Evidence that the Owner has received material must be provided to Owner's Representative.

1.3 QUALITY ASSURANCE

A. Manufacturer's directions and detailed drawings shall be followed in all cases where points are not shown in the Drawings and Specifications.

B. Drawings are generally diagrammatic and indicative of the work to be installed and do not show all offsets, fittings, sleeves, and other parts which may be required. Contractor shall carefully investigate the structural and finished conditions affecting all work and plan accordingly, furnishing such fittings, and other appurtenances as may be required to meet such conditions. The Work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

C. Before commencing irrigation system installation, Contractor shall resolve obstructions, grade differences or discrepancies in area dimensions that might not have been considered in engineering and shown on the Drawings.

1.4 COORDINATION AND SCHEDULING

A. Contractor shall notify Owner's Representative in advance for the following observation meetings, according to the time indicated, and shall provide documentation to Owner's Representative that the following meetings occurred and their outcome.

1. Pre-job conference - 7 days.

2. Sleeve inspection – 48 hours.

3. Pressure supply line installation and testing - 48 hours.

4. Automatic controller installation - 48 hours.

5. Control wire installation - 48 hours.

6. Lateral line and sprinkler installation - 48 hours.

7. Coverage test (prior to any planting installation) - 48 hours.

8. Final inspection - 7 days.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. PVC Pressure Main Line Pipe and Fittings

1. Pressure main line piping for sizes 4 inches and larger shall be C-900 with mechanical joints.

2. Pressure main line piping smaller than 4 inches inside sleeves, shall be Schedule 40.

3. Pressure main line piping for sizes 3 **inches** and smaller shall be ~~PVC Schedule 40~~ **PVC Class 200 SDR21** with solvent welded joints and with Schedule 80 fittings.

4. Pipe shall be made from NSF approved Type I, Grade I PVC compound conforming to ASTM resin specification D1785. All pipe shall meet requirements as set forth in Federal Specification PS-21-

70.

5. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.

6. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.

7. All PVC pipe must bear the following markings:

   a. Manufacturer's name.

   b. Nominal pipe size.

   c. Schedule or class.

   d. Pressure rating in PSI.

   e. NSF (National Sanitation Foundation) approval.

   f. Date of extrusion.

8. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable Iron Pipe Size (IPS) schedule and NSF seal of approval.

B. PVC Non-Pressure Lateral Line Piping

1. Non-pressure buried lateral line piping shall be PVC schedule 40 with solvent- welded joints.

2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipe shall meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.

3. Except as noted above, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in these specifications.

4. For all sprinkler head installations use schedule 80 thread nipples and risers, and schedule 40 fittings.

C. PVC Sleeves:

1. PVC sleeves shall be Schedule 40 with solvent weld joints. Install sleeves at 24 inches depth to top of pipe. Backfill sleeve trench with sand. Depth exception may be considered at concrete walks with

prior approval by Owner's Representative.

D. Brass Pipe and Fittings

1. Where indicated on the Drawings, use red brass threaded pipe.

2. Fittings shall be red brass conforming to Federal Specification #WW-P-460.

E. Galvanized Pipe Fittings

1. Where indicated on the Drawings, use galvanized steel pipe American National Standards Institute (ASA) Schedule 40 milled steel threaded pipe.

2. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.

3. All galvanized pipe and fittings installed below grade shall be wrapped with 2 layers of 10 mil pipe wrap.

4. Pipe lubricant: Permatex 51, or equal.

2.2 VALVES

A. Gate Valves

1. Gate valves 3 inches and larger shall be 125 lb. Static Water Pressure (SWP) bronze gate valve with screw-in bonnet, non-rising stem, solid wedge disc, threaded ends and a bronze or malleable iron handwheel, with a 2" operating nut.

2. Gate valves 2-1/2 inches and smaller shall be manufactured by Nibco, Aqua, Matco, or equal, 200 psi Water Oil Gas (WOG), 125 SWP, Screw-in bonnet, solid wedge.

B. Quick Coupling Valves

1. Quick coupling valves shall have a brass two-piece body designed for working pressure of 125 PSI operable with quick coupler.

2. Key size and type shall be as shown on Drawings.

3. Quick coupling valves shall be manufactured by Rain Bird (44LRC) or approved equal.

4. All quick coupling valves without integral stabilizers shall be equipped with cast ductile iron anti-rotation devices or anchors that attached to the base of the valve and can be secured by a single bolt, and shall be manufactured by Leemco (LS- 120, LS-150), Harco (82201, 82202) or equal.

C. Electrical Remote Control Valves

1. Electric control valves shall have a manual flow adjustment.

2. Provide one control valve box for each electric control valve.

3. Electric Remote Control Valves shall be manufactured by Rain Bird (PESB) with scrubber, or equal.

4. Pressure regulating modules as required for pressure reduction on new or existing valves manufactured by Rain Bird (PRS Dial), or equal, as noted on Drawings.

5. For pipe connections to valve bodies use Teflon tape material. Pipe dope shall not be used.

D. Drip Assemblies

1. Electric Remote Control Valves shall be Rainbird Drip control kits with PESB valves and Pressure regulating quick check basket filter, or equal.

2. Filters, valves and pressure regulators shall be as manufactured by Netafim, Rainbird, or equal and shall be as follows:

(a) Flows between 0.3 GPM and 20.0 GPM

(b) Flows between 15 GPM and 40 GPM

E. Associated Valves

1. Wye-Strainer

a. Brass construction for 3” and smaller, Cast Iron with flanged ends for 4” and larger.

b. Stainless steel 80-mesh

c. Same size as mainline

2. Ball valves 3 inches and smaller shall be brass.

F. Flow Sensor and Master Valve

1. Flow sensor and master valve assemblies shall be per plans or equal and must operate with controller. Install both units after brass gate valve at point of water connection. The master valve shall be main line-sized for project and have the capacity to have additional systems added on in the future. The flow sensor may be main line-sized or smaller, as shown on Drawings. This maximizes flow management capabilities to reduce water window times and improve efficiency.

2.3 BACKFLOW PREVENTION UNITS

1. Backflow prevention unit assemblies shall be per plans or equal. Shall be manufactured by Zurn or equal, model per plan.

2.4 BOOSTER PUMP

A. Booster pump

1. All booster bump equipment including but not limited to mechanical pump, check valve,

pressure valve, and controls shall be located to area shown on plan. Rainbird booster pump or equal, per plan.

2. Install on concrete pad with proper holes for inlet, outlet and power.

3. The pump enclosure shall be of a vandal and weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32, with a wall thickness of one eighth inch. The mounting base shall be manufactured entirely of stainless steel. The main housing shall be of solid sheet construction punched on the ends with louvers for ventilation. The enclosure shall be a center split design, having mounting lips on each end. The mounting base shall be submerged into the concrete a minimum of two inches, positioning the enclosure two and one half inches above the concrete for drainage purposes. The locking mechanism shall be of the full release type which allows for complete removal of the enclosure from its mounting base without the use of tools. The locking mechanism shall be a Stainless Steel Cross Bar style and provide for a padlock. Prior to ordering, contractor shall verify size of enclosure required to enclose all booster pump equipment. Rainbird models, VIT Strong Box Models PE-40AL/PE-60AL or equal.

2.5 CONTROL WIRING

A. Copper direct burial decoder cable with colored jacket sized according to length of the run, minimum 14

gauge. Run (1) extra set of decoder cable with a different colored jacket for future maintenance. All communication wire for controllers and sensors shall be installed in electrical conduit not less than 1 inch. Cable shall be manufactured by Rainbird, Hunter or approved equal.

B. Electrical Dry Connection. Spears DS -400, pre-filled dri-splice connector with crimp sleeves; DRYCONN #10222 waterproof connectors by King Innovations (#22 to #12 AWG), or equal. Waterproof under-ground wire connections.

2.6 AUTOMATIC CONTROLLERS

A. New automatic controller.

1. Locate as per plans.

2. Accessories per plans, no known equal.

2.7 MAIN LINE SHUT OFF BOX

A. Install main line shut off valve at point of connection in a Christy concrete G5 traffic box for main line shut off valves with “water” labeled lid, or equal.

2.8 CONTROL VALVE BOXES

A. Use 10 by 10-1/4 inch round box for all gate valves, Carson Industries #910-12B with green bolt down cover, or equal. Extension sleeve shall be PVC-6 inch minimum size.

B. Use 9 1/2 by 16 by 11 inch rectangular box for all electrical control valves, Carson Industries 1419-13B with green bolt down cover, or equal.

2.9 SPRINKLER HEADS

A. All sprinkler heads on any one system (zone) shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the Drawings and specified.

B. Double Swing Joint Assembly: These shall be fabricated in accordance with the detail. Use Schedule 80 threaded nipples and risers and Schedule 40 fittings.

C. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.

D. Low precipitation rate, multi-stream nozzles shall be Hunter MP Rotator series, or equal, and shall be used with 30psi or 40 psi pressure regulating heads (PROS-06/12-PRS40- CV-MP1000/2000/3000) per plans or equal.

2.10 LINE SOURCE SUB SURFACE DRIP IRRIGATION SYSTEMS

A. Drip tubing, type noted on Drawings.

1. Sub-surface drip tubing with in-line, pressure compensating emitters. Emitter and row spacing per Drawings.

2. Sub-surface drip tubing with in-line, pressure compensating emitters, factory wrapped with polypropylene fleece. Emitter and row spacing per Drawings.

2.11 DEEP ROOT WATERING TUBES

A. Deep Watering Tube: 4” diameter semi-rigid polyethylene mesh tube (36 inch) with adjustable bubbler. Construct assembly as shown in details or use Rainbird RWS or equal, size per Drawings.

2.12 REMOTE CONTROL VALVE IDENTIFICATION TAGS

A. 2-1/4 by 2-3/4 inch yellow polyurethane with valve number embossed on tag, as manufactured by Christy's Irrigation I.D. Tags, (714) 771-4142, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Exercise extreme care in excavating and working near existing utilities.

Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing Utilities Drawings for existing utility locations.

B. Refer to 1.4 Coordination and Scheduling for additional inspection requirements.

3.2 PREPARATION

A. Physical Layout

1. Prior to installation, Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads and layout of drip tubing.

2. All piping and tubing layout shall be approved by Owner’s Representative prior to installation.

B. Water Supply

1. Point of Connection (POC): Install flow sensor and master valve assemblies after brass gate valve. The sizes of master valve and flow sensors to be main line-sized or larger for project and have the capacity to have additional systems added on in the future.

2. Electrical Supply

a. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the Drawings.

3.3 INSTALLATION

A. Irrigation Controller

1. Contractor shall test for radio signal strength at relocation site.

2. Remove existing irrigation controller and salvage for relocation. Abandon or remove all existing wires (at contractor’s discretion).

3. Pour concrete pad in location shown on plan with appropriate conduits per plan details. Retrofit controller with appropriate upgrades as shown on plan and install at new location. Route wiring from all field valves and sensors to controller.

4. Contractor shall be responsible for final communications to Owner’s central control system.

B. Trenching

1. Provide a minimum cover of 24 inches for all pressure supply lines.

2. Provide a minimum cover of 18 inches for all non-pressure PVC lines.

3. Provide a minimum cover of 4 inches for all drip tubing

4. Provide a minimum cover of 18 inches for all control wiring.

C. Backfilling

1. A fine granular material backfill shall be initially placed on all lines. No foreign matter larger than 1/4 inch in size will be permitted in the initial backfill. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from 4 inch or greater clods of earth or 1/4 inch or greater stones, gravel or other debris. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. Flooding of trenches will be permitted only with approval of the Owner's Representative.

3. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments at no additional cost to the Owner.

D. Trenching and Backfill Under Paving

1. Trenches located under areas where paving (asphaltic concrete or concrete), will be installed shall be backfilled with sand (a layer 6 inches below the pipe and 3 inches above the pipe) and compacted in layers to 95 percent compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, as part of the sprinkler Work, cap and pressure test all piping under paving prior to the paving Work.

2. Piping under existing walks shall be done by jacking, boring or hydraulic driving where possible. Where any cutting or breaking of sidewalks or concrete is necessary permission shall be obtained from the Owner's Representative. No hydraulic driving will be permitted under concrete paving. Concrete paving shall be replaced back to nearest control joint. See Section 01 73 20 Cutting and Patching.

3. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

E. Pipe Assemblies

1. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

2. On PVC to metal connections, Contractor shall work the metal

connections first. Pipe tape shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters or machined PVC schedule 80 pipe nipples into which the pipe may be welded.
Do not install multiple assemblies in plastic sleeves.

3. Use fittings to change pipe directions. Do not deflect pipe beyond manufacturer's recommendations.

4. Do not install joints in sleeves or under pavement if length is less than 20 feet. Where pipe length exceeds 20 feet, use minimum number of joints.

5. Install PVC piping and fittings without tension on the fittings. Pipes should be inserted squrely and fully into socket of fittings.

F. Pipe Clearance: All pipes shall have a minimum clearance of 6 inches from each other and from lines of other Work. Parallel pipes shall not be installed directly over one another. No more than two pipes may be installed in a single trench.

G. High Voltage Wiring for Automatic Controller

1. Provide 120 volt power connection to the automatic controller.

H. Remote Control Valves

1. Install where shown on Drawings and details. When grouped together, allow at least 12 inches between valve box edges. Install each remote control valve in a separate valve box.

2. Each controller and station number shall be labeled at the valve with a 2-1/4 by 2- 3/4 inch yellow polyurethane I.D. tag attached to the control wire of the valve.

3. Set valve boxes perpendicular to adjacent walls and parallel to one another.

4. Thoroughly flush mainline before installing valves.

5. Install valve and box to maintain a minimum of 1 inch clear space between the top of the valve and the lid of the box.

6. Install valve box at the same level as soil grade, not above.

I. Control Wiring

1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.

2. Where more than 1 wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.

3. An expansion curl shall be provided within 3 feet of each wire

connection. Expansion curl at electric control valves shall be of sufficient length so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.

4. All splices shall be made with electric dry connections. Use one splice per connector.

5. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of Owner's Representative.

J. Flushing of System

1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the control valves shall be opened and a full head of water used to flush out the system.

2. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Owner's Representative.

3.4 EXISTING TREES

A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall first discuss with the Owner's Representative and get written permission for proposed trench route. Contractor shall use all possible care to avoid injury to trees and tree roots.

3.5 FIELD QUALITY CONTROL

A. Testing of Irrigation System

1. Contractor shall request the presence of the Owner's Representative in writing at least 48 hours in advance of testing. Testing of pressure mainlines shall occur prior to installation of electric control valves.

2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight.

3. All piping under paved areas shall be tested under hydrostatic pressure of 150 pounds per square inch, and proved watertight, prior to paving.

4. Sustain pressure in lines for not less than 2 hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.

5. All hydrostatic tests shall be made in the presence of Owner's Representative. No pipe shall be backfilled until it has been inspected, tested and approved in writing.

6. Furnish necessary force pump and all other test equipment.

7. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the Owner's Representative, to determine if the water coverage for planting areas is complete and adequate. This test shall be accomplished before any plants are planted.

B. Adjustment of the System

1. Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.

2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.

3. All sprinkler heads shall be set perpendicular to finished grades unless otherwise shown on the Drawings.

C. The entire sprinkler irrigation system shall be under full automatic operation for a period of 2 days prior to any planting. The Owner's Representative reserves the right to waive or shorten the operation period.

3.6 CLEAN-UP

A. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down.

3.7 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. Contractor shall operate each system in its entirety for the Owner's Representative at time of final observation. Any items deemed not acceptable by the Owner's Representative shall be reworked to the complete satisfaction of the Owner's Representative.

B. The controller must be set up and under full automatic operation before final inspection can occur and maintenance period can begin.

C. Controller charts and final as-built record drawings shall be submitted in both electronic form and as 1 full-size hard copy. Both must be provided to the Owner's Representative and approved before final inspection can occur and maintenance period can begin. Refer to 1.2.B. and C.

D. Contractor shall show evidence to the Owner's Representative that the Owner has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

END OF SECTION

SECTION 32 90 00 PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work: Provide landscape planting, complete in place, as shown and specified including; removal of rock, gravel and other construction related material, sub-grade treatment, soil replacement, rough grading, soil amendment and preparation, finish grading, planting, seeding, staking, header installation, decomposed granite installation, clean-up, and maintenance.

B. Related Sections:

1. Section 01 23 00 Alternates
2. Section 32 84 00 Planting Irrigation

1.2 SUBMITTALS

A. Submit documentation to Owner's Representative at least 60 days before planting certifying that all plant material is available, listing sources of materials.

B. Submittals shall include but not be limited to the following:

1. Fertilizer: Chemical and percentage composition.
2. Mulch: Size, type of material.
3. Soil testing report (after rough grading)
4. Amendments: Type, size and composition.
5. Seed: Botanical and common name, percentage by weight, percentages of purity, germination and weed seed for each grass seed species.
6. Planting schedule indicating anticipated dates for planting.
7. Linear Root Barrier

C. Quality Assurance Submittals:

1. Plants shall be subject to inspection and approval by Owner's Representative at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. The health

and vigor of the plant material is the sole responsibility of Contractor. Submit written request for inspection of plant material at place of growth to Owner's Representative stating location and quantity of plants to be inspected.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Deliver fertilizer to site in unopened containers bearing manufacturer's guaranteed chemical analysis.

2. Furnish Owner's Representative with copies of receipts for all amendments.

3. Deliver all plants with legible identification labels.

   a. Label trees, shrubs, bundles of plants, or groundcover plants.

   b. State correct plant name and size indicated on plant list.

   c. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 days.

4. Protect plant material during delivery to prevent damage to root ball or desiccation of leaves.

5. Notify Owner's Representative 7 days in advance of delivery of all plant materials and submit an itemized list of the plants in each delivery.

6. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

7. Ship and store seed, mulch and fertilizer with protection from weather or other conditions that would damage or impair the effectiveness of the product.

B. Storage

1. Store plant material in shade and protect from weather.

2. Maintain and protect plant material not to be planted within 4 hours in a healthy, vigorous condition.

C. Handling

1. Contractor is cautioned to exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and shall be replaced with undamaged materials at the Contractor's expense.

1.4 COORDINATION AND SCHEDULING

A. Perform planting only when weather and soil conditions are suitable in accordance with standards of industry.

B. Scheduling: Install trees, shrubs, and liner stock plant material before wood mulch is spread.

C. Observation Schedule. Contractor shall notify Owner's Representative in advance for the following site visits, according to the time indicated:

1. Plant material review at growing site - notify Owner's Representative at least 30 days before planting.
2. Pre-job conference - 7 days.
3. Final grade review - 48 hours.
4. Soil preparation.
5. Plant material review - 48 hours.
6. Planting operation review: One tree and plant of each size and installation method shall be approved prior to planting. All trees shall be laid out or locations marked. - 48 hours.
7. Planting layout review: all potted plants (shrubs and groundcovers) shall be laid out for review prior to installation – 48 hours.
8. Pre-maintenance - 7 days.
9. Final acceptance - 7 days.

1.5 SAMPLES AND TESTS

A. Owner's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.

B. Contractor shall have soil tested for soil amendments by a certified soil testing laboratory after rough grading operations are complete.

PART 2 - PRODUCTS

2.1 GENERAL

A. The following organic, soil amendments and fertilizer are based on typical campus soil composition and establish minimum requirements. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil samples are tested by the

Contractor and approved by the Owner's Representative. The amounts listed in the Preparation section are considered minimum amounts for the project unless directed otherwise by the Owner's Representative.

B. All materials shall be of, approved and first-grade quality when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis. Contractor shall supply Owner's Representative with a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance or bearing the manufacturer's guaranteed analysis.

2.2 HERBICIDES

A. Non-selective, systemic contact herbicide install per manufacturer's specifications, Roundup, or equal.

B. Pre-emergent herbicide (liquid or pelletized) install per manufacturer's specifications, Dimension or equal.

2.3 ORGANIC AMENDMENT

A. Amount of amendment shall be based on the soil analysis.

B. Green Compost: The producer shall be enrolled in the Seal of Testing Assurance Program (STA) sponsored by the US Composting Council and provide those specified test results. Test results shall list the source of the compost material and the location of where the compost was created. The compost shall pass all criteria for pathogens, heavy metals, maturity and stability. The compost shall be free of weeds and weed seeds, pathogens, Sudden Oak Death, trash, contaminants and foreign debris. The compost additionally shall comply with the following:

1. Gradation: A minimum of 90% of the material by weight shall pass a ½" screen. Material passing the ½" screen shall meet the following criteria.

PERCENT PASSING	SIEVE DESIGNATION
85 - 100	(3/8")
50 - 80	(No 8)
0 - 40	500 micron (No 35)

2. Organic content: Minimum 50% based on dry weight and determined by ash method. Minimum 250 lbs. organic matter per cubic yard of compost.

3. Carbon to nitrogen ratio: Maximum 30:1.

4. pH: 5.5 – 7.5 as determined in saturated paste and max 3 ppm soluble boron in the saturation extract.

5. Soluble salts: Soluble nutrients typically account for most of the salinity levels but sodium should account for less than 25% of the

total. To avoid a leaching requirement, the addition of the compost shall result in a final ECe of the amended soil of less than 4.0 dS/m @ 77 degrees Fahrenheit as determined in a saturation extract.

2.4 SOIL AMENDMENTS

A. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99 percent sulfur (expressed as elemental).

B. Iron Sulfate: 20 percent Iron (expressed as metallic iron), derived from ferric and ferrous sulphate, 10 percent sulfur (expressed as elemental).

C. Calcium Carbonate: 95 percent lime as derived from oyster shells.

D. Gypsum: Agricultural grade product containing 98 percent minimum calcium sulphate.

2.5 FERTILIZER

A. Plant Material One-Gallon Container Size or Larger

1. Planting Fertilizer: Pelleted or granular form shall consist of the following percents by weight and shall be mixed by commercial fertilizer supplier:

   a. 16 percent nitrogen

   b. 6 percent phosphoric acid

   c. 8 percent potash

2. Planting Tablets

   a. Shall be slow-released type with potential acidity of not more than 5 percent by weight containing the following percentages of nutrients by weight:

      (1) 20 percent nitrogen

      (2) 10 percent phosphoric acid

      (3) 5 percent potash

      (4) 2.6 percent combined calcium

      (5) 1.6 percent combined sulfur

      (6) 0.35 percent iron (elemental) from ferrous sulfate

   b. Shall be 21 gram tablets as manufactured by Agriform, Best Tabs, or equal, applied per manufacturer's instructions.

3. Sulphate of Potash: 0-0-50.

4. Single Super-phosphate: Commercial product containing 18-20 percent available phosphoric pentoxide

5. Urea Formaldehyde: 38-0-0.

B. Plugged Plant Material

1. Soil Conditioner

a. Gro-Power Plus (no known equal): Humus (bacteria included) based fertilizer and soil conditioner with soil penetrant shall consist of the following percents by weight:

5% nitrogen
3% phosphoric acid
1% potash
50% humus
15% humic acids

2.6 IMPORT TOPSOIL

A. Particle Size:

CLASS	PARTICLE SIZE RANGE	MAXIMUM, % WT.	MINIMUM, % WT.
Coarse Sand	0.5-2.0 mm	15	0
Silt Plus Clay	< 0.05 mm	50	25
Silt	0.002 - 0.05 mm	30	10
Clay	0 - 0.002 mm	25	10
OTHER CLASSES			
Gravel	2 - 13 mm	15	
Rock	> ½1/2 inch	10% by volume None > 1 inch	0
Organic Matter		15	0

B. The pH of saturated paste shall be between 5.5 and 7.5 without high qualitative lime content. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 milliohms per centimeter at 25 degrees centigrade. The boron content shall be no greater than one part per million as measured on the saturation extract. In order to ensure conformance, samples of the import soil shall be submitted to the laboratory for analysis prior to backfilling.

2.7 PLANT MATERIAL

A. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, weeds, plant diseases, sun scalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well "hardened"

systems and vigorous and fibrous root systems that are not root or pot-bound. Root conditions of the plants provided by Contractor in containers will be determined by removal of earth from the roots of not less than two plants or more than 2 percent of the total number of plants of each species or variety. Where container-grown plants are from several sources, the roots of not less than 2 plants of each species or variety from each source, will be inspected. In case the sample plants inspected are found to be defective, the Owner's Representative reserves the right to reject the entire lot or lots of plants represented by the defective samples.

B. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as shown on the Drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall conform with the measurements, if any, shown on the Drawings. Plants larger in size than specified may be used with the approval of the Owner's Representative. If the use of larger plants is approved, the ball of earth or spread of roots for each plant shall be increased proportionately.

C. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the Work and replaced with new plants at the Contractor's expense.

D. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the Owner's Representative.

E. Plant material shall be true to botanical and common name and variety as specified in "Annotated Checklist of Woody Ornamental Plants in California, Oregon and Washington," published by the University of California School of Agriculture (1979).

F. Nursery Grown Stock:

1. Grown under climatic conditions similar to those in locality of project.

2. Container-grown stock in vigorous, healthy condition, not root-bound or with root system hardened off.

3. Use only liner stock plant material which is well established in removable containers or formed homogenous soil sections.

2.8 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Mixture: Provide seed of grass species and varieties, proportions

by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated.

1. Pacific Coast Seed, “Native Erosion Control Mix” or equal
2. Seed Mix (at 45 lbs. per acre) shall consist of Bromus carinatus, Elymus glaucus, Fectuca microstachys and Trifolium willdenovii. Mixture per Seed Distributor.

C. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, non-toxic, free of plant growth or germination inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Non-asphaltic Tackifier; Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, non-toxic and free of plant growth or germination inhibitors.

2.9 SOD

2.10 PLUGS

1. No sod lawn in project.

A. No plugs in project.

2.11 STAKING MATERIALS

A. Lodge pole tree stakes

1. Provide 2 at each new planted tree as per detail.
2. Round and uniform with chamfered top and conical point.
3. 8 or 10 foot by 2 inches as required for height of tree
4. Pressure Treated Douglas Fir
5. Secure tree with tree ties.

B. Tree Tie:

1. Arthur Enterprises: Super Tree Tie, or equal. Vinyl impregnated 1 inch Nylon, waterproof, tensile strength 300 pounds, bursting strength 300 psi.

2.12 WATER

A. Provide or use only from Owner approved utility water source.

2.13 MULCH

A. Shall be Shredded Cedar Bark as supplied by: Redi-Gro, Sacramento, Sierra Organic, Manteca, Mallard Creek, Rocklin, or equal

B. The mulch shall consist of fibrous, woody bark mixture of varied particle size

such that:

PERCENT PASSING	SIEVE SIZE
90-100	25.4 mm (1 inch)
80-100	12.7 mm (1/2 inch)
20-60	6.35 mm (1/4 inch)

2.14 WOOD HEADERBOARDS

A. Headerboards shall be 2 by 4 inch pressure treated Douglas Fir or Redwood construction heart grade. Splices shall be made with 1 by 4 inch and shall not be less than 12 inches in length. Stakes shall be placed at intervals of not more than 4 feet and shall be 1 by 3 by 16 inches "construction heart redwood." All stakes shall be cut with level cut and set below top of headerboard.

B. On sharp turns and curves, four 1/2 by 4 inch laminated boards or two 1 by 4 laminated boards may be permitted.

C. Stakes and splices shall be nailed with galvanized common nails. Nail as required for solid installation.

D. Provide headerboards as shown on the Drawings and herein specified laid true to line and grade, in a workmanlike manner. Care shall be exercised in laying wood headers to protect adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on the back side of headerboard (away from turf or pavement).

2.15 METAL HEADERS

A. Metal Headers composed of steel and shall be 3/16 inch, powder-coated black or dark green, with 14 inch steel stakes. Depth shall be as follows:

1. Metal headers at tree wells shall be 4” deep.

B. Provide headers as shown on the Drawings and herein specified. They shall be laid true to line and grade, and in a workmanlike manner. Care shall be exercised in laying metal headers to protect adjacent improvements, shrubbery and other properties from damage. All stakes shall be placed on groundcover side of header.

2.16 SAND

A. Washed Silica Sand.

2.17 PLANTER DRAINAGE ROCK

A. Drainage rock shall be 1/4 inch pea gravel and shall be clean, hard, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

2.18 LINEAR ROOT BARRIER

A. Linear root barriers shall be Biobarrier manufactured by Typar, or equal.

B. Physical and Chemical Requirements

1. Fibers used in the manufacture of root control barrier substrate fabric shall consist of long chain synthetic polyolefins (at least 95% by weight) and a UV stabilizer. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other.

2. Nodules consisting of trifluralin, carbon black, and polyethylene compounded in a method utilizing time-released characteristics are permanently attached to the substrate fabric on 1-1/2” centers by a through injection molding process.

3. All substrate property values, with the exception of apparent opening size (AOS), in these specifications represent minimum average roll values (MARV) in the weakest principal direction (i.e., average test results of any roll in a lot sampled for conformance or quality assurance testing shall meet or exceed the minimum values provided herein). Values for AOS represent maximum average roll values.

4. Property values for the trifluralin are average run values.

B. Panels shall measure 20’ in width with a depth of 36” unless otherwise specified.

C. Physical properties shall equal or exceed the following:

D.

Overall Product Major Composition and Ingredients		**Typical**
Active Chemical*:	Trifluralin (a,a,a-Trufluro 2,6 - dinitro - N,N, - Dipropyl - p - toluidine)	17.5%
Inert Ingredients	100% Spunbonded Polypropylene, Polyethylene and Carbon	82.5%

Trifluralin Characteristics	Minimum Values English	Metric	Test Method*
Unit Weight	3.9 oz/yd^2	130 g/m^2	ASTM D-5261
Grab Tensile Strength	130 lbs.	575 N	ASTM D-4632
Elongation at Break	60%	60%	ASTM D-4632
Puncture Strength	40 lbs.	175 N	ASTM D-4833
Trap Tear	60 lbs	265 N	ASTM D-4533
Permittivity	0.7 sec.	0.7 sec.	ASTM D-4491
AOS (Max Value)	0.21 mm	0.21 mm	ASTM D-4751
Ultraviolet Stability	70% @ 500 hrs	70% @ 500 hrs	ASTM D-4355

PART 3 - EXECUTION

3.1 INSPECTION

A. Obtain Owner Representative's written acceptance that planting soils have been cleaned of all construction debris, including gravel, concrete, concrete washout, paints, asphalt, etc. Refer to preparation and planting installation paragraphs of this section.

B. Obtain Owner Representative's written acceptance that final grades have been established to within 1/10 foot prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. Contractor shall be responsible for shaping all planting areas as indicated on Drawings.

C. Prior to planting, inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.

D. Do not begin planting of trees until deficiencies are corrected or trees are replaced.

3.2 SOIL CLEANUP AND PREPARATION

A. Clean Up: Contractor shall review site conditions and previously completed rough grading to verify that all imported stones, stumps, gravel, concrete, asphalt, and other construction debris have been cleared from the site to a depth of 24 inches, prior to continuing project work. Contractor shall remove any and all germinated weeds.

B. Soil Cleanup, Replacement and Preparation:

1. The top 12 inches of clean (as approved by the Owner's

Representative) native soil shall be lifted and removed from the site prior to general construction. Clean topsoil shall be stockpiled on site, kept clear and free of debris and rock, and then used as needed for landscaping. Place a minimum of 12 inches of clean topsoil back into all planting areas. The next lower 12 inches of soil shall be cleared of all stones, stumps, debris, etc., larger than 1/4 inch in diameter, that are brought to the surface as a result of cultivations. Cultivation shall be by rototilling or ripping equipment. Call Underground Service Alert (USA) before beginning cultivation operations.

2. In areas where building foundations have been over-excavated and re- compacted, additional mitigation measures will be required to improve soil and drainage conditions for planting. These may include, but are not limited to: the installation of subsurface drainage systems for shrub and groundcover areas and individual tree pits; removal of additional soil from the planting areas beyond what is specified above until acceptable drainage and compaction levels are achieved; aeration tubes installed; radial soil trenches dug out around each tree; or other measures as determined and approved by the Owner's Representative. Mitigation measures shall be completed by the Contractor as required at no additional cost to the Owner. See Planting Installation paragraph for more information and additional related requirements.

3. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Amendments shall be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top 6 inches of soil.

4. Application Rates: (Per 1,000 square feet) the following organic, soil amendments and fertilizer establish minimum requirements. Specific amendments and fertilizer amounts will be determined after rough grading operations are complete and soil samples are tested by the Contractor and approved by the Owner's Representative. The amounts listed below are considered minimum amounts for the project unless directed otherwise by the Owner's Representative.

    a. Nitrogen stabilized organic amendment – 6 cubic yards for groundcover and shrub beds, 3 cubic yards for lawn areas. Owner's Representative may request delivery tags.

    b. Planting fertilizer - 15 lbs.

    c. Gypsum - 200 lbs.

    d. Soil sulphur - 20 lbs.

    e. Iron – 2 lbs.

    f. Calcium carbonate – 2 lbs.

C. Final Grades:

1. All areas shall be graded so that the final grades will be 1 inch below adjacent paved areas, sidewalks, valve boxes, headers, clean-outs, drains, manholes, etc. or as indicated on Drawings.

2. Surface drainage shall be away from all building foundations.

3. Eliminate all erosion scars prior to commencing maintenance period.

D. Disposal of Excess Soil: Dispose of any unacceptable or excess soil legally at an offsite location.

3.3 PLANTING INSTALLATION

A. General

1. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.

2. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-plant Weed Control

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days to allow systemic kill. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4 inch below the surface of the soil over the entire area to be planted.
2. After irrigation system is operational, apply water for 5 to 10 days as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by Owner’s Representative.
3. Maintain site weed free until final acceptance by the Owner’s Representative.

C. Layout of Major Plantings: Locations for plants and outlines of areas to be planted shall be marked on the ground by Contractor before any plant pits are dug. All such locations shall be approved by the Owner’s Representative. If underground construction or a utility line is encountered in the excavation of planting areas, other locations for planting may be selected by the Owner’s Representative. Layout shall be accomplished with flagged grade stakes indicating plant names and specified container size on each stake.

D. Planting of Trees and Shrubs:

1. Excavation for planting shall include the stripping and stacking of

all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits and planting beds.

2. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.

3. Protect all areas from excessive compaction when trucking plants or other material to the planting site.

4. All excavated holes shall have vertical sides and shall be of a size that is three times the diameter and 1 and 1/2 times the depth of the root ball for all trees and shrubs. After pits are dug, roughen the sides of the pit and loosen soil in the bottom of the pit to a depth of 3 inches. Construct foot-tamped mound in the bottom of the pit to support the plant at the proper level.

5. All prepared tree pits must be reviewed and approved by the Owner's Representative prior to the planting of any trees.

6. Percolation tests are required for 1 out of every 5 trees planted on a given site. Tree pits from each planting area of the project shall be tested for percolation. However, in areas where over-excavation of a building foundation has occurred, or any other construction practice typically resulting in extremely compacted subsoil conditions, all tree pits must be tested for percolation. Tree pits shall be filled with water and the drainage rate observed. Percolation rate shall be a minimum of the depth of the tree pit within 24 hours. If percolation/drainage rate is less than that - mitigation measures shall be implemented (see Soil Cleanup, Replacement and Preparation paragraph above) .

7. Do not handle container plants by the tops, stems or trunks at any time. Lift all plants so that the root ball is supported from the underside. Plants that do not have a satisfactory root system will be rejected. If plants do not have young feeder roots showing at the edge of the container, loosen their roots and score the root ball with a 1/2 inch deep vertical line to encourage new feeder root development.

8. Center plant in pit or trench. Crown of trees shall be 1 inch minimum above finish grade. Crown of shrubs shall be 1 inch above finish grade.

9. Face plants with fullest growth into prevailing wind.

10. Set plant plumb and hold rigidly in position until soil has been tamped firmly around ball or roots.

11. Backfill for trees and shrubs shall consist of amended native soil. If native soil is unsuitable or contaminated, use imported topsoil as

specified above.

12. All plants which settle deeper than the surrounding grade shall be raised to the correct level. After the plant has been placed, additional backfill shall be added to the hole to cover approximately 1/2 of the height of the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil.

13. Container Removal:

    a. Cut containers on 2 sides with a can cutter designed for the job.

    b. Do not injure root ball.

    c. Do not cut containers with spade or ax.

    d. After removing plant, superficially cut edge roots with knife on 3 sides.

14. Box Removal:

    a. Remove bottom of plant boxes before planting.

    b. Remove sides of box without damage to root ball after positioning plant and partially backfilling.

15. Plant Tablets:

    a. After the water has completely drained, planting tablets shall be placed as indicated below.

        1) Two tablets per 1-gallon container.

        2) Four tablets per 5-gallon container.

        3) Six tablets per 15-gallon container.

        4) Ten tablets per 24 inch box.

        5) Fourteen tablets per 36 inch box.

        6) Eighteen tablets per 48 inch and those box sizes which are larger.

    b. Planting tablets shall be set with each plant on top of the root ball while the plants are still in their containers so the required number of tablets to be used in each hole can be easily verified by the Owner’s Representative.

16. Backfill

    a. The remainder of the hole shall then be backfilled with 2/3

native soil and 1/3 organic amendment thoroughly blended and tamped firm.

b. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be of a depth sufficient to hold at least 2 inches of water. The basins shall be constructed of amended backfill materials. Remove basin in all turf areas after initial watering.

17. Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to shape the plant material as directed by the Owner's Representative. Pruning shall not be done prior to delivery of plants.

18. Staking: Staking of all trees shall be completed immediately after planting. All stakes shall be installed plumb and as indicated in Drawing details.

E. Planting of Groundcovers:

1. Groundcover plants shall be grown in flats or gallon containers as indicated on the Drawings. Flat grown plants shall remain in those flats until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.

2. Groundcover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the Drawings. Triangular spacing shall be used unless otherwise noted on the Drawings.

3. Each rooted plant shall be planted with its proportionate amount of flat or container soil. Plantings shall be immediately sprinkled with water after planting until the entire area is soaked to the full depth of each hole.

4. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations shall be repaired immediately.

F. Mulch

1. All groundcover, perennial, and shrub beds shall be dressed with a 3 inch layer of mulch, where slopes are not steeper than 2:1.

2. Pre-emergent weed control product shall be applied to all planting areas after completion of planting and prior to mulch application. Use Dimension, or equal and apply per manufacturer's recommendations.

G. Hardpan Conditions:

1. Where hardpan exists, whether it is in the form of caliche or other impervious clay, and it is within the top 2 and 1/2 feet of soil, use powered equipment to break through completely at each tree

location to allow drainage and root growth. Remove hardpan at least 1 - 1/2 feet greater than the root ball diameter of tree. Backfill with soil mix as specified.

2. Where hardpan is within the first 12 inches of soil, it shall be completely penetrated for all shrubs.

3.4 HEADERBOARD INSTALLATION

A. Wood and Metal Headers:

1. Headers: Install header true to line and grade as shown on the Drawings. Align header edges and set flush with adjacent paving.

2. Stakes: Stakes shall be a minimum of 12 inches long for wood and 14 inches for metal, and longer as required for solid anchorage.

3. Header is not required where perimeter of decomposed granite is bounded by a concrete curb or slab.

4. Landscape edging is to remain in place, securely staked to hold firmly to approved line and grade.

5. After finished compacted path surface has been achieved, finish adjacent shoulder by backfilling back of header with stockpiled topsoil, compacting to match existing undisturbed ground and slope to required grade and cross section.

3.5 LINEAR ROOT BARRIER

A. General

1. Linear root barriers shall extend a minimum of 10’ centered on tree trunk lying parallel with paving or utilities requiring protection.

2. Linear root barrier shall not be installed in a manner where entire root ball is encapsulated.

B. Existing Trees

1. Install linear root barrier at edge of utility trench in approximate locations shown on plan.

C. Newly Planted Trees

1. Install in locations as noted on plan.

3.6 CLEAN UP

A. During the progress of the Work, the Contractor shall keep the Project site in a neat and clean condition that is free of debris to the satisfaction of the Owner’s Representative. All materials and debris accumulated in

conjunction with completing this Work shall be legally recycled or disposed of by Contractor off campus. Refer to Section 01 74 00 Cleaning and Waste Management. Remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site.

B. The Contractor shall leave the site area broom-clean and shall wash down all walkways and other paved areas, leaving the premises in a clean and safe condition.

C. Promptly remove soil and debris created by work from paved areas and building walls. Clean wheels of vehicles before leaving site to avoid tracking soils onto surfaces of roads, walks, or other paved areas.

3.7 MAINTENANCE & PLANT ESTABLISHMENT

A. General: Maintain all plants and planting areas from time of delivery, through installation and maintenance period, until final acceptance.

B. Schedule: Submit proposed maintenance work schedule to Owner's Representative in writing for review at least 30 days prior to commencement of maintenance work. Maintenance work shall be done at times accepted by Owner.

C. Maintenance Procedures

1. General: Maintenance of new planting includes but is not limited to watering, cultivating, fertilizing, weeding, mulching, re-staking, resetting plants to proper grades or upright positions, restoring watering basins, mowing lawns to 2 inch height, removal of dead flowers and broken twigs, pest, disease and weed control, erosion control, restoring finish grades with accepted and tested imported topsoil, and taking precautions as necessary to prevent sunscald damage. Remove nursery tags and repair mulch 10 days before final acceptance.

2. Young tree pruning shall be conducted during the maintenance period by the Contractor as approved by the Owner's Representative after review by the Campus Arborist and in accordance with the Owner's standard tree pruning practices. Refer to Section 01 56 39 Tree and Plant Protection. Trees shall be pruned to encourage the growth of strong central leaders where applicable. Contractor shall notify Owner's Representative 48 hours in advance of any pruning operations.

3. Protection: Protect planting areas and plants against damage until final acceptance. Maintenance also includes temporary fences, barriers, and signs as required for protection. Treat or replace damaged plants as directed by Owner's Representative at no additional cost to Owner.

4. Fertilization: Apply potassium sulfate and 16-6-8 fertilizer at the rate of 6 pounds each per 1000 square feet, 30 days after installation.

5. Weed control:

   a. Keep site free of weeds during maintenance period.

   b. Identify weeds and apply accepted control methods.

   c. Herbicides, if used, shall be applied by licensed Pest Control Operator according to manufacturer's recommendations.

D. Observation for Maintenance Period Commencement: Request after work of this section and Section 32 84 00 Planting Irrigation is substantially complete. Maintenance Period shall begin upon written notice of acceptance by Owner's Representative and shall continue for a ~~minimum of 90 days~~ **1-year** until final acceptance.

END OF SECTION

SECTION 32 91 16

BIORETENTION FACILITIES

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. The location for a raingarden/ bioretention facility is identified on the plan and the design should provide so that each layer is built flat and level. The following must have consistent elevations throughout the facility:
   1. bottom of excavation/gravel layer (BGL)
   2. top of gravel storage layer (TGL)
   3. top of soil layer (TSL)

B. Bioretention soils shall:
   1. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour.
   2. Have sufficient moisture retention to support vigorous plant growth.
   3. Consist of the following mixture of fine sand and compost, measured on a volume basis:
      a. 60%-65% Sand
      b. 35%-40% Compost

1.2 MATERIALS

A. Gravel layer: “Class 1 permeable,” Caltrans specification 68-2.02F(2), is recommended. Drain rock or other granular material may be used; however, a membrane layer of pea gravel or other intermediate-sized material should cover the top of the gravel layer to prevent movement of fines from the soil layer into the interstices of the gravel layer. Do not use filter fabric for this purpose as it tends to clog.

B. Underdrain (if used): Use minimum 4" dia. PVC SDR 35 or equivalent, perforated pipe, installed with the holes facing down. The underdrain itself may be embedded in the gravel layer; the discharge elevation (typically, where the underdrain is connected to the overflow structure) is critical and must be no lower than the top of the gravel layer. Provide a threaded, capped cleanout connected by a sweep bend.

C. Planting Medium: A mixture of sand (60%- 75%) and compost (35%-40%) should be used.

D. Plantings and mulch: Select a plant palette to tolerate fast-draining soils and the microclimate specific to the location. The soil surface will be

inundated briefly and rarely (for a few hours on possibly up to 5 occasions during a wet winter, but typically less frequently) but otherwise dry unless irrigated. Consider the facility's relationship to the site and the resulting exposure to sun, heat, shade, and wind. Grasses, grass –like plants or low shrubs are appropriate for the bioretention facility. Three inches of mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 91 16

SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes pipe materials, fittings, valves, fire hydrants, and back flow devices for connection to the building from the utility source.
B. Fire water lines & pump will be a deferred submittal on the project.
C. Fence and Man Gates will be a deferred submittal on the project.

1.2 RELATED SECTIONS

A. Section 31 23 33 Trenching and Backfilling

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. CalTrans Standard Specifications.

2. American Association of State Highway and Transportation Officials

3. National Precast Concrete Association:

4. NPCA Quality Control Manual for Precast Plants.

5. NPCA Plant Certification Program.

6. American Society of Mechanical Engineers:

a. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

b. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

7. American Society for Testing and Materials:

    a. ASTM B32 – Standard Specification for Solder Filler Material.

    b. ASTM B813 – Standard Specification for Soldering Flux.

    c. ASTM B828 – Standard Specification for Copper Tubing Soldered Joints.

    d. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

    e. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

    f. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

    g. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

    h. ASTM F645 – Standard Specification for Selection, Design, and Installation of Thermoplastic Water Piping.

8. American Water Works Association:

    a. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

    b. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

    c. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

    d. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

9. Copper Development Association:

10. Copper Tube Handbook.

11. Underwriters Laboratories Inc.:

12. UL 246 - Hydrants for Fire - Protection Service.

13. Fire Protection Equipment Directory.

1.4 DEFINITIONS

A. Water-Distribution Piping: Exterior domestic or fire water piping.

B. Water Service: Exterior domestic and fire water services, owned and maintained by the California Water Service Company up to the water meter.

C. The following are industry abbreviations for plastic materials:

1. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

A. Product Data: Submit data for the following:

1. Piping specialties.

2. Valves and accessories.

3. Water meters and accessories.

4. Hydrants.

B. Field Quality-Control Test Reports: From Contractor.

C. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. Closeout Procedures include the following:

1. Water meters.

2. Valves.

3. Protective enclosures.

4. Hydrants as indicated.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional

requirements of piping and specialties and are based on the specific system indicated.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service- main products.

E. NSF Compliance:

1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew- point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand-wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's and written permission.

1.10 COORDINATION

A. Coordinate connection to water main with CalWater.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. PVC Pipe: ASTM D1785, Schedule 40.

1. Fittings: ASTM D2466, PVC.

2. Joints: ASTM D2855, solvent weld.

C. PVC Pipe: AWWA C900 DR14 Class 200. (to be used for fire water lines on the project)

1. Fittings: AWWA C111, cast iron.

2. Joints: ASTM D3139 compression gasket ring.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

C. Ductile-Iron Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

D. Ductile-Iron Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

E. Ductile-Iron Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.4 COPPER TUBE AND FITTINGS

A. Soft Copper Tube:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder- joint pressure type. Furnish only wrought-copper fittings if

indicated.

B. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 JOINING MATERIALS

A. Transition Couplings:

1. Underground Piping, NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2. Aboveground or Vault Piping: Pipe fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Soldering Flux: ASTM B 813, water-flushable type.

D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

2.6 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers:

a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.

c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

d. Crane Co.; Crane Valve Group; Stockham Div.

e. East Jordan Iron Works, Inc.

f. Grinnell Corporation; Mueller Co.; Water Products Div.

g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

h. McWane, Inc.; Kennedy Valve Div.
i. McWane, Inc.; Tyler Pipe; Utilities Div.

j. NIBCO INC.

k. United States Pipe and Foundry Company.

2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Mechanical joint.

c. Interior Coating: Complying with AWWA C550.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch diameter barrel.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.8 WATER METERS

A. Water meters will be furnished by CalWater.

2.9 FREESTANDING FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 33 – trenching and backfilling

3.4 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Water-Distribution Piping: Use the following piping materials for each size range:

1. NPS 3/4 to NPS 3 (DN 20 to DN 75): Soft copper tube, Type K (Type A) and soldered joints, or Schedule 40 PVC.

2. NPS 4 to 12 (DN 100 to DN 300): Ductile-iron or Class 200 PVC, mechanical joint pipe.

3.5 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, non-rising- stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron,

non-rising-stem, resilient-seated gate valves with valve box.

3.6 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.

2. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.

3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

4. PVC, ASTM D3139 compression gasket ring.

3.7 PIPING INSTALLATION

A. Water-Main Connection: Arrange with CalWater.

B. Install PVC, water-service piping according to AWWA C900 and AWWA M23.

C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

D. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

E. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

F. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

G. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping

systems when those systems are installed.

H. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

I. Anchor service-entry piping to building wall.

J. Install water-supply piping with shutoff valve in water supply to each post hydrant and drinking fountain. Use curb valve and service box.

3.8 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

2. PVC piping: According to AWWA M23.

B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.9 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.10 WATER-METER INSTALLATION

A. Water meters will be installed by CalWater.

3.11 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

3.12 CONNECTIONS

A. Connect water-distribution piping to service provided by California Water Service Company.

B. Connect water-distribution piping to interior domestic-water and fire-suppression piping.

3.13 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.14 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground water- service piping. Locate below finished grade, directly over piping.

3.15 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no

chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories (gravity systems only).

B. Connection of drainage system to existing drainage system.

C. Inlets and Cleanouts.

1.2 RELATED SECTIONS

A. Section 31 23 33 Trenching and Backfilling

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) A 746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2003.

B. ASTM D 3034 - Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings; 2004a.

C. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2005.

D. American Water Works Association (AWWA) C111/A21.11 – American National Standard for Rubber Gasket Joints For Cast Iron and Ductile Iron Pressure Pipe and Fittings; 2000.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

A. Product Data: Provide data acknowledging that products meet requirements of standards referenced.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. **Project Record Documents:**

1. Record location of pipe runs, connections, inlets, cleanouts, manholes and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 – PRODUCTS

2.1 DRAINAGE PIPE MATERIALS

A. Plastic Pipe: ASTM D 3034, Type PSM, SDR 35, Poly Vinyl Chloride (PVC) material; inside nominal diameter as indicated on Drawings.

B. Plastic Pipe Joint Seals: ASTM D 3212 PVC elastomeric joints using elastomeric seals complying with ASTM F 477.

C. Ductile Iron Pipe: A 746; inside nominal diameter as indicated on Drawings.

D. Ductile Iron Pipe Joint Seals: AWWA C111/A21.11 rubber gaskets.

E. Corrugated High Density Polyethylene Pipe (CPEP): Pipe shall have a smooth interior and annular exterior corrugations. Pipe and fitting material shall be high density polyethylene meeting ASTM D3350 minimum cell classification 324420C for 4-10 inches diameters or 335420C for 12-60 inches diameters. Pipes 4-10 inches in diameter shall meet American Association of State Transportation Officials (AASHTO) M252, Type S, and 12-48 inches diameter shall meet AASHTO M294, Type S. Pipe material shall be a slow crack resistance material evaluated using the single point notched constant tensile load (SP-NCTL) test. Average SP-NCTL test specimens must exceed 24 hours with no test result less than 17 hours.

F. Corrugated High Density Polyethylene Pipe (CPEP) Joint Device: Bell-and-spigot meeting AASHTO M252, AASHTO M294 or MP7. Joints shall be silt-tight and non-rated watertight. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477 with the addition that the gaskets shall not have any visible cracking when tested according to ASTM D1149 after 72-hour exposure in 50 PPHM ozone at 104 degrees

F.

G. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

H. Cast Iron Pipe: Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International. Hubless Couplings shall conform to CISPI Standard 310, shall be manufactured in the United States, and be certified by NSF® International. Heavy Duty and Medium Duty couplings shall conform to ASTM C 1540, shall be manufactured in the United States, and shall be used if indicated.

I. Joints: Joints shall be PVC specified in ASTM D3212, elastomeric joints using elastomeric seals complying with ASTM F477.

J. Fittings: Fittings shall be Husky SD 4000 for waste, and Husky 2000 for vent and conform to ASTM C-1540.

2.2 PIPE ACCESSORIES

A. Line Marker: Provide line markers in accordance with Section 33 05 26 Utility Line Signs, Markers, and Flags

2.3 CLEANOUTS AND CATCH BASINS

A. Cleanouts and Catch Basins: As indicated on Drawings.

2.4 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 23 33 Trenching and Backfilling.

B. Pipe Cover Material: As specified in Section 31 23 33 Trenching and Backfilling.

PART 3 EXECUTION

3.1 TRENCHING

A. See Section 31 23 33 Trenching and Backfilling for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.2 INSTALLATION - PIPE

A. Lay piping beginning at low point of system, true to grades and alignment indicated on Drawings, with unbroken continuity of invert.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

1. Plastic Pipe: Also comply with ASTM D 2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Install continuous line marker 18 inches above top of pipe; coordinate with Section 31 23 33 Trenching and Backfilling.

3.3 INSTALLATION - CATCH BASINS

A. Provide as recommended by manufacturer.

3.4 PIPE PENETRATIONS

A. For pipe penetrations through existing manholes, core through, provide gasket around pipe, grout penetration on both sides and provide a minimum of 6 inches around collar outside of the manhole or inlet structure penetration.

3.5 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished Work will conform as nearly as practicable to requirements specified for new Work.

B. Into underground structures or pipes 24 inches and larger: Cut opening into unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut ends of connection passing through pipe or structure wall to conform to shape of and be flush with inside wall. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground. Provide 3000 pounds per square inch concrete. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

C. Take care while making tap connections to prevent concrete or debris from entering existing pipe or structure. Remove debris, concrete, or other extraneous material, which may accumulate.

3.6 CLEANING

A. Piping greater than 6 inches: clean pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water to remove any debris.

B. Piping 6 inches and smaller: flush piping applying full size pipe flushing.

3.7 LEAK TESTING

A. Testing of all portions of the sewer including manholes is required.

B. For either exfiltration or infiltration test, the maximum leakage shall not exceed 250 gallons per inch of pipe diameter per mile per 24 hours as measured over a period of 30 minutes minimum. Should the leakage exceed the maximum allowable rate, the contractor shall repair, overhaul, or rebuild the defective portion of the sewer line. After repairs have been completed by the Contractor, the line shall be retested as specified above.

C. Manholes shall be filled with water to the rim of the frame casting and shall lose no more than 2 inches over a period of 30 minutes.

D. The final test shall be performed after the line has been laid and all backfill placed and compacted. The Contractor, at Contractor's option, may test the line at any time during construction. However, the final test for acceptance shall be made only after all backfill is in place and compacted. In the event that the exfiltration test prescribed above is impractical due to wet trench conditions, these portions of the sewer line where such conditions are encountered will be tested for infiltration. The Owner's Representative shall determine whether the exfiltration or infiltration test will be used.

E. Even though the test for leakage is within the prescribed limits, the Contractor shall repair any obvious leaks.

F. Low pressure air testing may be used in lieu of water testing at the option of the Contractor. Water testing may be required by the Owner's Representative. The following procedure shall be used for air testing:

1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.

2. If the pipe to be tested is submerged in ground water, insert a pipe

probe, by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.

3. Add air slowly to the portion of the pipe installation under test until the internal pressure is raised to 5.0 psig.

4. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.

5. After an internal pressure of 5.0 psig. is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

6. After the two minute period, disconnect the air supply and start stopwatch. The pressure of 5.0 psig. shall be maintained for 5 minutes.

7. As an alternate, the contractor may request the air testing procedure as presented in Section 306-1.4.4 of the 1997 edition of the “Greenbook” Standard Specifications.

END OF SECTION 33 41 00