REQUEST FOR PROPOSALS

FOR

City of Mission
Leo Peña Placita Park
Mobility Improvement Project
Mission, TX
803 N. Conway
Mission, TX 78572
RFP #18-071-12-11

IN

MISSION, TEXAS

STRUCTURAL ENGINEER

CHANIN ENGINEERING, LLC

11-20-17

COPY NO._____
DATED:_____

Leo Peña Placita Park
Mobility Improvement Project
Mission, TX

INDEX

INDEX OF DRAWINGS

1. ARCHITECTURAL DRAWINGS

A100 OVERALL SITE PLAN
A110 SITE PLAN
A120 HARDSCAPE PLAN-AREA A
A121 HARDSCAPE PLAN- AREA B
A130 ENLARGED PLANS
A131 ENLARGED PLANS
A132 ENLARGED PLANS
A133 ENLARGED PLANS
A140 SITE DETAILS
A141 SITE DETAILS
A200 SECTIONS
A201 SECTIONS
A202 SECTIONS
A203 SECTIONS
A210 WALL SECTIONS
A211 WALL SECTIONS
A300 CANOPY PLAN + ELEVATIONS

2. STRUCTURAL DRAWINGS

S1.00 GENERAL NOTES
S1.01 GENERAL NOTES
S2.00 DETAILS
S3.00 FOUNDATION PLAN RETAINING WALLS
S3.01 FOUNDATION PLAN STAGE/ RAMP
S4.00 FRAMING PLAN
S5.00 DETAILS
S5.01 DETAILS
S5.02 DETAILS

3. ELECTRICAL+ PLUMBING DRAWINGS

E1.0 ELECTRICAL LIGHTING SITE PLAN

E2.0 ELECTRICAL SPECIFICATIONS, LEGEND, RISER DIAGRAM, LIGHT FIXTURE/B SCHEDULES

E3.0 ELECTRICAL PANEL SCHEDULE

END OF SECTION

Leo Peña Placita Park
Mobility Improvement Project
Mission, TX

TABLE OF CONTENTS

END OF SECTION

NEW SOLICITATION FROM CITY OF MISSION

City of Mission
Leo Peña Placita Park Mobility Improvement Project
Proposal No. 18-071-12-11

City of Mission has issued this solicitation for proposals to be due **Monday, December 11, 2017 at 2:00 p.m. CST.** To be delivered and publicly opened at City Hall in the Purchasing Department 1201 East 8th, Ste. R101, Mission, TX 78572.

Plans and specifications may be obtained at the office of:
City of Mission – Purchasing Department
1201 E. 8th Street
Mission, TX 78572
956-580-8667

Solicitations and Addendums will be posted to the City of Mission Website at
http://www.missiontexas.us/bid-opportunities-2/
in the bid opportunities section or may be picked up at the Purchasing Department.

City of Mission
Crissy Cantu
Purchasing Buyer
ccantu@missiontexas.us
(956)580-8667

City of Mission
Instructions to Offerors – General Terms & Conditions
Proposal Name/No.: Leo Peña Placita Park Mobility Improvement Project RFP #18-071-12-11

Please read your specifications thoroughly and be sure that the offered complies with all requirements. Any variation from the specifications will not be allowed. If you are the successful proposer, it will be required that **"Leo Peña Placita Park Mobility Improvement Project"** be provided as specified or as agreed upon by the City of Mission.

(1) Introduction and Purpose of Solicitation

The City is seeking sealed proposals from qualified firms or individuals interested in providing all labor, materials, and equipment for the **Leo Peña Placita Park Mobility Improvement Project**. Contractors are to submit proposal in accordance with the specifications attached hereto and any other miscellaneous scope elements identified in specifications.

(2) Type of Business

(a) The Proposer represents as part of its offer that it operates as (Mark one with an "X"):

☐ an individual ☐ a sole proprietorship

☐ a partnership ☐ a corporation

☐ another entity _____.

(3) Interest of Public Officials

The offeror represents and warrants that no employee, official, or member of the Council (Executive Committee) of the City is or will be pecuniarily interested in or benefited directly or indirectly as a result of this contract.

(4) Covenant Against Gratuities

The offeror represents as part of its offer that neither it nor any of its employees, representatives or agents have offered or given gratuities (in the form of entertainment, gifts or otherwise) to any director, officer or employee of the City with the view toward securing favorable treatment in the awarding, amending, or the making of any determination with respect to the performing of the contract.

(5) Preparation of Proposals

(a)Proposers are expected to examine the Pricing Schedule, General Terms & Conditions, all drawings, specifications, the statement of work, and all other provisions of, and attachments to, the solicitation, whether incorporated by reference or otherwise, prior to the submission of proposals. Failure to do so will be at the proposer's risk.

(b)Each proposer shall furnish the information required by the solicitation. Proposals shall be submitted on the proposal form contained in the solicitation. Proposers shall sign and print or type their name on the proposal form and each continuation sheet on which they make an entry. Erasures or other changes must be initialed by the person signing the proposal. Proposals signed by an agent of the proposer (other than an officer or a partner of the proposer) are to be accompanied by evidence of the agent's City (unless such evidence has been previously furnished to the City).

(c)All blanks on the proposal form shall be filled in by typewriter or printed in ink with a firm fixed unit price for items proposal. Unit prices shall include packing unless otherwise specified. In case of any discrepancy between a unit price and any extended or total price required by the proposal form, the unit price will be presumed to be correct, subject, however, to correction to the same extent and in the same manner as any other mistake.

(d)Proposals for property or services other than those specified in the Schedule will not be considered unless specifically authorized in the solicitation. Any condition, qualification, or limitation of the proposal may be a basis for rejection of the proposal as nonresponsive.

(e)The proposer must state a definite time for delivery of property or for performance of services unless otherwise specified in the solicitation. All measurements shall be in the system of weights and measures in common usage in the United States, and pricing shall be in U.S. dollars.

(6) Submission of Proposals

(a) Proposals and modifications thereof shall be enclosed in sealed envelopes or sealed cartons and submitted to the Buyer of the City of Mission at the address specified in the solicitation. The proposer shall show the hour and date specified in the solicitation for receipt of proposals, the solicitation number, and the proposer's name, address, and telephone number on the face of the envelope or carton.

(b) Telegraphic proposals will not be considered unless authorized by the solicitation; however, proposals may be modified or withdrawn by written or telegraphic notice, provided such notice is received prior to the hour and date specified for receipt of proposals.

(c) Samples of items, when required, must be submitted within the time specified and, unless otherwise specified in the solicitation, at no expense to the City. If not destroyed by testing, samples will be returned at the proposer's request and expense, unless otherwise specified in the solicitation.

(d) Each copy of the proposal shall include the legal name of the proposer and a statement whether the proposer is a sole proprietorship, a corporation, or any other legal entity. A proposal for a corporation shall further give the state of incorporation and have the corporate seal affixed to it.

(7) Acknowledgement by Signature

Proposals must give full firm name and address of proposer, and be manually signed. Failure to do so will disqualify your proposal. **Person signing proposal must show title or CITY TO BIND HIS FIRM IN A CONTRACT.** ***Firm name and authorized signature must appear on each page that calls for this information.***

(8) Pre-Proposal Conference and Questions Concerning the Solicitation

(a) A pre-proposal conference is scheduled for all interested parties to discuss the solicitation requirements. Details concerning the conference date, time and location are provided below:

PRE-PROPOSAL CONFERENCE:
(Highly Recommended)
****** There WILL be a conference. ******
LOCATION: City of Mission City Hall
1201 E. 8th Street
Mission, TX 78572
DATE: November 28, 2017 TIME: 10:00 AM CST

(b) Questions and requests for clarification relating to this solicitation, shall be submitted in writing, to the contact person identified in the Solicitation, Offer and Award Form by mail, facsimile or commercial courier, at least three (3) working days in advance of the scheduled conference to allow sufficient time for responses to be considered and prepared by the City. Questions concerning the solicitation that are not addressed at the conference, if one is held, shall be submitted in writing no later than five (5) working days in advance of the offer submission due date and time, which is the minimum time required for the City's reply to reach offerors before the offer submission due date and time, as required by the "Acknowledgement of Amendments to the Invitations for Proposals" clause. Questions received less than five (5) working days in advance of the offer submission due date and time will be responded only if the City determines that the question and its response would have a material and substantive impact on the solicitation.

(9) Explanation to Proposers

Any explanation desired by a proposer regarding the meaning or interpretation of the solicitation, drawings, specifications, etc., must be requested in writing from the City's authorized representative and with sufficient time allowed for a reply to reach proposers before the submission of proposals. Oral explanations or instructions given before the award of any contract, at any pre-proposal conferences or otherwise, will not be binding on the City. Any information given to a proposer concerning an interpretation of the solicitation will be furnished to all proposers as an amendment to the solicitation, if such information is necessary to proposers in submitting proposals on the solicitation or if the lack of such information would be prejudicial to uninformed proposers.

(10) Acknowledgment of Addendums to Request for Proposals

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Proposers shall acknowledge receipt of any addendums to this solicitation: (1) by signing and returning the addendums; or (2) by identifying the addendums number and date in the space provided for this purpose on the proposal form; or (3) by letter or telegram. The City must receive the acknowledgment by the time and at the place specified for receipt of proposals.

(11) STATE SALES TAX MUST NOT BE INCLUDED IN PROPOSAL. Contractors are not tax exempt.

(12) Deviations

Any additions, deletions, deviations or variations from the following specifications shall be specified in your proposal for review by the Architect or Engineer. Any parts not specifically mentioned which are necessary for the work to be complete and for use or which are normally furnished as standard equipment shall be furnished by the successful proposer and shall confirm in strength, quality, and workmanship to the accepted standard of the industry.

(13) Evaluation and Basis for Award

(a) It is understood that the City reserves the right to accept or reject any and all Proposals and to re-solicit for Proposals, as it shall deem to be in the best interests of the City of Mission**.** Receipt and consideration of any Proposals shall under no circumstances obligate the City of Mission to accept any Proposals. If an award of contract is made, it shall be made to the responsible Proposer whose Proposal is determined to offer the best value taking into consideration the relative importance of the evaluation factors set forth in the RFP and conducting open and honest dialogue with top proposer(s), giving proposer(s) the opportunity to adapt their initial offering and/or giving the City the opportunity to modify its initial requirements in order to reach a mutually beneficial partnership.

(b) One Award

One contract award is anticipated under this solicitation. Multiple contract awards shall not be made. A written award (or acceptance of proposal) which is mailed, telegraphed, or otherwise furnished to the successful proposer within the time for acceptance specified in the solicitation shall be deemed to result in a binding contract without further action by either party.

(c) The contract will be awarded to the responsive and responsible Proposer who's Proposal, conforming to the solicitation, will offer BEST VALUE to the City, price and other factors considered. A responsible Proposer is one who affirmatively demonstrates to the City that the Proposer has adequate financial resources and the requisite capacity, capability, and facilities to perform the contract within the delivery period or period of performance, has a satisfactory record of performance on other comparable projects, has a satisfactory record of integrity and business ethics, and is otherwise qualified and eligible to receive award under the solicitation and laws or regulations applicable to the procurement.

(d) Any financial data submitted with any Proposal hereunder or any representation concerning facilities or financing will not form a part of any resulting contract; provided, however, that if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished hereunder is incomplete, inaccurate, or not current.

(14) Preparation of Proposals

(a)Offeror(s) are expected to examine the Pricing Schedule, General Terms & Conditions, all drawings, specifications, the statement of work, and all other provisions of, and attachments to, the solicitation, whether incorporated by reference or otherwise, prior to the submission of Proposals. Failure to do so will be at the Proposer's risk.

(b)Each Proposer shall furnish the information required by the solicitation. Proposals shall be submitted on the Proposal form(s) contained in the solicitation. Offeror(s) shall sign and print or type their name on the Proposal form and each continuation sheet on which they make an entry. Erasures or other changes must be initialed by the person signing the Proposal. Proposals signed by an agent of the Proposer (other than an officer or a partner of the Proposer) are to be accompanied by evidence of the agent's authority (unless such evidence has been previously furnished to the City).

(15) Submission of Proposals

(a) Proposals and modifications thereof shall be enclosed in sealed envelopes or sealed cartons and submitted to the Purchasing Director of the City of Mission at the address specified in the solicitation. The Proposer shall show the hour and date specified in the solicitation for receipt of Proposals, the solicitation number, and the Proposer's name, address, and telephone number on the face of the envelope or carton.

(b) Telegraphic Proposals will not be considered unless authorized by the solicitation; however, Proposals may be modified or withdrawn by written or telegraphic notice, provided such notice is received prior to the hour and date specified for receipt of Proposals.

(c) Each copy of the Proposal shall include the legal name of the Proposer and a statement whether the Proposer is a sole proprietorship, a corporation, or any other legal entity. A Proposal for a corporation shall further give the state of incorporation and have the corporate seal affixed to it.

(16) Completion of Responses

a) Information presented in the Proposals will be used to evaluate proposal(s) and to determine the Proposer(s) which will be selected.

b) Responses shall be completed in accordance with the requirements of this RFP. Statements made by a Proposer shall be without ambiguity, and with adequate elaboration, where necessary, for clear understanding

c) Proposals shall be limited to a <u>maximum</u> of forty (40) 8-1/2" X 11" pages (one side only and including cover letter) using a font size no smaller than 11 point and one inch margins. Maximum number of pages excludes the required procurement documents adopted for this project.

(17) Evaluation and Selection of Proposals:

General:

a) **Separate Packages.** Proposers are required to respond to this RFP with two separate packages: a technical proposal and a price proposal. City of Mission's Evaluation Committee will evaluate proposals found to be responsive and responsible.

b) **Responsiveness.** In order for a Proposer to be eligible to be awarded the Contract, the Proposal must be responsive to the Request for Proposal, and City of Mission must be able to determine that the

proposer is responsible to perform the Contract satisfactorily. Responsive Proposals are those complying in all material aspects of the solicitation. Proposals which do not comply with all the terms and conditions of this solicitation may be rejected as nonresponsive. A Proposer may, at any time after the submission of the Proposal, be requested to submit further written evidence verifying that the firm(s) meets the criteria necessary to be determined a responsible Proposer. Refusal to provide requested information may result in the Proposer being declared nonresponsive, and the Proposal may be rejected.

c) **Organization of Proposal Materials.** To enhance the comparability and facilitate evaluation, all proposals must be organized addressing each of the evaluation criteria as set forth in the section entitled "Evaluation Criteria." **The Evaluation Committee may reject proposals if found to be in an unorganized manner.** An Evaluation Committee will evaluate all proposals submitted for this project.

(18) Adjective Scoring Ratings

Each criterion will be rated using the **Adjectival Scoring Method** as follows:

Definition of Adjective Rankings:

Outstanding	Satisfies all of the agency's requirements, with extensive detail indicating a feasible approach & a thorough understanding of the project. The proposal has numerous significant strengths that are not offset by weaknesses. Meets or exceeds specified performance or capability evaluation standards required under the technical provisions in a beneficial way to the City of Mission. **The proposal has an overall low degree of risk.**
Good	Satisfies all of the City's requirements, with adequate detail of a feasible approach & an understanding of the project. The proposal has some significant strengths or numerous minor strengths that are not offset by weaknesses. **The proposal has an overall low to moderate degree of risk.**
Acceptable:	Proposal satisfies all of the City's requirements, with minimal detail indicating a feasible approach and a minimal understanding of the project. **The proposal has an overall moderate to high degree of risk.**
Marginal	Proposal satisfies all of the City's requirements, with minimal detail indicating a feasible approach and a minimal understanding of the project. **The proposal has an overall high degree of risk.**
Unacceptable:	Proposal contains at least one major error, omission, or deficiency that indicates a lack of understanding of the project. The approach cannot be expected to meet requirements or involves a very high risk. None of these conditions can be corrected without a major rewrite or proposal revision. Fails to meet an acceptable evaluation standard and the deficiency is uncorrectable. Firm lacks essential information to support a proposal.

A rating of —Acceptable is required to be eligible for award consideration. Offeror is cautioned to be aware of this standard when preparing your Proposal.

(19) Definitions for Technical Evaluation

Clarifications:	Communications with an offeror for the sole purpose of eliminating minor irregularities, informalities, or apparent clerical mistakes in the proposal. Unlike discussions, clarifications do not give the offeror an opportunity to revise or modify its proposal, except to the extent that correction of apparent clerical mistake results in revisions.

Discussions: Oral or written communications including negotiations between the Authority and an offeror (other than clarifications) that; involves information essential for determining the acceptability of the proposal or to cure identified defects in the proposal.

Deficiencies: Defects in the proposal which preclude acceptance. Involves any part of the Offeror's proposal which would not satisfy the City's minimum requirements established in the solicitation. Included failures to meet specifications, submit information, or questionable technical or management approaches. Items disclosed during discussions, evaluated in two categories: material-basis for rejection because further discussions would be meaningless; curable –may be corrected by clarifications or discussions and brought into the competitive range.

Weakness: Includes ambiguities, lack of complete descriptions, errors in interpretation, omissions of essential information, inadequate information, all of which are considered curable in discussions. An excessive number of clarifications may in itself constitute a weakness.

Strengths: Elements of the proposal that meet or exceed the minimum requirements of the solicitation and provide an identified benefit to the City.

(20) Evaluation of Proposals

The City of Mission **representatives** will review and evaluate Proposals using the **Adjectival Scoring Method**. The evaluation of Proposals shall be based on criteria described below. All Proposals will be evaluated as a whole, and the City of Mission may invite one or more of the Respondents to attend a formal interview, if necessary. The interview will allow the invited Respondent(s) to further discuss the proposals with the City, and to respond to questions from the City. It is the intent of the City of Mission via this Request for Proposals (RFP) to identify the Contractor that offers the Best Value through open and honest dialogue with Top Proposer(s) giving proposer(s) the opportunity to adapt their initial offering and/or giving the City the opportunity to modify its initial requirements in order to reach a mutually beneficial partnership. The Evaluation Committee will present the evaluation results to City Council for contract award consideration and execution based on the evaluation criteria and the outcome of the negotiations.

(21) Submittal Detail:

1. Statement of Organization – Proposers are permitted to supply additional information that will assist the City in understanding the proposer's organization.

2. Method of Approach – Proposer must provide a thorough description of the overall construction approach and describe why this is the best approach for the City.

3. Experience and Performance History – Proposer must disclose the amount of time that Proposer has been in business. Proposers shall provide a list of municipalities similar to the City for which the Proposer or any affiliate has provided similar services.

4. References – Proposers shall provide a minimum of five (5) references from officials at public agencies, cities, or towns served by the proposer with services substantially similar to those for which the Proposer is submitting a proposal. Letters of reference will be accepted.

5. Key Personnel – The successful proposer shall provide all personnel required to perform the scope of Services in accordance with specifications and plans. Proposer shall ensure personnel bear some means of individual identification, such as uniform with name badges, name tags, or identification cards. Description of policies and procedures that are in place to ensure that personnel performing services are qualified and proficient.

(22) Evaluation Criteria

Contract's proposal will present the elements in response to the following criteria:

Firm and Sub-Contractor Identification and Experience- Identify each firm on the construction team; describe the composition, legal form, and organizational structure. A description of the firm and sub-contractor, including the number of employees and their disciplines, their philosophy on serving clients, location, and number of years the firm has been in business conducting the described project requirements.

Qualifications of key personnel – Description on the depth of experience of the construction team with park improvement projects, specifically directly comparable to projects constructed within the past 5 years. Include a description of how the project will be organized, identification of the **key** project team members by name, field of expertise, and specific responsibilities on the project. Provide a discussion of projects for which the offeror has been responsible. The examples should be as similar as possible to this RFP in project type, magnitude, complexity, cost, design or features and scope. Each example shall indicate in detail the general character, scope, location, cost, and date of completion of the project. If the offeror represents the combining of two or more companies for the purpose of this RFP, each company shall discuss project examples.

Technical Approach, Scope of Work, and Schedule- Provide a detailed description of the contractor's proposed unique approach, for the completion of the project identified in this RFP. The contractor may propose alternate tasks that will meet the project objectives. A detailed Gantt chart schedule for completing the tasks outlined in the RFP. The narrative should include considerations of "Fast Track" construction. Include in the narrative the offeror's proposed processes for handling field problems, assuring quality and assuring Designer of Record involvement throughout the construction period. The offeror shall provide a Project Management Plan. This is an overall plan showing how the offeror will control the job.

Value engineering: Innovative, creative, or cost saving proposals that meet or exceed the project requirements are encouraged and will receive consideration accordingly. Offerors who desire to propose alternatives for City of Mission consideration are encouraged to do so, but should first propose the requirement as specified in the City of Mission RFP documents. Each alternative shall include an explanation of what the benefits are and why the Offeror believes the alternative is in the best interest of the City of Mission. Costs and or credits, by item, shall be listed by the offeror as an option addendum to the price schedule in the RFP. Acceptance of these proposed options will be at the sole discretion of the City of Mission.

Price Proposal- Offerors shall complete all portions of the Price Proposal Schedule and furnish one original and three copies in a separate sealed envelope. The purpose of the price/cost evaluation is to determine whether an offeror's proposed prices/costs for the project are reasonable and realistic in relation to the RFP requirements and demonstrate an offeror understands the proposal requirements.

- Price Breakdown. Include price breakdown, in the contractors format in this package.

- Any offer (proposal) received that exceeds the Architects Estimated Project Cost amount may result in proposal rejection without discussion and without being evaluated or considered for award.

- The City of Mission will conduct a price/cost evaluation of each offeror's proposal to determine whether or not each proposal is reasonable and realistic. Proposals unrealistically high or low in price, when compared to the Architects Estimated Project Cost, and market conditions evidenced by other competitive proposals received, may be indicative of an inherent lack of understanding of the RFP requirements and may result in proposal rejection without discussion. Any inconsistency, whether real or apparent, between proposed performance and price must be clearly explained in the price proposal. For example, if unique and innovative approaches or conditions are the basis for an unbalanced/inconsistently priced proposal, the nature of these approaches and their impact on price must be completely documented. The burden of proof of cost (Price) realism rests solely with the offeror.

(23) Interviews, Discussions, and Negotiations:

a) **Interviews:** Staff will determine whether acceptance of the most favorable initial proposal without discussion is appropriate, or whether interviews and/or discussions should be conducted with all Proposers.

b) **Negotiations.** The committee or designated members of the committee will negotiate with the Proposer whose proposal is found to offer the Best Value. Firm engaged in negotiations may be allowed to submit a final supplement called a "best and final offer." The City reserves the right to negotiate all elements that comprise the successful Contractor's response to ensure that the best possible consideration be afforded through open and honest dialogue.

(24) Non-Responsive Proposal

To be considered for award, a Proposal must be "responsive"; i.e., comply in all material respects with the Request for Proposals. Proposals must be responsive so that all Offeror(s) may stand on an equal footing and the integrity of the competitive procurement system may be maintained. Examples of nonresponsive Proposals include:

(a) failure to sign the Proposal;

(b) failure to acknowledge receipt of a material amendment to the Invitation for Proposals;

(c) Proposals containing any exception to, or any qualification of, any material requirement of the Request for Proposals;

(d) Proposals imposing any condition or altering the rights of the Authority (e.g., conditioned on the occurrence of any event, the receipt of material or parts, "negotiation" of the warranty, or nondisclosure of information);

(e) failure to furnish items or information required to be submitted with the Proposal;

(f) Proposals which are indefinite, uncertain, or ambiguous (the consideration of which would give the Proposer an unfair competitive advantage); and

(g) Proposals containing unsolicited descriptive literature if the Proposal creates any uncertainty as to whether the Proposer is offering to conform to the specifications.

(25) Independent Contractor

The Contractor at all times shall be an independent contractor. The Contractor shall be fully responsible for all acts and omissions of its employees, subcontractors, and their suppliers, and shall be specifically responsible for sufficient supervision and inspection to ensure compliance in every respect with the contract requirements. There shall be no contractual relationship between any subcontractor or supplier of the Contractor and the City by virtue of this contract. No provision of this contract shall be for the benefit of any party other than the City and the Contractor.

(26) Milestone Schedule

The Contractor must submit a brief schedule within **10 calendar** days from Notice of Award showing how he intends to organize and perform the work for this contract.

(27) Permits and Responsibilities

The Contractor shall, without additional expense to the City, be responsible for obtaining any necessary licenses and permits and for complying with any federal, state, county, and municipal laws, codes, and regulations applicable to the performance of the work, including, but not limited to, any laws or regulations requiring the use of licensed contractors to perform parts of the work. The Contractor also shall be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence and shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. The Contractor also shall be responsible for all materials delivered and work

performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(28) Private Utility Construction

The Contractor shall schedule and coordinate his work effort with any private utility contractor who may be relocating private utilities during this construction period. The utility companies are to be notified in writing ten (10) calendar days prior to commencing any work effort affecting the utility. Reconfirmation will be obtained by the Contractor by telephone forty-eight (48) hours prior to beginning work.

(29) Foreseen Delay

When delay can be foreseen, contractor shall give prior notice to the City of Mission. Contractor must keep City of Mission advised at all times of status on the completion of project. Default in promised delivery (without acceptable reasons) or failure to meet specifications, authorizes the City of Mission to purchase such deliver/service **"Leo Peña Placita Park Mobility Improvement Project"** off contract**.** The contractor will be liable for any increase in cost incurred due to defaulting on **"Leo Peña Placita Park Mobility Improvement Project"** project.

a. Acceptable reasons for delayed of project are as follows; Act of God (floods, tornadoes, hurricanes, etc.), acts of government, fire strikes, war. Actions beyond the control of the successful contractor.

(30) Liquidated Damages

LIQUIDATED DAMAGES FOR DELAY: And the CONTRACTOR agrees that time is the essence of this contract, and that for each day of delay beyond the number of working days herein agreed upon for the completion of the work herein specified and contracted for (after due allowance for such extension of time as is provided for under Extension of Time herein) above the OWNER may withhold permanently for the CONTRACTOR'S total compensation, the sum of five hundred dollars per day Dollars $500.00/day) as stipulated damages for such delay.

Contractors are advised that any part of the specifications that are not met within the time of completion regardless of how major or minor it might be shall be grounds for none acceptance and collection of liquidated damages and forfeiture of bonds.

(31) Confidential Data

Each contractor may clearly mark each page of the proposal that contains trade secrets or other confidential commercial or financial information which the contractor believes should not be disclosed outside the City. Disclosure of requested information will be determined in accordance with the Texas Open Records Act.

(32) Cancellation of Solicitation

This solicitation may be cancelled by the City before or after receipt of proposals (as applicable).

(33) Removal of Contract Personnel

(a) The Contractor and any subcontractor acknowledge that any person assigned to work under this Contract must perform their duties so as to not unduly impair contract performance. By assigning a person to work under this Contract, the Contractor agrees to be responsible for the behavior of that person during contract performance.

(b) The Contractor acknowledges that the City has the right to require the removal of any Contractor or subcontractor employee that the Engineer, Project Manager, or Purchasing Director determine, at their sole discretion, to be negatively effecting performance of work under the contract. Examples of such behavior include: (1) conduct which poses a threat to the safety of anyone working under the contract; (2) conduct which is disruptive to contract performance; (3) careless work performance; and

(4) other behavior determined by one of the three (3) project officials to be objectionable or unduly hindering contract performance.

(c) Upon receipt of written notice from the Purchasing Director that a person's behavior is unduly impairing contract performance, the Contractor agrees to remove that person from doing any further work on the contract, and to cause that person to be removed from the worksite. The Contractor agrees that it is not entitled to any additional costs it may incur as a result of the removal of the person named by the Purchasing Director.

(34) Discrepancies or Omissions

Proposer shall carefully examine the proposal forms, general terms and conditions, and specifications. Should the Contractor find discrepancies in, or omissions from proposal forms, general terms and conditions, specifications, or other documents, or should he/she be in doubt as to their meaning, he/she should at once notify the Purchasing Department (Mission City Hall, (956) 580-8667) and Engineer and obtain clarification by addendum prior to submitting any proposal.

(35) Compliance with Federal, State and Local

Contractors must comply with all applicable federal, state and local laws, rules, regulations and ordinances and statutes relating to purchasing in the State of Texas in addition to the requirements of this form.

(36) Change Orders

Change orders will be limited; Contractors must thoroughly review specifications in order to factor in any unforeseen costs. Change orders on this project shall be considered and accepted at the request of the City of Mission or if agreed upon by both contractor and the City of Mission.

(37) Allowance

Any change either deletion or addition in quantities will be based off the unit cost per line item agreed upon in contract.

(38) Site Investigation and Conditions Affecting the Work

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including, but not limited to, (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, flooding patterns and water drainage, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor acknowledges that its undertaking to complete the contract within the contract schedule includes an allowance for the normal number of days in which contract work may be partially or totally delayed because of weather during the season and at the location the contract will be performed and that the Contractor shall not be entitled to excusable delays or compensation for such delays. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, access to the site, and territory surrounding the site, including all exploratory work done by the Engineer and City as well as from the drawings and specifications made a part of this contract. **Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work or for proceeding to perform the work successfully without additional expense to the City.**

(b) The City assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the City. Nor does the City assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of

its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(39) Indemnification

The Contractor agrees to indemnify and save harmless the City, the Purchasing Director and any assistants from all suits and actions of every nature and descriptive brought against them or any of them, for or on account of the use of patented appliances, products or processes, and he/she shall pay all royalties and charges which are legal and equitable. Evidence of such payment or satisfaction shall be submitted upon request of the Purchasing Director, as a necessary requirement in connection with the final estimate for payment in which such patented appliance, products or processes are used.

(40) BILLING AND PAYMENT INSTRUCTIONS:

The City of Mission will execute payment by mail within thirty (30) working days after each percentage of work has been completed and found to meet specifications for **"Leo Peña Placita Park Mobility Improvement Project"** as indicated below.

(a) Invoices may be submitted once per month to and shall conform to policies or regulations adopted from time to time by the City. Invoices shall be legible and shall contain, as a minimum, the following information: (1) the contract and purchase order number (if any); (2) a complete itemization of all costs including quantities ordered and delivery order numbers (if any); (3) any discounts offered to the City under the terms of the contract; (4) evidence of the acceptance of the supplies or services by the City; (5) unique traceable invoice number(s); and (6) any other information necessary to demonstrate entitlement to payment under the terms of the contract. Failure to provide the above critical information may result in the rejection and return of the invoice for resubmission with complete data.

(b) Subject to the withholding provisions of the contract, payment shall be made within 30 days after the City's receipt of a properly prepared invoice.

(41) Funding

Funds for this procurement have been provided through the Federal Transportation Administration (FTA) and local funds. The award of a proposal or contract hereunder will not be construed to create a debt of the City which is payable out of funds beyond the current designated funds for this project. .

(42) Proposal Bond

The Contractor is specifically advised that the proposal must be accompanied by a proposal bond from a reliable surety company licensed to operate in the State of Texas, totaling five percent (5%) of the total amount of the proposal, as a guaranty that if awarded the proposal, the Contractor shall meet all specification requirements and delivery date(s). A certified cashier's check will be allowed in lieu of a proposal bond for five (5%) of the total amount for the project.

a) Contractor's failure to comply with specification requirements and delivery date(s) shall forfeit the check(s) or proposal bond(s) as identified in this paragraph of these general terms and conditions to Contractors. Such check(s) or proposal bond(s) will be returned to all except three lowest Contractors within ten (10) business days after opening of proposals, and the remaining check(s) or proposal bond(s) to exclude the successful Contractor will be returned promptly after an official awarded of contract.

b) Certified cashier's check or proposal bond from a reliable surety company of the awarded Contractor shall be returned upon receipt of final delivery/acceptance of said goods or services along with payment/performance bond(s) by the Owner. If no award has been made within (60) days after opening of proposals, check(s) and/or proposal bond(s) will be returned accordingly.

(43) Performance and Payment Bonds

(a) **Performance Bond**. The Contractor shall provide a Performance Bond if the contract amount exceeds $100,000.

(b) **Payment Bond**. The Contractor shall provide a Payment Bond if the contract amount exceeds $25,000.

(c) All required bonds shall be provided in an amount equal to **one hundred percent (100%) of the contract amount**. The surety company providing the bonds must be authorized to do business in the State of Texas. The surety company shall be approved for the amount of the bonds and, either hold a certificate of City from the U.S. Department of Treasury or have obtained reinsurance from a Treasury listed insurer, in accordance with the requirements of Article 7.19-1, Vernon's Texas Insurance Code, as amended.

(d) The Contractor shall be required to submit all required bonds within **ten (10) days** from the date of **Notice of Award** to the purchasing department.

(44) Submission of Schedule of Subcontractor(s)/Subconsultant(s)

Each offeror should include with proposal a completed Schedule of Subcontractor(s)/Subconsultant(s) form provided as Attachment 1 to General Terms and Conditions with their offer. The contents of the form may be a factor used in determining an offeror's responsibility.

(45) Duty to Inform

If, at any time during the performance of the contract the Contractor becomes aware of an actual or potential problem, fault, or defect in the project or any non-conformance with any contract document, federal, state or local law, rule, or regulation, the Contractor shall give immediate written notice thereof to the Engineer. If the Contractor is aware of any such problem, fault, defect or non-conformance, or should be aware through proper diligence of any such problem, fault, defect or non-conformance, and the Contractor fails to give the required notice, the Contractor shall assume full responsibility therefore and shall bear all costs attributed thereto.

(46) Insurance Requirements for Supply/Services and/or Construction

(a) Required Coverage. The Contractor shall, at all times during the term of this contract and extended terms thereof, provide and maintain the following types of insurance protecting the interests of the City of Mission and the Contractor with limits of liability not less than those specified below.

Commercial General Liability insurance or its equivalent, **listing City of Mission as an additional insured**, providing limits of not less than $500,000 for bodily injury and property damage per occurrence, consistent with potential exposure to City under the Texas Tort Claims Act. Coverage should include injury to or death of persons and property damage claims arising out of the services, construction, etc. provided with a general aggregate of $1,000,000, and a products and completed operations aggregate of $1,000,000. Coverage should include: Damaged to rented premises at a minimum of $100,000 per occurrence. There shall not be any policy exclusions or limitations for the following as well:

Contractual Liability covering Contractor's obligations herein
Personal Injury Advertising Liability
Medical Payments
Fire Damage Legal Liability
Broad Form Property Damage
Liability for Independent Contractors

(b) Automobile liability insurance policy with combined single limit of at least Five Hundred Thousand Dollars ($500,000.00) per occurrence, consistent with potential exposure to City under the Texas Tort Claims Act.

(c) Uninsured/Underinsured motorist coverage in an amount equal to the bodily injury limits set forth immediately above;

(d) A Five Hundred Thousand Dollar ($500,000.00) Comprehensive General Liability insurance policy providing additional coverage to all underlying liabilities of City consistent with potential exposure of City under the Texas Tort Claims Act;

(e) Workers' Compensation and Employers' Liability- insurance is equivalent to State of Texas Workers' Compensation Statutory Limits, providing limits of not less than $1,000,000 for each accident, each disease per employee $1,000,000, and policy limit of no less than $1,000,000. There shall not be any policy exclusions or limitations.

(f) Certificates of Insurance. Before commencing execution of this contract, and within 7 calendar days from date of award of contract, the Contractor shall furnish Original proof of insurance via Certificates of Insurance satisfactory to the City of Mission at the following addresses,

City of Mission
Eduardo Belmarez, Purchasing Director
1201 E. 8th Street
Mission, TX 78572
Proposal #18-071-12-11

evidencing that insurance as required by paragraph (a) above is in force, stating policy number dates of expiration and limits of liability thereunder. All copies of policies and Certificates of Insurance submitted to the City shall be in a form and content acceptable to the City.

(g) Approval of Forms and Companies. All coverage described in this contract shall be in a form and content satisfactory to the Purchasing Director. No party subject to the provisions of this contract shall violate or knowingly permit to be violated any of the provisions of the policies of insurance described herein. All insurance should be provided by insurance companies with a Best's rating of A- or better. Please include proof of such rating with your coverage documents.

(h) Additional Insured Endorsement. The policy or policies providing Commercial General Liability, and as otherwise required above, shall be endorsed to name City of Mission, their directors, officers, representatives, agents, and employees as Additional Insurers with respects to operations performed by or on behalf of the Contractor in the performance of this contract via ISO endorsements CG 2037 or its equivalent. The policy shall also be endorsed to name other interests as directed by City of Mission.

(i) Notice of Cancellation or Material Changes. Policies and/or Certificates shall **specifically** provide that a thirty (30) day notice of cancellation, non-renewal, or material change be sent to the City.

(j) Multiple Policies. The limits of liability as required above may be provided by a single policy of insurance or a combination of primary, excess, or umbrella liability policies. But in no event shall the total limit of liability of any one occurrence or accident be less that the amount shown above.

(k) Deductibles. Companies issuing the insurance policies and the Contractor shall have no recourse against the City for payment of any premiums or assessments for any deductibles, as all such premiums and deductibles are the sole responsibility and risk of the Contractor.

(l) Subcontractors. If any part of the work is sublet, the Contractor shall require any and all subcontractors performing work under this contract to carry General Liability and Products, and Construction Liability Insurance, with limits of liability that Contractor shall deem appropriate and adequate to protect the interests of the City. In the event a subcontractor is unable to furnish insurance in accordance to section (a) above, the Contractor shall endorse the subcontractor as an Additional Insured. Insurance certificates for subcontractors shall be furnished to the City of Mission upon request.

(m) No Release. The carrying of the above-described coverage shall in no way be interpreted as relieving the Contractor of any other responsibility or liability under this agreement, or any applicable law, statute, regulation, or order.

(47) Inspection of Construction

(a) The word "work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work called for by this contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the City. All work shall be conducted under the general direction of the Engineer and is subject to inspection and testing by the City at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Inspections and tests by the City are for the sole benefit of the City and do not: (1) relieve the Contractor of responsibility for providing adequate quality control measures; (2) relieve the Contractor of responsibility for damage to or loss of the material before acceptance; (3) constitute or imply acceptance; or (4) affect the continuing rights of the City after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of an inspector from the City does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specifications without the Engineers written authorization.

(e) The Contractor shall promptly furnish, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Engineer. The City may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The City shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Engineer not to conform to contract requirements, unless in the public interest the City consents to accept the work with an appropriate downward adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the City may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the City decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Engineer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the City shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Engineer determines can be accepted separately. Subject to the provisions of the "Warranty of Construction" clause hereof, acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the City's rights under any warranty or guarantee.

(48) Project Management

(a) Contractor Representative

The Contractor shall appoint an individual acceptable to the City to serve as Project Manager for this contract. This individual shall be fully responsible for the day-to-day activities under this contract and shall be physically present on the job site during work performance. The Project Manager, or his City approved designee, shall have the authority to represent the Contractor on all technical and contractual issues relating to the work and shall serve as the primary point of contact for the City. In the event of multiple work sites, and with advance approval from City, the Project Manager responsibilities may be delegated to a City approved superintendent or foreman. The Contractor shall not replace, without prior written notice to and consent by the Purchasing Director, remove or reassign any key personnel. However, the Contractor shall, if requested to do so by the City, remove or reassign any personnel not acceptable to the City. The Contractor shall designate a primary and an alternate contact for notification of emergency work. The Purchasing Director shall be furnish appropriate phone numbers for contracting these individual 24 hours a day via beepers, answering service or other approved means

(49) Warranty of Construction

(a) In addition to any other warranties in this contract, the Contractor warrants, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed, by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of **one (1) year** from the date of final acceptance of the work. If the City takes possession of any part of the work before final acceptance, this warranty for such part of the work shall continue for a period of **one (1) year** from the date the City takes possession.

(c) The Contractor shall remedy at the Contractor's expense (i) any failure to conform to the contract requirements or (ii) any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to real or personal property owned or controlled by the City, when the damage is the result of: (1) the Contractor's failure to conform to contract requirements; or (2) any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for **one (1) year** from the date of repair or replacement.

(e) The Engineer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the City shall have the right to replace, remove, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) make arrangements with the material manufacturer to provide the required warranty before installation (2) obtain all warranties that would be given in normal commercial practice; and (3) require and enforce all warranties to be executed, in writing, for the benefit of the City.

(50) Accident Prevention

(a) In performing this contract, the Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoiding work interruptions. For these purposes, the Contractor shall: (1) provide appropriate safety barricades, signs, and signal lights; (2) comply with all safety standards required by federal, state, or local law and any additional standards customarily employed in connection with the type of work being performed or the conditions at the site; and (3) ensure that any additional measures the Engineer or Public Works Director determine to be reasonably necessary for this purpose are taken.

(b) The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment. The Contractor shall report this data in the manner prescribed by the Engineer.

(c) The Architect, Engineer or Public Works Director shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to take corrective action promptly, the Architect or Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under these circumstances.

(d) The Contractor shall be responsible for its subcontractors' compliance with this clause.

(51) Municipality's Right to Carry Out the Work

If the Contractor fails or refuses to carry out all or any part of the work in accordance with the contract requirements or within the contract schedule and fails or refuses to correct such deficiency within seven (7) days of receipt of written notice thereof from the City of Mission, the City, in its sole discretion and without waiving any other rights it may have, may elect to correct such deficiencies and charge the Contractor the cost of such corrections. Nothing in this clause shall relieve the Contractor of its obligation to perform the remainder of the work in accordance with the contract.

(52) Cleaning Up

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the City. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Engineer.

(53) Governing Law

The rights, obligations, and remedies of the parties shall be governed by the laws of the State of Texas. Whenever there is no applicable state statute or decisional precedent governing the interpretation of, or disputes arising under or related to, this contract, then federal common law, including the law developed by federal boards of contract appeals, the United States Claims Court (formerly the Court of Claims), and the Comptroller General of the United States, shall govern. Venue for any action shall lie exclusively in Hidalgo County, Texas. This is the complete agreement between the parties. If any provision of the contract is found to be invalid or unenforceable, the remaining provisions shall not be impaired.

(54) Title to Submittals

All information, drawings, or other submittals required to be furnished by the Contractor to the City under this contract shall become the property of the City.

(55) Royalties and Patents

The Contractor shall pay all royalties and license fees. The Contractor shall defend all suits or claims for infringement of any patent rights and shall save the City harmless from loss on account thereof, except when a particular design, process, or product of a particular manufacturer is specified by the City; provided, that, if the Contractor has reason to believe that the design, process, or product specified infringes a patent, the Contractor shall be responsible for such loss unless it promptly gives such information to the Purchasing Director.

(56) Progress Payments

(a) The City shall pay the Contractor the contract price as provided in this contract.

(b) The City shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Architect/Engineer, on estimates approved by the Architect/Engineer. If requested by the Architect or the Engineer, the Contractor shall furnish a breakdown of the total contract price showing the amount included therein for each principal category of the work, in such detail as requested, to provide a basis for determining progress payments. In the preparation of estimates, the Engineer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site may also be taken into consideration if consideration is specifically authorized by this contract and the Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) In making these progress payments, there shall be retained 10 percent of the estimated amount until final completion and acceptance of the contract work. However, if the Architect or Engineer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Architect or Engineer may authorize payment to be made in full without retention of a percentage. When the work is substantially complete, the Architect or Engineer shall retain an amount that they consider adequate protection of the City and may release to the Contractor all or a portion of any excess amount. Also, on completion and acceptance of each separate building, public work, or other division of the contract for which the price is stated separately in the contract, payment may be made for the completed work without retention of a percentage.

(d) All materials and work covered by progress payments made shall, at the time of the payment, become the sole property of the City, but this shall not be construed as relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work, or waiving the right of the City to require the fulfillment of all of the terms of the contract.

(e) The City shall, upon request, reimburse the Contractor for the entire amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor furnishes evidence of full payment to the surety. Such reimbursement shall be part of, and not in addition to, the contract price.

(f) The City shall pay the amount due the Contractor under this contract after: (1) completion and acceptance of all work; (2) presentation of a properly executed voucher; and (3) presentation of a release of all claims against the City arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release.

(g) Concurrently with the submission of each request for a progress payment under this contract, the Contractor shall certify that all due and payable bills with respect to the contract work either have been paid or will be paid with the proceeds of the current request for progress payment.

(h) The City may withhold all or part of any progress payment otherwise due the Contractor if any one or more of the following conditions exist: (1) the Contractor fails to prosecute the work to completion in a diligent, efficient, timely, and workmanlike manner and in strict accordance with the provisions of the contract; (2) the Contractor fails to use an adequate amount or quality of personnel or equipment to complete the work without undue delay; (3) the Contractor fails to make prompt payments to its subcontractors, suppliers, materialmen, or laborers; (4) any part of such payment to the Contractor is attributable to work which is defective or not performed in accordance with the contract requirements; provided, however, such payment shall be made as to the part thereof attributable to work which is performed in accordance with the contract requirements and is not defective; or (5) the Contractor is otherwise in default of any of its obligations under the contract.

(57) Final Acceptance

Final acceptance of the work will be subject to inspection by the Engineer, Purchasing Director, Public Works Director and/or their authorized representative. Any portion of the work that does <u>not</u> pass inspection will have to be corrected before The City does a final acceptance of the project. After the Contractor has satisfactorily completed the work assigned under the contract, the Contractor may then submit on a monthly basis, an invoice for the payment of unpaid moneys owed on the contract. Upon

completion of the contract, the City shall issue a Notice of Final Acceptance to the Contractor. If the City determines that all contractual requirements have not been satisfied, it shall withhold issuance of the Notice of Final Acceptance until completion of all outstanding requirements.

(58) Default

(a) If the Contractor refuses or fails (i) to commence the work within the time required by this contract, (ii) to prosecute the work or any separable part with the diligence that will ensure its completion within the time specified in this contract, including any extension, (iii) to provide sufficient and properly skilled workmen or proper materials or equipment to complete the work in an acceptable manner and without delay, (iv) to promptly pay its subcontractors, laborers, and materialmen, (v) to perform any of its other obligations under this contract, or (vi) to complete the work within the time specified in this contract ("events of default"), the City may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work). In this event, the City may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the City resulting from events of default, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the City in completing the work.

(b) The Contractor's right to proceed shall not be terminated because of delays nor the Contractor charged with damages under this clause, if --

(1) the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor (examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the City in either its public or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the City, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers); and

(2) the Contractor, within 10 days from the beginning of any delay (unless extended by the Purchasing Director), notifies the Purchasing Director in writing of the causes of delay. The Purchasing Director shall ascertain the facts and the extent of the delay. If, in the judgment of the Purchasing Director, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Purchasing Director shall be final and conclusive on the parties but subject to appeal under the "Disputes" clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the City.

(d) The rights and remedies of the City in this clause are in addition to any other rights and remedies provided by law or under this contract. Time is of the essence for all delivery, performance, submittal, and completion dates in this contract.

(59) Termination for Convenience

The Purchasing Director may, whenever the interests of the City so require, terminate this contract, in whole or in part, for the convenience of the City. The Purchasing Director shall give written notice of the termination to the Contractor specifying the part of the contract terminated and when termination becomes effective.

(a) The Contractor shall incur no further obligations in connection with the terminated work, and, on the date set in the notice of termination, the Contractor will stop work to the extent specified. The Contractor shall also terminate outstanding orders and subcontracts as they relate to the terminated work. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders connected with the terminated work. The Purchasing Director may direct the Contractor to assign

the Contractor's right, title, and interest under terminated orders or subcontracts to the City. The Contractor must still complete the work not terminated by the notice of termination and may incur obligations as are necessary to do so.

(b) The Purchasing Director may require the Contractor to transfer title and deliver to the City in the manner and to the extent directed by the Purchasing Director: (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated; and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the City. The Contractor shall, upon direction of the Purchasing Director, protect and preserve property in the possession of the Contractor in which the City has an interest. If the Purchasing Director does not exercise this right, the Contractor shall use its best efforts to sell such supplies and manufacturing materials.

(c) The City shall pay the Contractor the following amounts:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of --

(i) the cost of this work;

(ii) a sum, as profit on (i), above, determined by the Purchasing Director to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Purchasing Director shall allow no profit under this subparagraph

(iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including --

(i) accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) the termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(3) The total sum to be paid the Contractor under this subparagraph shall not exceed the total contract price plus the reasonable settlement costs of the Contractor reduced by the amount of payments otherwise made, the proceeds of any sales of construction, supplies, and construction materials under this subparagraph, and the contract price of work not terminated.

(60) Termination for Default

(a) The City may, subject to the provisions of paragraph (c) below, by written notice of default to the Contractor, terminate the whole or any part of this contract in either one of the following circumstances:

(1) if the Contractor fails to make delivery of the supplies or to perform the service within the time specified herein or any extension thereof; or

(2) if the Contractor fails to perform any of the other provisions of this contract, or so fails to make progress as to endanger performance of this contract in accordance with its terms, and in either of these two circumstances does not cure such failure within a period of 10 days (or such longer period as the Purchasing Director may authorize in writing) after receipt of notice from the Purchasing Director specifying such failure.

(b) In the event the City terminates this contract in whole or in part as provided in paragraph (a) of this clause, the City may procure, upon such terms and in such manner as the Purchasing Director may deem

appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the City for any excess costs for such similar supplies or services; provided, that the Contractor shall continue the performance of this contract to the extent, if any, it has not been terminated under the provisions of this clause.

(c) Except with respect to defaults of subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the contract arises out of causes beyond the control and without the fault or negligence of the Contractor. Such causes may include, but are not restricted to, the following: acts of God or of the public enemy, acts of the City, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; provided, however, in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor. If the failure to perform is caused by the default of a subcontractor and if such default arises out of causes beyond the control of both the Contractor and subcontractor and without the fault or negligence of either of them, the Contractor shall not be liable for any excess costs for failure to perform, unless the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the Contractor to meet the required delivery schedule.

(d) If this contract is terminated as provided in paragraph (a) of this clause, the City, in addition to any other rights provided in this clause, may require the Contractor to transfer title and deliver to the City in the manner and to the extent directed by the Purchasing Director (i) any completed supplies and (ii) such partially completed supplies and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information, and contract rights (hereinafter called "manufacturing materials") as the Contractor has specifically produced or specifically acquired for the performance of such part of this contract as has been terminated; and the Contractor shall, upon direction of the Purchasing Director, protect and preserve property in possession of the Contractor in which the City has an interest. Payment for completed supplies delivered to and accepted by the City shall be at the contract price. Payment for manufacturing materials delivered to and accepted by the City and for the protection and preservation of property shall be in an amount agreed upon by the Contractor and Purchasing Director. Failure to agree to such amount shall be a dispute concerning a question of fact within the meaning of the Disputes Clause of this contract. The City may withhold from amounts otherwise due the Contractor for such completed supplies or manufacturing materials such sum as the Purchasing Director determines to be necessary to protect the City against loss because of outstanding liens or claims of former lien holders.

(e) If, after notice of termination of this contract under the provisions of this clause, it is determined for any reason that the Contractor was not in default or that the default was excusable under the provisions of this clause, the rights and obligations of the parties shall be those provided in the Termination for the Convenience of the City Clause hereof. Failure to agree to any such adjustment shall be a dispute concerning a question of fact within the meaning of the Disputes Clause of this contract.

(f) The rights and remedies of the City provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract. Time is of the essence for all delivery, performance, submittal, and completion dates in this contract.

(g) As used in paragraph (c) of this clause, the terms "subcontractor" and "subcontractors" mean subcontractor(s) at any tier.

CERTIFICATIONS & FEDERAL CLAUSES

(FEDERALLY ASSISTED CONSTRUCTION, ALTERATION OR REPAIR CONTRACT)

** NOTE: THIS SECTION MUST BE COMPLETED AND RETURNED WITH THE OFFER **

(61) Disadvantaged Business Enterprise (DBE)

The offeror represents as part of its offer that it (Mark one with an "X"):

☐ is ☐ is not

a disadvantaged business enterprise (DBE). A DBE is defined as "a for-profit small business concern which is at least 51 percent owned by one or more socially and economically disadvantaged individuals, or in case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more socially and economically disadvantaged individuals and whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it." For purposes of this definition, socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Asian-Pacific Americans, Subcontinent Asian Americans, Native Americans, women; and any additional groups whose members are designated as socially and economically disadvantaged by the Small Business Administration (SBA), at such time as the SBA designation becomes effective.

(62) Disadvantaged Business Enterprise Goals

If goals have been established, by submission of this offer, the offeror certifies that it will comply with the provisions of "Disadvantaged Business Enterprise Provisions," and will meet such goals as are established in any ensuing contract. The Lower Rio Grande DBE goals will apply for this project.

(63) Certification of Independent Price Determination

(a) By submission of this offer, the offeror certifies, and in the case of a joint offer, each party thereto certifies as to its own organization, that in connection with this procurement:

(1) The prices in this offer have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other offeror or with any competitor.

(2) Unless otherwise required by law, the prices which have been quoted in this offer have not been knowingly disclosed by the offeror and will not knowingly be disclosed by the offeror prior to the opening (in the case of an advertised procurement) or prior to award (in the case of a negotiated procurement), directly or indirectly to any other offeror or to any competitor; and

(3) No attempt has been made or will be made by the offeror to induce any other person or firm to submit or not to submit an offer for the purpose of restricting competition.

(b) Each person signing this offer certifies that:

(1) He is the person in the offeror's organization responsible within that organization for the decision as to prices being offered herein and that he has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above; or

(2) He: (i) is not the person in the offeror's organization responsible within that organization for the decision as to the prices being offered herein but that he has been authorized in writing to act as an agent for the persons responsible for such decision in certifying that such persons have not participated, and will

not participate, in any action contrary to (a)(1) through (a)(3) above, and as their agent does hereby so certify; and (ii) has not participated, and will not participate, in any action contrary to (a)(1) through (a)(3) above.

(64) Access Requirements for Individuals with Disabilities

The Contractor shall comply with all applicable requirements of the Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. 12101 et seq. and 49 U.S.C. 322; Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. 794; Section 16 of the Federal Transit Act, as amended, 49 U.S.C. app. 1612; and the following regulations and any amendments thereto:

(1) US. DOT regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49 CFR Part 37;

(2) US. DOT regulations, "Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance," 49 CFR Part 27;

(3) US. DOT regulations, "Americans With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles," 49 CFR Part 38;

(4) Department of Justice (DOJ) regulations, "Nondiscrimination on the Basis of Disability in State and Local Government Services," 28 CFR Part 35;

(5) DOJ regulations, "Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities," 28 CFR Part 36;

(6) General Services Administration regulations, "Construction and Alteration of Public Buildings," "Accommodations for the Physically Handicapped," 41 CFR Part 101-19;

(7) Equal Employment Opportunity Commission (EEOC) "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630;

(8) Federal Communications Commission regulations, "Telecommunications Relay Services and Related Customer Premises Equipment for the Hearing and Speech Disabled," 47 CFR Part 64, Subpart F; and

(9) FTA regulations, "Transportation for Elderly and Handicapped Persons," 49 CFR Part 609.

(65) Audit and Inspection of Records

(a) This clause is applicable if this contract was entered into by means of negotiation and shall become operative with respect to any modification to this contract whether this contract was initially entered into by means of negotiation or by means of formal advertising.

(b) The Purchasing Director shall maintain records, and the Purchasing Director, the US. Department of Transportation, and the Comptroller General of the United States or any of their duly authorized representatives shall, until the expiration of **three (3) years** after final payment under this contract, have access to and the right to examine any directly pertinent books, documents, papers and records of such Contractor, involving transactions related to the contract, for the purpose of making audit, examination, excerpts and transcriptions.

(c) The Contractor further agrees to include in all his subcontracts hereunder a provision to the effect that the subcontractor agrees that the Purchasing Director, the US. Department of Transportation, and the Comptroller General of the United States or any of their duly authorized representatives shall, until the expiration of three years after final payment under this contract, have access to and the right to examine any directly pertinent books, documents, papers and records of such subcontractor, involving transactions related to the subcontract, for the purpose of making audit, examination, excerpts and transcriptions.

(66) Incorporation of Federal Transit Administration (FTA) Terms

These provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth herein. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1E, dated June 19, 2003, are hereby incorporated by reference. All FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this contract.

(67) Cargo Preference - Use of United States-Flag Vessels

This clause applies to contracts involving materials, equipment, or commodities that may be transported by ocean vessel in carrying out the terms of the contract. As required by 46 C.F.R. Part 381, the Contractor agrees:

(a) To utilize privately owned United States-Flag commercial vessels to ship at least fifty percent (50%) of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, materials, or commodities pursuant to this section, to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels.

(b) To furnish within twenty (20) working days following the date of loading for shipments originating with the United States, or within thirty (30) working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading, in English, for each shipment of cargo described in paragraph (a) above to the City (through the Prime Contractor in the case of subcontractor bills-of-lading), to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, D.C. 20590, and to the FTA recipient, marked with appropriate identification of the Project.

(c) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract that may involve the transport of equipment, material, or commodities by ocean vessel.

(68) Fly America Requirements

The Contractor agrees to comply with 49 U.S.C. 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and subrecipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

(69) Buy America Provision

This solicitation and the resulting contract are subject to the Buy America requirements of 49 U.S.C. § 5323(j) and the Federal Transit Administration’s implementing regulations found at 49 CFR § 661, the provisions of each of which are incorporated herein by reference. These regulations require, as a matter of responsiveness, that the proposer or offeror submit with its offer a completed certification in accordance with 49 CFR § 661.6 or § 661.12, as appropriate. These certifications are set forth in Exhibit U of this solicitation.

(70) FTA Protest Procedures

(a) In accordance with the provision of this solicitation any interested party who is aggrieved or adversely affected in connection with this solicitation, or award of a contract as a result of this solicitation, may protest to the Purchasing Director, and appeal any adverse decision of the Purchasing Director to the City’s Council or its duly authorized representative.

(b) Paragraph 7(l) of Federal Transit Administration (FTA) Circular 4220.1E prescribes the limited circumstances under which FTA will review a protest and establishes the detailed procedures that must be

followed by a protestor. Under those procedures, FTA will only review protests submitted by an "interested party" regarding: (1) the alleged failure of the City to have or follow its written protest procedures, or its alleged failure to review a complaint or protest; or (2) violations of Federal law or regulation.

(c) Copies of paragraph 7(l) of FTA Circular 4220.1E will be furnished to any offeror without charge upon written request to the Purchasing Director.

(71) Federal Transit Administration

As a result of the enactment of the Federal Transit Act Amendments of 1991, the Urban Mass Transportation Administration (UMTA) was redesignated as the Federal Transit Administration (FTA). Accordingly, whenever in the solicitation reference is made to either the "Urban Mass Transportation Administration" or "UMTA", that reference shall be considered as referring to either the "Federal Transit Administration" or "FTA", as appropriate.

(72) Notice of Federal Requirements

The Contractor is advised that Federal requirements applicable to this contract as set forth in federal law, regulations, policies, and related administrative practices may change during the performance of this contract. Any such changes shall also apply to this contract

(73) Certification of Eligibility

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(74) Program Fraud and False or Fraudulent Statements or Related Acts

(a) The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq . and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this contract. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

(b) The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.

(c) The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions

(75) Compliance with Davis-Bacon and Related Act Regulations

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3 and 5 are hereby incorporated by reference in this contract.

(76) Equal Employment Opportunity

(a) During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, disability or national origin.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, disability or national origin. This shall include, but not be limited to: employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

(3) **The Contractor shall post in conspicuous places available to employees and applicants for employment, notices to be provided by the Purchasing Director that explain this clause.**

(4) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, disability or national origin.

(5) The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Purchasing Director advising the labor union or workers' representatives of the Contractor's commitments under this clause and Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor will comply with **Executive Order 11246**, as amended, and the rules, regulations, and relevant orders of the Secretary of Labor.

(7) The Contractor will furnish to the Purchasing Director all information required by **Executive Order 11246**, as amended, and by the rules, regulations, and orders of the **Secretary of Labor**. **Standard Form 100 (EEO-1)** or any successor form, is the prescribed form to be filed within **thirty (30) days** following the award, unless filed within twelve (12) months preceding the date of award.

(8) The Contractor shall permit access to its books, records, and accounts by the Purchasing Director, the Federal Transit Administration, and the Secretary of Labor for purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations and orders.

(9) In the event it is determined that the Contractor is not in compliance with this clause or with any rule, regulation or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Federal or Federally-assisted contracts in accordance with procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, or by the rules, regulations and orders of the Secretary of Labor, or as otherwise provided by law.

(10) The Contractor shall include the provisions of paragraphs (1) through (10) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor. The Contractor shall take such action with respect to any subcontract or purchase order as the Purchasing Director or the FTA or the Secretary of Labor may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, however, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction. The Contractor may request the United States to enter into such litigation to protect the interests of the United States.

(b) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures 41 CFR. 60-1.1.

(77) Davis-Bacon Act

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR. Part 3), the full amount of wage and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics, subject to the provisions of subparagraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b) (1) The Purchasing Director shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Purchasing Director shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Purchasing Director agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Purchasing Director to the Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Purchasing Director or will notify the Purchasing Director within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the Purchasing Director do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Purchasing Director shall refer the questions, including the views of all interested parties and the recommendation of the Purchasing Director, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Purchasing Director or will notify the Purchasing Director within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(78) Payrolls and Basic Records

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of **three (3) years** thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled "Davis-Bacon Act," that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b) (1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Purchasing Director. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, US. Government Printing Office, Washington, D.C. 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract, which shall certify:

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, at 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth in the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Purchasing Director or authorized representatives of the Purchasing Director or the Department of Labor. The Contractor or subcontractor shall permit the Purchasing Director or representatives of the Purchasing Director or Department of Labor to interview employees during working hours on the job. The contractor or subcontractor fails to submit the required records or to make them available, the Purchasing Director may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(79) Subcontracts (Labor Standards)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled "Davis-Bacon Act, Contract Work Hours and Safety Standards Act - Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations and Certification of Eligibility," and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b) (1) Within fourteen (14) days after award of the contract, the Contractor shall deliver to the Purchasing Director a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract. (2) Within fourteen (14) days after contract award of any subsequently awarded subcontract the Contractor shall deliver to the Purchasing Director an updated completed SF 1413 for such additional subcontract.

(80) Title VI Civil Rights Act of 1964

During the performance of this contract, the Contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "Contractor"), agrees as follows:

(a) Compliance with Regulations. The Contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation (hereinafter, "DOT") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

(b) Nondiscrimination. The Contract, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

(c) Solicitations for Subcontracts, Including Procurement of Materials and Equipment. In all solicitations either by competitive proposal or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or

supplier shall be notified by the Contractor of the Contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, religion, color, sex, age, or national origin.

(d) Information and Reports. The Contractor shall provide all information and reports required by the Regulations or directive issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information and its facilities as may be determined by the City or the Federal Transit Administration (FTA) to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information is required or a Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the City, or FTA, as appropriate, and shall set forth what efforts it has made to obtain the information.

(e) Sanctions for Noncompliance. In the event of the Contractor's noncompliance with the nondiscrimination provisions of this contract, the City shall impose such contract sanctions as it or FTA may determine to be appropriate, including, but not limited to:

(1) Withholding of payments to the Contractor under the contract until the Contractor complies; and/or

(2) Cancellation, termination or suspension of the contract, in whole or in part.

(f) Incorporation of Provisions. The Contractor shall include the provisions of paragraphs (a) through (f) of this clause in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The Contractor shall take such action with respect to any subcontract or procurement as the City or FTA may direct as a means of enforcing such revisions including sanctions for noncompliance: provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the Contractor may request the City, and, in addition, the United States to enter into such litigation to protect the interests of the City and the United States.

(81) Withholding of Funds

The Purchasing Director shall, upon his or her own action or upon written request of an authorized representative of the FTA or Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Purchasing Director may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(82) Project Signs

The Contractor shall erect at the site of construction, and maintain during construction, signs satisfactory to the City and the Department of Transportation identifying the project and indicating that the Federal Government is participating in the development of the project.

(83) Disputes Concerning Labor Standards

The United States Department of Labor has set forth in 29 CFR Parts 5, 6 and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the "Disputes" clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the City, the US. Department of Labor, or the employees or their representatives.

(84) Energy Policy and Conservation Act

The Contractor shall recognize mandatory standards and policies relating to energy efficiency contained in the State Energy Conservation Plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. Section 6321 et seq.).

(85) Clean Air and Water Certification

Applicable if the offer exceeds $100,000, or the Purchasing Director believes that orders under an indefinite contract in any year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Air Act [42 U.S.C. 7413(c)(1)] or the Water Act [33 U.S.C. 1319 (c)], and is listed by the Environmental Protection Agency (EPA) as a violating facility, and the acquisition is not otherwise exempt.

By submission of this offer, the offeror certifies that:

(a) Any facility to be used in the performance of this proposed contract (Mark one with an "X"):

□ **is** □ **is not listed on the EPA List of Violating Facilities;**

(b) It will immediately notify the Purchasing Director, before award, of the receipt of any communication from the Administrator, or a designee of the EPA, indicating that any facility which it proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) It will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(d) Definitions:

(1) "Air Act," as used in this clause, means the Clean Air Act (42 U.S.C. 7401 et seq.).

(2) "Clean air standards," as used in this clause, means:

(i) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738.

(ii) An applicable implementation plan as described in Section 110(d) of the Air Act [42 U.S.C. 7410(d)];

(iii) An approved implementation procedure or plan under Section 110(c) or Section 111(d) of the Air Act [42 U.S.C. 7411(c) or (d)]; or

(iv) An approved implementation procedure under Section 112(d) of the Air Act [42 U.S.C. 7412(d)].

(3) "Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by Section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pre-treatment regulations as required by Section 307 of the Water Act (33 U.S.C. 1317).

(4) "Compliance," as used in this clause, means compliance with:

(i)Clean air or water standards; or

(ii)A schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

(5) "Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised, by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee of the Environmental Protection Agency, determines that independent facilities are co-located in one geographical area.

(6) "Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251 et seq.).

(e) The Contractor agrees:

(1) To comply with all the requirement of Section 114 of the Clean Air Act (42 U.S.C. 7414) and Section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best effort to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this paragraph (b)(4).

(86) Compliance with Copeland Act Requirements

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(87) Contract Termination - Debarment

A breach of the contract clauses entitled "Davis-Bacon Act, Contract Work Hours and Safety Standards Act - Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance With Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations or Certification of Eligibility" may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(88) Certification of Non-Segregated Facilities

(a) By the submission of this offer, the offeror certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control, where segregated facilities are maintained.

(b) The offeror agrees that a breach of this certification is a violation of the Equal Opportunity Clause in the contract.

(c) As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion or nation origin, because of habit, local custom or otherwise.

(d) It further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will:

(1) obtain identical certifications from proposed subcontractors before the award of subcontracts under which the subcontractor will be subject to the Equal Opportunity clause;

(2) Retain such certifications in its files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods).

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for such subcontract or for all subcontracts during a period (i.e., quarterly, semiannually or annually).

Note: the penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

(89) Restrictions on Lobbying

(a) The Contractor shall timely comply with the requirements of the lobbying restrictions set forth in 31 U.S.C. § 1352 and 49 CFR Part 20, and as those authorities may be hereafter amended.

(b) If a Standard Form LLL, Disclosure of Lobbying Activities, is required to be completed by the Contractor or subcontractor at any tier, such disclosure form shall be furnished to the Purchasing Director.

(90) Certification of Restrictions on Lobbying

This Certification is applicable if the offer exceeds $100,000.

(a) By submission of this offer, the offeror certifies, to the best of his or her knowledge or belief, that:

(1) No Federal appropriated funds have been paid, or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, or the entering into of any cooperative agreement; and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, Disclosure of Lobbying Activities, in accordance with its instructions [as amended by "Government-wide Guidance for New Restrictions on Lobbying," Fed. Reg. 1413 (1/19/96)].

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

(b) This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352 (as amended by the Lobbying Disclosure Act

of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 or not more than $100,000 for each such failure.

(c) As required by subparagraph (a) above, for each subcontract at any tier exceeding $100,000, the certification and Disclosure Form (if required) shall be filed with the next tier above, and retained by that contractor with the appropriate subcontract. If a Disclosure Form is submitted, it shall be forwarded from tier to tier until received by the City of Mission, Purchasing Director.

(91) Drug-Free Workplace Program Certification

(a) By submission of a proposal, the Contractor certifies and agrees that, with respect to the Contractor and all employees of the Contractor to be utilized in the performance of any contract resulting from this solicitation, it will establish a drug-free workplace program that complies with the provisions of the Drug-Free Workplace Program Clause of the General Provisions.

(b) Failure of the Contractor to have the drug-free workplace program complying with this certification and the Drug-Free Workplace Program Clause of the General Provisions available for the City's review and approval as part of the City's pre-award responsibility survey will be deemed a lack of responsibility rendering the Contractor unqualified and ineligible for award.

(92) Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion

(a) Primary Covered Transactions. [This certification applies to the offer submitted in response to this solicitation and will be a continuing requirement throughout the term of the prime contract.]

(1) The accordance with the provisions of Appendix A to 49 Code of Federal Regulations (CFR) Part 29, the offeror certifies to the best of its knowledge and belief, that it and its principals:

(i) are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(ii) have not within a three-year period preceding this offer been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes, or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(iii) are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(ii) of this Certification; and

(iv) have not within a three-year period preceding this offer had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the offeror is unable to certify to any of the statements in this Certification, the offeror shall attach an explanation to this offer.

(b) Lower Tier Covered Transactions. [This certification applies to a subcontract at any tier expected to equal or exceed $25,000, and will be a continuing requirement throughout the term of the prime contract.]

(1) In accordance with the provisions of Appendix B to 49 Code of Federal Regulations (CFR) Part 29, the prospective lower tier participant (subcontractor) certifies, by submission of this offer, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

(c) The Certification required by subparagraph (b), above, shall be included in all applicable subcontracts and a copy furnished to the Purchasing Director upon execution of the Certification.

(93) Communication Policy and Certification

(a) All oral and written communications with City regarding this solicitation should be exclusively with, or on subjects and with persons approved by, the person identified in Block 3 of the solicitation cover sheet. Discussions or communications with any other person could result in disclosure of proprietary or other competitive sensitive information or otherwise create the appearance of impropriety or unfair competition and, thereby, compromise the integrity of City's procurement system. If competition issues cannot be resolved through normal communication channels, the City will address any protest from actual or prospective competitors claiming any impropriety in connection with this procurement.

(b) By submission of this offer, the offeror certifies that it has not, and will not prior to contract award, communicate orally or in writing with any City employee or other representative (including City Board members, City contractors, or City consultants) other than the individual, or person(s) and on subjects approved by the individual, named in Block 3 of the solicitation, except as described below: (CHECK "NONE" IF NONE EXISTS.)

□ **NONE**

Name of City Representative	Date and Subject of Communication

{provide attachment, if necessary}

(c) This certification concerns a material representation of fact upon which reliance will be placed in awarding a contract. If it is later determined that the offeror knowingly rendered an erroneous certification, in addition to any other remedies the City may have, the Purchasing Director may terminate the contract resulting from this solicitation for default and/or recommend that the offeror be debarred or suspended from doing business with City in the future. In addition, a false entry could be a violation of Texas Penal Code paragraph 37.10.

(d) The proposer/offeror shall provide immediate written notice to the Purchasing Director if, at any time prior to contract award, he/she learns that its certification was, or a subsequent communication makes, the certification erroneous.

(94) Conflict of Interest Certification

By submission of this offer, I certify that:

(a) I have read and understand the General Provisions clause entitled "Interest of Public Officials" that will be incorporated into any contract resulting from this solicitation. I further understand that the pecuniary interest in that clause includes employment relationships.

(b) I understand the City has an internal conflict of interest policy for its employees that includes as an actual or possible conflict of interest whether or not a member of the employee's immediate family works for a firm doing, or seeking to do, business with the City.

(c) Mark one with an "X":

□ To the best of my knowledge and belief, no employee of my firm is related to a City employee; or

□ An employee of my firm is related to an City employee and a letter to the Purchasing Director explaining that relationship is attached.

(d) The requirements of this certification have been passed through to all first-tier subcontractors or subconsultants anticipated to be used at the time of the submission of my offer.

****

SIGNATURE BLOCK FOR ALL REPRESENTATIONS & CERTIFICATIONS

****

NAME OF OFFEROR & ADDRESS (INCLUDE ZIP &PHONE)

SIGNATURE:

TYPE NAME:

DATE:

OFFERORS MUST SET FORTH FULL, ACCURATE AND COMPLETE INFORMATION AS REQUIRED BY THIS SOLICITATION (INCLUDING THIS ATTACHMENT). FAILURE TO DO SO MAY RENDER THE OFFER NONRESPONSIVE OR UNACCEPTABLE.

A FALSE STATEMENT IN ANY OFFER SUBMITTED TO THE CITY MAY BE A CRIMINAL OFFENSE IN VIOLATION OF SECTION 37.10 OF THE TEXAS PENAL CODE.

(95) Wage Rates

All persons employed in the performance of the work under this contract, or any subcontracts hereunder, shall be paid not less than the general rates of per diem, holiday, and overtime wages prevailing in the locality for work of a similar character (which wages are specified in an attachment to this contract). Failure to comply with this provision shall subject the Contractor to the penalties prescribed in the Texas Government Code, Chapter 2258, Prevailing Wage Rates, as amended.

Prevailing Wage Legal Requirements

General Decision Number: TX170008 01/06/2017 TX8

Superseded General Decision Number: TX20160008

State: Texas

Construction Types: Heavy and Highway

Counties: Cameron, Hidalgo and Webb Counties in Texas.

HEAVY & HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/06/2017

* SUTX2011-003 08/02/2011

Rates Fringes

CEMENT MASON/CONCRETE
FINISHER (Paving & Structures)...$ 12.46

FORM BUILDER/FORM SETTER
(Structures).....$ 12.30

FORM SETTER (Paving & Curb).....$ 12.16

LABORER
Asphalt Raker.....$ 10.61
Flagger.....$ 9.10
Laborer, Common.....$ 9.86
Laborer, Utility.....$ 11.53
Pipelayer.....$ 11.87
Work Zone Barricade
Servicer.....$ 12.88

POWER EQUIPMENT OPERATOR:
Asphalt Distributor.....$ 13.48
Asphalt Paving Machine.....$ 12.25
Broom or Sweeper.....$ 10.33
Crane, Lattice Boom 80
Tons or Less.....$ 14.39
Crawler Tractor.....$ 16.63
Excavator, 50,000 lbs or
less.....$ 12.56
Excavator, over 50,000 lbs..$ 15.23
Foundation Drill, Truck
Mounted.....$ 16.86
Front End Loader Operator,
Over 3 CY.....$ 13.69
Front End Loader, 3 CY or
less.....$ 13.49
Loader/Backhoe.....$ 12.77
Mechanic.....$ 15.47
Milling Machine.....$ 14.64
Motor Grader Operator,

Rough.....$ 14.62
Motor Grader, Fine Grade....$ 16.52
Scraper.....$ 11.07

Servicer.....$ 12.34

Steel Worker (Reinforcing).....$ 14.07

TRUCK DRIVER
Lowboy-Float.....$ 13.63
Single Axle.....$ 10.82
Single or Tandem Axle Dump..$ 14.53
Tandem Axle Tractor with
Semi Trailer.....$ 12.12

WELDER.....$ 14.02

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of

the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

CITY OF MISSION
Attachment 1 to General Terms and Conditions - Schedule of Subcontractor(s)/Subconsultant(s)

Offerors should provide information on **all** of their prospective subcontractor(s)/subconsultant(s) who submit proposals/proposals in support of this solicitation. Use additional sheets as needed.

Project Name: **"Leo Peña Placita Park Mobility Improvement Project"** **Solicitation Number**: **Proposal No: 18-071-12-11**

Name of Prime Contractor:____

NAMES AND ADDRESSES OF SUBCONTRACTOR(S)/SUBCONSULTANT(S)	TYPE OF WORK TO BE PERFORMED	MINORITY OR WOMAN FIRM? (Check all that apply)	PREVIOUS YEAR'S ANNUAL GROSS RECEIPTS
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.
NAME: ADDRESS: PHONE: FAX: E-MAIL: TAX ID #: CONTACT PERSON:	TYPE OF WORK: AGE OF FIRM:	YES ☐ NO ☐ IF YES: DBE ☐ OR MBE ☐ OR WBE ☐	☐ less than $500K ☐ $500K - $2 mil. ☐ $2 mil. - $5 mil. ☐ more than $5 mil.

Name/Title of Person completing this form: ___________________________________

Signature____ Date_____________________

City Of Mission
Vendor Acknowledgment Form - Non-Collusive Proposal Certification
Proposal Name/No.: "Leo Peña Placita Park Mobility Improvement Project"/ 18-071-12-11

I/We have read instructions to Contractor and specifications. My/Our proposal conforms to all proposal specifications, conditions, and instructions as outlined by *CITY OF MISSION*.

Signing the Acknowledgment Form confirms that our company will enter into a binding contract with CITY OF MISSION for item(s) awarded to our company. I/We have read instructions to Contractor and specifications.

The undersigned Contractor, by signing and executing this proposal, certifies and represents to the CITY OF MISSION that Contractor has not been offered, conferred or agreed to confer any pecuniary benefit, as defined by §1.07(a)(6) of the Texas Penal Code, or any other thing of value as consideration for the receipt of information or any special treatment or advantage relating to this proposal; the Contractor also certifies and represents that Contractor has not offered, conferred or agreed to confer any pecuniary benefit or other things of value as consideration for the recipient's decision, opinion, recommendation, vote or other exercise of discretion concerning this proposal; the Contractor certifies and represents that Contractor has neither coerced nor attempted to influence the exercise of discretion by any officer, trustee, agent of employee of the CITY OF MISSION concerning this proposal on the basis of any consideration not authorized by law; the Contractor also certifies and represents that Contractor has not received any information not available to other Contractors so as to give the undersigned a preferential advantage with respect to this proposal; the Contractor further certifies and represents that Contractor has not violated any state, federal or local law, regulation or ordinance relating to bribery, improper influence, collusion or the like and that Contractor will not in the future offer, confer, or agree to confer any pecuniary benefit or other thing of value to any officer, trustee, agent or member of the CITY OF MISSION in return for the person having exercised the person's official discretion, power or duty with respect to this proposal; the Contractor certifies and represents that it has not now and will not in the future offer, confer, or agree to confer a pecuniary benefit or other thing of value to any officer, trustee, agent or member of CITY OF MISSION in connection with information regarding this proposal, the submission of this proposal, the award of this proposal or the performance, delivery or sale pursuant to this proposal.

Date: _____

Company Name: _____

Signature: _____

Title: _____

Note: This form, along with the Execution of Offer, must be filled in and submitted with the sealed proposal.

TO: OWNER

The undersigned, as Contractors, declares that the only person or parties interested in this proposal as principals are those named herein, that this proposal is made without collusion with any other person, firm or corporation; that he has carefully examined the form of contract, Notice to Contractors, specifications and the plans thereon referred to, and has carefully examined the locations, and conditions and classes of materials of the proposed work; and agrees that he will provide all the necessary labor, machinery, tools, and apparatus, and other items incidental to construction, and will do all the work and furnish all the materials called for in the contract and specifications in the manner prescribed therein and according to the requirements of the Engineer/Architect as therein set forth.

The Contractor shall attach to his/her proposal sheet a list of any exceptions to the specifications.

It is understood that the following quantities of work to be done at unit prices are approximate only and are intended principally to serve as a guide in evaluating proposals.

It is further agreed that the quantities of work to be done at unit price and materials to be furnished, may be increased or diminished as may be considered necessary, in the opinion of the Engineer/Architect, to complete the work fully as planned and contemplated, and that all quantities of the work, whether increased or decreased, are to be performed at the unit prices set forth below except as provided for in the specifications.

It is further agreed that lump sum prices may be increased to cover additional work ordered by the Engineer/Architect, but not shown on the plans or required by the specifications, in accordance with the provisions of the General Conditions. Similarly, they may be decreased to cover deletion of work so ordered.

The proposal security accompanying this proposal shall be returned to the Contractor, unless in case of the acceptance of the proposal the Contractor shall fail to execute a contract and file a performance bond and payment bond within the ten (10) days after its acceptance and release of notice of award, in which case the proposal security shall become the property of the OWNER, and shall be considered as payment for damages due to delay and other inconveniences suffered by the Owner on account of such failure of the Contractor. It is understood that the Owner reserves the right to reject any or all proposals.

The undersigned agrees, unless hereinafter stated otherwise to furnish all materials as shown and specified in the Plans and Specifications.

Proposer hereby agrees to commence work under this contract within 10 days after notice to PROCEED is issued and complete the work within **180 calendar days**.

Receipt is acknowledged of the following addenda:

No. _____ Dated _____ No. _____ Dated _____

No. _____ Dated _____ No. _____ Dated _____

No. _____ Dated _____ No. _____ Dated _____

Proposer agrees that the Owner has the right to accept or reject any or all proposals and to waive any or all formalities.

DATE: _____ Respectfully submitted,

BY: _____
(Signature)

_____
(Type or Print Name)

_____
(Title)

_____
(Company)

_____
(Address)

_____

_____
(Phone Number)

(Seal - If contractor is a Corporation)

_____
(Fax Number)

Federal ID or SS# Number: _____

*Signature on this form indicates agreement with "Instructions to Proposer-General Terms and Conditions, Pricing, and Specifications"

PROPOSAL FORM

PROJECT: **Leo Peña Placita Park Mobility Improvement Project RFP #18-071-12-11**
PLACE: 1201 E. 8th St., Mission, TX 78572
DATE: Monday, December 11, 2017
SUBMISSION TIME: 2:00 pm CST

Pursuant to and in compliance with the Request for Competitive Sealed Proposal and the proposed Contract Documents, prepared by Chanin Engineering, LLC. relating to the above referenced project, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the work at the place where the work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, and addenda, thereto, including furnishing of any and all labor and materials for all General Construction and Site Work, for the following sum of money:

A. PROPOSAL
All labor, materials, services and equipment necessary for completion of the work shown on the drawings and in the specifications. All divisions included, minus alternates.

TOTAL COST DOLLAR ($_____) _____

_____

1. If awarded this Contract, the undersigned will execute a satisfactory Construction Contract, Performance Bond, Labor and Material Payment Bond and proof of insurance coverage, with the Owner for the entire work as per the Contract Documents within ten (10) days after notice of award. It is agreed that this bid is subjected to the Owner's acceptance for a period of forty five (45) days from the date of opening.

B. The following are alternates to the Base Bid: It is understood that if no figure is listed for an Alternate, it may be accepted and there will be no change in the Base Bid amount indicated above. Strike out (add) or (deduct) as required for each alternate. Refer Specification Section 1200, "Alternates" for complete description of the Alternates.

Alternate #1 METAL SCREENS ALONG STAGE WALL: TOTAL COST DOLLAR
($_____) _____

_____

Alternate #2 METAL SCREENS ALONG WEST SIDE OF PLAZA BENCHES: TOTAL COST DOLLAR
($_____) _____

_____

Alternate #3 DECOMPOSED GRANITE: TOTAL COST DOLLAR ($_____)
_____

Alternate #4 STEEL SHADE CANOPY STRUCTURE: TOTAL COST DOLLAR
($_____) _____
_____

Alternate #5 ARTIFICIAL TURF AT AMPHITHEATER SEATING: TOTAL COST DOLLAR ($_____) _____
_____

Alternate #6 EDGING: TOTAL COST DOLLAR ($_____)_____
_____

D. Contract Execution:

If awarded this contract the undersigned will execute a satisfactory Construction Contract, Performance Bond, Labor and Material Payment Bond and proof of insurance coverage, with the Owner for the entire work as per the contract Documents within 10 days after notice of award. It is agreed that this proposal is subjected to the Owners acceptance for a period of 45 (forty-five days) from the above date.

E. Enclosed is a Cashiers Check or Proposal Bond in the amount of $_____ in compliance with the specification requirements. (5% of highest amount bid.)

The above Check or Proposal Bond is to become the property of the Owner in the event the Construction Contract (when offered by the Owner) and the bonds and proof of insurance coverage are not executed within the time set forth above.

F. Extra Work:

The undersigned agrees that should any change in the work or extra work be ordered the allowance for overhead and profit combined shall be as scheduled below, but in no case shall it exceed 5%. The following applicable percentages shall be added to the extra work cost as defined by Section 16 of the General Conditions.

1. Allowance to the Contractor for overhead and profit for extra work provided by his own forces: Maximum 5%

2. Allowance to the Contractor for overhead and Profit for extra work provided by a subcontractor and supervised by the Contractor: Maximum 5%

3. The General Contractor shall not be allowed to charge the Owner for “extended overhead” changes relating to Change of Orders or weather delays.

G. The Undersigned agrees to the following:

A. To furnish all labor and materials as shown and specified
B. To complete the base proposal (and any alternates selected) including anticipated delays due to inclement weather or muddy ground conditions in ____ calendar days.
C. To work ____ working days per week
D. To start work ____ days after notice of award of contract.

H. The full amount of all Allowances as specified in the General Requirements. Division I, of the Specifications, is included in the bid item price shown

I. Receipt is acknowledgment of the following addenda:

No._____ Dated_____
No._____ Dated_____
No._____ Dated_____
No._____ Dated_____
No._____ Dated_____
No._____ Dated_____

J. The Offeror attests and affirms that he and his subcontractors are skilled and experienced in the use and interpretation of plans, specifications, addenda and related proposal documents and, that he has carefully reviewed the plans, specifications, addenda and related proposal documents for this project and has found them to be free of conflicts and/or ambiguities and sufficient for proposal and construction purposes. Further, he has carefully examined the soils reports and the site of the work, and, through his own personal observations, has satisfied himself as to the nature, location and requirements of the work; the character, quality and quantity of materials required; the difficulties likely to be encountered; the other items and/or conditions which may affect the satisfactory performance of the work. He has based his proposal solely on these documents, and personal observations, and has not relied in any way on any explanation or interpretation, oral or written, from any source other than those written and issued by the Architect/Engineer.

K. Offeror agrees that the Owner has the right to accept or reject any or all proposals and to waive all informalities

The undersigned affirms that the information provided herein is true and sufficiently complete so as not to be misleading and has the authority to bind the represented company to a contract.

Title of Official	Signature Official
Date	Company Name

Sealed if Proposal Is Corporation

City of Mission

GENERAL BUSINESS QUESTIONNAIRE

(SUPPLIES, SERVICES AND CONSTRUCTION)

This questionnaire, the requested list of references and the authorization to release financial information are used in part to assist in determining a potential contractor's responsibility. Offerors shall submit the General Business Questionnaire information with the bid/proposal, as indicated in the Table of Contents page 2 of the Solicitation, Offer and Award Form. All information must be current and traceable. Each venturer of a joint venture must submit a separate signed form.

City of Mission reserves the right to make additional inquiries based on information submitted, or the lack thereof. Questions concerning this questionnaire or the authorization form should be directed to the contact person identified on the Solicitation, Offer and Award Form. In cases where a question does not apply or if unable to respond, offeror should refer to the item number, repeat the question, and indicate N/A (Not Applicable) or N/R (No Response), as appropriate. Offeror will explain the reason when responding N/A or N/R.

1. Name of Offeror ("Business"): _____

2. List name(s) and business address of owners, officers and directors for corporations, partners for partnerships, and ventures for joint ventures sole proprietors (attach additional pages as necessary).

   _____
   _____
   _____

3. Number of years in business under present business name: _____

4. If applicable, list all other names under which the Business identified above operated in the last 5 years.

   _____
   _____
   _____

5. Annual Gross Revenue (Past year): (M represents millions, K represents thousands)
   ☐$100K or less ☐$100K-$500K ☐$500K-$1M ☐$1M-$5M ☐$5M-$10M
   ☐$10M-$16M ☐$16M or Over

6. Will bidder/proposer provide a copy of its financial statements for the past two (2) years, if requested by City of Mission? ☐Yes ☐No

7. Number of current employees: _____

8. Has the Business, or any officer or partner thereof, failed to complete a contract? ☐Yes ☐No

9. Is any litigation pending against the Business? ☐Yes ☐No

10. Is offeror currently for sale or involved in any transaction to expand or to become acquired by another business entity? If yes, offeror needs to explain the expected impact, both in organizational and directional terms. ☐Yes ☐No

    _____
    _____
    _____

11. Has the Business ever been declared "not responsible" for the purpose of any governmental agency contract award? ☐Yes ☐No

12. Has the Business been debarred, suspended, proposed for debarment, declared ineligible, voluntarily excluded, or otherwise disqualified from bidding, proposing, or contracting?
☐Yes ☐No

13. Are there any proceedings pending relating to the Business' responsibility, debarment, suspension, voluntary exclusion, or qualification to receive a public contract?
☐Yes ☐No

14. Has the government or other public entity requested or required enforcement of any of its rights under a surety agreement on the basis of a default or in lieu of declaring the Business in default?
☐Yes ☐No

15. Is the Business in arrears on any contract or debt? ☐Yes ☐No

16. Has the Business been a defaulter, as a principal, surety, or otherwise? ☐Yes ☐No

17. Have liquidated damages or penalty provisions been assessed against the Business for failure to complete work on time or for any other reason? ☐Yes ☐No

18. Does offeror have a contingency plan or disaster recovery plan in the event of a disaster? If so, then Bidder will provide a copy of the plan. ☐Yes ☐No

19. Does offeror have quality assurance program? If yes, offeror will describe its quality assurance program, its quality requirements, and how they are measured. ☐Yes ☐No

20. If a "yes" response is given under questions 9 through 19, please provide a detailed explanation including dates, reference to contract information, contacts, etc. (attach additional pages as necessary).

_____
_____
_____
_____
_____
_____

I, individually and on behalf of the business named in this Business Questionnaire, do by my signature below, certify that the information provided in this questionnaire is true and correct. I understand that any false statements or misrepresentations regarding the Business named above may result in: 1) termination of any or all contracts which City of Mission has or may have with the Business; 2) disqualification of the Business from consideration for contracts; 3) removal of the Business from City of Mission's vendors' list; or/and 4) legal action(s) applicable under federal, state, or local law.

Name: _____ Title: _____

Signature: _____ Date: _____
(Owner, CEO, President, Majority Stockholder or Designated Representative)

LIST OF REFERENCES FOR SIMILAR PROJECTS

Use additional pages as necessary.

1. Project:
   Date of Completion (if applicable):
   Contact Person:
   Company Name:
   Address:
   Telephone Number:
   Fax Number:
   E-mail Address:

2. Project:
   Date of Completion (if applicable):
   Contact Person:
   Company Name:
   Address:
   Telephone Number:
   Fax Number:
   E-mail Address:

3. Project:
   Date of Completion (if applicable):
   Contact Person:
   Company Name:
   Address:
   Telephone Number:
   Fax Number:
   E-mail Address:

4. Project:
   Date of Completion (if applicable):
   Contact Person:
   Company Name:
   Address:
   Telephone Number:
   Fax Number:
   E-mail Address:

AUTHORIZATION FOR RELEASE OF FINANCIAL INFORMATION

This authorization will be used to obtain information to assist City of Mission in determining a potential contractor's financial responsibility. Your signature authorizes the release of financial information to the City of Mission Purchasing Department for this purpose. All information must be current and traceable. Each venturer of a joint venture must submit a separate signed form.

This authorization form shall be submitted in accordance with the applicable provision(s) in General Terms and Conditions, or as otherwise requested. City of Mission reserves the right to make additional inquiries based on information submitted, or the lack thereof.

Name of Bank/Financial Institution

Account Number

Address

Account Type: e.g., Savings, Checking, Other (Identify)

City, State, Zip Code

Name of Bank Officer Familiar with the Account

Telephone

Fax

Email Address

Name of Business

Address

City

State

Zip Code

I, individually and on behalf of the Business named above, do by my signature below, certify that the information provided is true and correct, and authorize the release of financial information for verification of financial responsibility. I understand that any false statements or misrepresentations regarding the Business named above may result in: 1) termination of any or all contracts which City of Mission has or may have with the business; 2) disqualification of the Business from consideration for contracts; 3) removal of the Business from City of Mission's vendors list; or/and 4) legal action(s) applicable under federal, state or local law.

Name: _____ Title: _____

Signature: _____ Date: _____

(Owner, CEO, President, Majority Stockholder, or Designated Representative)

City of Mission

EXHIBIT U

BUY AMERICA CERTIFICATE

(FEDERALLY ASSISTED CONTRACT)

INSTRUCTIONS

INSTRUCTIONS:

If the ***OFFER PRICE EXCEEDS $100,000***, ***complete*** the certificate and ***submit it*** with your offer.

SECTION **(1)** Complete ***only*** for **IRON, STEEL** or **MANUFACTURED PRODUCTS.**

SECTION **(2)** Complete ***only*** for **ROLLING STOCK** and **ASSOCIATED EQUIPMENT.**

SECTION **(3) SIGN** and **COMPLETE** ***always***.

CAUTION: ***Failure to return this form or to mark the appropriate*** ❒ in Section (1) ***OR*** Section (2) ***AND complete the information*** in Section (3), ***including a signature***, may render your offer ***nonresponsive*** or ***unacceptable*.**

DEFINITIONS: *(Pursuant to 49 CFR 661)*

ASSOCIATED EQUIPMENT: All components or subcomponents of Rolling Stock, including, but not limited to, train control, communication and traction power equipment, and as otherwise defined in 49 CFR 661.11.

IRON AND STEEL PRODUCTS: All construction materials made primarily of iron or steel and meant for use in infrastructure projects, including, but not limited to, structural iron or steel, iron or steel beams and columns, running rail and contact rail. This certification does not apply to iron or steel used as components or subcomponents of other manufactured products or rolling stock, or to metallurgic processes involving refinement of steel additives.

MANUFACTURED PRODUCT: An item produced as a result of processes to alter the form or function of materials or of elements of the product in a manner adding value and transforming those materials or elements so that they represent a new end product functionally different from that which would result from the mere assembly of elements or materials.

ROLLING STOCK: Transit vehicles, such as buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats, as well as, vehicles used for support services.

City of Mission

EXHIBIT U

BUY AMERICA CERTIFICATE

(FEDERALLY ASSISTED CONTRACT)

CERTIFICATE

SECTION (1); Certify only for IRON, STEEL or MANUFACTURED PRODUCTS: (*Mark One*)

❒ **CERTIFICATE OF COMPLIANCE WITH SECTION 165(a)**. The offeror hereby certifies that it ***will comply*** with the requirements of Section 165(a) of the Surface Transportation Assistance Act of 1982, as amended, and the applicable regulations of 49 CFR Part 661;

--OR--

❒ **CERTIFICATE FOR NON-COMPLIANCE WITH SECTION 165(a)**. The offeror hereby certifies that it ***cannot comply*** with the requirements of Section 165(a) of the Surface Transportation Assistance Act of 1982, as amended, but it ***may qualify for an exception*** to the requirement pursuant to Section 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 CFR Part 661.7.

SECTION (2); Certify only for ROLLING STOCK and ASSOCIATED EQUIPMENT: (*Mark One*)

❒ **CERTIFICATE OF COMPLIANCE WITH SECTION 165(b)(3)**. The offeror hereby certifies that it ***will comply*** with the requirements of Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, and the applicable regulations of 49 CFR Part 661.11;

--OR--

❒ **CERTIFICATE FOR NON-COMPLIANCE WITH SECTION 165(b)(3)**. The offeror hereby certifies that it ***cannot comply*** with the requirements of Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, but it ***may qualify for an exception*** to the requirement consistent with Section 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 CFR Part 661.7.

SECTION (3); OFFEROR'S SIGNATURE: *(Sign, Date and Enter Your Title and the Name of Your Company)*

_____ _____

SIGNATURE **DATE**

_____

TITLE

_____

NAME OF COMPANY

City of Mission

EXHIBIT V

EMPLOYEE INFORMATION REPORT

SECTION A - TYPE OF REPORT

Indicate by marking in the appropriate box the type of reporting unit for which this copy of the form is submitted (*MARK ONLY ONE BOX*).

- ☐ Single Establishment Employer Report
- ☐ Multi-Establishment Employer, Consolidated Report (Required)
- ☐ Multi-Establishment Employer, Headquarters Unit Report (Required)
- ☐ Multi-Establishment Employer, Individual Establishment Report (submit one for each establishment with 50 or more employees)
- ☐ Multi-Establishment Employer, Special Report

Total number of reports being filed by this company (answer only if consolidated report).	

SECTION B-COMPANY IDENTIFICATION (To be answered by all)

Parent Company Name & Address:		
Establishment Completing Report Name & Address (Omit if same as above)		
	Employer ID Number:	

SECTION C - ESTABLISHMENT INFORMATION (Omit on the Consolidated Report)

1. What is the major activity of this establishment? (Be specific, i.e., manufacturing steel castings, retail grocer, wholesale plumbing supplies, title insurance, etc. Include the specific type of product or type of service provided, as well as the principal business or industrial activity.)

SECTION D-EMPLOYMENT DATA

Employment at this establishment -- Report all permanent full-time and part-time employees including apprentices and on-the-job trainees unless specifically excluded as set form in the instructions. Enter the appropriate figures on all lines and in all columns. Blank spaces will be considered zeros.

JOB CATEGORIES	NUMBER OF EMPLOYEES										
	Overall Totals (Sum of Col. B Thru K)	MALE					FEMALE				
		White (Not of Hispanic Origin)	Black (Not of Hispanic Origin)	Hispanic	Asian or Pacific Islander	American Indian or Alaskan Native	White (Not of Hispanic Origin)	Black (Not of Hispanic Origin)	Hispanic	Asian or Pacific Islander	American Indian or Alaskan Native
Officials/Managers											
Professionals											
Technicians											
Sales Workers											
Office & Clerical											
Craft Workers (Skilled)											
Operatives (Semi-Skilled)											
Laborers (Unskilled)											
Service Workers											
TOTAL											

Answer if not consolidated report:	Dates of Payroll Period Used	Does the establishment employ apprentices?

SECTION E - CERTIFICATION

Check One:	☐ All reports are accurate and were prepared in accordance with the instructions (check on consolidated only) ☐ This report is accurate and was prepared in accordance with the instructions.

Name/Title of Certifying Official		Signature		Date:
Contact Name	Address (Number & Street)			
Title	City & State	Zip Code	Telephone	Extension

AGREEMENT FORM

SECTION 00500

AGREEMENT (Stipulated Sum)

The Agreement shall be executed as per the attached sample form.

END OF SECTION

FORM OF AGREEMENT FOR ENGINEERING CONSTRUCTION

THIS AGREEMENT, MADE ON THE 28th day of August, by and between the **City of Mission**

party of the first part, hereinafter called the OWNER, and **Contractor** Address

party of the second part, hereinafter called the CONTRACTOR.

It is understood ENGINEER representing OWNER shall be Chanin Engineering, LLC.

WITNESSETH, That the Contractor and the Owner, for the consideration hereinafter named, agree as follows:

ARTICLE I - SCOPE OF THE WORK.

The Contractor hereby agrees to furnish all of the materials and all of the equipment and labor necessary and to perform all of the work shown on the drawings and described in the specifications for the project entitled **Leo Peña Placita Park Mobility Improvement Project** for the contract sum of $_____, (IN WORDS), herein referred to as the Work.

The following shall be the Contract Documents:

1. Form of Agreement For Engineering Construction;
2. The General Conditions for Engineering Construction;
3. The Drawings and Specifications prepared by Chanin Engineering LLC and Consultants for the project.
4. The Contractor's Response to Competitive Sealed Bids/Schedule of Values.

ARTICLE II - TIME OF COMPLETION.

The Contractor shall achieve Substantial Completion within one hundred eighty (180) days of issuance of a notice to proceed issued to the Contractor. Final Completion shall be obtained within thirty days of Substantial Completion. Time is of the essence in all phases of the Work. It is specifically understood and agreed by and between Owner and Contractor that time is of the essence in the Substantial Completion and Final Completion of the Work and Owner shall sustain actual damages as a result of Contractor's failure, neglect or refusal to achieve said deadlines. Such actual and direct damages are, and will continue to be, impracticable and extremely difficult to determine. Execution of this Agreement under these specifications shall constitute agreement by Owner and Contractor that the amounts stated below are the minimum value of the costs and actual and direct damages caused by failure of Contractor to substantially complete the work within the allotted times, that such sums are liquidated direct damages and shall not be construed as a penalty, and that such sums may be deducted from payments due Contractor if such delay occurs. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not completed within the agreed time, or within the extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damages being caused by additional compensation to personnel, for loss of interest on money, and other miscellaneous increased costs, all of which are difficult to exactly ascertain. Failure to substantially complete the Work within the designated period, or as it may be extended, shall be construed as a breach of this Agreement. It is expressly agreed as a part of the consideration inducing the Owner to execute this Agreement that the Owner may deduct from the Final Payment made to the General Contractor a sum equal to $500.00 per day for each and every additional calendar day beyond the agreed date of Substantial Completion. Timely Final Completion is an essential condition of this Agreement. Contractor agrees to achieve Final Completion of the Agreement within 30 days of the designated or extended date of Substantial Completion. Owner and Contractor agree that should Contractor fail to achieve Final Completion of the

Agreement by the deadline, Owner shall continue to be damaged to a greater degree by such delay. Contractor and Owner agree that the amount of liquidated damages for each calendar day Final Completion is delayed beyond the date set for Final Completion shall be the sum of $500.00 per day. Owner may deduct from the Final Payment made to Contractor, or, if sufficient funds are not available, then Contractor shall pay Owner the amounts specified per day for each and every calendar day the breach continues after the deadline for Final Completion of the Work.

Such damages shall be in addition to, and not in lieu of, any other right or remedies. Owner may have against Contractor for failure to timely achieve Substantial and/or Final Completion. If the Work is not completed by the time stated in the Agreement, or as extended, no payments for Work completed beyond that time shall be made until the Project reaches Final Completion

ARTICLE III - THE CONTRACT SUM.

The contract sum shall be **$**_____(IN WORDS),_____
Changes in the work made under Section 16 of the General Conditions, and not included in Article I, that cannot be classified as coming under any of the Contract units may be done at mutually agreed-upon unit price, or under the provisions of Article V "Extra Work".

ARTICLE IV - PROGRESS PAYMENTS
The Owner shall make payments on account of the Contract as follows:
Attached hereto as an attachment is the Schedule of Values apportioning the various divisions or phases of Work. Each line item contained in the Schedule of Values shall be assigned a monetary price such that the total of all such items shall equal the Contract Price.
The Contractor shall submit to the Owner and Engineer a monthly application for payment no later than the twenty-fifth (25th) day of the calendar month for the preceding thirty (30) days. Applications for payments shall be itemized and supported by the Contractor's Schedule of Values and any other substantiating data as required by the Owner. Payment applications may include payment requests on the account of properly authorized interim Change Documents. The Owner shall pay the amount otherwise due on any payment application, less any amounts as set forth below, no later than thirty days after Owner and Engineer approve the monthly application. The Owner may deduct, from any progress payment, such amounts as may be retained.
If approved by the Owner, applications for payment may include materials and equipment not incorporated into the Work but delivered to the suitable stored on-site and applicable insurance, storage and transportation costs to the site. Approval of payment applications for stored materials and equipment shall be conditioned on submission by the Contractor of bills of sale and proof of applicable insurance, or such other procedures satisfactory to the Owner to establish the proper valuation of the stored materials and equipment, the Owner's title to such materials and equipment, and to otherwise protect the Owner's interests therein, including transportation to the site.

As a prerequisite for payment, the Contractor shall provide, if requested by the Owner, partial lien and claim waivers in the amount of the application for payment and affidavits from its Subcontractors, materialmen and suppliers for the completed Work. **If such waivers are conditioned upon payment, Owner shall have the right to pay the amount due to such Subcontractor, materialman or supplier directly in return for an unconditional waiver.**

From each progress payment made prior to the time Substantial Completion of the Work has been reached, the Owner shall retain five percent (10%) of the amount otherwise due after deduction of any amounts as provided herein.

The Owner may adjust or reject a Contractor payment application or nullify a previously approved Contractor payment application, in whole or in part, as may reasonably be necessary to protect the Owner from loss or damage based upon the following, to the extent that the Contractor is responsible therefor under the Agreement:

1. the Contractor's repeated failure to perform the Work as required by the Contract Documents;
2. loss or damage arising out of or relating to this Agreement and caused by Contractor, to

the Owner, or others to whom the Owner may be liable.

3. the Contractor's failure to properly pay Subcontractors for labor, materials, equipment or supplies furnished in connection with the Work.

4. nonconforming or Defective Work not corrected in a timely fashion;

5. reasonable evidence of delay in performance of the Work such that the Work will not be completed within the Contract Time, and that the unpaid balance of the Contract Price is not sufficient to offset any direct damages that may be sustained by the Owner as a result of the anticipated delay caused by the Contractor; and

6. reasonable evidence demonstrating that the unpaid balance of the Contract Price is insufficient to fund the cost to complete the Work.

The Owner shall give written notice to the Contractor at the time of disapproving or nullifying an application for payment of the specific reasons therefor. When the above reasons for disapproving or nullifying an application for payment are removed, payment will be made for the amounts previously withheld.

Neither the Owner's payment of progress payments nor its partial or full use or occupancy of the project constitutes acceptance of Work not complying with the Contract Documents.

ARTICLE V - EXTRA WORK

If the Engineer orders, in writing, the performance of any work not covered by the Drawings or included in the Specifications, and for which no items in the contract are provided, and for which no unit price or lump sum are provided.

(a) The contractor shall be reimbursed for all costs incurred in doing the work, and shall receive an additional payment of 5% of all such cost to cover his indirect overhead costs, plus 5% of all costs, including indirect overhead, as his fee.

(b) The "Cost of the Work" shall be determined as the net sum of the following items:

1. Job Office and all necessary temporary facilities such as buildings, use of land not furnished by the Owner, access roads and utilities. The costs of these items include construction, furnishings and equipment, maintenance during the period that they are needed, demolition and removal. Salvage valued agreed on or received by the Contractor shall be credited to the Owner.

2. All materials used on the work whether for temporary or permanent construction.

3. All small tools and supplies; all fuel, lubricants, power, light, water and telephone service.

4. All plant and equipment at specified rental rates and terms of use. If the rental rates do not include an allowance for running repairs and repair parts needed for ordinary maintenance of the plant and equipment, then such items of cost are to be included in the Cost of the Work.

5. All transportation costs on equipment, material and men.

6. All labor for the project and including the salaries of superintendents, foremen, engineers, inspectors, clerks and other employees or officers, who do not devote their full time to their work.

7. All payroll charges such as Social Security payments, unemployment insurance, workmen's compensation insurance premiums, pension and retirement allowances, and social insurance premiums, vacation and sick leave allowances applicable to wages or salaries paid to employees for work done in connection with the contract.

8. All premiums on fire, public liability, property damage or other insurance coverage authorized or required by the Engineer or the Owner or regularly paid by the Contractor in the conduct of his business.

9. All sales, use, excise, privilege, business, occupation, gross receipt and all other taxes paid by the Contractor in connection with the work, but excluding state income derived from this contract and Federal Income taxes.

10. All travel or other related expense of general supervisory employees for necessary visits to the job excluding expenses of such employees incurred at the Home Office of the contractor.

11. All Subcontracts approved by the Engineer or Owner.

12. Any other cost incurred by the Contractor as a direct result of executing the Order, subject to approval by the Engineer.

13. Credit to the Owner for the following items:
    a. Such discounts on invoices as may be obtained provided that the Owner advances sufficient funds to pay the invoices within the discount period.

    b. The mutually agreed salvage value of materials, tools or equipment charged to the Owner and taken over by the Contractor for his use or sale at the completion of the work.

    c. Any rebates, refunds, returned deposits or other allowances properly credited to the Cost of the work.

(c) The cost of the work done each day shall be submitted to the Engineer in a satisfactory form on the succeeding day, and shall be approved by him or adjusted at once.

(e) Prior to Contractor's performance of any "extra work," the Owner, Engineer and Contractor shall execute a change order to memorialize the work and the cost.

ARTICLE VI – CONTRACT ATTACHMENTS

Attached and made part of the contract documents are the following:

1. HUB Declaration
2. Conflict of Interest Questionnaire
3. W-9

IN WITNESS WHEREOF the parties hereto have executed this Agreement, the day and year first above written.

AGREED:

OWNER: City of Mission

BY: _____
Mayor- Norberto Salinas

WITNESS:

BY: _____

CONTRACTOR

COMPANY: _____

BY: _____
Printed Name and Title of Official

WITNESS:
BY: _____
(CORPORATE SEAL)

BONDS AND CERTIFICATES

SECTION 00600

The Contractor shall furnish the following Bonds and Certificates to be delivered simultaneously with the executed contract:

A. Performance Bond
B. Labor and Materials Payment Bond
C. Certificates of Insurance

The Performance, Labor and Materials bond shall be provided on Bonds which comply with Article 5160 of the Revised Civil Statutes of the State of Texas as amended by Acts of the 64th Legislature 1975 and Acts of the 65th Legislature,1977.

The Surety on such bonds shall be a surety company satisfactory to the Owner. See Article 11 of the supplementary condition.

Costs of the above stated bonds and insurance are to be included in the bid.

Attorneys-in-Fact who sign bonds must file with each bond a certified and effective dated copy of their Power of Attorney.

The Performance Bond shall guarantee the repair and maintenance of all defects due to faulty materials and workmanship that appear within one (1) year from date of substantial completion.

END OF SECTION

WAGE RATES

SECTION 00820

PART 1. GENERAL

1.1 Requirements:

A. Pay not less than the minimum wage scale and benefits accepted within the local construction industry.

B. No claims for additional compensation will be considered by the Owner because of payments of wage rates in excess of the applicable rate contained in this contract.

C. All contractors and subcontractors shall be equal opportunity employers.

1.2 Workmanship Standards:

Comply with the recognized workmanship quality standards within the industry as applicable to each unit of work, including ANSI standards where applicable. Project workmen should be paid in accordance with accepted pay scales for similar experience level and work in the area. It is a requirement that each category of tradesman or installer performing the work be pre-qualified, to the extent of being familiar with the applicable and recognized quality standards for his category of work, and being capable of workmanship complying with those standards.

1.3 Payroll:

A. In compliance with Article 515a, Sections 2 and 3, and Article 5159d, Section II of the Revised Civil Statute referenced above, the Owner reserves the following rights:

1. To receive weekly payroll records.
2. To have the Contractor provide required earning statements to employees.

1.4 Minimum Wage Rates:

A. Pay prevailing basic wage listed, plus any applicable fringe benefits.

B. In no case shall wages be less than the federally determined prevailing (Davis-Bacon and Related Acts) wage rate, as issued by the U.S. Department of Labor and contained in the contract documents. In addition the successful bidder must ensure that employees and applicants for employment are not discriminated against because of race, sex, age or national origin.

PREVAILING WAGE SCALE NOTICE

1. This determination of prevailing wages shall not be construed to prohibit the payment of more than the rates named. Under no conditions shall any laborer, workman or mechanic employed on this job be paid less than the minimum wage scale.

2. In execution of this contract, the contractor must comply with all applicable state and federal laws, including but not limited to laws concerned with labor, equal employment opportunity, safety, and minimum wage.

END OF SECTION

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Facility Owner Information:

1. Owner Name: City of Mission
2. Owner's Representative:
    a. Eduardo Belmarez, Purchasing Director
3. Owner's Engineer:
    a. Engineer: Miguel Chanin, PE; Chanin Engineering; 956-687-9421
    b. Direct technical questions to Owner's Engineer.
    c. Where individual specification sections refer to Owner, Owner may elect to delegate submittal and response responsibilities to Owner's Consultant.

B. Facility Information:

1. Facility Name: Leo Peña Placita Park Mobility Improvement Project
2. Facility Location: 803 N. Conway, Mission, TX 78572

C. Project Information:

1. Project Name: Leo Peña Placita Park Renovations

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Park Renovations

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

A. Use of Site, Limited: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Use of Site: Limit use of Project site to work in areas indicated and as directed by Owner. Do not disturb portions of Project site beyond areas in which the Work is indicated, including designated lay-down areas.

a. Do not use Owner's toilet rooms.

2. Driveways, Walkways and Entrances: Keep driveways, facility loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

A. Owner Occupancy: Owner will occupy site including existing and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used

facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:30 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: 24 hour notice to Owner.

2. Hours for Utility or Services Shutdowns: 24 Hour notice to Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.

2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Project: Use of tobacco products on the Project site is not permitted.

F. Controlled Substances: Use of other controlled substances on the Project site is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

PRICE AND PAYMENT PROCEDURES

SECTION 01200

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Allowances.

B. Contingency allowances.

C. Testing and inspection allowances.

D. Schedule of Values.

E. Application for Payment.

F. Change procedures.

G. Defect assessment.

H. Unit prices.

I. Alternates.

1.2 ALLOWANCES

A. Costs Included in Allowances: Cost of product to Contractor or Subcontractor, less applicable trade discounts; delivery to Site and applicable taxes unless stated otherwise in Allowance Schedule.

B. Costs Not Included in Allowances but Included in Contract Sum/Price: Product handling at Site including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing unless stated otherwise in Allowance Schedule.

C. Architect/Engineer Responsibilities:
   1. Consult with Contractor for consideration and selection of products.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Architect/Engineer in selection of products, suppliers, and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. Upon notification of selection by Engineer, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process Shop Drawings, Product Data, and Samples. Arrange for delivery.

5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Supplemental Instructions.

F. Allowance Schedule:
1. Allowance No.2 Irrigation Allowance
2. Allowance No. 3 Site Signage Allowance

1.3 CONTINGENCY ALLOWANCES

A. Include in Contract a stipulated sum/price of $60,000 for use upon Owner's instruction as a contingency allowance.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, will be included in Supplemental Instructions authorizing expenditure of funds from this contingency allowance. No bonding, overhead, and profit will be included.

C. Funds will be drawn from contingency allowance only by Supplemental Instructions.

D. At closeout of Contract, funds remaining in contingency allowance will be credited to Owner by Change Order.

1.4 SCHEDULE OF VALUES

A. Submit printed and electronic file schedule on AIA G702 - Continuation Sheet for G703 or similar document provided by Engineer.

B. Submit Schedule of Values as electronic file within 15 days after date of Owner-Contractor Agreement for approval .

C. Format: Use Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Section. Also identify Site mobilization, bonds and insurance.

D. Include in each line item amount of allowances as specified in this Section. For unit cost allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

E. Include separately from each line item, direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.5 APPLICATION FOR PAYMENT

A. Submit three copies AIA G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or similar document provided by Engineer.

B. Content and Format: Use Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

E. Submit three copies of waivers requested by Owner.

F. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1. Partial release of liens from major Subcontractors and vendors.
2. Record Documents as specified in Section 01700 - Execution Requirements, for review by Owner, which will be returned to Contractor.
3. Affidavits attesting to off-Site stored products.
4. Construction Progress Schedule, revised and current as specified in Section 01330 - Submittal Procedures.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Submittals Schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Initial progress report.
8. Report of preconstruction conference.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. "Contractor's Affidavit of Payment of Debts and Claims."
5. "Contractor's Affidavit of Release of Liens."
6. "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

1.6 CHANGE PROCEDURES

A. Submittals: Submit name of individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Architect/Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Interpretation (RFI) and Clarifications: Allot time in construction scheduling for liaison with Architect/Engineer; establish procedures for handling queries and clarifications.
   1. Use Standard - Request for Information document for requesting interpretations.
   2. Architect/Engineer may respond with a direct answer on the Request for Interpretation form.

D. Architect/Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions.

E. Architect/Engineer may issue Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change. Contractor will prepare and submit estimate within 7 days.

F. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation.

G. Unit Price Change Order: For Contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of that which are not predetermined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Change Order.

H. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

I. Correlation of Contractor Submittals:
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
   2. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub schedules to adjust times for other items of Work affected by the change, and resubmit.
   3. Promptly enter changes in Record Documents.

1.7 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct appropriate remedy or adjust payment.

C. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.

D. Authority of Engineer to assess defects and identify payment adjustments is final.

E. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected products.

1.8 UNIT PRICES

A. Authority: Measurement methods are delineated in individual Specification Sections.

B. Measurement methods delineated in individual Specification Sections complement criteria of this Section. In event of conflict, requirements of individual Specification Section govern.

C. Take measurements and compute quantities. Architect/Engineer will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated on Proposal Form are for Contract purposes only. Actual quantities provided shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at contracted unit sum/prices.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Architect/Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

G. Measurement of Quantities:
   1. Weigh Scales: Inspected, tested, and certified by applicable State of Texas weights and measures department within past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
   3. Metering Devices: Inspected, tested, and certified by applicable State of Texas department within past year.
   4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel, or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
   5. Measurement by Volume: Measured by cubic dimension using mean length, width, and height or thickness.
   6. Measurement by Area: Measured by square dimension using mean length and width or radius.
   7. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.

8. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

1.9 ALTERNATES

A. Alternates quoted on Proposal Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement. The Owner-Contractor Agreement may identify certain Alternates to remain an Owner option for a stipulated period of time.

B. Coordinate related Work and modify surrounding Work. Description for each Alternate is recognized to be abbreviated but requires that each change shall be complete for scope of Work affected.
   1. Coordinate related requirements among Specification Sections as required.
   2. Include as part of each Alternate: Miscellaneous devices, appurtenances, and similar items incidental to or necessary for complete installation.
   3. Coordinate Alternate with adjacent Work and modify or adjust as necessary to ensure integration.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Quantity allowances.

2. Contingency allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.

2. Divisions 2 through 48 Sections for items of work covered by allowances.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.

2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1 Construction Contingency Allowance: $60,000.00 contingency for use according to Owner's written instructions.

B. Allowance No. 2 Irrigation Allowance: $20,000 includes, design, material costs, receiving, handling and installation and overhead and profit.

C. Allowance No 3. Site Signage Allowance:10,000 for signage and plaques includes design, material costs, receiving, handling and installation and overhead and profit.

END OF SECTION 012100

SECTION 01 29 00 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Owner at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Contractor's name and address.
      c. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets Owner’s payment form included in the Project Manual.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Schedule Updating: Include each Change Order as a new line item on the subsequent Application for Payment.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included at end of this Section.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner will return incomplete applications without action.
    1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Owner by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
    1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
    2. When an application shows completion of an item, submit final or full waivers.
    3. Owner reserves the right to designate which entities involved in the Work must submit waivers.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. Schedule of Values.
2. Contractor's Construction Schedule.
3. Products list.
4. Schedule of unit prices.
5. Copies of building permits.
6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
7. Initial progress report.
8. Report of preconstruction conference.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. Evidence that claims have been settled.
7. Final, liquidated damages settlement statement.

END OF SECTION 01 29 00

SECTION 013000 ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and Project conditions.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Preinstallation meetings.

F. Closeout meeting.

G. Alteration procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
   1. Coordination Drawings: Prepare as required to coordinate all portions of Work. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important.

D. Coordination Meetings: In addition to other meetings specified in this Section, hold coordination meetings with personnel and Subcontractors to ensure coordination of Work.

E. In finished areas conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion.

G. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. Engineer will schedule and preside over meeting after Notice of Award.

B. Attendance Required: Architect/Engineer, Owner, Resident Project Representative, appropriate governmental agency representatives, Construction Project Manager, and Contractor.

C. Minimum Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and Progress Schedule.
5. Designation of personnel representing parties in Contract, and Architect/Engineer.
6. Communication procedures.
7. Procedures and processing of requests for interpretations, field decisions, field orders, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Critical Work sequencing.

D. Construction Project Manager: Record minutes and distribute copies to participants within seven days after meeting, with Architect/Engineer, Owner, and those affected by decisions made.

1.4 SITE MOBILIZATION MEETING

A. Construction Project Manager will schedule and preside over meeting at Project Site prior to Contractor occupancy.

B. Attendance Required: Architect/Engineer, Owner, Contractor, Contractor's superintendent, Construction Project Manager.

C. Minimum Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls.
4. Temporary utilities.
5. Security and housekeeping procedures.
6. Schedules.
7. Procedures for testing.
8. Procedures for maintaining record documents.
9. Requirements for startup of equipment.
10. Inspection and acceptance of equipment put into service during construction period.

D. Construction Project Manager: Record minutes and distribute to participants within 7 days after meeting.

1.5 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.

B. Construction Project Manager shall make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, and Architect/Engineer, Owner, as appropriate to agenda topics for each meeting.

D. Minimum Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittal schedule and status of submittals.
6. Review of off-Site fabrication and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on Progress Schedule and coordination.
13. Other business relating to Work.

E. Construction Project Manager: Record minutes and distribute to participants within 7 days after meeting.

1.6 PREINSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Architect/Engineer four days in advance of meeting date.

D. Prepare agenda and preside over meeting:
1. Review conditions of installation, preparation, and installation procedures.
2. Review coordination with related Work.

E. Record minutes and distribute to participants within seven days after meeting.

1.7 CLOSEOUT MEETING

A. Schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Construction Project Manager, Major Subcontractors, Architect/Engineer, Owner, and others appropriate to agenda.

C. Notify Architect/Engineer four days in advance of meeting date.

D. Minimum Agenda:
   1. Start-up of facilities and systems.
   2. Operations and maintenance manuals.
   3. Testing, adjusting, and balancing.
   4. System demonstration and observation.
   5. Operation and maintenance instructions for Owner's personnel.
   6. Contractor's inspection of Work.
   7. Contractor's preparation of an initial "punch list."
   8. Procedure to request Architect/Engineer inspection to determine date of Substantial Completion.
   9. Completion time for correcting deficiencies.
   10. Inspections by authorities having jurisdiction.
   11. Certificate of Occupancy and transfer of insurance responsibilities.
   12. Partial release of retainage.
   13. Final cleaning.
   14. Preparation for final inspection.
   15. Closeout Submittals:
      a. Project record documents.
      b. Operating and maintenance documents.
      c. Operating and maintenance materials.
      d. Affidavits.
   16. Final Application for Payment.
   17. Contractor's demobilization of Site.
   18. Maintenance.

E. Record minutes and distribute copies to participants within 7 days after meeting.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 ALTERATION PROCEDURES

A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.
   1. Perform Work not to interfere with operations of occupied areas.
   2. Keep utility and service outages to a minimum and perform only after written approval of Owner.
   3. Indoor temperature control must be maintained at all times.
   4. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

B. Materials: As specified in product Sections; match existing products with new [**and salvaged**] products for patching and extending Work.

C. Employ skilled and experienced installer to perform alteration and renovation Work.

D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01700 - Execution Requirements.

E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

F. Remove debris and abandoned items from area and from concealed spaces.

G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.

H. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

I. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original condition.

J. Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with neat transition to adjacent finishes.

K. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

END OF SECTION

SECTION 013230 CONSTRUCTION PROGRESS SCHEDULES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. Format for network analysis schedules.

D. Network analysis schedules.

E. Bar chart schedules.

F. Review and evaluation.

G. Updating schedules.

H. Distribution.

1.2 SUBMITTALS

A. Within 10 days after date of Owner-Contractor Agreement**,** submit proposed preliminary network diagram defining planned operations for first **60** days of Work, with general outline for remainder of Work.

B. Participate in review of preliminary and complete network diagrams jointly with Architect/Engineer.

C. Within 20 days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete network analysis consisting of network diagrams and mathematical analyses.

E. Submit updated network schedules every 14 days.

F. Any changes to schedule must be submitted at least 7 days in advance.

G. Post as electronic file to Project Team.

H. Submit network schedules under transmittal letter form specified in Section 01330 - Submittal Procedures.

I. Schedule Updates:
   1. Overall percent complete, projected and actual.
   2. Completion progress by listed activity and sub activity, to within **five working** days prior to submittal.
   3. Changes in Work scope and activities modified since submittal.
   4. Delays in submittals or resubmittals, deliveries, or Work.
   5. Adjusted or modified sequences of Work.
   6. Other identifiable changes.
   7. Revised projections of progress and completion.

J. Narrative Progress Report:
   1. Submit with each monthly submission of Progress Schedule.
   2. Summary of Work completed during the past period between reports.
   3. Work planned during the next period.
   4. Explanation of differences between summary of Work completed and Work planned in previously submitted report.
   5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
   6. Corrective action taken or proposed.

1.3 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel specializing in CPM scheduling with two years' minimum experience in scheduling construction work of complexity comparable to the Project and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: 2 years' minimum experience in using and monitoring CPM schedules on comparable Projects.

1.4 FORMAT FOR NETWORK ANALYSIS SCHEDULE

A. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable Specification Section number.

B. Scale and Spacing: To allow for notations and revisions.

1.5 NETWORK ANALYSIS SCHEDULES

A. Prepare network analysis diagrams and supporting mathematical analyses using critical path method.

B. Illustrate order and interdependence of activities and sequence of Work; how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.

C. Illustrate complete sequence of construction by activity, identifying Work of separate stages. Indicate dates for submittals and return of submittals; dates for procurement and delivery of

critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.

D. Mathematical Analysis: Tabulate each activity of detailed network diagrams using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum **15**-day intervals. Status of critical activities.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; accrue float time to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

E. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, of accepting revised completion dates, and of recomputing of scheduled dates and float.

F. Required Sorts: List activities in sorts or groups:
   1. By preceding Work item or event number from lowest to highest.
   2. By longest float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values list.
   7. List of basic input data-generating report.
   8. List of activities on critical path.

G. Prepare subschedules for each stage of Work and Sequencing of Construction Plan identified in Section 01100 – Summary.

H. Coordinate contents with Schedule of Values in Section 01330 - Submittal Procedures.

1.6 BAR CHART SCHEDULES

A. Format: Bar chart Schedule, to include at least:
   1. Identification and listing in chronological order of those activities reasonably required to complete the Work, including:

      a. Subcontract Work.
      b. Major equipment design, fabrication, factory testing, and delivery dates including required lead times.
      c. Move-in and other preliminary activities.
      d. Equipment and equipment system test and startup activities.
      e. Project closeout and cleanup.

f. Work sequences, constraints, and milestones.

2. Listings identified by Specification Section number.
3. Identification of the following:

a. Horizontal time frame by year, month, and week.
b. Duration, early start, and completion for each activity and subactivity.
c. Critical activities and Project float.
d. Subschedules to further define critical portions of Work.

1.7 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of schedules with Architect/Engineer at each submittal.

B. Evaluate Project status to determine Work behind schedule and Work ahead of schedule.

C. After review, revise schedules incorporating results of review, and resubmit within 10 days.

1.8 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Upon approval of a Change Order, include the change in the next schedule submittal.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit sorts as required to support recommended changes.

G. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect including effects of changes on schedules of separate Contractors.

1.9 DISTRIBUTION

A. Following joint review, distribute copies of updated schedules to Contractor's Project site file, to Subcontractors, suppliers, Architect/Engineer, Owner.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 013300 SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions.

B. Submittal procedures.

C. Construction progress schedules.

D. Proposed product list.

E. Product data.

F. Use of electronic CAD files of Project Drawings.

G. Shop Drawings.

H. Samples.

I. Other submittals.

J. Design data.

K. Test reports.

L. Certificates.

M. Manufacturer's instructions.

N. Manufacturer's field reports.

O. Erection Drawings.

P. Construction photographs.

Q. Contractor review.

R. Architect/Engineer review.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's and Construction Project Manager's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Architect/Engineer's and Construction Project Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Transmit each submittal with Transmittal Letter.

B. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.

C. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

D. Schedule submittals to expedite Project, and deliver to Engineer at business address. Coordinate submission of related items.

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

F. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

G. Allow space on submittals for Contractor and Architect/Engineer review stamps.

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

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

J. Submittals not requested will not be recognized nor processed.

K. Incomplete Submittals: Architect/Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Architect/Engineer.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Comply with Section 013230 - Construction Progress Schedules.

1.5 PROPOSED PRODUCT LIST

A. Within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.6 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Architect/Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus two copies Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01700 - Execution Requirements.

1.7 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Architect/Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of opaque reproductions Contractor requires, plus **two** copies Engineer will retain.

E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01700 - Execution Requirements.

1.8 SAMPLES

A. Samples: Action Submittal: Submit to Architect/Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:
   1. Submit to Architect/Engineer for aesthetic, color, and finish selection.
   2. Submit Samples of finishes, textures, and patterns for Architect/Engineer selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01700 - Execution Requirements.

1.9 OTHER SUBMITTALS

A. Closeout Submittals: Comply with Section 01700 - Execution Requirements.

B. LEED Submittals: Comply with Section 01351 - Sustainable Project Requirements.

C. Permits: Within 15 days after date of Owner-Contractor Agreement, submit a list of permits and licenses to be obtained, identifying the granting agency and the required date of permit submittal.

1.10 DESIGN DATA

A. Informational Submittal: Submit data for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

1.11 TEST REPORTS

A. Informational Submittal: Submit reports for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.12 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Architect/Engineer.

1.13 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Architect/Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.14 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit report within 5 days of observation to Architect/Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.15 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Architect/Engineer or Owner.

1.16 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of construction throughout progress of Work produced by an experienced photographer acceptable to Architect/Engineer.

B. Twice monthly submit photographs.

C. Digital Images: Deliver complete set of digital image electronic files on CD-ROM to Owner with Project record documents. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as sensor, uncropped.
   1. Digital Images: Uncompressed TIFF format, produced by digital camera with minimum sensor size of 4.0 megapixels, and image resolution of not less than 1024 by 768 pixels.
   2. Date and Time: Include date and time in filename for each image.

1.17 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:
   1. Determination and verification of materials including manufacturer's catalog numbers.
   2. Determination and verification of field measurements and field construction criteria.
   3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
   4. Determination of accuracy and completeness of dimensions and quantities.
   5. Confirmation and coordination of dimensions and field conditions at Site.
   6. Construction means, techniques, sequences, and procedures.
   7. Safety precautions.
   8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Architect/Engineer.

1.18 ARCHITECT/ENGINEER REVIEW

A. Do not make "mass submittals" to Architect/Engineer. "Mass submittals" are defined as six or more submittals or items in one day or **15** or more submittals or items in one week. If "mass submittals" are received, Architect/Engineer's review time stated above will be extended as necessary to perform proper review. Architect/Engineer will review "mass submittals" based on priority determined by Architect/Engineer after consultation with Owner and Construction Project Manager.

B. Informational submittals and other similar data are for Architect/Engineer's information, do not require Architect/Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order, or Construction Change Directive.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
   1. Division 1 Section "Allowances" for testing and inspecting allowances.
   2. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect and/or roof consultant.
   2. Notify Architect and/or roof consultant seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's and/or roof consultant approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

J. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, roof consultant and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect, roof consultant and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 10 days of date established for the Notice to Proceed.
   1. Distribution: Distribute schedule to Owner, Architect, roof consultant, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect, roof consultant and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and/or roof consultant with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. To be determined by the Owner, roof consultant, and/or Architect

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to owner, roof consultant and/or Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for owner, roof consultant, and/or Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

1.1 SECTION INCLUDES

A. Temporary facilities under Construction Management Agreement.

B. Temporary Utilities:
   1. Temporary sanitary facilities.

C. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Project identification.
   6. Traffic regulation.
   7. Fire-prevention facilities.

D. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pest and rodent control.
   9. Pollution control.

E. Removal of utilities, facilities, and controls.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 TEMPORARY FACILITIES UNDER CONSTRUCTION MANAGEMENT AGREEMENT

A. Temporary Provisions Provided by Construction Manager:
   1. Temporary barriers, barricades, covered walkways, fencing, exterior closures, and interior closures.
   2. Temporary field offices.
   3. Cleaning during construction.
   4. Access roads and approaches.

5. Temporary elevator.
6. Temporary sanitary facilities.
7. Temporary heating and ventilating after enclosure.
8. Temporary electrical service and distribution system for power and lighting.
9. Temporary telephone and internet service.

B. Each Contractor: Coordinate provisions with Construction Manager and provide the following items as necessary for execution of the Work including associated costs:
1. Construction aids.
2. Temporary fire protection, dust control, erosion and sediment control, water control, noise control, and other necessary temporary controls.
3. Temporary barriers, barricades, and similar devices as necessary for safety and protection of construction personnel and public.
4. On Construction Manager's approval, may provide temporary field office including electrical service and temporary telephone.
5. Temporary tree and plant protection.
6. Temporary heating before building enclosure.
7. Electrical service required in addition to temporary service and distribution provided by Construction Manager.
8. Temporary provisions for protection of installed Work.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of Project mobilization.

B. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and inspection of products to suit requirements in Section 01 60 00 - Product Requirements.

C. Preparation: Fill and grade Sites for temporary structures sloped for drainage away from buildings.

D. Maintenance and Cleaning:
1. **Weekly** janitorial services for field offices; periodic cleaning and maintenance for sheds and storage areas.
2. Maintain walks free of mud, water, snow, and the like.

E. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas to same or better condition as original condition.

1.5 VEHICULAR ACCESS

A. Construct temporary access roads from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires and provide detours as necessary for unimpeded traffic flow.

D. Locate as **approved by Owner**.

E. Provide unimpeded access for emergency vehicles. Maintain **20** wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to **fire hydrants and control valves** free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

1.6 PARKING

A. **Arrange for** temporary surface parking areas to accommodate construction personnel.

B. Locate as **approved by Owner**.

C. If Site space is not adequate, provide additional off-Site parking.

D. Use of existing parking facilities used by construction personnel is **not** permitted.

E. Do not allow heavy vehicles or construction equipment in parking areas.

F. Do not allow vehicle parking on existing pavement.

G. Maintenance:
1. Maintain traffic and parking areas in sound condition **free of excavated material, construction equipment, products.**
2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

1.7 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, before enclosing spaces.

C. Broom and vacuum clean interior areas before starting surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from Site **weekly** and dispose of off-Site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.8 PROJECT IDENTIFICATION

A. Project Identification Sign:
   1. **One** painted sign[**s**] of construction, design, and content shown on Drawings, location designated.
   2. Content:
      a. Project title and name of Owner.
      b. Names and titles of authorities.
      c. Names and titles of Architect/Engineer and Consultants.
      d. Name of Prime Contractor.
   3. Graphic Design, Colors, and Style of Lettering: Designated by Architect/Engineer.

B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

C. Maintenance: Maintain clean signs and supports; repair deterioration and damage.

D. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.9 TRAFFIC REGULATION

A. Signs, Signals, and Devices:
   1. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs: As approved by authorities having jurisdiction.
   2. Traffic Control Signals: As approved by local jurisdictions.
   3. Traffic Cones, Drums, Flares, and Lights: As approved by authorities having jurisdiction.
   4. Flag Person Equipment: As required by authorities having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
   1. Consult with authorities having jurisdiction and establish public thoroughfares to be used for haul routes and Site access.
   2. Confine construction traffic to designated haul routes.
   3. Provide traffic control at critical areas of haul routes to regulate traffic and to minimize interference with public traffic.

E. Traffic Signs and Signals:
   1. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.
   3. Relocate signs and signals as Work progresses, to maintain effective traffic control.

F. Removal:
   1. Remove equipment and devices **when no longer required.**
   2. Repair damage caused by installation.

1.10 FIRE-PREVENTION FACILITIES

A. Prohibit smoking within buildings under construction **and demolition**.

B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

1.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations **and demolition**.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way **and for public access to existing building**.

C. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

1.12 ENCLOSURES AND FENCING

A. Construction: **Contractor's option.**

B. Provide **6**foot high fence around construction Site; equip with vehicular **and pedestrian** gates with locks.

1.13 SECURITY

A. Security Program:
   1. Protect Work on **existing premises** from theft, vandalism, and unauthorized entry.
   2. Initiate program **in coordination with Owner's existing security system** at Project mobilization.
   3. Maintain program throughout construction period until **Owner occupancy**.

B. Personnel Identification:
   1. Provide identification badge for each person authorized to enter premises.
   2. Badge to Include: Personal photograph, name and employer.
   3. Maintain list of accredited persons and submit copy to Owner on request.
   4. Require return of badges at expiration of employment on the Work.

1.14 WATER CONTROL

A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.

1.15 DUST CONTROL

A. Execute Work by methods that minimize raising dust from construction operations.

B. Provide positive means to prevent airborne dust from dispersing into atmosphere.

1.16 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, drains, and other devices to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts and clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation. Promptly apply corrective measures.

1.17 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise from <_____> and noise produced by construction operations.

1.18 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

D. Do not use materials and equipment removed from existing premises except as specifically permitted by Contract Documents.

E. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Comply with delivery requirements in Section 01 74 19 - Construction Waste Management and Disposal.

B. Transport and handle products according to manufacturer's instructions.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to manufacturer's instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Provide off-Site storage and protection when Site does not permit on-Site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Section 01 25 00 - Substitution Procedures.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

B. Cord and Plug: Furnish minimum 6-foot (2-m) long cord and plug including grounding connector for connection to electric wiring system. Cord of longer length may be specified in individual Specification Sections.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance.

B. Product options.

C. Product substitution procedures.

1.2 QUALITY ASSURANCE

A. **Contract is** based on products and standards established in Contract Documents without consideration of proposed substitutions.

B. Products specified define standard of quality, type, function, dimension, appearance, and performance required.

C. Substitution Proposals: Permitted for specified products except where specified otherwise. Do not substitute products unless substitution has been accepted and approved in writing by Owner.

1.3 PRODUCT OPTIONS

A. See Section 01 60 00 - Product Requirements.

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Document Instructions to Bidders specifies time restrictions for submitting requests for substitutions during Bidding period.

B. Substitutions **may** be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data, substantiating compliance of proposed substitution with Contract Documents, including:
   1. Manufacturer's name and address, product, trade name, model, or catalog number, performance and test data, and reference standards.
   2. Itemized point-by-point comparison of proposed substitution with specified product, listing variations in quality, performance, and other pertinent characteristics.
   3. Reference to Article and Paragraph numbers in Specification Section.
   4. Cost data comparing proposed substitution with specified product and amount of net change to Contract Sum.
   5. Changes required in other Work.
   6. Availability of maintenance service and source of replacement parts as applicable.
   7. Certified test data to show compliance with performance characteristics specified.
   8. Samples when applicable or requested.

9. Other information as necessary to assist Architect/Engineer's evaluation.

D. A request constitutes a representation that **Bidder:**
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for substitution as for specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will coordinate installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
   6. Will reimburse Owner **and Architect/Engineer** for review or redesign services associated with reapproval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals without separate written request or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

1.5 INSTALLER SUBSTITUTION PROCEDURES

A. Document - Instructions to Bidders specifies time restrictions for submitting requests for substitutions during Bidding period.

B. Document each request with:
   1. Installer's qualifications.
   2. Installer's experience in work similar to that specified.
   3. Other information as necessary to assist Architect/Engineer's evaluation.

C. Substitution Submittal Procedure:
   1. Submit **electronic files to Project website** of Request for Substitution for consideration. Limit each request to one proposed substitution.
   2. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 017000 EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Starting of systems.
C. Demonstration and instructions.
D. Testing, adjusting, and balancing.
E. Project record documents.
F. Operation and maintenance data.
G. Manual for materials and finishes.
H. Manual for equipment and systems.
I. Spare parts and maintenance products.
J. Product warranties and product bonds.
K. Maintenance service.
L. Examination.
M. Preparation.
N. Execution.
O. Cutting and patching.
P. Protecting installed construction.
Q. Final cleaning.

1.2 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
   1. Submit maintenance manuals, Project record documents, digital images of construction photographs and other similar final record data in compliance with this Section.
   2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
   3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
   4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
   5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
   6. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
   7. Perform final cleaning according to this Section.

B. Substantial Completion Inspection:
   1. When Contractor considers Work to be substantially complete, submit to Engineer:

a. Written certificate that Work, or designated portion, is substantially complete.
b. List of items to be completed or corrected (initial punch list).

2. Within seven days after receipt of request for Substantial Completion, Engineer will make inspection to determine whether Work or designated portion is substantially complete.
3. Should Engineer determine that Work is not substantially complete:
   a. Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
   b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer.
   c. Engineer will reinspect Work.
   d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.
4. When Engineer finds that Work is substantially complete, Engineer will:
   a. Prepare Certificate of Substantial Completion on EJCDC C-625 - Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Architect/Engineer and Owner (final punch list).
   b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
5. After Work is substantially complete, Contractor shall:
   a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
   b. Complete Work listed for completion or correction within 30 working days.
6. Owner will occupy all of building as specified in Section 01100 - Summary.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
1. When Contractor considers Work to be complete, submit written certification that:
   a. Contract Documents have been reviewed.
   b. Work has been examined for compliance with Contract Documents.
   c. Work has been completed according to Contract Documents.
   d. Work is completed and ready for final inspection.
2. Submittals: Submit following:
   a. Final punch list indicating all items have been completed or corrected.
   b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
   d. Accounting statement for final changes to Contract Sum.
   e. Contractor's affidavit of payment of debts and claims on AIA G706 - Contractor's Affidavit of Payment of Debts and Claims.
   f. Contractor affidavit of release of liens.
   g. Consent of surety to final payment on AIA G707 - Consent of Surety to Final Payment Form.
3. Perform final cleaning for Contractor-soiled areas according to this Section.

D. Final Completion Inspection:
1. Within seven days after receipt of request for final inspection, Engineer will make inspection to determine whether Work or designated portion is complete.
2. Should Engineer consider Work to be incomplete or defective:

a. Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
b. Contractor shall remedy stated deficiencies and send second written request to Engineer that Work is complete.
c. Engineer will reinspect Work.
d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.

1.3 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify Engineer and Owner seven days prior to startup of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.

H. Submit a written report according to Section 01330 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment and instructed by qualified representative who is knowledgeable about the Project.

C. Video Recordings: Provide high-quality color video recordings of demonstration and instructional sessions. Engage commercial videographer to record sessions. Include classroom instructions, demonstrations, board diagrams, and other visual aids. Include menu navigation.

D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

H. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, product data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates used.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
   1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
   2. Include locations of concealed elements of the Work.
   3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
   4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
   5. Identify and locate existing buried or concealed items encountered during Project.
   6. Measured depths of foundations in relation to finish [first] [main] floor datum.
   7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   9. Field changes of dimension and detail.
   10. Details not on original Drawings.

G. Submit marked-up paper copy documents to Engineer before Substantial Completion.

H. Submit PDF electronic files of marked-up documents to Engineer before Substantial Completion.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
      g. Safety precautions to be taken when operating and maintaining or working near equipment.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop Drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes before Substantial Completion. Draft copy be reviewed and returned after Substantial Completion, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes within ten days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom-manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product Specification Sections.

I. Include listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.8 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes before Substantial Completion. Draft copy will be reviewed and returned after Substantial Completion, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes within ten days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Include color-coded wiring diagrams as installed.

G. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

H. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

I. Include servicing and lubrication schedule and list of lubricants required.

J. Include manufacturer's printed operation and maintenance instructions.

K. Include sequence of operation by controls manufacturer.

L. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

M. Include control diagrams by controls manufacturer as installed.

N. Include Contractor's coordination drawings with color-coded piping diagrams as installed.

O. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

P. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

Q. Include test and balancing reports as specified in Section 01400 - Quality Requirements.

R. Additional Requirements: As specified in individual product Specification Sections.

S. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Deliver to Project Site and place in location as directed by Owner ; obtain receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in Specification Sections during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
   1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
   2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
   3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Architect/Engineer for final decision.

E. Allow for expansion of materials and building movement.

F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
   1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
   2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Architect/Engineer for final decision.
   2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and nonconforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products according to requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material, to full thickness of penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

K. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.
   1. Employ experienced personnel or professional cleaning firm.

B. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.

C. Replace filters of operating equipment.

D. Clean debris from roofs, gutters, downspouts, and drainage systems.

E. Clean Site; sweep paved areas, rake clean landscaped surfaces.

F. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

Orange Made, LLC
910 Redwood Ave, Ste 10
McAllen, Texas 78501
P 956-800-4384

11/20/2017

Architect's Project No. 16017

LEO PEÑA PLACITA PARK
MOBILITY IMPROVEMENT PROJECT

Mission, TX

TABLE OF CONTENTS

Sections listed in this Table of Contents pertain to Architect

TABLE OF CONTENTS

DIVISION 3- CONCRETE

DIVISION 4- MASONRY

DIVISION 5- METALS

DIVISION 31- SITE CONSTRUCTION

END OF SECTION

11-20-17

Leo Pena Placita Park Mobility Improvement Project
Table of Contents

Division	Section Title

November 20, 2017

MEP SOLUTIONS ENGINEERING
MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
600 E. BEAUMONT AVE. SUITE 2 McALLEN, TX 78501 (956) 664-2727
TEXAS BOARD OF PROFESSIONAL ENGINEERS REGISTRATION # F-9748

SECTION 03 10 00

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Sections:
1. Section 032000 - Concrete Reinforcement.
2. Section 033000 - Cast-in-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

E. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum .03 perms when tested in accordance with ASTM E96, Procedure A.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347 ACI 301 ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with State Municipality of Highways Public Work's standard.

1.6 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

2.2 FORMWORK ACCESSORIES

A. Vapor Retarder: Where indicated on Drawings, 10 mil thick polyethylene sheet manufacture by:
   1. Stego Wrap Class A: by Stego Industries LLC (887) 464-7834
   2. Griffolyn by Reef Industries (800) 231-6074
   3. VaporBlock 10 by Raven Industries (800) 635-3456
   4. Perminator Vapor – May by W.R. Meadows (800) 342-5976
   5. Xtreme by Tex-Trude (281) 452-5961
   6. Or Equivalent

B. Bituminous Joint Filler: ASTM D1751.

C. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

D. Water Stops: Rubber Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

****** OR ******

E. Waterstop: Flexible strip of bentonite waterproofing compound in coil form for joints in concrete construction.
1. Colloid Environmental Technologies Company Model.
2. TC MiraDRi Model.
3. Paramount Technical Products Model.
4. Substitutions: Section 016000 - Product Requirements Not Permitted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:
1. Earth forms are not permitted.

B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.

5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 ACI 318.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

F. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

G. Install fillet and chamfer strips on external corners of beams joists columns and.

H. Install void forms in accordance with manufacturer's recommendations.
1. SureVoid Products, Inc., Englewood, CO (800) 458-5444.

I. Do not reuse wood formwork more than times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

G. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

H. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

I. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

J. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

K. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

L. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

M. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301 ACI 318.

****** OR ******

B. Camber slabs and beams 1/4 inch per 10 feet in accordance with ACI 301 ACI 318.

3.8 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements 017000 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Sections:
1. Section 031000 - Concrete Forms and Accessories.
2. Section 033000 - Cast-in-Place Concrete.
3. Section 033500 - Concrete: Reinforcement for concrete floor toppings.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530.1 - Specifications for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:
1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
1. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, and ACI 318.

B. Prepare shop drawings in accordance with ACI SP-66.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Deformed and Plain Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped steel; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Mechanical type; full tension and compression; sized to fit joined reinforcing.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice, and ACI 318, on and all applicable codes.

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318 and all applicable codes.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous deformed bar or wire.

F. Form ties and stirrups from the following:
   1. For bars No. 10 and Smaller: No. 3 deformed bars.
   2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Galvanized Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI.

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Make completed reinforcement available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
1. Do not weld crossing reinforcement bars for assembly.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 of one bar diameter, but not less than 1 inch.
1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement in accordance with ACI 318 applicable code as follows:

Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches

Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

3.2 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318 and IBC 2006.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
6. Periodic Weld Inspection: Other welded connections.

3.4 SCHEDULES

A. Reinforcement For Superstructure Framing Members: Deformed bars, unfinished.

B. Reinforcement For Foundation Wall Framing Members and Slab-on-Grade:Deformed bars and wire fabric, galvanized finish.

C. Reinforcement For Parking Structure Framing Members: Deformed bars, epoxy-coated finish.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Foundation walls.
   2. Supported slabs.
   3. Slabs on grade.
   4. Control, expansion and contraction joint devices.
   5. Equipment pads.
   6. Light pole base.
   7. Flagpole base.

B. Related Sections:
   1. Section 031000 - Concrete Forms and Accessories: Formwork and accessories. Placement of joint device joint device anchors in formwork.
   2. Section 032000 - Concrete Reinforcement.
   3. Section 033500 - Concrete Finishing.
   4. Section 033900 - Concrete Curing.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 308.1 - Standard Specification for Curing Concrete.
   5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. ASTM C33 - Standard Specification for Concrete Aggregates.
   4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.

8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173/C173M - 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 C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

33. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum .03 perm when tested in accordance with ASTM E96.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, admixtures.

C. Design Data:
1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
   a. Hot and cold weather concrete work.
   b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.

3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 318.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

1.7 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.9 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal

B. Normal Weight Aggregates: ASTM C33.
1. Coarse Aggregate Maximum Size: 1.5

C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Fly Ash: ASTM C618 type C or F.

C. Silica Fume: ASTM C1240.

2.3 ACCESSORIES

A. Vapor Retarder: ASTM E1745 Class A; 10 mil thick; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler; Asphalt impregnated fiberboard or felt, tongue and groove profile.

****** OR ******

B. Joint Filler: ASTM D1752; Closed cell, resiliency of 95 percent if not compressed more than 50 percent of original thickness.

C. Sealant: ASTM C309, Type I approved by Asphalt and Vinyl composition Tile Institute, 30% minimum solids content.

2.5 CONCRETE MIX

A. Select proportions for normal weight concrete in accordance with ACI 301 Method 1

B. Provide concrete for the following criteria:

Material and Property	Measurement
Compressive Strength (7 day)	2100 psi
Compressive Strength (28 day)	3000 psi
Cement Type	ASTM C150
Aggregate Size (maximum)	1.5 inch
Air Content	Do not use air entrainment for concrete mixes.
Slump	5 inches

C. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.
   1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
   2. Do not use calcium chloride nor admixtures containing calcium chloride.

3. Use set retarding admixtures during hot weather.

D. Site Mixed Concrete: No site mixed concrete is allowed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.

D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight by adhesive applied between overlapping edges and ends as per manufacturer recommendations.

E. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

F. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

G. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor finish.

H. Install joint covers in one piece longest practical length, when adjacent construction activity is complete.

I. Deposit concrete at final position. Prevent segregation of mix.

J. Place concrete in continuous operation for each panel or section determined by predetermined joints.

K. Consolidate concrete.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Do not interrupt successive placement; do not permit cold joints to occur.

O. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

P. Screed floors and slabs on grade level, maintaining surface flatness of F_f of 35.

3.4 CONCRETE FINISHING

A. Finish concrete floor surfaces to requirements of Section 03350.

B. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Protect concrete footings from freezing for minimum 5 days.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces as specified in Section 03390.

D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.

E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

E. Concrete Inspections:
1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
1. Sampling Procedures: ASTM C172.
2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured field cured.
3. Sample concrete and make one set of three cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
4. When volume of concrete for any class of concrete would provide less than 3 sets of cylinders, take samples from three randomly selected batches, or from every batch when less than 3 batches are used.
5. Make one additional cylinder during cold weather concreting, and field cure.

G. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C173/C173M.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39.
2. Test Acceptance: In accordance with ACI 318 .
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42/C42M.
   2. Test Acceptance: In accordance with ACI 318.
   3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218; tested at 28 days.
   1. Maximum Concentration: As permitted by applicable code.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections as directed by Architect/Engineer

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.9 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Foundation Walls: 3,000 psi 28 day concrete, form finish with honeycomb filled surface.

B. Underside of Supported Floors and Structure Exposed to View: 4,000 psi 28 day concrete, sack rubbed finish.

C. Exposed Portico Structure: 4,000 psi 28 day concrete, air entrained, smooth stone rubbed finish.

3.10 SCHEDULE - JOINT FILLERS

A. Basement Floor Slab Perimeter:Joint filler Type A set 1/8 inch below floor slab elevation.

B. Exterior Retaining Wall at Loading Dock: Joint filler Type F recessed 3/8 inch with sealant cover.

END OF SECTION

SECTION 03 35 00

CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finishing concrete floors [and floor toppings].
   2. Floor surface treatment.

B. Related Sections:
   1. Section 033000 - Cast-in-Place Concrete: [Prepared concrete floors ready to receive finish;] [control and formed expansion and contraction joints and joint devices].
   2. Section 03360 - Concrete Finishes: Exposed aggregate finish.
   3. Section 033900 - Concrete Curing.
   4. Section 079513 - Expansion Joint Cover Assemblies.
   5. Section 079200 - Joint Sealers.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International:
   1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on concrete hardener, sealer, curing compounds curing papers and slip resistant treatment, compatibilities, and limitations.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

1.8 COMPOUNDS - HARDENERS AND SEALERS

A. Chemical Hardener: Magnesium fluorosilicate and zinc fluorosilicate blend

PART 2 EXECUTION

2.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are acceptable to receive the Work of this section.

2.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Wood float surfaces receiving quarry tile, ceramic tile, and cementitious terrazzo with full bed setting system.

C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set quarry tile, and thin set ceramic tile.

D. Steel trowel surfaces which are scheduled to be exposed.

2.3 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

C. Finish concrete to achieve the following tolerances:

1. Under Glazed Tile on Setting Bed: F(F) 35 and F(L) 20.
2. Under Resilient Finishes: F(F) 75 and F(L) 50.
3. Exposed to View and Foot Traffic: F(F) 75 and F(L) 40.
4. Correct slab surface when actual F(F) or F(L) number for floor installation measures less than required.

D. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 03 39 00

CONCRETE CURING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes initial and final curing of horizontal and vertical concrete surfaces.

B. Related Sections:
1. Section 033000 - Cast-In-Place Concrete.
2. Section 033500 - Concrete Finishing.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
3. ACI 308.1 - Standard Specification for Curing Concrete.
4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on curing compounds, mats, paper, film, compatibilities, and limitations.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

PART 2 PRODUCTS

2.1 MATERIALS

A. Membrane Curing Compound Type 1.

B. Membrane Curing Compound: ASTM C1315 Type I.

C. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are ready to be cured.

3.2 INSTALLATION - HORIZONTAL SURFACES

A. Cure concrete in accordance with ACI 308.1.

B. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

****** [OR] ******

C. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

****** [OR] ******

D. Absorptive Mat: Spread cotton fabric over floor slab areas. Spray with water until mats are saturated, and maintain in saturated condition for 7 days.

****** [OR] ******

E. Absorptive Mat: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.

3.3 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution Requirements: Protecting finished Work.

B. Do not permit traffic over unprotected floor surface.

3.4 SCHEDULES

A. Storage Area Slabs: Absorptive mats, burlap-polyethylene type.

B. Retaining Walls: Membrane curing compound, acrylic type, clear color.

C. Concrete Pavement: Membrane curing compound, opaque color.

D. Other Floor Areas: Membrane curing compound, acrylic type, translucent color.

END OF SECTION

SECTION 03 60 00

GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portland cement grout.
   2. Rapid curing epoxy grout.
   3. Non-shrink cementitious grout.

B. Related Sections:
   1. Section 033000 - Cast-in-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society of Testing and Materials:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
   5. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
   6. ASTM C531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   7. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacings and Polymer Concretes.
   8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
   1. CRD C621 - Non-Shrink Grout.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I and II.

B. Water:
1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
a. Corrosion of steel.
b. Volume change increasing shrinkage cracking.
c. Efflorescence.
d. Excess air entraining.

C. Fine Aggregate:
1. Washed natural sand.
2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID CURING EPOXY GROUT

A. Rapid Curing Epoxy Grout: High strength, three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies.

Compressive Strength	ASTM C579	12,000 psi at 7 days
Tensile Strength	ASTM C307	2,000 psi minimum
Coefficient of Expansion	ASTM C531	30x10-6 in per degree F
Shrinkage	ASTM C827	None

2.3 NON-SHRINK CEMENTITIOUS GROUT

A. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum

Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

2.4 FORMWORK

A. Refer to Section 031000 for formwork requirements.

2.5 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.2 MIXING

A. Portland Cement Grout:
1. Use proportions of 2 parts sand and 1 part cement, measured by volume.
2. Prepare grout with water to obtain consistency to permit placing and packing.
3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water;after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
5. Do not add additional water after grout has been mixed.
6. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000 psi in 28 days.

****** [OR] ******

3.3 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.4 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.5 FIELD QUALITY CONTROL

A. Submit proposed mix design of each class of grout to inspection and testing firm for review prior to commencement of Work.

B. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04 05 14

MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 042000 - Unit Masonry Assemblies: Installation of mortar and grout.
2. Section 042016 - Reinforced Unit Masonry Assemblies: Installation of mortar and grout.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
2. ASTM C91 - Standard Specification for Masonry Cement.
3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
4. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
8. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
11. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
12. ASTM C476 - Standard Specification for Grout for Masonry.
13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
15. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
16. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
17. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
18. ASTM C1329 - Standard Specification for Mortar Cement.

19. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal requirements.

B. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Portland Cement: ASTM C150, Type I

B. Calcium chloride is not permitted.

2.2 MIXES

A. Mortar Mixes:
1. Extended Life Mortar: ASTM C1142, Type RS

B. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before mixing process.
3. Re-temper only within two hours of mixing.

C. Grout Mixes:

1. Grout for Non-Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 grout.
2. Grout for Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 grout.
3. Application:
   a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
   b. Fine Grout: For grouting other spaces.

D. Grout Mixing:
1. Mix grout in accordance with ASTM C94/C94M, modified to use ingredients complying with ASTM C476.
2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.

3.3 FIELD QUALITY CONTROL

A. Establishing Mortar Mix: In accordance with ASTM C270.

B. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.

C. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.

D. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.

E. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

END OF SECTION

SECTION 04 20 16

REINFORCED UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete masonry units, reinforcement, anchorage, and accessories.

B. Related Sections:
1. Section 040514 - Masonry Mortar and Grout: Mortar and grout.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
4. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM A951 - Standard Specification for Masonry Joint Reinforcement.
8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
9. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
10. ASTM C27 - Standard Classification of Fireclay and High-Alumina Refractory Brick.
11. ASTM C34 - Standard Specification for Structural Clay Load-Bearing Wall Tile.
12. ASTM C55 - Standard Specification for Concrete Brick.
13. ASTM C56 - Standard Specification for Structural Clay Non-Load-Bearing Tile.
14. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
15. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

16. ASTM C73 - Standard Specification for Calcium Silicate Face Brick (Sand-Lime Brick).
17. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
18. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
19. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
20. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
21. ASTM C212 - Standard Specification for Structural Clay Facing Tile.
22. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
23. ASTM C315 - Standard Specification for Clay Flue Linings.
24. ASTM C530 - Standard Specification for Structural Clay Non-Loadbearing Screen Tile.
25. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
26. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
27. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
28. ASTM C1261 - Standard Specification for Firebox Brick for Residential Fireplaces.
29. ASTM C1283 - Standard Practice for Installing Clay Flue Lining.
30. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
31. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Concrete Masonry Compressive Strength
   1. Concrete Masonry Units: 1900 psi minimum net area compressive strength.

1.4 SUBMITTALS

A. Samples for Initial Selection and Verification: For each type and color of the following:
   1. Exposed CMUs.

2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

B. Section 013300 - Submittal Procedures: Submittal requirements.

C. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement.

D. Product Data:
1. Submit data for masonry units and fabricated wire reinforcement.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; normal weight.

2.2 ACCESSORIES

A. Single Wythe Joint Reinforcement: ASTM A951; ladder type; 0.148 inch diameter side rods with 0.148 inch diameter cross ties.

B. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars.

C. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15 inch embedment.

1. Hot-Dipped Galvanizing: ASTM A153/A153M.
2. Mechanical Galvanizing: ASTM B695; Class 55.

D. Mortar and Grout: As specified in Section 04065.

E. Joint Filler: Closed cell rubber; oversized 50 percent to joint width; self expanding.

F. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide [square-edged] [bullnose] units for outside corners unless otherwise indicated.

G. Exposed Faces: Provide color and texture matching the range represented by Architect's sample. See architectural drawings.

2.3 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than “slightly effloresced” is not acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Placing And Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as Work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Isolate masonry from vertical structural framing members with movement joint .
9. Isolate top of masonry from horizontal structural framing members and slabs or decks.

E. Joint Reinforcement And Anchorage:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
6. Embed anchors embedded in concrete attached to structural steel members. Embed anchorages in every sixth brick.

F. Lintels:
1. Install precast concrete lintels over openings.
2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
3. Openings Up To 42 inches Wide: Reinforce openings as indicated on Drawings.
4. Openings From 42 inches Up To 78 inches Wide: Reinforce openings as indicated on Drawings.
5. Openings Over 78 inches: Reinforce openings as indicated on Drawings.
6. Do not splice reinforcing bars.

7. Support and secure reinforcing bars from displacement.
8. Place and consolidate grout fill without displacing reinforcing.
9. Allow masonry lintels to attain specified strength before removing temporary supports.
10. Maintain minimum 8 inches bearing on each side of opening.

G. Grouted Components:
1. Reinforce bond beam with 1, No. 5 bar.
2. Reinforce pilaster with 1, No. 6 bar in each cell.
3. Lap splices bar diameters required by code.
4. Support and secure reinforcing bars from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. At bearing locations, fill masonry cores with grout for minimum 12 inches either side of opening.

H. Reinforced Masonry:
1. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcing, reinforcement bars, and grout as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03200.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

I. Control And Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
a. Exterior Walls: 20 feet on center and within 10 feet on one side of each interior and exterior corner.
b. Interior Walls: 30 feet on center.
c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
4. Size control joint in accordance with Section 07900 for sealant performance.
5. Form expansion joint by omitting mortar and cutting unit to form open space.

J. Cutting And Fitting:
1. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.4 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation From Alignment of Pilasters: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
3. Plus or minus 1 inch when distance is between 8 and 24 inches.
4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
5. Plus or minus 2 inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

A. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.6 CLEANING

A. Section 017000 - Execution Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.7 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.

D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 047200 - CAST STONE MASONRY

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 SUMMARY

A. Section Includes:

1. Cast stone trim including the following:
   a. Wall caps.

B. Related Sections:
1. Section 042000 "Unit Masonry" for installing cast stone units in unit masonry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.

E. Full-Size Samples: For each **color, texture, and shape** of cast stone unit required.

1. Make available for Architect's review at Project site.
2. Approved Samples may be installed in the Work.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

B. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60 (Grade 420). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

2.2 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Innovative Block of South Texas or approved equal.

B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

E. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

    a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
    b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures: **As selected by Architect from manufacturer's full range**.

2.3 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from [**Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666**] [**steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M**].

B. Dowels: 1/2-inch- (12-mm-) diameter, round bars, fabricated from [**Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666**] [**steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M**].

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.4 MORTAR MIXES

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

B. Comply with ASTM C 270, Proportion Specification.

1. For setting mortar, use **Type N**.
2. For pointing mortar, use **Type N**.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Application: Use pigmented mortar for exposed mortar joints.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints [**1/4 to 3/8 inch (6 to 10 mm)**] wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

H. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than [**3/8 inch (10 mm)**].
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

C. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joint of width indicated, but not less than [**3/8 inch (10 mm)**].

F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural shapes.
2. Channels and angles.
3. Hollow structural sections.
4. Structural pipe.
5. Structural plates and bars.
6. Fasteners, connectors, and anchors.
7. Fasteners, connectors, and anchors.
8. Grout.

B. Related Sections:
1. Section 036000 - Grout: Grout for setting base plates.
2. Section 052100 - Steel Joists.
3. Section 053123 - Steel Roof Deck
4. Section 055000 – Metal Fabrications: Steel Fabrications affecting structural steel work.

1.2 REFERENCES

A. American Institute of Steel Construction:
1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
3. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
4. AISC Seismic Provisions for Structural Steel Buildings.
5. AISC Specification for Allowable Stress Design of Single-Angle Members.
6. AISC Specification for the Design of Steel Hollow Structural Sections.
7. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
8. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
10. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
11. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
15. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
16. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
19. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
20. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
21. ASTM A847 - Standard Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.
22. ASTM A852/A852M - Standard Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick.
23. ASTM A913/A913M - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
24. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
25. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

26. ASTM E94 - Standard Guide for Radiographic Examination.
27. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments.
28. ASTM E165 - Standard Test Method for Liquid Penetrant Examination.
29. ASTM E709 - Standard Guide for Magnetic Particle Examination.
30. ASTM F436 - Standard Specification for Hardened Steel Washers.
31. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
32. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
33. ASTM F1852 - Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Research Council on Structural Connections:
1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Paint.
3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
4. SSPC SP 3 - Power Tool Cleaning.
5. SSPC SP 6 - Commercial Blast Cleaning.
6. SSPC SP 10 - Near-White Blast Cleaning.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.
2. Connections.
3. Cambers
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Mill Test Reports: Submit indicating structural strength and destructive and non-destructive test analysis.

D. Manufacturer’s Mill Certificate: Certify products meet or exceed specified requirements.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualifications within previous 12 months.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Code of Standard Practice for Steel Buildings and Bridges. Section 10.
3. AISC Seismic Provisions for Structural Steel Buildings.
4. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.
5. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
6. AISC Specification for the Design of Steel Hollow Structural Sections.
7. AISC Specification for Allowable Stress Design of Single-Angle Members.
8. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
9. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
10. ASCE 19.

1.5 COORDINATION

A. Section {013000 - Administrative Requirements}: Requirements for coordination.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992/A992M; Grade 50

B. Structural M-Shapes: ASTM A36/A36M; Grade 50

C. Structural T-Shapes: Cut from structural W-shapes.

D. Channels and Angles: ASTM A36/A36M.

E. Round Hollow Structural Sections: ASTM A500, Grade B.

F. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.

G. Structural Plates and Bars: ASTM A36/A36M.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. Bolts: ASTM A307; Grade A or B.
   1. Finish: Unfinished

B. High Strength Bolts: ASTM A325; Type 1 or ASTM A490; Type 1.
   1. Finish: Unfinished

C. Nuts: ASTM A563 heavy hex type.
   1. Finish: Unfinished

D. Washers: ASTM F436; Type 1, circular
   1. Finish: Unfinished

E. Threaded Rods: ASTM A36/A36M; Grade A.
   1. Finish: Unfinished

F. Forged Structural Steel Hardware:
   1. Clevises and Turnbuckles: ASTM A108; Grade 1085.
   2. Eye Nuts and Eye Bolts: ASTM A108; Grade 1030.
   3. Sleeve Nuts: ASTM A108; Grade 1018.
   4. Rod Ends, Yoke Ends and Pins, Cotter Pins, and Coupling Nuts: Carbon steel.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days

B. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

2.5 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.6 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3.

B. Shop prime structural steel members.

C. Galvanizing for Structural Steel Members: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

D. Galvanizing for Fasteners, Connectors, and Anchors:
1. Hot-Dipped Galvanizing: ASTM A153/A153M.
2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Shop test bolted and welded connections as specified for field quality control tests.

C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components and shear connectors indicated on Drawings.

C. Field connect members with threaded fasteners; tighten to snug tight for bearing type connections.

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Grout [under base plates in accordance with Section 036000.

B. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.

C. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.

D. Moist cure grout.

E. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

F. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Bolted Connections: Inspect in accordance with AISC specifications.
1. Visually inspect all bolted connections.

2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.

C. Welding: Inspect welds in accordance with AWS D1.1.
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Visually inspect all welds.
3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
4. Liquid Penetrant Inspection: ASTM E165.

D. Correct defective bolted connections and welds.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field application of high-performance coating systems.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1.3 QUALITY ASSURANCE

A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each color and type of coating required. Comply with procedures specified in PDCA P5.

1. Approved benchmark samples may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1.5 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are within the range dictated by the manufacturer’s instructions.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly before proceeding with or continuing coating operation.

2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. High-Performance Coatings: Full, unused containers equal to 5 percent of each material and color applied, but not less than 1 gal. or 1 case, as appropriate.

1.7 WARRANTY

A. Special Warranty: General Contractor's standard form in which the General Contractor agrees to extend warranty of the performance of the material application for a period of 2 (two) years after date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.

B. Products of the following manufacturers are listed in other Part 2 articles and use the abbreviated names shown in parentheses:

1. Sherwin Williams; Industrial and Marine Coatings (S-W).
2. Tnemec Company, Inc.

2.2 MATERIALS, GENERAL

A. Material Compatibility: For each finish indicated, provide separate component coat materials of one manufacturer that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality material for each coating material specified.

C. Colors: As selected from manufacturer's full range.

D. Primer: Acrylic or epoxy primer of topcoat manufacturer recommended in writing by manufacturer for use with intermediate and topcoats and substrate indicated under environmental conditions indicated.

E. Intermediate Coat: Epoxy intermediate coat of topcoat manufacturer recommended in writing for use with primer, and topcoat, and substrate indicated under environmental conditions indicated.

2.3 EXTERIOR HIGH-PERFORMANCE TOPCOATS

A. High-Gloss Polyurethane: High-gloss, aliphatic polyurethane enamel.

B. Semigloss Polyurethane: Semigloss, aliphatic polyurethane enamel.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: Application of coatings indicates Applicator's acceptance of surfaces and conditions.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from primer Applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.

2. Notify Architect about anticipated problems before using coatings specified over substrates primed by others.

C. Preparation:

1. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

2. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
3. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
4. Cementitious Substrates: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.

    a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

5. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
    b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.

    c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

6. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

    a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

7. Galvanized Metal:
   Allow to weather a minimum of 12 months prior to coating. Solvent clean per SSPC-SP1, then prime as required. When weathering is not possible or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

8. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation:

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. Coating Application:

1. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
2. Apply coatings to exposed surfaces, including areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place, and maintain system integrity and provide desired protection.

    a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

F. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. Omit primer on metal surfaces that have been shop primed and touchup painted.
2. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
3. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
5. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

G. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.

a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
b. Brush out and work brush coats into surfaces in an even film.
c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.

a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
b. Apply each coat to provide the equivalent hiding of brush-applied coats.
c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

H. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying topcoats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a topcoat with no burn-through or other defects caused by insufficient sealing.

K. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

L. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

M. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

3.2 HIGH-PERFORMANCE COATING SCHEDULE

A. Exterior Surfaces:

1. Exposed Structural Steel and Accessories: Color as selected by Architect.
   Surface preparation: Commercial blast cleaning as per SSPC-SP6. Note: Do not use this paint system if surface has been hot dipped galvanized.

   a. Primer : Tnemec Series 90-97 Tneme-Zinc 2.5 - 3.5 dry mils
   b. First Coat: Tnemec Series 27WB Typoxy 4.0 – 6.0 dry mils
   c. Finish Coat: Tnemec Series 740 UVX 3.0 – 5.0 dry mils

2. Exposed Structural Steel and Accessories: Color as selected by Architect.

   a. First Coat: Primer formulated for severe environment, S-W Epolon II, Rust Inhibitive Epoxy Primer.
   b. Second Coat: Intermediate coat, S-W Hi-Solid Polyurethane two-component, low VOC, aliphatic, acrylic polyurethane resin coating.
   c. Topcoat: Clear coat urethane, S-W Diamond-Clad.

END OF SECTION

SECTION 133100 – ARCHITECTURAL SHADE FABRIC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cables and fittings.

B. Tensioned fabric.

1.2 RELATED REQUIREMENTS

A. 051200 - Structural Steel Framing; for structural steel of structure support tensioned fabric.

1.3 SUBMITTALS

A. Qualification Data: For Installer, fabricator.

B. Delegated-Design Submittal: For assemblies indicated to comply with performance requirements and design criteria, including analysis data and drawings signed and sealed by the qualified professional engineer responsible for their preparation including:
   1. Verify the fabric meets minimum engineering requirements.
   2. Details fabric attachment methods and identify thickness of all membrane plates, clamps and other attachment components.
   3. Cable sizes and pretension requirements.

C. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.

D. Shop Drawings:
   1. Show intended fabric attachment hardware and details.
   2. Identify direction, details and locations of fabric seams.
   3. Show details of fabric dimensions including length of spans, sag curvature and actual shaded area.

E. Samples:
   1. Tensioned Fabric: 8.5 inch x 11 inch samples of tensioned fabric for appearance, texture, finish and light transmittance. Provide sample for each color selected.
   2. Accessories: One of each exposed accessory in selected color and finish.

F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, attachment methods, and perimeter conditions requiring special attention.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Data: For tensioned fabric structures including:

1. Methods for maintaining tensioned fabric structure fabrics and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

1.4 QUALITY ASSURANCE

A. Fabric Manufacturer's Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience in tensioned fabric manufacture.

B. Fabricator/Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience on projects of similar size, complexity and fabric.

1.5 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.6 WARRANTY

A. Fabric Manufacturer Warranty: Provide manufacturer's standard 15 year material replacement warranty for water resistance and tearing of fabric.

PART 2 - PRODUCTS

2.1 FABRIC MANUFACTURERS

A. Specification is based on COMMERCIAL 95 Architectural Shade Fabric by GALE PACIFIC.
   1. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.
      a. Include side by side comparison of performance, design criteria and features listed for both specified product and proposed substitution.
      b. Include full set of product data and samples for both specified product and proposed substitution.

2.2 DESCRIPTION

A. Fabrication and installation of tensioned fabric and all associated cables, fittings and accessories.

2.3 PERFORMANCE AND DESIGN CRITERIA

A. Design shade fabric and fittings:
   1. In accordance with fabric manufacturer's requirements for warranted installation.
   2. To allow for thermal movements from ambient and surface temperature changes of 120 deg F, ambient; 180 deg F, material surfaces.

3. To limit corrosion and prevent galvanic action by isolating metals and other materials from direct contact with incompatible materials.
4. To provide criteria on which the design is based:
    a. Expected Fabric Life: 25 years.

B. Solar Reflectance Index (SRI): minimum values dictated by basis of design fabric, calculated in accordance with ASTM E1980, Approach II.

2.4 MATERIALS

A. Cables and Fittings:
1. Fittings:
    a. Stainless Steel Fittings: Basis of Design Product: Structural Cable components by Ronstan or PFEIFER Wire Rope & Lifting. Comparable and substituted products will be judged based on the specified performance and design criteria, features, and warranty.
        1) Performance Criteria:
            a) Connectors of types indicated or required, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
            b) Material: 316 Grade Stainless Steel and Chrome-plated Bronze threaded turnbuckle fittings to prevent galling.
        2) Features:
            a) Swage attachment to cables
            b) Aesthetic of finish.
            c) Long term adjustability.
            d) Long term rust resistance.
2. Structural Cable:
    a. Stainless Steel Strand: Complying with ASTM A 368; strand configuration, diameter, cable constructions and minimum breaking load to be selected by delegated design engineer.

B. Tensioned Fabric:
1. Basis of Design Product: COMMERCIAL 95 Architectural Shade Fabric by GALE PACIFIC. Comparable and substituted products will be judged based on the specified performance and design criteria, features, warranty, and qualifications.
    a. Performance Criteria: See attached specification sheet.
    b. Color: 2 colors to be selected by Architect from manufacturer’s full range of colors.

2.5 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.2 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Cables and Fittings: Install in accordance with delegated design documents and manufacturer's instructions.

C. Tensioned Fabric: Install in accordance with delegated design documents and manufacturer's instructions.

3.4 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

END OF SECTION

Commercial 95®

Product Profile **Architectural Shade Fabric**

Rev.13 5/13

Product Description

Commercial 95® is a high quality knitted shade fabric designed for tension structures, awnings and shade covers specifically for commercial architectural applications; supplied in bulk rolls.

Material

Yarn	UV stabilised HDPE
Construction	Monofilament & tape
Pattern	Lock-stitch knitted
Temperature range	-30°C to +75°C

Features

- Strong HDPE 100% recyclable fabric won't rot or absorb moisture.
- Stentered (heat-set) to reduce shrinkage and for ease of fabrication.
- 10 year UV degradation warranty on fabric.
- 100% Lead and Phthalate free
- Greenguard® and Oeko-Tex® certified
- Engineered in Australia to meet the harsh climate.

Usage Instructions

- Do not use against flames.
- Contact with organic solvents, halogens or highly acidic substances may reduce the service life of the fabric and void the warranty.
- Biaxial elastic material properties available on request.

Properties

Nominal fabric mass *(AS 2001.2.13)*	340 gsm ± 20
Approximate thickness	1.6 mm

Performance

Tensile Strength - Warp	635 N/50mm
Elongation at break	95.6 %
Tensile Strength - Weft	2494 N/50mm
Elongation at break *(AS 2001.2.3.1)*	70.4 %
Wing Tear – Warp (mean)	187 N
Wing Tear – Weft (mean) *(AS 2001.2.10)*	359 N
Bursting Pressure (mean) *(AS 2001.2.4)*	3500 kPa
Bursting Force (mean) *(AS 2001.2.19)*	2146 N

Flammability

(AS 1530.2)
Flammability Index *(range 0-100)* 14
AS 1530 Part 2 & 3 certificates available on request

Suggested Specification

Shadecloth fabric shall be compliant to Australian standard AS 4174 and shall be Synthesis
Commercial 95 knitted HDPE monofilament & tape shade fabric offering a UV block up to 97%.

Colour	Code	Nom Width	Length	Cover Factor	Shade Factor	Av % Trans	Av. UVR Trans	Av. PAR Trans	% UVR Block	PF Rating	PF Mean
Aquatic Blue	444938	3.00 m (folded)	40 m	96.8%	90.2	9.8%	6.4%	11.2%	93.6%	15.0	32.2
Black	444945			98.2%	97.4	2.6%	2.6%	2.7%	97.4%	35.0	59.8
Brunswick Green	444952			96.2%	93.9	6.1%	4.9%	6.3%	95.1%	15.0	32.6
Cayenne	455255			92.0%	87.0	13.0%	6.0%	11.6%	94.0%	11.0	14.7
Cedar	465360			94.9%	87.7	12.3%	6.5%	12.6%	93.5%	18.0	19.4
Charcoal	444969			94.7%	94.2	5.8%	5.3%	5.8%	94.7%	11.4	23.2
Cherry Red	444976			90.1%	75.3	24.7%	10.7%	22.4%	89.3%	8.8	12.1
Desert Sand	444983			94.0%	85.0	15.0%	3.6%	16.1%	96.4%	10.0	20.3
Deep Ochre	444990			95.1%	91.3	8.7%	5.6%	8.5%	94.4%	12.1	26.3
Gun Metal	455262			97.1%	96.2	3.8%	2.3%	3.9%	97.7%	23.0	54.9
Natural	445003			97.9%	74.3	25.7%	3.2%	30.1%	96.8%	35.0	62.4
Navy Blue	445010			96.2%	94.4	5.6%	4.8%	5.7%	95.2%	14.7	33.3
Rivergum Green	445027			94.7%	85.0	15.0%	7.7%	15.6%	92.3%	12.6	20.8
Sky Blue	445034			95.2%	90.4	9.6%	6.2%	9.9%	93.8%	16.0	21.3
Steel Grey	445041			95.6%	88.4	11.6%	7.0%	12.3%	93.0%	13.1	26.1
Turquoise	445058			94.0%	90.0	10.0%	5.7%	11.7%	94.3%	11.9	18.0
Yellow	445072			98.3%	77.2	22.8%	2.9%	25.0%	97.1%	45.0	71.3

Approx. roll weight:	44 kg
Approx. roll diameter:	0.32 m
Core diameter:	35 mm

Tested according to AS 4174 Synthetic Shadecloth
Av. % Transmis. = Average % Transmission within the 290-770nm spectrum
Av. UVR Transmis. = Average % Transmission within the 290-400nm spectrum
Av. PAR Transmis. = Average % Transmission within the 408-770nm spectrum
UPF (Ultraviolet Protection Factor)
PF (Rating) = actual rating assigned to material tested, inc standard deviation.
PF (Mean) = average of PF values tested, excludes standard deviation.

The above results are typical averages from quality assurance testing and are not to be taken as a minimum specification nor as forming any contract between GALE Pacific and another party. Due to continuous product improvement product specifications are subject to alteration without notice.

As the use and disposal of this product are beyond GALE Pacific's control, regardless of any assistance provided without charge, GALE Pacific assumes no obligation or liability for the suitability of its products in any specific end use application. It is the customer's responsibility to determine whether GALE Pacific's products are appropriate for the specific application and complies with any legal & patent regulations.

AU	P 1800 331 521	F +61 3 9518 3398	gpcommercial.com
NZ	P 0800 555 171	F 0800 555 172	
UAE	P +971 4 881 7114	F +971 4 881 7167	
USA	P 1800 560 4667	F +1 407 772 0553	gpcommercialusa.com

Commercial® 95 340

Architectural Shade Fabric

Commercial 95® 340 is the flagship of GALE Pacific's Architectural Shade Fabrics range. It is the name synonymous with commercial-grade shade cloth in many parts of the world. Designed for use on tension structures and suitable for a wide variety of applications, Commercial 95® 340 offers the ultimate combination of maximum sun protection, strength and durability to ensure maintenance-free, long-life performance.

Made from high quality UV-stabilised HDPE in GALE Pacific's off-shore facility – Commercial 95® 340 was engineered in Australia as a strong and stable outdoor fabric for tension structures and shade sail applications.

It is 100% lead and phthalate free and is the first architectural shadecloth in the world to be granted Oeko-Tex® 100 and Greenguard® certification.

Features	Benefits
Knitted lock-stitch construction	Fray and tear resistant
Tape and monofilament yarn	Excellent balance between strength and UV block
Strong HDPE	Won't rot or absorb moisture
Stentered (heat set)	Virtually eliminates any possibility of shrinking once installed and provides ease of fabrication
UV Block range 89.3% - 97.7%	Reduces sun exposure for safe and extended time outdoors
10 Year UV degradation Warranty on fabric	Reduced costs; Peace of Mind
100% Lead and Phthalate free	Healthier environment
Greenguard® and OEKO-TEX® certified	Confidence in operational quality assurance
Engineered in Australia	Meets harsh environmental conditions
100% Recyclable	Addresses environmental concerns

Applications

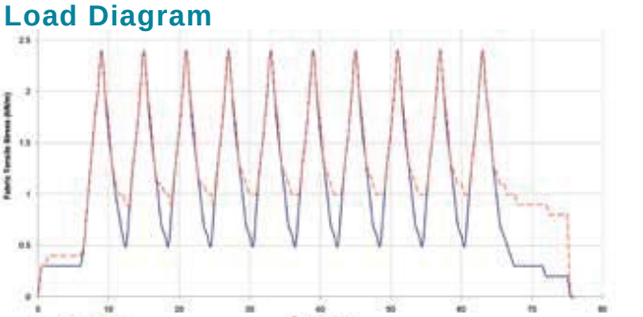
- Tension structures
- Awnings
- Shade sails
- Car Park structures

Usage Instructions

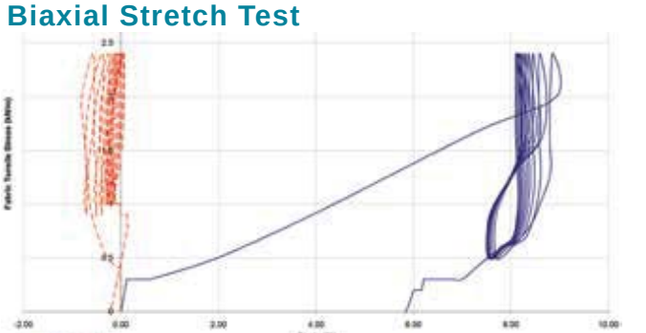
Do not use against flames.

Contact with organic solvents, halogens or highly acidic substances may reduce the service life of the fabric and void the warranty.

Load Diagram



Biaxial Stretch Test



Material

Yarn	Knitted UV-stabilised HDPE
Construction	Monofilament & tape
Pattern	Lock-stitch knitted
Temperature range	-30°C to +70°C
Roll length	40m
Roll width	3m width (folded)

Properties

Nominal fabric mass (AS 2001.2.13)	340gsm ± 20
Approximate thickness	1.6mm

Performance

Tensile Strength-Warp	635 N/50mm
Elongation at break (%)	95.6
Tensile Strength-Weft (AS 2001.2.3.1)	2494 N/50mm
Wing Tear – Warp (mean)	187 N
Wing Tear – Weft (mean) (AS 2001.2.10)	359 N
Elongation at break (%)	70.4
Bursting Pressure (mean) (AS 2001.2.4)	3500 kPa
Bursting Force (mean) (AS 2001.2.19)	2146 N

Flammability

(AS2001.2.19)	
Flammability Index (range0-100)	14

Lead & Phthalate Tests

(CPSIA Section 101(a)(2))	
Lead not detected	PASS
(CPSIA Section 108)	
Phthalate not detected	PASS

Suggested Specification

Shadecloth fabric shall be compliant to Australian standard AS 4174 and shall be Commercial 95 340 knitted HDPE monofilament & tape shade fabric offering a UV block up to 97%.

Colour	Code	Nom Width*	Length**	Cover Factor	Shade Factor	Av % Trans	Av% UVR Trans	Av PAR Trans	%UVR Block	PF	PF Calculated
Aquatic Blue	444938	3m	40m	96.8	90.2	9.8	6.4	11.2	93.6	15.0	32.2
Black	444945	3m	40m	98.2	97.4	2.6	2.6	2.7	97.4	35.0	59.8
Navy Blue	445010	3m	40m	96.2	94.4	5.6	4.7	5.7	95.2	14.7	33.3
Sky Blue	445034	3m	40m	95.2	90.4	9.6	6.2	9.9	93.8	16.0	21.3
Brunswick Green	444952	3m	40m	96.2	93.9	6.1	4.9	6.3	95.1	15.0	32.6
Cayenne	455255	3m	40m	92.0	87.0	13.0	6.0	11.6	94.0	11.0	14.7
Cedar	465360	3m	40m	94.9	87.7	12.3	5.3	12.6	94.7	18.0	19.4
Charcoal	444969	3m	40m	94.7	94.2	5.8	5.3	5.8	94.7	11.4	23.2
Cherry Red	444976	3m	40m	90.1	75.3	24.7	10.7	22.4	89.3	8.8	12.1
Desert Sand	444983	3m	40m	94.0	85.0	15.0	3.6	16.1	96.4	10.0	20.3
Gun Metal	455262	3m	40m	97.1	96.2	3.8	2.3	3.9	97.7	23.0	54.9
Natural	445003	3m	40m	97.9	74.3	25.7	3.2	30.1	96.8	35.0	62.4
Deep Ochre	444990	3m	40m	95.1	91.3	8.7	5.6	8.5	94.4	12.1	26.3
Rivergum	445027	3m	40m	94.7	85.0	15.0	7.7	15.6	92.3	12.6	20.8
Steel Grey	445041	3m	40m	95.6	88.4	11.6	7.0	12.3	93.0	13.1	26.1
Turquoise	445065	3m	40m	94.0	90.0	10.0	5.7	11.7	94.3	11.9	18.0
Yellow	445072	3m	40m	98.3	77.2	22.8	2.9	25.0	97.1	45.0	71.3

Approx. roll weight: 44kg

Approx. roll diameter: 0.32m

Core diameter: 35mm

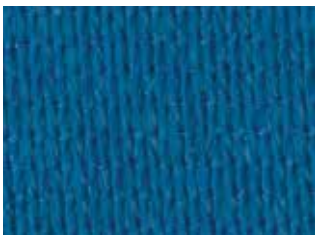
**Folded. **Roll.*

The above results are typical averages from independent testing and quality assurance testing and are not to be taken as a minimum specification nor as forming any contract between GALE Pacific and another party. Due to continuous product improvement product specifications are subject to alteration without notice.

As the use and disposal of this product are beyond GALE Pacific's control, regardless of any assistance provided without charge, GALE Pacific assumes no obligation or liability for the suitability of its products in any specific end use application. It is the customer's responsibility to determine whether GALE Pacific's products are appropriate for the specific application and complies with any legal & patent regulations.

The calculated protection factor is for the material only and does not account for the effect of indirect UVR when situated at a distance from the persons being protected.

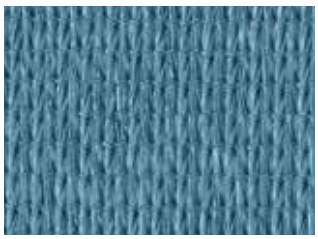
Colours Available



Aquatic Blue 444938
93.6% UVR Block

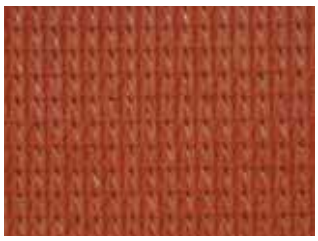
Black 444945
97.4% UVR Block

Navy Blue 445010
95.2% UVR Block



Sky Blue 445034
93.8% UVR Block

Brunswick Green 444952
95.1% UVR Block



Cayenne 455255
94.0% UVR Block

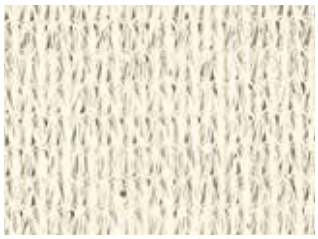
Cedar 465360
94.7% UVR Block

Charcoal 444969
94.7% UVR Block

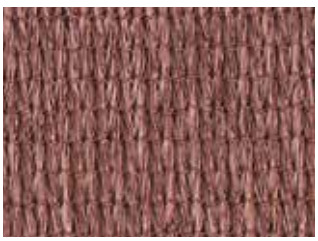
Cherry Red 444976
89.3% UVR Block

Desert Sand 444983
96.4% UVR Block

Gun Metal 455262
97.7% UVR Block

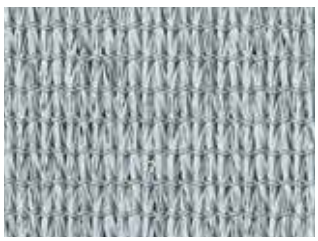


Natural 445003
96.8% UVR Block

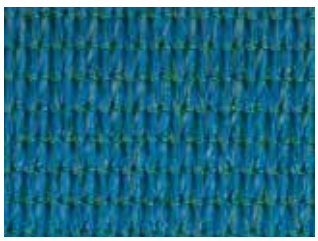


Deep Ochre 444990
94.4% UVR Block

River Gum Green 445027
92.3% UVR Block



Steel Grey 445041
93.0% UVR Block



Turquoise 445065
94.3% UVR Block

Yellow 445072
97.1% UVR Block

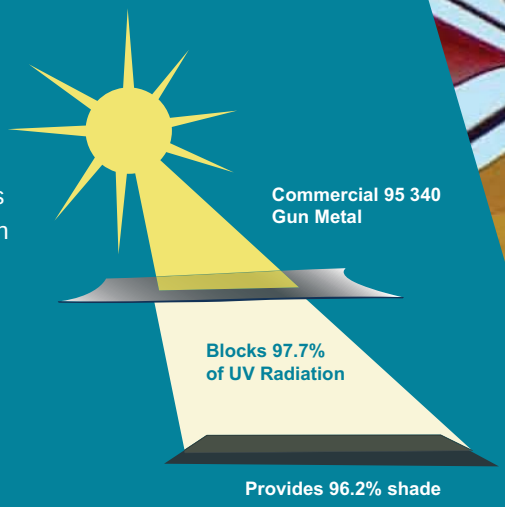
Please note, due to the limitations of the printing process, colours may not represent the true colour

GALE Pacific architectural shade fabrics are designed to be strong and stable for use in architectural, outdoor, large-scale tension structures. All GALE Pacific architectural shade fabrics offer the ultimate combination of maximum sun protection, strength and durability to ensure maintenance-free, long-life performance.

GALE Pacific architectural fabrics are 100% lead and phthalate free and the first architectural shade cloth in the world to be granted Oeko-Tex Standard 100 and Greenguard Certification.

UVR Block & PF Ratings

All GALE Pacific shade fabrics have been fully tested according to AS4174 by the Australian Radiation Protection & Nuclear Safety Agency and feature the highest PF results available to deliver the highest level of UVR protection of any commercial shade cloth. Commercial 95 340 shade fabric ranges up to 97.7% UVR block which is considered as “excellent protection” under guidelines set by Australia’s Sun Smart and the Cancer Council.



The % UVR block relates to the ability of the shadecloth to reflect or absorb UVR within the 290nm to 400nm range of the spectrum. Heightened exposure to UVR has been shown to increase the rates of skin cancer. Therefore, the percentage of UVR block is an important factor when selecting shadecloth designed to protect people.

Commercial 95 340 is OEKO-TEX® Standard 100 and Greenguard children and school certified.

As the demand for healthy, sustainable products continues to expand, consumers and building industry professionals increasingly demand substantiation of product sustainability claims and rely on trustworthy third-party certifiers to guide purchasing and specification decisions. GREENGUARD & Oeko-Tex Standard 100 Certification provides the market with solutions and resources to ensure healthier environments, and provides manufacturers with credible tools to legitimize and promote their sustainability

The GREENGUARD and Oeko-Tex Standard 100 Certifications set stringent limits for products to achieve in several key areas such as:

- Limiting Volatile Organic Compound (VOC) content
- Lowering formaldehyde emissions
- Lowering lead and phthalate content

100% LEAD AND PHTHALATE FREE

CONFIDENCE IN TEXTILES
Tested for harmful substances
according to Oeko-Tex® Standard 100
12.HUS.15194 Hohenstein

Children & Schools GREENGUARD® Indoor Air Quality Certified

Specialised Textiles ASSOCIATION MEMBER

2 HDPE

UV WARRANTY KNITTED 10 YEAR UV WARRANTY KNITTED

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Ground rods.
   2. Ground rings.
   3. Grounding arrangements and connections for separately derived systems.
   4. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

G. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.5 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural

drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: ANSI C80.3.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Thomas & Betts Corporation.
    b. Walker Systems, Inc.; Wiremold Company (The).
    c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Butler Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson & Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Walker Systems, Inc.; Wiremold Company (The).
    g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. NewBasis.

2.8 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.9 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit .
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 1-Inch (25-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage[**and system or service type**].

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

C. Tag: [**Type I**] <**Insert drawing designation**>:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.10 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [**30**] <**Insert number**> A, and [**120**] <**Insert number**> V to ground: Identify with [**self-adhesive vinyl label**] [**self-adhesive vinyl tape applied in bands**]. Install labels at [**10-foot (3-m)**] [**30-foot (10-m)**] maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.

   c. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.

   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where

splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual.

Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches (100 mm) high.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Substations.
    h. Emergency system boxes and enclosures.
    i. Motor-control centers.
    j. Enclosed switches.
    k. Enclosed circuit breakers.
    l. Enclosed controllers.
    m. Variable-speed controllers.
    n. Push-button stations.
    o. Power transfer equipment.
    p. Contactors.
    q. Remote-controlled switches, dimmer modules, and control devices.
    r. Battery-inverter units.
    s. Battery racks.
    t. Power-generating units.
    u. Monitoring and control equipment.
    v. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL SYSTEM

1. GENERAL SUMMARY

A. THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF IT WERE WRITTEN HEREIN:
   i. 265100-INTERIOR LIGHTING
   ii. 265600-EXTERIOR LIGHTING

B. RELATED SECTIONS
   i. Drawings and provisions necessary for any contractual agreement, including the following section(s)

2. DEFINITIONS

A. BAS: Building Automation System
B. IP: Internet protocol
C. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event alarm signals, tabulated reports, and event logs.
D. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A

3. SYSTEM DESCRIPTION

A. DESIGN PERFORMANCE REQUIREMENTS
   i. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) stand-alone lighting control zones 3) network backbone for remote or time based operation.
   ii. Intelligent lighting control devices shall consist of one or more basic lighting control components: occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
   iii. System must interface directly with intelligent LED luminaires such that only CAT-5e cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section)
   iv. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.
   v. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

vi. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
vii. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
viii. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
ix. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone "bus power supplies" shall not be required in all cases.
x. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
xi. System shall have one or more primary wall mounted network control "gateway" devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
xii. System shall use "bridge" devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.
xiii. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.
xiv. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
xv. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or Wi-Fi backbone.
xvi. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
    1. Auto-On / Auto-Off (via occupancy sensors)
        a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
        b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
        c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
    2. Manual-On / Auto-Off (also called Semi-Automatic)
        a. Pushing a switch will turn lights on.

b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Manual-On to Auto-On/Auto-Off
    a. Pushing a switch will turn lights on.
    b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
    c. Sequence can be reset via scheduled (ex. daily each morning) events
4. Auto-to-Override On
    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
    b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
    c. Sequence can be reset via scheduled (ex. daily each morning) events
5. Manual-to-Override On
    a. Pushing a switch will turn lights on.
    b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
    c. Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
7. Multi-Level Operation (multiple lighting levels per manual button press)
    a. Operating mode designed specifically for bi-level applications
    b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
    c. Eliminates user confusion as to which of two buttons controls which load
    d. Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
    e. Depending on the sequence selected, every button push steps through relays states according to below table:

	Alternating Sequence		Full On Sequence		3 Step On Sequence	
Sequence State #	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On
3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(*step only present for devices without separate off button)

f. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to "step" in a sequence that achieves bi-level operation is present.
g. A taskbar style desktop application shall be available for personal lighting control.
h. An application that runs on "smart" handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.
i. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.
j. Control software shall enable integration with a BMS via BACnet IP.
k. System shall provide the option of having pre-terminated plenum rated CAT-5e cabling supplied with hardware.

4. SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)
B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
C. Other Diagrams – as needed for special operation or interaction with other system(s)
D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
E. Hardware and Software Operation Manuals
F. Other operational descriptions as needed
G. Owner Training Documentation
H. Contractor Installation Training Documentation

5. QUALITY ASSURANCE

A. NEMA Compliance: All system components shall comply with all applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
B. UL Approval: All applicable equipment shall be tested to and listed under UL standard 508 and shall bear labels to indicate compliance. System listed by ETL or under other UL sections shall provide documentation proving compliance with UL standard 508 and/or 916 as applicable.
C. NEC Compliance: All system components shall comply with all applicable sections of the National Electrical Code (NEC) as required.
D. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
E. All components and the manufacturing facility where product was manufactured must be ROHS compliant.
F. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
G. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

2. COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.
B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.
C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

3. WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

4. PRODUCTS

A. APPROVED MANUFACTURERS
    i. The following manufacturers have been approved and will be allowed to bid, provided the submittal clearly indicates the design criteria and performance of specifications indicated in Lighting Control System Specification 26.00.00
        1. **nLight® Network Control System** from **Sensor Switch**, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).
    ii. **nLight Network Control System** from Sensor Switch is the basis of design.
    iii. All other manufacturers not listed will require (2) sets of a side by side comparison noting any deviation from product specified in their submittal

documentation submitted to the engineer (7) days prior to bid date. The specifying engineer must approve any proposed substitutions in writing by addendum. The document requirements may include, but are not limited to, the following:

1. Full layout and design of each control area clearly mapping every individual device necessary for a complete working system.
2. Wiring and delineation of all parts and devices
3. Submittal riser diagrams with specification sheets and instruction sheets for all devices in the system proposed

5. INDIVIDUAL DEVICE SPECIFICATION

A. Control Module (Gateway)

i. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
ii. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
iii. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
iv. Device shall automatically detect all devices downstream of it.
v. Device shall have a standard and astronomical internal time clock.
vi. Device shall have one RJ-45 10/100 Base T Ethernet connection.
vii. Device shall have a USB port
viii. Each control gateway device shall be capable of linking 1500 devices to the management software.
ix. Device shall be capable of using a dedicated or DHCP assigned IP address.
x. Network Control Gateway device shall be the following Sensor Switch model Series:

nGWY2

B. Networked System Occupancy Sensors

i. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
ii. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic based sensing technologies shall not be accepted.
iii. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.
iv. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Infrared/Automatic Gain Control Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants.
v. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as

these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology.

vi. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

vii. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.

viii. Sensors shall be available in multiple lens options which are customized for specific applications.

ix. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5e low voltage cabling with RJ-45 connectors.

x. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5e connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

xi. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

xii. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5e cabling.

xiii. Sensors shall be equipped with an automatic override for 100 hour burn-in of fluorescent lamps. This feature must be available at any time for lamp replacements.

xiv. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.

xv. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

xvi. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.

xvii. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)

xviii. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls

xix. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:

nWSX (PIR, 1 Relay)

nWSX PDT (Dual Tech, 1 Relay)

nWSX PDT LV (Dual Tech w/ Night Light, No Relay, Raise/Lower Dim Ctrl)

xx. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.

xxi. Fixture mount sensors shall be capable of powering themselves via a line power feed.
xxii. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
xxiii. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
xxiv. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM(B) 9	1	-	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nCM(B) 6	1	-	High Bay	PIR

C. Networked System Daylight (Photocell and or Dimming) Sensors
i. Photocell shall provide for an on/off set-point, and a dead-band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
ii. Photocell and dimming sensor's set-point and dead-band shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
iii. Dead-band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
iv. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
v. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
vi. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
vii. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
viii. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
ix. Sensor shall be the following Sensor Switch model numbers, with device options as specified:

nCM(B) PC (on/off))

nCM(B) ADC (dimming)

nCM(B) PC ADC (on/off, 0-10 VDC dimming)

nCMR(B) PC (on/off, single relay)

nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

D. Networked System Power (Relay) Packs
   i. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
   ii. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
   iii. All devices shall have two RJ-45 ports.
   iv. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
   v. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
   vi. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
   vii. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
   viii. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
   ix. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
   x. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
   xi. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
   xii. Specific Secondary Packs shall be available that control louver/damper motors for skylights.

xiii. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

xiv. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:

nPP16 (Power Pack w/ 16A relay)

nPP16 D (Power Pack w/ 16A relay and 0-10VDC dimming output)

nSP16 (Secondary Pack w/ 16A relay)

nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)

nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)

nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)

nSP5 PCD MLV (Secondary Pack w/ 5A relay and magnetic low voltage dimming output)

nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)

nPS 80 (Auxiliary Bus Power Supply)

E. Networked System Relay & Dimming Panels

i. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.

ii. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.

iii. Panel shall provide one 0-10VDC dimming output paired with each relay.

iv. Panel shall power itself from an integrated 120/277 VAC supply.

v. Panel shall be capable of operating as either two networked devices or as one.

vi. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5e.

vii. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection

viii. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:

nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)

F. Networked Auxiliary Input / Output (I/O) Devices

i. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.

ii. Devices shall have two RJ-45 ports

iii. Communication and low voltage power shall be delivered to each device via standard CAT-5e low voltage cabling with RJ-45 connectors.

iv. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
v. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
vi. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
vii. Specific I/O devices shall sense state of low voltage outdoor photocells
viii. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
ix. Specific I/O devices shall sense.
x. Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:

nIO D (I/O device with 0-10 dimming output)

nIO 1S or **nIO RLX** (I/O device with contact closure or 0-10VDC dimming input)

nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in **nIO PC KIT** only)

nIO X (Interface device for communicating with RS-232 enabled AV Touch Screens

G. Networked System Wall Switches & Dimmers
i. Devices shall recess into single-gang switch box and fit a standard GFI opening.
ii. Devices shall be available with zero or one integrated Class 1 switching relay.
iii. Communication and low voltage power shall be delivered to each device via standard CAT-5e low voltage cabling with RJ-45 connectors.
iv. All sensors shall have two RJ-45 ports.
v. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
vi. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
vii. Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by syncing up to 20 mA of current (typically 40 or more ballasts).
viii. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
ix. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
x. Devices with mechanical push-buttons shall be made available with custom button labeling
xi. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

xii. Wall switches and dimmers shall be the following Sensor Switch model numbers, with device options as specified:

nPODM (single on/off, push-buttons, LED user feedback)

nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)

nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)

nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

H. Communication Bridges
   i. Device shall surface mount to a standard 4" x 4" square junction box.
   ii. Device shall have 8 RJ-45 ports.
   iii. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
   iv. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5e cabled connection.
   v. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
   vi. Communication Bridge devices shall be the following Sensor Switch model numbers:

nBRG 8 (8 Ports)

6. LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.
F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

7. MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software
B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
D. A printable network inventory report shall be available via the software.
E. A printable report detailing all system profiles shall be available via the software.
F. Software shall require all users to login with a User Name and Password.
G. Software shall provide at least three permission levels for users.
H. All sensitive stored information and privileged communication by the software shall be encrypted.
I. All device firmware and system software updates must be available for automatic download and installation via the internet.
J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

8. BMS COMPATIBILITY

A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.
B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.
C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

9. Pre-construction Jobsite Visit

A. Pre-construction On-site Services

Project electrical contractor/distributor shall contact Spectrum Lighting – San Antonio to schedule jobsite meeting prior to the beginning of the installation of the lighting control system. Purpose of the meeting is to review installation documentation provided by the system manufacturer and submittals. Discussion should include wiring conventions and specific wiring requirements. Installation of specific devices are also to be addressed. Purpose is to review any questions regarding the installation of the lighting control system by the installing contractor.

Prior to commissioning Spectrum Lighting field service technical shall visit the jobsite to confirm progress and answer any additional questions. Commissioning date is to be confirmed at the time of this visit. Training agenda shall be provided to the contractor/distributor. Contractor/distributor shall confirm owner representative and specifying engineer attendance at lighting system demonstration and/or for training. Contractor/distributor shall provide to field service technician programming information as required for commissioning to include zone assignments, time schedules for operation, presets for all control stations, programming sequences for dynamic LED fixtures, emergency operation, blink warn, and system override. Programming information is required for system set-up and pre-commissioning.

B. Lighting Control System Commissioning and Training

Prior to energizing lighting control system the following must be completed:

No component of the lighting control system shall be energized prior to a factory certified field service engineer has approved the installation of the system by the project electrical contractor. Failure to have a factory certified field service technician approve the installation and commission the system will relieve the manufacturer of the lighting control equipment of all responsibility relating to damaged parts or warranty. The electrical contractor/distributor shall contact Spectrum Lighting at least 3 weeks prior to the requested commissioning date to schedule a field service engineer to be at the jobsite. Request shall be in writing and shall include filled out commissioning request form and dated jobsite photos of the dimmer and/or relay panels.

Lighting Control system is defined as the dimmer/relay panel(s) and all associated control stations and related accessories.

The electrical contractor is responsible to install the entire lighting control system, all power feeders, all load wiring, and control wiring. Equipment shall be installed according to the manufacturer's instructions, contract documents, and national and local codes and regulations.

Equipment shall be plumb and level to the finished floor. All components of the lighting control system shall be clean, free of dust and paint spatters. Components shall be unmarred or damaged. All cable shall be dressed, neatly routed, and labeled. All conduit shall be securely attached to the dimmer/relay panel.

C. Commissioning

Each dimmer/relay panels shall be individually tested with the connected load as designed. Each dimmer/relay should be tested with its connected load as specified. Each dimmer/relay shall be tested by the electrical contractor (with a multi-meter) to confirm what voltage is being passed and to confirm that no voltage is being passed when the circuit is open.

A representative of the owner shall be present to observe the testing/demonstration of the dimmer/relay panels. Each individual dimmer/relay panel shall be load tested with all circuits on while under load for a minimum of 1 hour.

Where external devices are to be attached to the dimmer/relay panel including photocell, occupancy sensor, time clock, and/or control stations, operation of each device should be verified at the panel and specific circuits that are programmed to be controlled by the external device(s).
Where control signals originate from the dimmer/relay panel for control of lighting fixtures, the control signal shall be tested by the electrical contractor to confirm that it is being delivered to each lighting fixture. Proper operation of the lighting fixtures shall be confirmed as part of the system testing/demonstration.

D. Training

Training shall be provided for the owner's representative and contractor. Prior to commissioning owner's representative and electrical contractor/distributor shall acknowledge receipt of training agenda. Electrical contractor/distributor shall confirm that specifying engineer has been contacted and been invited to attend the system demonstration and/or training. All product and lighting control system documentation and operation's manuals shall be provided by electrical contractor/distributor at the time of training.
Training is to include, but not be limited to: basic operation of lighting control system, set-up of system and control panels, operation of control stations, programming of system, basic be-bugging, and overall system testing. At completion of training session all in attendance shall sign the commissioning technician's field service report to confirm participation in the training session.
Completed field service report shall be submitted to the electrical contractor/distributor and specifying engineer.

E. Follow-up Contact

Approximately 90 days following the commissioning of the lighting control system Spectrum Lighting shall contact the electrical contractor/distributor/owner to confirm that the system is operating correctly and answer any operational questions that have come-up since commissioning.

F. Warranty Review and Follow-up Visit

Approximately 300 days following commissioning of the lighting control system Spectrum Lighting shall contact the owner's representative who attended the system demonstration and training and electrical contractor/distributor to schedule a visit to the jobsite. Visit shall be scheduled so that testing of the lighting control system and related equipment can be conducted without disturbing normal operation of the jobsite. In attendance should be owner's representative and contractor.
The lighting control system shall be demonstrated to confirm operation. All system programming shall be confirmed and when necessary adjusted to meet the set-up or current requirements. When programming needs to be adjusted the new system configuration files shall be forwarded by the field service technician to the system manufacturer, as required. Copies can be provided to owner's representative upon request. Any questions regarding operation of the system shall be addressed at this time. Any lighting control equipment that is not operating as defined by the specification shall be repaired or replaced at the discretion of the field service technician. Projected dates for completion of all changes will be included in the follow-up report. All system changes and updates shall be documented by the field service technician and provided in a written report to the owner's representative, contractor, and specifying engineer.

10. EXECUTION AND INSTALLATION

A. Refer to all recommendations set forth by the manufacturer
B. Preparation
    i. Contractor shall provide a set of floor plan drawings, and shall coordinate with the manufacturer / manufacturer's representative the necessary electronic documents necessary to lay out the drawings
C. It is the manufacturer's responsibility to select the appropriate type of sensor for each room, under the following constraints:
    i. Provide sensors in all spaces required by current IECC. Provide dual technology occupancy sensors in all bathrooms.
    ii. It will the contractor's / manufacturer's responsibility to provide the quantity of sensors required for complete and proper coverage in the control area. Sensors shall be able to detect single or multiple occupants in the room. The contractor shall decide the most effective way to run low voltage wiring, while adhering to manufacturer's layout recommendations
    iii. Adjustments to sensors may be done at the room level, or remote via Sensor View software
    iv. Install low voltage lighting control devices only in electrical boxes that are clean, free from debris, excess building material, and similar matter.
D. Wiring
    i. All branch circuit wiring shall be installed in approved raceway
    ii. Low voltage wiring shall be installed in approved raceway where concealed in inaccessible locations or exposed. Where the low voltage wiring is concealed in accessible ceiling plenums, it may, to the Contractor's option, be routed without a raceway using air, plenum-rated multi-conductor cable. All control wiring shall be minimum 18 AWG stranded copper.
    iii. All low voltage wiring shall be color coded and identified or tagged at terminations to assist with future maintenance.

End of Section

SECTION 262416 - PANELBOARDS

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 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Electronic-grade panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
    c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

E. Mains: Circuit breaker or Lugs only.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
i. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
l. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

8. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

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 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Wall-box motion sensors.
4. Isolated-ground receptacles.
5. Snap switches and wall-box dimmers.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
5.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Hubbell; CR 5253IG.
      b. Leviton; 5362-IG.
      c. Pass & Seymour; IG6300.

   2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; GF20.
      b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; L520R.
      b. Hubbell; HBL2310.
      c. Leviton; 2310.
      d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Hubbell; IG2310.
      b. Leviton; 2310-IG.

   2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap.

Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 2221L.
      b. Hubbell; HBL1221L.
      c. Leviton; 1221-2L.
      d. Pass & Seymour; PS20AC1-L.
   2. Description: Single pole, with factory-supplied key in lieu of switch handle.

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 1995.
      b. Hubbell; HBL1557.
      c. Leviton; 1257.
      d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 1995L.
      b. Hubbell; HBL1557L.
      c. Leviton; 1257L.
      d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 6111 for 120 V, 6117 for 277 V.
      b. Hubbell; WS1277.
      c. Leviton; ODS 10-ID.
      d. Pass & Seymour; WS3000.
      e. Watt Stopper (The); WS-200.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; AT120 for 120 V, AT277 for 277 V.
      b. Leviton; ODS 15-ID.
   3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Hubbell; ATP1600WRP.
      b. Leviton; ODWWV-IRW.
      c. Pass & Seymour; WA1001.
      d. Watt Stopper (The); CX-100.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200.

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP120HBRP.
b. Leviton; ODWHB-IRW.
c. Pass & Seymour; HS1001.
d. Watt Stopper (The); CX-100-3.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

F. Exterior Occupancy Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; PS200-10.
b. Watt Stopper (The); EW-100-120.
c.

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.8 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

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 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. 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.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.

2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, time delay.
2. Feeders: Class L, time delay.
3. Motor Branch Circuits: Class RK1, time delay.
4. Other Branch Circuits: Class RK1, time delay.
5. Control Circuits: Class CC, fast acting.

B. Plug Fuses:

1. Motor Branch Circuits: Type S, dual-element time delay.
2. Other Branch Circuits: Type S, dual-element time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
3. Lugs: Compression type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Lugs: Compression type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 262816

SECTION 265600 - 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 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s).

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factors: 1.0.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
   a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load

imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

F. Field quality-control reports.

G. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty

period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings. Contractors wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications.

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.

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 relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping 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. 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.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. 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.

L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.

M. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Dark bronze.

N. 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.

2.3 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.

2.4 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.5 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.6 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.7 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: As specified on fixture schedule.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

H. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

I. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As indicated by manufacturer's designations.

2.8 ALUMINUM POLES

A. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: As specified on fixture schedule.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as luminaire.

E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Dark bronze.

2.9 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

F. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.5 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 Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. 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 Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.

3. Ground metallic components of pole accessories and foundations.

3.7 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600

SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 310513 - Aggregates for Earthwork.
   2. Section 320516 - Aggregates for Exterior Improvements.
   3. Section 312213 - Rough Grading.
   4. Section 312323 - Backfill.
   5. Section 312317 - Trenching.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. 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.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

PART 2 PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material:Perform in accordance with ASTM D698.

C. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698.

D. When tests indicate materials do not meet specified requirements, change material and retest.

E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials subsoil and topsoil not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing surface debris.
2. Removing designated trees, shrubs, and other plant life.
3. Removing abandoned utilities.
4. Excavating topsoil.

B. Related Sections:
1. Section 312213 - Rough Grading.
2. Section 312318 - Rock Removal.

PART 2 EXECUTION

2.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

2.2 PREPARATION

A. Call Local Utility Line Information not less than three working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

2.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

2.4 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs within marked areas. Remove stumps.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

2.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

D. Do not burn or bury materials on site. Leave site in clean condition.

2.6 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.

D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, compacting site for site structures, building pads.

B. Related Sections:
1. Section 310513 - Soils for Earthwork: Soils for fill.
2. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
3. Section 311000 - Site Clearing: Excavating topsoil.
4. Section 312316 - Excavation and Fill: Building excavation.
5. Section 312318 - Rock Removal.
6. Section 312323 - Backfill: General building area backfilling.
7. Section 312317 - Trenching: Trenching and backfilling for utilities.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. 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.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

PART 2 EXECUTION

2.1 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in continuous layers and compact as required.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

2.3 FIELD QUALITY CONTROL

A. Perform in place compaction tests in accordance with the following:
   1. As required by geotechnical engineer.

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil densification.
2. Excavating for building foundations.
3. Excavating for slabs-on-grade.
4. Excavating for site structures.

B. Related Sections:
1. Section 310513 - Soils for Earthwork: Stockpiling excavated materials.
2. Section 310516 - Aggregates for Earthwork: Stockpiling excavated materials.
3. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 312318- Rock Removal: Removal of rock during excavating.
5. Section 312323- Backfill.
6. Section 312317 - Trenching: Excavating for utility trenches.

1.2 REFERENCES

A. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

B. Local utility standards when working within 24 inches of utility lines.

PART 2 EXECUTION

2.1 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade.

C. Excavate to working elevation for piling work.

D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 02320 and Section 02324.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Trim excavation. Remove loose matter.

G. Notify Architect/Engineer of unexpected subsurface conditions.

H. Correct areas over excavated with structural fill.

I. Remove excess and unsuitable material from site.

J. Repair or replace items indicated to remain damaged by excavation.

2.2 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil treatment for termite control.

B. Related Sections:
   1. Section 310513 - Soils for Earthwork: Backfill materials.
   2. Section 312316 - Excavation and Fill: Subgrade preparation.
   3. Section 033000 - Cast-In-Place Concrete: Slabs on grade and foundations placed over treated soil.

1.2 REFERENCES

A. Environmental Protection Agency:
   1. EPA FIFRA - Federal Insecticide, Fungicide and Rodenticide Act.

B. National Pest Management Association:
   1. NPMA WDO - Wood Destroying Organism Library.

1.3 SUBMITTALS

A. Product Data: Submit toxicants to be used, composition by percentage, dilution schedule, intended application rate. Include product label information.

B. Test Reports: Indicate regulatory agency approval reports.

C. Manufacturer's Application Instructions: Indicate caution requirements and in accordance with current product label of chosen pesticide.

D. Certify applications followed NPMA WDO for termite control or other regional location guidance.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record moisture content of soil before application, date and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage.

B. Operation and Maintenance Data: Indicate re-treatment schedule.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing the Work of this sectionand licensed in State of Texas.

1.6 SEQUENCING

A. Section 011000 - Summary: Work sequence.

B. Apply toxicant immediately prior to installation of vapor barrier under slabs-on-grade in accordance with product label supplemented by the NPCA’s ARP for termiticiding or local requirements.

1.7 WARRANTY

A. Warranty: Include coverage for damage and repairs to building and building contents caused by termites. Repair damage. Re-treat where required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Toxicant Chemical: EPA FIFRA approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

2.2 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements:Verification of existing conditions before starting work.

B. Verify soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

C. Verify final grading and excavation are complete.

3.2 APPLICATION

A. Apply toxicant at locations indicated in Schedule at end of section.

B. Apply extra treatment to structure penetration surfaces including pipe or ducts, and soil penetrations including grounding rods or posts.

C. Re-treat disturbed treated soil with same toxicant as original treatment.

D. When inspection or testing identifies presence of termites, re-treat soil and re-test.

3.3 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution Requirements: Protecting finished Work.

B. Do not permit soil grading over treated work.

END OF SECTION

SECTION 31 63 29

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Machine drilled shaft.
   2. Placing shaft liner.
   3. Shear rings.
   4. Concrete fill.
   5. Reinforcement.

B. Related Sections:
   1. Section 032000 - Concrete Reinforcement: Requirements for concrete reinforcement.
   2. Section 033000 - Cast-In-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 336.1 - Reference Specification for the Construction of Drilled Piers.

B. ADSC - The International Association of Foundation Drilling:
   1. ADSC TL-4 - Drilled Shafts: Construction Procedures and Design Methods.

C. ASTM International:
   1. ASTM A252 - Standard Specification for Welded and Seamless Steel Pipe Piles.
   2. ASTM D1143 - Standard Test Method for Piles Under Static Axial Compressive Load.
   3. ASTM D4380 - Standard Test Method for Density of Bentonitic Slurries.
   4. ASTM D4381 - Standard Test Method for Sand Content by Volume of Bentonitic Slurries.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Store and handle controlled slurry materials in accordance with manufacturers instructions.

C. Mix, store, and transport controlled slurry materials using equipment made for this purpose.

PART 2 PRODUCTS

2.1 DRILLED CONCRETE PIERS AND SHAFTS

A. Concrete Materials and Mix: Specified in Section 033000.

B. Reinforcement: Specified in Section 032000.

C. Equipment: Appropriate to dewater excavated shaft.

D. Controlled Slurry:
1. Use controlled bentonite or polymer slurry only at locations specified or indicated on Drawings.
2. Bentonite and Polymer Materials: Suitable for intended purpose according to manufacturer.
3. Controlled Slurry Properties:

Properties	Results at 68EF	Test Methods
Density, before concreting, for slurry 1 ft from pier bottom	64 pcf max.for polymer slurry	API 13B,Section 1 (Mud Balance)
	85 pcf max for bentonite slurry	ASTM D4380
Marsh funnel viscosity, for entry slurry and pier slurry	26-50 sec/qt	API 13B,Section 2 (Marsh Funnel and Cup)
Sand content by volume, before concreting for slurry 1 ft from pier bottom	1% max for polymer slurry	API 13B,Section 4 (Sand Screen Set)
	25% max for bentonite slurry	ASTM D4381
pH, during excavation	8-12	API 13B,Section 6 (Paper test strips or glass-electrode pH meter)

4. Provide physical or chemical treatment of water or slurry necessary to meet specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready for Work of this section.

3.2 PREPARATION

A. Use placement method that will not cause damage to nearby structures.

B. Document existing conditions for existing structures susceptible to damage:
   1. Before move, inspect existing structure thoroughly and notify Architect/Engineer in writing of visible defects and factors capable of affecting safe movement of structure to final location.
   2. Compile list of existing visible defects to building structure, finishes, and accessories. This list will form basis for determining required repair Work after move.

C. Notify adjacent and affected land owners and building occupants within 14 days before proceeding with the Work.

D. Notify utility companies to mark location of existing underground services. Do not begin work of this section until existing underground services are marked.

E. Provide survey benchmarks and control points before beginning construction of piers.

F. Protect underground utilities and structures near the Work, from damage.

3.3 INSTALLATION

A. Drill vertical pier shafts to diameters and depths indicated.

B. Place steel liners immediately after drilling. Set firmly in place. Use shaft liner when free water is encountered.

C. Clean shaft and bottom of loose material. Maintain shafts free of water.

D. Allow inspection of shaft and liner prior to placement of reinforcement and concrete.

E. Provide dowels for connection of caps and grade beams.

F. Concreting: In accordance with Section 03300 and the following requirements:
   1. General:
      a. Do not place concrete before Architect/Engineer has inspected pier.
      b. Inspect piers before concreting, to verify loose material within pier has been removed.
      c. Place concrete immediately after completion of cleaning operation and inspection. When concreting is postponed, repeat cleaning and inspection.
      d. Place concrete in one continuous operation without cessation from bottom of pier to cut-off elevation to ensure complete homogeneity of concrete throughout pier with no possibilities of cavities, air pockets, honeycombing or cold joints forming in concrete.

e. Concrete Slump Dry Method: 5 to 6 inches.

3.4 DRILLING TOLERANCES

A. Section 014000 - Quality Requirements Tolerances.

B. Tolerances for deviations from design position, orientation and elevation:
1. Maximum Deviation from Position at Top of Shaft: 3 inches.
2. Maximum Deviation of Pier Shaft Radius at Bottom of Shaft: Minus 0 inches.
3. Maximum Deviation of Pier Cut-Off Elevations: Plus 1 inch and minus 3 inches.

C. Furnish corrective design and construction required to accommodate deviations exceeding specified tolerances, including replacement of piers, when necessary.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and Section inspection services.

B. Engage licensed surveyor to perform survey work specified in this section, including survey of design and actual pier locations, and plumbness.

C. Monitor benchmarks and survey control points for displacement during construction. Correct or replace displaced survey controls. Verify previous measurements relying on displaced controls.

D. Submit survey information as the Work progresses, to expedite construction operations.

E. Contractor Supervision: Provide supervision of each phase of drilled pier construction. Check each drilled pier or shaft for required depth, clean-up, workmanship, and for tolerance requirements before concrete is placed.

F. Unacceptable Piers: Piers that fail, are placed out of position, exceed allowable tolerances, have defect inclusions, or are damaged.

G. Provide additional piers or replace piers failing to conform to specified requirements.

END OF SECTION

SECTION 321416 - UNIT PAVING

GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brick pavers on sand bed.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 04 0513 - Masonry Mortaring.
   3. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. C902 - Standard Specification for Pedestrian and Light Traffic Paving Brick.

1.3 SUBMITTALS

A. Submittals for Review:
   1. Product Data: Descriptive data for pavers.
   2. Samples: Full size paver samples in each size and color.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years documented experience in work of this Section.

B. Mockup:
   1. Size: Minimum 4 x 8 feet.
   2. Show: Paver color and texture, maximum color range, paver pattern, and joint profile.
   3. Locate where directed.
   4. Approved mockup may remain as part of the Work.

1.5 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not install mortar when surrounding air or substrate surface temperature is below 40 degrees F or above 90 degrees F during or 48 hours after completion of the work.
   2. Do not install mortar when wind velocity exceeds 15 MPH or relative humidity exceeds 70 percent.
   3. At end of working day and during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Innovative Block of South Texas, Ltd.
   2. Acme Brick Co. (www.brick.com)
   3. Belden Brick Co. (www.beldenbrick.com)
   4. Endicott Clay Products. (www.endicott.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Brick Pavers:
   1. ASTM C902, Class MX, Type I.
   2. Size: Nominally 4 x 8 x 2-1/4 inch thick.
   3. Color and surface finish: Smooth with mix of 4 colors to match existing brick pavers at park.

2.3 ACCESSORIES

A. Sand: ASTM C33, sharp, normal weight sand, 3/8 inch maximum particle size.

B. Joint Sealers: Specified in Section 07 9200.

C. Masonry Cleaner: Type recommended by masonry manufacturer.

2.4 MIXES

A. Setting and Pointing Mortar: Specified in Section 04 0513.

PART 3 EXECUTION

3.1 PAVER INSTALLATION - SAND BED METHOD

A. Place sand to minimum 1-1/2 inch compacted thickness.

B. Screed off to true surface at required line and grade.

C. Lightly wet and roller compact to uniform density.

D. Place pavers in pattern as existing park paver design.

E. Place and tamp each brick individually.

F. Place half units or special shaped units at edges and interruptions. Machine saw partial units.

G. Spread sand over completed pavers and sweep into joints. Remove excess sand.

H. Allowable Tolerances: Surfaces true to level or indicated slopes with plus or minus 1/4inch in 10 feet tolerance.

3.2 CLEANING

A. Protect adjacent and underlying surfaces.

B. Apply masonry cleaner in accordance with manufacturer's instructions.

C. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

END OF SECTION

SECTION 321500 - AGGREGATE SURFACING, SOIL BARRIER, EDGINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate surfacing.
   2. Soil barrier.
   3. Edgings.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).
   2. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

1.3 SUBMITTALS

A. Submittals for Review:
   1. Samples:
      a. 1 pint containers of proposed aggregate illustrating color, size, and gradation.
      b. 12 inch length of proposed composite edging illustrating color and size.
      c. 12 x 24 inch soil barrier samples.

1.4 QUALITY ASSURANCE

A. Furnish aggregate from single source throughout Work.

1.5 PROJECT CONDITIONS

A. Do not place aggregate on soft, muddy, or frozen surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate:
   1. Type: Decomposed granite.
   2. Size: 3/8”
   3. Color: Buff

2.2 ACCESSORIES

A. Soil Barrier: Geosynthetic fabric manufactured specifically for control of weeds under paving or in landscape areas.
   a. Basis of Design: **MIRAFI 140N** or Approved Equal.

B. Edging: Composite, 6 inches high, 20 foot length, with pre-drilled composite stakes.
   a. Basis of Design: **Epic Edge 6 x 20' by Epic Plastics** or Approved Equal.

C. Herbicide: Non-selective type; submit for approval.

PART 3 EXECUTION

3.1 PREPARATION

A. Correct irregularities in subgrade gradient and elevation by scarifying and reshaping.

B. Compact subgrade to minimum 95 percent of ASTM D698 standard Proctor maximum dry density at or near optimum moisture content.

C. Apply herbicide in accordance with manufacturer's instructions. Allow vegetation to die before proceeding.

3.2 INSTALLATION

A. Install edging to lines and profiles indicated, with ends nested. Secure with stakes at ends and maximum 24 inches on center.

B. Place soil barrier over subgrade; install in accordance with manufacturer's instructions.

C. Spread aggregate over subgrade in maximum 1-1/2" inch lifts to minimum 4 inch compacted thickness.

D. Level and contour surfaces to elevations and gradients indicated.

E. If necessary, add small quantities of fine aggregate to assist in compaction.

F. Roller compact each lift to minimum 90 percent relative density.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

H. Tolerances:
   1. Maximum variation from flat surface: 1/4 inch in 10 feet.
   2. Maximum variation from thickness: 1/4 inch.
   3. Maximum variation from elevation: 1/2 inch.

END OF SECTION

Leo Peña Placita Park
Mobility Improvement Project
Mission, TX

SECTION 32 18 22 - SYNTHETIC PLAYGROUND TURF

Artificial Turf – SoftLawn Bermuda Blend –CX133

PART 1 – GENERAL

1.01 WORK

A. Furnishing, delivery, installation and warranty of a complete synthetic turf system including drainage, synthetic turf, and resilient infill material.

1.02 RELATED SECTIONS

A. Section 02300 – Earthwork
B. Section 321123 – Aggregate subbase

1.03 REFERENCES

A. ATSM Standard Test Methods
    - D1577 – Standard Test Method for Linear Density of Textile Fiber
    - D5848 – Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
    - D418 – Standard Test Method for Testing Pile Yarn Floor Covering Construction
    - D1338 – Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
    - D1682 – Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
    - D5034 – Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
    - F1551 – Standard Test Methods for Water Permeability
    - D2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
    - F355 – Standard Test Method for Shock-Absorbing Properties of Playing Surfaces
    - D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
B. STC Suggested Guidelines for the Essential Elements of Synthetic Turf Systems

1.04 PROJECT CONDITIONS

A. Coordinate all work with the work of other sections to avoid delay and interference with other work.
B. Protect excavations by shoring, bracing sheeting, underpinning, or other methods as required to prevent cave-ins or loose dirt from entering excavations. Barricade open excavations and post warning lights at work adjacent to public streets and walks.

1.05 SITE INSPECTION

A. The inspection shall include a check for planarity. The finished surface shall not vary from a true plane more than 1/4" in 10 feet when measured in any direction. The Contractor shall provide all required tools and materials needed for the planarity check, which may include but not be limited to, a laser level, string line, straight edge and/or other assessment materials. The Contractor shall mark in the field any deviations from grade in excess of those specified above, as well as provide a marked up plan locating the deviations. The Contractor shall correct any deviations to the satisfaction of the Engineer and Synthetic Turf installer.
B. The compaction of aggregate base shall be 95% to Standard Proctor and surface tolerances shall not exceed ¼" over 10 feet.
C. The Contractor shall have a state registered surveyor conduct an elevation survey of the area in a 25' grid to determine and verify that subgrade elevations and slopes are within previously specified tolerances. This elevation survey may require further verification of smaller areas within the 25' grid if determined necessary by the Engineer.
D. When any or all corrective procedures have been completed, the finished sub-base surface must be re-inspected, with the same representatives attending as the initial inspection. If required, additional repair and inspections are to be conducted until the subbase surface is deemed acceptable by the Engineer and Synthetic Turf Installer
E. Once the sub-base surface has been deemed acceptable, the Contractor shall submit a written certificate indicating the acceptance of:
    1. The sub-base construction finished surface as totally suitable for the application of the selected synthetic turf system, and
    2. The sub-base construction as totally suitable for work under this section to proceed with the final installation and fully warrant the athletic surface installation for the period and conditions specified herein.
F. Commencement of work under this section shall constitute acceptance of the work completed under other sections by the Contractor, acceptance of dimensions of the subbase, and hence, no claims for extra work based upon these conditions will be permitted.

1.06 ENVIRONMENTAL CONDITIONS

A. Install synthetic turf surfacing only when ambient air temperature is 35 F or above and the relative humidity is below 35% or as specified by the product manufacturer. Installation will not proceed if rain is imminent.
B. Install product only when prepared base is suitably free of dirt, dust, and petroleum products, is moisture free and sufficiently secured to prevent unwanted pedestrian and vehicular access.
C. Maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
D. Adjacent streets, sidewalks, and property shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.

1.07 QUALITY CONTROL

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Manufacturer:
   1. Basis of design shall be "SoftLawn Bermuda Blend CX133" synthetic turf system as provided by STI®. www.synthetic-turf.com OR APPROVED EQUAL.
   2. Materials other than those listed must be approved 15 days prior by written addendum. Materials from non-approved manufacturers will not be accepted.
   3. Must be experienced in the manufacturing of tall pile synthetic infill grass systems with the same fiber as specified.
   4. Manufacturer must be a member in good standing with the STC.
   5. Manufacturer must utilize best practices as certified by ISO-9001 and ISO-14001.
   6. Manufacturer must be owned and operated in the U.S.A.
   7. Manufacturer must have no periods of insolvency over the last 25 years.

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. The Synthetic Turf Installer must provide competent workmen skilled in this type of synthetic grass installation. All technicians must have installed similar synthetic turf.

C. Prior to the beginning of installation, the Synthetic Turf Installer shall inspect the subbase. The installer will accept the sub-base in writing when the general contractor provides test results for compaction, planarity and permeability that are in compliance with the synthetic turf manufacturer's recommendations and as stated herein.

D. Remove defective Work, whether the result of poor workmanship, defective products or damage, which has been rejected by the Engineer as unacceptable. Replace defective work in conformance with the Contract Documents.

1.08 SUBMITTALS

A. Submit the following with Proposal:
   1. Submit the exact product name/description as well as the name and location of the manufacturers and suppliers of each component. Manufacturers and suppliers must not be changed after the contract is awarded unless approved by the Owner in writing.
   2. Submit two (2) samples, 12"x12" minimum size, illustrating details of finished product as bid, including full cross section of subbase, turf, and infill material.
   3. Product Literature: Submit two (2) copies of manufacturer's recommended installation and maintenance information, including any technical criteria for evaluation of the installed product. Descriptions of all equipment recommended for the maintenance and repair of turf product, as well as a list of any activities not recommended relative to the warranty.
   4. Submit a 1-lb sample of the selected bid infill material(s).
   5. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.

6. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
   a. Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
   b. Primary & Secondary Backing Weights, ASTM D418 or D5848
   c. Tuft Bind, ASTM D1335
   d. Grab Tear Strength, ASTM D1682 or D5034
7. ASTM test submittals may vary by no more than ¼" and 6 oz. of the specified product to bid. Bid winner must show NEW ASTM TESTS with contract submittals.
8. Name and experience of the designated supervisory personnel assigned to this project shall be submitted with the proposal. Changes to this assignment after contract can only be made if approved in writing by the Owner. Include a listing of other on-site personnel and their experience.
9. The Synthetic Turf Installer and Turf Manufacturer shall provide evidence that the turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

1.09 WARRANTY

A. The Contractor shall provide a minimum eight (8) year warranty policy by the manufacturer, against defects in materials and workmanship. Defects shall include, but not be limited to ultraviolet ray fading, degradation, or excessive wear of fiber.
B. Warranty shall be for full replacement of any damaged product within the warranty period. Warranty shall be comprehensive and sufficient to replace all turf if necessary.
C. Warranty shall become effective from the date of substantial completion.
D. The Warranty shall contain no usage limits for warranted turf.
E. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

PART 2 PRODUCTS

2.01 SUPPLIER QUALIFICATIONS

A. The Owner has conducted an extensive review of synthetic turf products, including visiting installed sites and review of other agencies' review criteria. Based upon their research, they have established the following criteria for acceptance of a synthetic turf product. No variation from these criteria shall be allowed. The Owner's review is considered final.
B. The Synthetic Turf Installer shall have minimum experience of at least 5 years, actively selling, installing and maintaining in-fill synthetic turf project of similar size.
C. The Synthetic Turf Installer must provide a list of references based on previous installations.
D. Installation team shall be established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of 5 years' experience with 15 foot wide tufted materials.

2.02 TURF SYSTEM

A. Turf Fiber:
   1. The turf fiber must be tufted to the backing with a minimum tuft bind of 10 pounds.
   2. The tufted fiber weight shall be a minimum of 60 ounces per square yard.
   3. The turf fiber shall be non-abrasive and a minimum of 100 microns thick.
   4. The turf fiber must contain less than 100 ppm of lead chromate in all colors.
   5. The turf fibers must be from the same dye lots.
   6. The turf fibers must be guaranteed for a period of Eight Years not to fade or fail (as distinguished from a change in texture) or have a pile height decrease to 50% of pile height as result of UV degradation.
   7. The turf fiber must retain a minimum of 75% of its original fibril width after 10,000 cycles on the Lisport Studded Roll Test Machine.

   8. The pile fiber shall possess the following characteristics:

Characteristic	Value	Test
Linear Density (Denier)	14200	ASTM D 1577
Yarn Thickness	250 Microns (PE Mono); 100 Microns (PP)	ASTM D 3218
Tensile Strength	103 N (PE Mono);16.5 N (PP)	ASTM D 2256
Pile Weight*	60 oz./yd2	ASTM D 5848
Fiber manufacturer must be from the same source		

The above specifications are nominal. *Values are +/- 5%.

   9. The pile fabric shall possess the following physical characteristics

Characteristic	Value	Test
Finished Pile Height*	1.25" (31.75mm)	ASTM D 5823
Product Weight (total)*	87 oz./yd2	ASTM D 3218
Primary Backing Weight*	7.4 oz./yd2	ASTM D 2256
Secondary coating Weight**	20 oz./yd2	ASTM D 5848
Fabric Width	15' (4.57m)	ASTM D 5793
Tuft Gauge	3/8"	ASTM D 5793
Grab Tear Strength	200-1b-F	ASTM D 5034
Tuft Bind	>10-1b-F	ASTM D 1335
Infill (Sand)	2 lbs Silica Sand	None
Infill (Rubber)	N/A	None

Except where noted as a minimum, the above specifications are nominal.

* Values are +/- 5%. **All values are +/- 3 oz./yd2.

B. Backing Material
   a. Primary Backing:
      i. Primary backing must be a dual layered woven polypropylene material.
      ii. Primary backing system weight must be a minimum of 7.0 ounces/square yard.

b. Secondary Backing:
    i. Secondary backing system weight must be a minimum of 20 ounces/ square yard.
    ii. Secondary backing shall saturate the primary backing and effectively lock the fiber tufts in place to the primary backing.
    iii. Secondary backing must be a heat activated polyurethane coating with no vegetable based polyols.
    iv. Secondary backing system shall have minimum tuft bind strength of 10 pounds.
    v. Secondary backing must have Drainage Perforations: 3/16" to ¼" diameter at 4 inches or less on center each way. Non-perforated backing is not acceptable.

C. Turf roll seams: to be sewn or glued on site so that no openings larger than the porous backing mat openings are created. All turf fabric edges to be securely bound as per the perimeter detail design. Adhesives for joining seams of turf together shall be Nordot 34G Glue, Mapei 2K, Turf Claw, hot melt technology or equivalent. No substitutions.
D. Fabric surface: shall be constructed and installed in minimum widths of 15 feet with no longitudinal or transverse seams.
E. The entire system shall be resistant to weather, including ultra-violet light and heat degradation; insects, rot, mildew and fungus growth and be non-allergenic and non-toxic.
F. The turf material shall be non-combustible and pass the DIN standard Pill Burn test or ASTM D 2859.

2.03 SYNTHETIC GLUE MATERIAL

A. Adhesive products shall be Nordot 34G, Mapei 2K, Turf Claw, hot melt technology or equivalent as approved by the engineer.
B. Any adhesive products required for the installation of a proposed turf system shall be purpose-suited to the system. The material and application methods shall be as recommended by the adhesive manufacturer.
C. Disposal of adhesive containers and unused adhesives as well as any fees resulting from such disposal shall be the responsibility of the Contractor.

2.04 INFILL MATERIAL

A. The synthetic infill material shall consist of a blend of graded, silica sand and treated and mixed ground rubber.
    1. Sand: specially-graded, dust-free silica sand shall be placed on the turf in a minimum quantity of 1 pound/ square foot and shall include test results that demonstrate the following minimum properties:
        a. Color – tan
        b. Sand shall be round non-angular in shape
        c. Roundness – 0.6+
        d. Hardness - 0.6-0.8 on the Mohs Scale
        e. Size – 1.00 mm ± 0.15 mm

f. Density – 90 – 95 lbs/ cu ft.
g. Dust - < 0.001 %
h. Angle of Repose - < 30°
i. Sand shall be heavy metal safe

2. Rubber: Rubber is SBR ambient (styrene butadiene rubber) rubber, color black, 10-18 mesh, that is 99% fiber free and is heavy metal safe. Rubber shall be placed on the turf in a minimum quantity as referenced the table in Section 2.02 in this document and shall be of the following Mesh Size Distribution:

Mesh Size	% Retained
a. 10	0-15%
b. 12	5-30%
a. 16	40-70%
b. 20	15-35%
c. 30	0-10%
d. 40	0-1%
e. Pan	0-1%

PART 3 EXECUTION

3.01 GENERAL

A. Installation of the synthetic turf system is to comply with the manufacturer's recommendations, requirements and the reviewed and approved shop drawings.
B. Perform all work in strict accordance with the Contract Documents and the manufacturer's specifications and instructions. Only those skilled technicians proposed in the bid phase are to be assigned to this project by the Contractor.
C. The designated Supervisor for the Synthetic Turf Installer must be present during any and all construction activity associated with the field installation, including testing, cleanup and training.
D. All products and equipment are to be from sources approved by the authorized turf manufacturer and conform to the specifications.

3.02 PRODUCT DELIVERY, STORAGE & HANDLING

A. Deliver products to site in original containers and wrappers as agreed between the Engineer and Contractor. Inspect products upon delivery for damage.
B. Store products in a location and in a position that protects them from crush damage or any other defects.
C. Handle and store (on and off site) all materials safely to ensure their physical properties are not adversely affected and that they are not subject to vandalism or damage.
D. Rubber and sand infill shall arrive dry and loose.
E. Adhesives shall arrive in dry, sealed containers.

3.03 TURF INSTALLATION

A. Install synthetic turf system in accordance with the manufacturer's written installation instructions.
B. Turf shall be attached to the perimeter edge as shown in the construction plans and as per the manufacturer.
C. All seams shall be brushed thoroughly before infill materials are installed.
D. All terminations shall be as detailed and approved in the shop drawings.

3.04 INFILL INSTALLATION

A. The synthetic turf shall be thoroughly brushed prior to installation of infill materials to remove wrinkles.
B. Turf shall remain free draining at all times before, during and after the infill materials are installed.

3.05 CLEANING AND COMPLETION

A. Protect all installed work from other construction activities as installation progresses.
B. The Contractor shall keep the area clean throughout the construction period and free from the installation process, including track surfaces.
C. Upon completion of the installation, thoroughly clean surfaces and site of all refuse resulting from the installation process, including track surfaces.
D. Any damage to existing fixtures or facilities resulting from the installation of the synthetic turf system shall be repaired to original condition at the Contractor's expense prior to Substantial Completion and commencement of the Warranty Period.
E. A deficiency list will be produced by the Engineer at the conclusion of the project. All installation project deficiencies not in dispute must be remedied by the Contractor prior to the issuance of a certificate of Substantial Completion.
F. Contractor to provide a written acceptance by the Turf Manufacturer that the turf and base system is installed in accordance with their recommendations prior to final completion.

END OF SECTION

SECTION 32 9223 - SODDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sod installation.
   2. Maintenance.
   3. Fertilizing.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. Turfgrass Producers International (TPI) - Guideline Specifications to Sodding.

1.3 SUBMITTALS

A. Quality Control Submittals:
   1. Submit certification for grass species and sod source.

1.4 QUALITY ASSURANCE

A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding upper two corners.

B. Sod Producer: Company specializing in sod production and harvesting with minimum 3 years documented experience, and certified by the State of Texas.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

C. Do not deliver more sod than can be installed within 24 hours.

B. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sod:
   1. ASPA [certified,] [approved,] [nursery grown] [field grown] grade; cultivated grass sod, strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 square feet.
   2. Species: **Tifway 419 Bermuda**

2.2 ACCESSORIES

A. Fertilizer: type recommended for grass with post-emergent herbicide. Provide submittal prior to install for approval.

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.3 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with ASPA Guidelines.

B. Cut sod in area not exceeding 1 square yard, with minimum 1/2 inch and maximum 1 inch topsoil base.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare subsoil; eliminate uneven areas and low spots.

B. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

C. Remove contaminated topsoil.

3.2 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod within 24 hours after harvesting to prevent deterioration.

C. Lay sod tight without open joints and without overlapping; stagger end joints 12 inches minimum. Do not stretch sod pieces.

D. Lay smooth.

E. Place top elevation of sod 1/2 inch below adjoining edging, paving, curbs.

F. On slopes 1:2 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.

G. Immediately after installation, roll sod; remove air pockets, voids, and minor depressions and irregularities.

H. Fill voids between sod pieces with topsoil. Rake excess topsoil into sod but do not smother grass with topsoil.

3.3 WATERING

A. Water sodded areas within 2 hours after installation, to saturation.

B. Continue watering daily using less water; ensure moisture to 4 inch depth but avoid standing water.

C. When root growth is observed by lifting corners of sod, reduce watering to alternating days.

D. After 14 days, if root growth prevents sod corners from being lifted, allow sod to dry to permit mowing.

3.4 MAINTENANCE

A. Maintain lawn areas by watering, mowing, and weeding from date of installation until Substantial Completion.

B. Water to minimum depth of 2 inches; provide temporary hoses and sprinklers for non-irrigated areas.

C. Mow weekly after grass reaches 2 inch height. Neatly trim edges.

D. Remove clippings immediately after mowing and trimming.

E. Remove weeds and foreign grass weekly. Use herbicides only if approved by Architect.

3.5 FERTILIZING

A. After first mowing, apply fertilizer in accordance with manufacturer's instructions.

B. Lightly water to aid in dissipation of fertilizer.

END OF SECTION

SECTION 329413 - TREE ROOT BARRIER

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 Summary
- A. Section Includes:
  1. Furnishing and installation of Tree Root Barrier
- B. Related Sections:
  1. Division 32 – Exterior Improvements

1.3 Definitions
- A. Tree Root Barrier: Plastic mechanical barrier in modular panels used to redirect and guide tree roots down and away from hardscape surfaces.
- B. Linear Application: Installation method of Tree Root Barrier, used in a straight line along the hardscape to be protected.
- C. Surround Application: Installation method of Tree Root Barrier, surrounding a planting area perimeter.
- D. Root Pruning Application: Installation method of Tree Root Barrier, used for existing trees in planting areas where existing roots must be severed for installation.

1.4 Submittals
- A. Product data: Manufacturers standard literature defining materials for use on the Project.
- B. Samples, if required by Architect:
  1. Tree root barrier: One full length panel.
- C. Quality control: Complete installation instructions specified, may be combined with product data.

1.5 Quality Assurance
- A. Manufacturer’s qualifications:
  1. Minimum twenty (20) years experience in tree and plant protection.

1.6 Delivery, Storage and Handling
- A. Packing and Shipping
  1. Provide materials in original, unopened containers with manufacturer’s labels intact and legible.
- B. Acceptance at Site
  1. Damaged materials will not be accepted, as determined by visual inspection.
  2. Rejected materials shall be removed from project site immediately.

C. Storage and Protection
   1. Store materials in dry area in manufacturer's protective packaging, in original containers with labels and instructions intact.

PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers: OR APPROVED EQUAL
   1. Products specified as standard of quality are manufactured by DeepRoot Green Infrastructure, LLC. (DeepRoot), 530 Washington Street, San Francisco, CA 94111; 800.458.7668; fax 800.277.7668; www.deeproot.com
   2. Products meeting standards listed within this specification may be acceptable for use subject to approval of product list and samples.

2.2 MANUFACTURED UNITS

A. Tree Root Barrier
   1. 12" Depth, UB 12-2
      a. Material: black, recyclable, injection molded panel manufactured with 75% reprocessed polypropylene with added ultraviolet inhibitors.
      b. Dimensions: 0.080" (2.03 mm) wall thickness in modules 24" (609 mm) long and 12" (305 mm) deep.
      c. Additional specifications:
         i. 3/8" (9.53mm) wide integral molded 0.060" (1.52mm) thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
         ii. Integral molded vertical root directing ribs; 0.060" (1.52mm) thickness by 1/2" (12.7mm) deep spaced at 6" (152mm) O.C.
         iii. Integral molded horizontal anti-lift ground lock tabs; 0.060" (1.52mm) thickness by 2" (50.8mm) long by 1/2" (12.7mm) wide; minimum three per panel.
         iv. Integral zipper joining system for panel connections.

   2. 18" Depth, UB 18-2
      a. Material: black, recyclable, injection molded panel manufactured with 75% reprocessed polypropylene with added ultraviolet inhibitors.
      b. Dimensions: 0.075" (1.90 mm) wall thickness in modules 24" (609 mm) long and 18" (457 mm) deep.
      c. Additional specifications:
         i. 3/8" (9.53mm) wide integral molded 0.060" (1.52mm) thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
         ii. Integral molded vertical root directing ribs; 0.060" (1.52mm) thickness by 1/2" (12.7mm) deep spaced at 6" (152mm) O.C.

iii. Integral molded horizontal anti-lift ground lock tabs; 0.060" (1.52mm) thickness by 2-1/4" (57.15mm) long by 3/8" (9.53mm) wide; minimum nine per panel.
iv. Integral zipper joining system for panel connections.

3. 24” Depth, UB 24-2
   a. Material: black, recyclable, injection molded panel manufactured with 75% reprocessed polypropylene with added ultraviolet inhibitors.
   b. Dimensions: 0.080” (2.03 mm) wall thickness in modules 24” (609 mm) long and 24" (609 mm) deep.
   c. Additional specifications:
      i. 3/8" (9.53mm) wide integral molded 0.060" (1.52mm) thickness double top edge with stiffening ribs; bottom edge attached to vertical root deflecting ribs.
      ii. Integral molded vertical root directing ribs; 0.060" (1.52mm) thickness by 1/2" (12.7mm) deep spaced at 6" (152mm) O.C.
      iii. Integral molded horizontal anti-lift ground lock tabs; 0.075" (1.90mm) thickness by 2" (50.8mm) long by 1/2" (12.7mm) wide; minimum twelve per panel.
      iv. Integral zipper joining system for panel connections.

4. 36” Depth, UB 36-2
   a. Material: Extruded Homopolymer Polyethylene with ultraviolet inhibitors.
   b. Dimensions: 0.080” (2.03 mm) thick, in modules 24” (609mm) wide and 36” (910 mm) deep.
   c. Integral vertical root directing ribs at 6” (152mm) O.C.
   d. Integral joining system for panel connections.

5. 48” Depth, UB 48-2
   a. Material: Extruded Homopolymer Polyethylene with ultraviolet inhibitors.
   b. Dimensions: 0.080” (2.03 mm) thick, in modules 24” (609mm) wide and 48” (1220 mm) deep.
   c. Integral vertical root directing ribs at 6” (152mm) O.C.
   d. Integral joining system for panel connections.

INSTALLATION

3.1 EXAMINATION

A. Verification of conditions
   1. Verify other work in other sections is complete in order to minimize site impacts by installation of tree root barrier.
   2. Any damage to site work due to installation of tree root barrier shall be repaired at the expense of the Contractor.

3.2 Linear Applications

A. For installation along linear applications of hardscapes:
   1. Assemble the appropriate number of root barrier panels using Zipper Joining System.
   2. Trench immediately adjacent to hardscape to the appropriate depth for installation of specified root barrier so that top of barrier is ½”-1” (12.7mm to 25.4mm) above finished soil grade.
   3. Place root barrier in trench, vertical ribs facing toward planting area and tree roots.
   4. Where possible, use hardscape as a guide for root barrier alignment.
   5. Backfill adjacent planting soil against the root barrier to promote clean fit to hardscape. Fill to finish grade per project specifications.

3.3 Surround Applications

A. For installation within individual tree openings or planters that require root barrier protection along all sides of hardscapes.
   1. Assemble the appropriate number of root barrier panels using Zipper Joining System.
   2. Trench immediately adjacent to hardscape to the appropriate depth for installation of specified root barrier so that top of barrier is ½”-1” (12.7mm to 25.4mm) above finished soil grade.
   3. Place root barrier in trench, vertical ribs facing toward planting area and tree roots.
   4. Where possible, use hardscape as a guide for root barrier alignment.
   5. Backfill adjacent planting soil against the root barrier to promote clean fit to hardscape. Fill to finish grade per project specifications.
   6. Distribute soil evenly to maintain the shape of the root barrier and compact per project specifications.

3.4 Silva Cell System Applications

A. For installation within and adjacent to Silva Cell system applications.
   1. Assemble the appropriate number of root barrier panels using Zipper Joining System.
   2. Trench immediately adjacent to Silva Cell frames to the appropriate depth for installation of specified root barrier so that top of barrier is ½”-1” (12.7mm to 25.4mm) above finished soil grade.
   3. Place root barrier in trench, vertical ribs facing toward planting area and tree roots.
   4. Where possible, use hardscape as a guide for root barrier alignment.
   5. Backfill adjacent planting soil against the root barrier to promote clean fit to hardscape. Fill to finish grade per project specifications.
   6. Distribute soil evenly to maintain the shape of the root barrier and compact per project specifications.

END OF SECTION

LEO PEÑA PLACITA PARK RENOVATIONS

CIVIL TECHNICAL SPECIFICATIONS

SECTION	DESCRIPTION
Section 02221	Trench Excavation, Backfill and Compaction
Section 02580	Storm Sewer Appurtenances
Section 02590	Reinforced Concrete Pipe
Section 02601	Flexible Base
Section 02612	Hot Mix Asphalt Concrete Pavement
Section 02660	Concrete Curb and Gutter and Valley Gutter
Section 03300	Cast In Place Concrete
Section 19000	Trench Protection System

SECTION 02221 TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.

B. All work must be done in accordance with these specifications and the safety requirements of the State Of Texas and OSHA Standards.

1.02 JOB CONDITIONS:

A. Site Acceptance:
1. Accept site in condition existing during Contract time frame.
2. Ground water/surface water found during construction are conditions of the contract and responsibility of Contractor.

B. Adverse Weather:
1. Place no backfill that is excessively wet or frozen.
2. Place no backfill in excessively wet or frozen trenches.

PART 2 - PRODUCTS

2.01 PIPE BEDDING AND BACKFILL:

A. The type of bedding shall be stated on the Plans or in the Special Provisions of the contract document. Determination of source of materials for bedding and backfill to meet the stated conditions shall be responsibility of CONTRACTOR, but use of such materials shall be subject to approval of ENGINEER.

B. Excavated Material Backfill:
Excavated material may be used in the trench backfill, provided that all hard rock and stones having any dimensions greater than 6 inches and frozen earth debris and roots larger than 2 inches are removed for the initial backfill.

C. Select Backfill:
Select backfill shall be gravel, fine rock cuttings, sand, sandy loam or loam free from excessive clay. Rock cuttings shall have no dimension greater than 2 inches.

D. Sand Backfill:
Sand backfill shall be clean, hard, durable, uncoated grains, free from lumps and organic material. All sand materials must pass a No. 8 Sieve.

E. Granular Backfill:
Granular backfill shall be free flowing, such as sand or hydraulically graded stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 2 inches in diameter, clay and organic matter.

F. Controlled Density Fill:
Use high slump mixture of portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal. Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

G. Thermoplastic Pipe Backfill:
Use a cohesionless material, such as sand, crushed stone, or pea gravel, with a maximum size not exceeding 3/8 inch.

2.02 CRADLING ROCK:

A. Use crushed rock or stone with 70-100% passing 1> inch sieve and no more than 50% passing 1 inch sieve, and no stones over 2 inches in diameter.

2.03 SHEETING, SHORING AND BRACING:

A. Use sound timber or structural steel in the shapes and sizes required in accordance with Section 19000, Trench Protection System.

PART 3 - EXECUTION

3.01 GENERAL:

A. Dewatering:

1. Execute work "dry". No pipe or conduits shall be laid or concrete poured on excessively wet soil.

2. Prevent surface water from flowing into excavation.

3. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.

4. No sanitary sewer shall be used for disposal of trench water.

B. Protection of Existing Utilities:

1. Notify all utilities of location and schedule of work.

2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility OWNER and ENGINEER of conflicts between existing and proposed facilities.

3. Repair, relay, or replace existing utilities damaged, destroyed, or disrupted during work. Unless specified otherwise, replacement will be at the CONTRACTOR'S expense.

C. Sheeting, Shoring and Bracing:

1. Provide as required in accordance with Section 19000 Trench Protection System, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.

2. Leave sheeting and shoring in place where removal might cause damage to work or otherwise indicated on drawings. If left in place, cut sheeting 18 inches or more above top of pipe.

3. Movable trench shield shall not be used below the spring line of the pipe unless authorized in writing by the ENGINEER. When movable trench shield is allowed in writing by the ENGINEER below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade:

1. Grades may be adjusted 1.5 feet (plus or minus) from plan grades to suit unforeseen construction conflicts or conditions with approval of ENGINEER.

2. No additional compensation will be made for such changes.

3.02 EXCAVATION AND TRENCHING:

A. General:

1. Method of excavation at CONTRACTOR'S option.

2. Excavate by hand under tree roots 3 inches and larger, and under and around structures and utilities.

3. Stockpile and replace topsoil to a minimum of 8 inches for surface restoration in grassed or agricultural areas.

B. Trench Characteristics:

1. Depth: as indicated on plans for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.

2. Width:

a. Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing.

b. Maximum width as follows:

Pipe Size Inches	Max. Trench Width
4 & 6	2'-0"
8 & 10	2'-4"
12	2'-6"
15	2'-9"
18	3'-0"
Over 18	Pipe O.D. + 12"

3. Trench walls must be vertical from trench bottom to 12 inches above top of pipe and above that may be vertical or sloped above pipe to conform to excavating safety codes.

4. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.

5. Trench bottom shall be free of large stones and other foreign material.

3.03 SOFT, SPONGY OR UNSTABLE MATERIALS:

A. If this type of material is encountered during excavation or trenching, stop work and notify ENGINEER.

B. Perform remedial work as directed by ENGINEER.

C. If material is judged by ENGINEER to be unsuitable and removal is authorized or required, remove and replace with stable trench material as directed by ENGINEER.

3.04 ROCK EXCAVATION:

A. Excavate any rock to maintain minimum 6-inch clearance around pipe.

B. Remove and dispose rock material not suitable for backfill in a proper manner.

C. Use of explosives not permitted without prior written authorization from applicable regulating agencies, OWNER, and ENGINEER.

D. Provide Special Hazard Insurance covering liability if blasting operations are approved.

3.05 BEDDING:

A. Place pipe after bottom of trench has been excavated to proper depth and grade.

B. Place, compact, and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for full length of pipe. Extreme care is to be taken to ensure proper backfill under the pipe haunches, especially for thermoplastic pipe installation.

C. Provide bedding as described in following table unless indicated otherwise on Plans or in Special Provisions.

Pipe Material	Minimum Bedding Class
1. Vitrified Clay Pipe	Class C (Granular Foundation)*
2. Non-reinforced Concrete Pipe	Class C (Shaped Subgrade)*
3. Reinforced Concrete Pipe	Class C* (Shaped Subgrade)*
4. Ductile Iron Pipe	Class D*
5. Steel Cylinder	Class C (Shaped Subgrade)*
6. Thermoplastic Pipe	**

* Refers to plan detail, "Trench Bedding Circular Pipe."

** Refers to plan detail, "Flexible Pipe Bedding And Backfill."

D. Thermoplastic Pipe Bedding. The pipe shall be bedded in a foundation of compacted cohesionless material, such as sand, crushed stone, or pea gravel, with a maximum size not exceeding 3/8". This material shall extend a minimum of six (6) inches below the pipes outside wall or outermost ribs, and shall be carefully and accurately shaped to fit the lowest part of the pipe exterior up to the pipe's spring line.

3.06 TRENCH BACKFILL

A. Use excavated material backfill (2.01B) unless otherwise specified.

B. Use Sand Backfill for all trenches within 5 feet of buildings and beneath areas, paved streets or existing exposed utilities.

C. Initial Backfill:

1. Place backfill after pipe has been bedded and checked for alignment, grade and internal obstructions.

2. Carry out in an orderly fashion after authorization to cover pipe has been given.

3. Allow no more than 300 feet of trench to be open at one time.

4. Do not backfill until concrete or mortar has sufficiently cured.

5. Record location of connections and appurtenances before backfilling.

6. Place by hand in approximately 6 inch layers (loose measurement) and tamp with hand operated tamping equipment until a minimum cover of 12-inches above top of pipe is obtained.

7. Backfill simultaneously on both sides of pipe to prevent displacement.

8. Particular attention is necessary when backfilling thermoplastic pipe. After the pipe structure has been installed on bedding as required by plan details it shall be backfilled according to the following:

Backfill shall consist of a cohesionless material, such as sand, crushed stone, or pea gravel, and having a maximum size not to exceed 3/8". The backfill material shall be placed along both sides of the completed pipe structure(s) to a depth of twelve (12) inches above the pipe. The backfill shall be placed in uniform layers not exceeding six (6) inches in depth (loose measurement), wetted if required, and thoroughly compacted between the pipe structure and the sides of the trench. Until a minimum cover of twelve (12) inches is obtained, only hand operated tamping equipment will be allowed within vertical planes two (2) feet beyond the horizontal projection of the outside surfaces of the structure.

9. All initial backfill shall be compacted to a minimum of 95 percent Standard Proctor Density.

D. Subsequent Backfill:

1. Place backfill into trench at an angle so that impact on installed pipe is minimized.

2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, or cause the installed pipe to be moved from the established grade or alignment.

3. Area under or within 5 feet of pavement; and under or within 2 feet of utilities, buildings, or walks shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 95 percent Standard Proctor Density.

4. Areas not under or within 5 feet of pavement; and under or within 2 feet of existing or proposed utilities, buildings, or walks shall be backfilled in layers not more than 10-inches in depth and compacted to a minimum 90 percent Standard Proctor Density.

5. Compaction method for subsequent backfill is at discretion of CONTRACTOR with following exceptions:

   a. If in OWNER'S or ENGINEER'S opinion compaction method presents potential damage to pipe, it will not be allowed.
   b. Compaction of any backfill material by flooding or jetting will require prior written authorization of ENGINEER.
   c. Heavy equipment shall not be used over pipe envelope before a minimum of 48 inches of backfill have been placed over top of pipe.

6. Mound excavated materials no greater than 6 inches in open areas only.

E. Controlled Density Fill:

1. Use where shown on plans.

2. Provide suitable forms to limit volume of control density fill material.

3. Prevent flow of material into existing drain lines.

4. Protect exposed utility lines during placement.

5. Place material in accordance with suppliers' written recommendations unless directed otherwise by ENGINEER.

3.07 EXCESS MATERIAL:

A. Waste excess excavated material where directed by ENGINEER.

3.08 TESTING:

A. Unless specified elsewhere, testing will be the responsibility of the OWNER.

B. Standard Proctor Density:

1. ASTM D698.

2. One (1) required for each type of material encountered.

C. In Place Density:

1. ASTM D1556 (Sand Cone)

2. ASTM D2167 (Balloon)

3. ASTM D3017 (Nuclear)

D. One (1) test per each 400 cubic yards of backfill placed.

PART 4 - MEASUREMENT AND PAYMENT

4.01 TRENCH EXCAVATION:

A. Trench excavation shall be considered incidental to pipeline installation.

B. Payment shall be made at the contract unit price per cubic yard only if a bid item is established in the contract.

4.02 BACKFILL:

A. Payment for backfill shall be made at the contract unit price per cubic yard only if a separate bit item is established in the contract.

B. No allowance shall be made for waste removal or disposal.

C. If ENGINEER orders an initial backfill material other than that specified in contract, it shall be paid for as an extra in price per cubic yard as compacted in place, EXCEPT if a higher class embedment is ordered by ENGINEER because the CONTRACTOR has over-excavated the trench width.

D. If the CONTRACTOR over-excavates the trench width and the ENGINEER orders the next higher class of embedment to be used, the embedment shall be paid for as if the original specified embedment was used.

E. If the ENGINEER orders the excavated material to be removed and disposed of and replaced with another material and a separate bid item is not established as a bid item, the material shall be paid as an extra.

F. If the CONTRACTOR fails to compact the backfill to the density requirements, the ENGINEER may order the material removed and replaced at no cost to the OWNER.

G. The disposal of rejected material shall be done in a proper manner and shall be at no cost to the OWNER.

END OF SECTION

SECTION 02580 STORM SEWER APPURTENANCES

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of furnishing and installing appurtenances except manholes, for storm sewers in accordance with details on the plans and as specified herein as directed by the ENGINEER.

B. The various types of structures and appurtenances such as inlets, headwalls, energy dissipators, etc. are designated on the plans by letters or by numbers indicating the particular design of each. Each type shall be constructed in accordance with the details indicated and to the depth required by the profiles and schedules given.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The construction plans will specify the size and material for the pipe between the storm sewer main and the storm water collection structure.

B. The various types of storm inlets and their relation to curb and gutter, or valley gutter are shown on the Standard Detail Drawings. Construction plans will identify the type to be constructed.

C. Grating size, material, and configuration shall conform to the Standard Detail Drawings.

2.02 MATERIALS:

A. Concrete

1. Concrete for cast in place miscellaneous structures shall be Class A concrete when used with precast pipe sewer construction and Class C concrete when used with monolithic pipe sewer construction.

2. Concrete for precast structures shall be 3000 psi and comply with the applicable requirements of ASTM C 478.

B. Mortar:

1. Mortar shall be composed of 1 part Portland Cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Section 03300 for fine aggregate.

2. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight of the total dry mix.

C. Reinforcement:

Reinforcing Steel shall conform to Section 03330.

D. Brick:

1. Bricks shall be of first quality, sound, hard-burned brick. Shale bricks, if used, shall be homogeneous, thoroughly and uniformly burned.

2. Bricks shall not absorb more than 17 percent of water by weight submerged in water for 24 hours, having been in a completely dry state prior to placing in water.

3. Clay brick shall conform to the requirements of ASTM C 62, Grade SW. concrete brick meeting the requirements of ASTM C 55, Grade A, shall be acceptable.

E. Concrete Block:
Concrete blocks when indicated shall conform to ASTM C 139.

F. Frames, Grates, Rings and Covers:
Frames, grates, rings and covers shall conform to Section 02571.

G. Miscellaneous Items:

Cast iron for supports, steps and inlet units shall conform to the shape and dimensions indicated. The casting shall be clean and perfect, free from sand or blow holes or other defects. Cast iron casting shall meet the requirements of ASTM A 48, Class 30. Steel for temporary covers when used with Stage Construction shall be adequate for the loads imposed.

PART 3 - EXECUTION

3.01 INSTALLATION OF DRAINAGE FACILITIES:

A. Excavation and backfilling for the storm inlet shall be accomplished in accordance with Section 02227.

B. Trenching, backfilling, and compaction for the connecting pipe between the storm sewer main and the storm inlet shall conform to the specifications contained in Section 02221. Pipe shall be installed in accordance with Section 02590.

C. All pipe and structures shall be installed per location and elevations, as shown on the construction plans. If during the course of installation, an underground obstruction (i.e., existing utility line) the work shall stop and the ENGINEER shall be immediately notified so that the problem can be resolved.

D. Direct connection to storm sewer main will be permitted if the main is a minimum of 36 inches in diameter (I.D.) and the connecting line is not greater than 12-inches (I.D.). If storm sewer mains are 48 inches (I.D.) or larger, the connecting line diameter may be increased to 18 inches (I.D.). For connecting line sized greater than those specified above, the connecting to the main will be made into a manhole or by inserting into the main a factory constructed wye. Connection to the main will comply with the Standard Detail Drawings.

E. Removal of curb and gutter, and sidewalk for installation of a storm inlet shall be made at a scored or full depth joint.

F. Existing pavement removal and replacement shall conform to Part 6 and Section 02571 and shall conform to residential or arterial pavement sections of the same material (asphalt or Portland Cement concrete) as the existing pavement.

G. No width greater than 1/2 inch will be permitted between the inlet grate and the roadside portion of the inlet frame.

H. Private drainage facility installations, which are to be constructed under the authorization of "Drainage Facilities within Public Right-of-Way," shall comply with the Standard Detail Drawings and appropriate sections of this publication.

I. The construction inlets shall be done as soon as is practicable after sewer lines into the inlet are complete. All sewers shall be cut neatly at the inside face of the walls of the inlet and pointed up with mortar.

J. Bases for cast in place inlets may be placed prior to or at the CONTRACTOR'S option after the sewer is constructed.

K. The inverts passing out or through an inlet shall be shaped and grout across the floor of the inlet as indicated. This shaping may be accomplished by

adding shaping mortar or concrete after the base is cast or by placing the required additional material with the base.

L. All miscellaneous structures shall be completed in accordance with the details indicated. Backfilling to original ground elevation shall be in accordance with the provisions of the appropriate items and as directed by the ENGINEER.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Pavement removal and replacement will be measured by the square yard.

B. Trenching, backfilling and compaction will not be measured or paid, but will be considered incidental to other items.

C. Frame, grates, rings and covers will not measured or paid, but will be considered incidental to other items.

D. Connecting pipe shall be measured by the linear foot along centerline of pipe from the main side wall of the inlet to the centerline of the main.

E. Storm sewer inlets shall be measured per each for the type and size specified.

F. All miscellaneous structures satisfactorily completed in accordance with the plan and specifications will be measured as complete units per each.

4.02 PAYMENT:

A. The accepted quantities of pavement removal and replacement shall be paid for at the unit bid price per square yard per type of replacement paving material.

B. The accepted quantities of connecting pipe shall be paid at the unit bid price per linear foot per type and size of pipe, and shall include pipe in place and all necessary jointing materials.

C. The accepted quantities of storm inlets will be paid at the unit price per each per type of storm inlet, and shall include: structure, grating, excavation, backfilling and compaction, and curb removal and replacement, as defined in Bid Proposal.

D. The accepted quantities of special complete structures shall be paid at the unit bid price per each.

E. Compensation, whether by contract pay item or incidental work will be for furnishing all material, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02590 REINFORCED CONCRETE PIPE

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This Item shall govern for furnishing and installing all concrete pipe and materials and for constructing precast concrete pipe culverts or precast concrete sewer mains, laterals, stubs and inlet leads. The pipes shall be of the sizes, strengths and dimensions shown on the plans and shall include all connections to new or existing pipes, sewers, manholes, inlets, headwalls and other appurtenances and jointing materials as may be required to complete the work.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Except as modified herein, precast reinforced concrete pipe shall conform to the design shown on the plans and to ASTM C76 or C655 for circular pipe.

B. All precast concrete pipe shall be machine made or cast by a process which will provide for uniform placement of the concrete in the form and compaction by mechanical devices which will assure a dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete will not be acceptable for use in precast concrete pipe.

C. Unless otherwise shown on the plans, not more than two (2) holes may be placed in the top section of precast pipe for lifting and placing. The holes may be cast, cut, or drilled in the wall of the pipe. The holes shall not exceed three (3) inches in diameter at the inside surface of the pipe wall. Not more than one (1) longitudinal wire or two (2) circumferential wires may be cut per layer of reinforcing steel when locating lift holes in the pipe wall. After the pipe is in place, lift holes shall be filled with concrete or mortar or precast concrete plugs to the satisfaction of the Engineer.

TABLE A
CIRCULAR PIPE
(CLASS, D-LOAD EQUIVALENTS)

C76	C655
CLASS I	800D-LOAD
CLASS II	1000D-LOAD
CLASS III	1350D-LOAD
CLASS IV	2000D-LOAD
CLASS V	3000D-LOAD

2.02 DESIGN:

A. Reinforced concrete pipe for jacking, boring or tunneling shall meet the requirements of the pertinent ASTM specification with the following additional requirements:

1. The pipe shall have circular reinforcement and for 30 inch and larger diameters shall have an additional layer of Class III reinforcement, 12 inches long, extending into both the tongue and groove of the joint to within 3/4 inch of the end of the tongue and the groove. The minimum wall thickness shall be wall "B" for the diameter specified, unless special designs are required. The minimum concrete compressive strength for jacking and boring pipe shall be 5000 psi. Variations in the laying length of opposite sides shall not exceed 3/8 inch for pipe diameters 24 inches through 60 inches and 1/2 inch for pipe diameters 66 inches and larger. The maximum joint taper shall be 7 degrees for tongue and groove pipe and 2 degrees for O-ring gasket pipe. Pipe manufactured to these additional requirements shall be marked to identify pipe for jacking and boring.

B. The Construction Plans will provide a summary indicating the locations and length for all pipes. Additionally, the diameter required D-load and/or class for full circle pipe, will also be shown.

2.03 PHYSICAL TEST REQUIREMENTS:

A. The acceptability of the pipe shall be determined by the results of the physical tests outlined herein; by appropriate material tests required in ASTM C76, C506, C507, or C655; by absorption tests on selected samples from the wall of the pipe; and by inspection of the finished pipe to determine its conformance with the required design and its freedom from defects. Three-Edge Bearing tests shall be performed on one (1) pipe for each 100’ of pipe or fraction thereof of each design or shape, size, class or D-load for the load to produce a 0.01 inch crack and, at the discretion of the Engineer, the pipe may be tested to ultimate load.

B. As an alternate to the Three-Edge Bearing test, concrete pipe 60 inches in diameter and larger may be accepted on the basis of compressive strength of cores cut from the wall of the pipe. The manufacturer shall furnish facilities and personnel for taking the cores and determining the compressive strength of the samples. Three-Edge Bearing tests and core tests shall be in accordance with ASTM C497.

C. The manufacturer shall plug and seal coreholes in the pipe wall, after testing, in a manner satisfactory to the Engineer.

2.04 MARKING:

The following information shall be clearly marked on each section of pipe:

A. The class or D-load of pipe.

B. The date of manufacture.

C. The name or trademark of the manufacturer.

D. One end of each section of pipe with elliptical reinforcement shall be clearly marked during the process of manufacture or immediately thereafter on the inside and the outside of opposite walls to show the location of the "top" or "bottom" of the pipe as it should be installed, unless the external shape of the pipe is such that the correct position of the top and bottom is obvious. Marking shall be indented on the pipe section or painted thereon with waterproof paint.

E. Pipe for jacking and boring shall be identified for the intended use.

2.05 INSPECTION:

The quality of materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Engineer at the pipe manufacturing plant. In addition, the finished pipe shall be subject to further inspection by the Engineer at the project site prior to and during installation.

A. Causes for Rejection. Pipe shall be subject to rejection for failure to conform to any of the specification requirements. Individual sections of pipe may be rejected because of any of the following:

1. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint.

2. Defects that indicate imperfect proportioning, mixing and molding.

3. Surface defects indicating honeycombed or open texture.

4. Damaged ends, where such damage would prevent making a satisfactory joint.

5. Any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more, regardless of position in the wall of the pipe.

B. Repairs. Pipe may be repaired if necessary, because of occasional imperfections in manufacture or accidental injury during handling and will be acceptable if, in the opinion of the Engineer, the repairs are sound, properly

finished and cured, and the repaired pipe conforms to the requirements of the specifications.

C. Rejections. All rejected pipe will be plainly marked by the Engineer by painting colored spots over the Division of Materials and Tests monogram on the inside wall of the pipe and on the top outside wall of the pipe. The painted spots shall be sufficient to identify the rejected pipe but no larger than four (4) inches in diameter. Rejected pipe shall not be defaced in any other manner. The Contractor shall remove the rejected pipe from the project and replace with pipe meeting the requirements of this Item.

D. Jointing Materials. Unless otherwise specified on the plans the Contractor shall have the option of making the joints using any of the materials described herein. For all jointing materials except mortar, the Contractor shall furnish the Engineer the Manufacturer's Certificate of Compliance.

1. Mortar for joints shall be in accordance with the section, "Jointing", of this Item.

2. Cold Applied, Plastic Asphalt Sewer Joint Compound shall consist of natural and/or processed asphalt base, suitable volatile solvents and inert filler. The consistency is to be such that the ends of the pipe can be coated with a layer of the compound up to one-half inch thick by means of a trowel. The joint compound shall cure to a firm, stiff plastic condition after application. The material shall be of a uniform mixture and any small separation occurring in the container shall be stirred to a uniform mix before use.

   This material shall meet the following requirements when tested in accordance with Test Method Tex-526-C:

Asphalt Base, 100% - % Volatites - % Ash, % by weight	28-45
Volatiles, 212° F Evaporation, 24 h, % by weight	10-26
Mineral Matter, determined as Ash, % by weight	30-55
Consistency, Cone Penetration, 150 q, 5 sec, 77° F	150-275

3. Rubber Gaskets shall conform to ASTM C361 or C443. The design of the joints and permissible variations in dimensions shall be in accordance with ASTM C443. The Contractor shall furnish the Engineer the Manufacture’s Certificate of Analysis.

4. Cold Applied Preformed Plastic Gaskets. Preformed plastic gaskets shall be suitable for sealing joints of tongue and groove concrete pipe. The gasket sealing the joint shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The gasket joint sealer shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength, and shall be supplied in extruded rope-form of suitable cross-section. The size of the plastic gasket joint sealer shall be in accordance with the manufacturer's recommendations and be of sufficient size to properly seal the joint. The plastic gasket joint sealer shall be so constructed as to provide evidence of proper installation either by means of "squeeze-out" of the gasket material on the inside or outside around the pipe joint circumference or by means of tabs, projections or other such indicators placed at established intervals around the circumference of the pipe joint. Plastic gasket joint sealers shall be Type 1 or Type 2. Type 1 gaskets shall meet the "squeeze-out" requirements and Type 2 gaskets shall meet the requirements for tabs, projections or other indicators. The gasket joint sealer shall be protected by a suitable wrapper designed that when removed, the jointing material maintains integrity.

   The chemical composition of the gasket joint sealing compound for Type 1 and 2, as shipped, shall meet the following requirements:

COMPOSITION	TEST METHOD	ANALYSIS
Bitumen, Petroleum Plastic Content, % by weight	ASTM D4	50-70
Ash-Inert Mineral Matter, % by weight	Tex-526-C	30-50
Volatile Matter, 325 F, % by weight	Tex-506-C	2.0 max.

   The gasket joint sealing compound when immersed for 30 days at ambient room temperature separately in five (5) percent solution of caustic potash; a five (5) percent solution of hydrochloric acid; a five (5) percent solution of sulfuric acid; and a saturated H2S solution, shall show no visible deterioration.

   The physical properties of the gasket joint sealing compound as shipped shall meet the following requirements:

PROPERTY	TEST METHOD	REQUIREMENT	
		Type 1	Type 2
Ductility @ 77 F (cm), min.	Tex-503-C	5.0	5.0
Softening Point, F	Tex-505-C	275	275
Penetration			
32 F (300g) 60 sec., min.	Tex-502-C	--	65
77 F (150g) 5 sec.	Tex-502-C	50-120	50-120
115 F (150g) 5 sec., max.	Tex-502-C	--	150

PART 3 – EXECUTION

3.01 CONSTRUCTION METHODS

A. Excavation. All excavation shall be in accordance with the requirements of Section 02221, "Trench Excavation, Backfill, and Compaction", except where tunneling or jacking methods are shown on the plans or permitted by the Engineer.

B. Shaping and Bedding. Shaping and bedding shall be in accordance with Section 02221, “Trench Excavation, Backfill, and Compaction".

C. Laying Pipe. Unless otherwise authorized by the Engineer, the laying of pipe on the bedding shall be started at the outlet end with the spigot or tongue end pointing downstream and shall proceed toward the inlet end with the abutting sections properly matched, true to the established lines and grades. Where bell and spigot pipe are used, cross trenches shall be cut in the foundation to allow the barrel of the pipe to rest firmly upon the bedding. These cross trenches shall be not more than two (2) inches larger than the bell ends of the pipe. Proper equipment shall be provided for hoisting and lowering the sections of pipe into the trench without disturbing the bedding and the sides of the trench. The ends of the pipe shall be carefully cleaned before the pipe is placed. As each length of pipe is laid, the mouth of the pipe shall be protected to prevent the entrance of earth or bedding material. The pipe shall be fitted and matched so that when laid in the bed the pipe shall form a smooth, uniform conduit. When elliptical pipe with circular reinforcing or circular pipe with elliptical reinforcing is used, the pipe shall be laid in the trench in such position that the markings "Top" or "Bottom", shall not be more than five (5) degrees from the vertical plane through the longitudinal axis of the pipe.

Multiple installations of reinforced concrete pipe shall be laid with the center lines of individual barrels parallel. Unless otherwise shown on the plans, the following clear distances between outer surfaces of adjacent pipes shall be used:

Diameter 18"	24"	30"	36"	42"	48"	54"	60" to 64"
Clear 0’-9" Distance Between Pipes	0’-11"	1’-1"	1’-3"	1’-5"	1’-7"	1’-11"	2’-0"

D. Jointing.

1. Joints sealed with portland cement mortar shall be made as follows:

   Mortar shall consist of one (1) part cement, two (2) parts sand and sufficient water to make a plastic mix. The pipe ends shall be cleaned and wetted before making the joint. The lower half of the bell or groove and the upper half of the tongue or spigot shall be plastered with mortar. After the pipes are tightly jointed, mortar shall be packed into the joint from both inside and outside the pipe. The inside shall be finished smooth and flush with adjacent joints of pipe. Over the joint outside the pipe, a bead shall be formed at least one (1) inch on either side of the joint and of semicircular cross section for tongue and groove joints, but for bell and spigot joints, the mortar shall form a 45° fillet between the outer edge of the bell and the spigot. Mortar joints shall be cured by keeping the joints wet for at least 48 hours or until the backfill has been completed, whichever comes first. No jointing shall be done when the atmospheric temperature is at or below 40 F. Mortared joints shall be protected against freezing by backfilling or other approved methods for at least 24 hours.

   No mortar banding on the outside of pipe will be required for driveway culverts.

   At the Contractor's option, and with the approval of the Engineer, pipes which are large enough for a man to enter may be furnished with the groove not less than one-half of an inch and not more than three-fourths of an inch longer than the tongue. Such pipe may be laid and backfilled without mortar joints. Care shall be exercised to avoid displacing the joints during the backfilling operations. After the backfilling has been completed, the space between the end of the tongue and the groove on the interior of the pipe shall be cleaned of all foreign material, thoroughly wetted and filled with mortar around the entire circumference of the pipe and finished flush.

   The Contractor shall make available for the use of the Engineer, an appropriate rolling device similar to an automobile mechanic's "Creeper" for conveyance through small size pipe structures.

   Mortar joints will be required for irrigation wells, vents and similar vertical

structures.

2. Joints using Cold Applied, Plastic Asphalt Sewer Joint Compound shall be made as follows:

   Both ends of the pipes shall be clean and dry. A one-half inch thick layer of the compound shall be troweled or otherwise placed in the groove end of the pipe covering not less than two-thirds of the joint face around the entire circumference. Next, the tongue end of the next pipe shall be shoved home with sufficient pressure to make a tight joint. After the joint is made any excess mastic projecting into the pipe shall be removed. Backfilling of pipe laid with asphalt mastic joints may proceed as soon as the joint has been inspected and approved by the Engineer. Special precautions shall be taken in placing and compacting backfill to avoid damage to the joints.

3. Joints using Rubber Gaskets shall be made as follows:

   Where rubber gasket pipe joints are required by the plans the joint assembly shall be made according to the recommendations of the gasket manufacturer. Water tight joints will be required when using rubber gaskets. Backfilling may begin when approved by the Engineer.

4. Joints using Cold Applied Preformed Plastic Gaskets shall be made as follows:

   Before laying the pipe in the trench, the plastic gasket shall be attached around the tongue or groove near the shoulder or hub of each joint in accordance with the gasket manufacturer's recommendations. The protective wrapper shall be removed and the gasket pressed firmly to the clean, dry surface of the pipe, as recommended by the manufacturer. The joint sealer must be placed in such a manner that no dirt or other deleterious materials will come in contact with the joint sealing material.

   After the tongue is correctly aligned with the flare of the groove, the wrapper or wrappers on the gasket shall be removed and the pipe shall be pulled or pushed home with sufficient force to properly seal the joint. Any joint material pushed out into the interior of the pipe that would tend to obstruct the flow shall be removed. (Pipe shall be pulled home in a straight line with all parts of the pipe on line and grade at all times.)
   Backfilling of pipe laid with plastic gasket joints may proceed as soon as the joint has been inspected and approved by the Engineer. Special precautions shall be taken in placing and compacting backfill to avoid damage to the joints.

   When the atmospheric temperature is below 60 F, plastic joint seal gaskets shall either be stored in an area warmed to above 70 F, or

artificially warmed to this temperature in a manner satisfactory to the Engineer. Gaskets shall then be applied to pipe joints immediately prior to placing pipe in trench, followed by connection to previously laid pipe.

5. Connections and Stub Ends. Connections of concrete pipe to existing pipes, pipe sewers or sewer appurtenances shall be as shown on the plan.

   The bottom of existing structures shall be mortared or concreted if necessary to eliminate any drainage pockets created by the connections. Any damage to the existing structure resulting from making the connection shall be repaired by the Contractor, to the satisfaction of the Engineer, at the Contractor's expense.

   Unless otherwise shown in the plans, connections between concrete pipe and corrugated metal pipe shall be made with a suitable concrete collar having minimum thickness of twelve (12) inches.

   Stub ends, for connections to future work not shown on the plans, shall be finished by installing watertight plugs into the free end of the pipe.

6. Backfilling. After the pipe has been placed, bedded and jointed as specified, filling and/or backfilling shall be done in accordance with the applicable requirements of Item 400, "Excavation and Backfill for Structures". When mortar joints are specified, no fill or backfill shall be placed until the jointing material has been cured for at least six hours. Special precautions shall be taken in placing and compacting the backfill to avoid any movement of the pipe or damage to the joints. For all pipe structures where joints consist of materials other than mortar, immediate backfilling will be permitted.

7. Re-use of Appurtenances. When existing appurtenances are specified on the plans for reuse, the portion to be reused shall be severed from the culvert and moved to the new position previously prepared by hoisting with a crane, rolling, or other approved methods. Connections shall conform to the requirements for joining sections of pipes, as designated herein or as shown on the plans. Any portion of the headwalls or pipe attached to the appurtenance damaged during the moving operations by the Contractor shall be restored to its original condition at the Contractor's expense. The Contractor may remove and dispose of the existing appurtenances and construct new appurtenances at his expense in accordance with the pertinent specifications and design shown on the plans or as furnished by the Engineer.

8. Protection of Pipe. Unless otherwise shown on the plans or permitted in writing by the Engineer, no heavy earth moving equipment will be permitted to haul over the structure until a minimum of four (4) feet of

permanent or temporary, compacted fill has been placed thereon. Pipe damaged by the Contractor's equipment shall be removed and replaced by the Contractor at the Contractor's expense.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

This Item will be measured by the linear foot. Such measurement will be made between the ends of the pipe barrel along the flow line. Where spurs or branches, or connections to existing pipe lines are involved, measurement of the spur or new connecting pipe will be made from the intersection of the flow line with the outside surface of the pipe into which it connects. Where inlets, headwalls, catch basins, manholes, junction chambers, or other structures are included in lines of pipe; that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included. For multiple pipes, the measured length will be the sum of the lengths of the barrels measured as prescribed above.

4.02 PAYMENT:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Reinforced Concrete Pipe" and "Reinforced Concrete Pipe (Sewers)" of the size and D-load or class specified.

This price shall be full compensation for furnishing, hauling, placing and joining of pipes; for cutting of skews or slopes, for all connections to new or existing structures; for moving and reusing appurtenances where required; for removing and disposing of portions of existing structures as required; and for all labor, tools, equipment and incidentals necessary to complete the work.

Trenching, backfilling and compaction will not be measured or paid, but will be considered incidental to other items in accordance with Section 02221, "Trench Excavation, Backfill, and Compaction". Protection methods for excavation greater than 5 feet in depth will be measured and paid for as Item 02223, “Trench Protection System.”

END OF SECTION

SECTION 02601 FLEXIBLE BASE

PART I - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of furnishing and placing a foundation course for surface courses or for other base courses.

B. Flexible base shall be composed of either caliche (argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand or other granular materials), crushed stone, gravel, iron ore topsoil, sand shell, or crushed slag.

C. Flexible base shall be constructed as specified herein in one or more courses in conformance with details, lines and grades shown on the plans, and as established by the ENGINEER.

D. When lime stabilization of the subgrade is specified, the flexible base is to be added in accordance with Section 02240, Lime stabilization.

PART 2 -PRODUCTS

2.01 MATERIALS:

A. Materials for flexible base shall be crushed or uncrushed as necessary to comply with the requirements hereinafter specified.

B. Materials shall consist of durable course aggregate particles mixed with approved binding materials.

2.02 LIME STABILIZATION:

A. Where shown on the plans, or directed by the ENGINEER, material for flexible base shall be lime stabilized in accordance with the provisions of Section 02240.

2.03 TYPES:

A. Type A - Crushed or broken aggregate (excluding gravel aggregate).

B. Type B - Gravel Aggregate

C. Type C - Iron Ore Topsoil

D. Type D - Shell Aggregate with Sand Admixture

E. Type E - Shell Aggregate with Sand and Caliche Admixture

F. Type F - Caliche

G. Type G - Crushed Slag

H. Unless otherwise noted on the plans, the CONTRACTOR may use any one type of these types provided the material used meet the requirements set forth in the specification test limits herein.

2.04 GRADES:

A. Unless otherwise shown on the plans or directed by the ENGINEER, the final course of base material shall consist of Grades 1 or 2 as specified in Table 02601-1.

B. Base courses or subbase materials, unless otherwise noted on the plans or directed by the ENGINEER, may consist of Grades 1, 2, 3, or 4, as specified in Table 02601-1.

C. All grades shall, when tested in accordance with standard laboratory test procedures, meet the physical requirements set forth in Table 02601-1.

D. Testing of flexible base materials shall be in accordance with the following test procedures:

TEST	TESTING PROCEDURE
Preparation for soil constants and sieve analysis	TEX-101-E
Liquid Limit	TEX-104-E
Plastic Limit	TEX-105-E
Plasticity Limit	TEX-106-E
Sieve Analysis	TEX-110-E
Wet Ball Mill	TEX-116-E

Triaxial Test TEX-117-E (Part I or II)

E. Unless otherwise specified on the plans, samples for testing the material for Soil Constants, Gradation and Wet Ball Mill shall be taken prior to the compaction operations.

F. Unless otherwise specified on the plans, samples for triaxial tests shall be taken from the stockpile or from production, as directed by the ENGINEER, where stockpiling is required and from production where stockpiling is not required.

TABLE 02601-1

PHYSICAL REQUIREMENTS FOR FLEXIBLE BASE MATERIALS

	GRADES			
TYPES	Grade 1: (Triaxial class 1 Min. compressive strength, psi: 45 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	Grade 2: (Triaxial Class 1 to 2.3) Min. compressive strength, psi: 35 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	Grade 3: (Unspecified Tri axial Class)	Grade 4:
TYPE A Crushed or Broken Aggregate (excluding gravel aggregate)	Retained on % Sq. Sieve 1-3/4.....0 7/8".....10-35 3/8".....30-50 No. 4.....45-65 No. 40.....70-85 Max LL.....35 Max PI.....10 Wet Ball Mill Max Amt.....40 in Passing No. 40.....20	Retained on % Sq. Sieve 1-3/4".....0-10 No. 4.....45-75 No. 40.....60-85 Max LL.....40 Max PI.....12 Wet Ball Mill Max. Amt.....50 Max Increase in Passing No. 40.....20	Retained on % Sq. Sieve 1-3/4".....0-10 No. 40.....60-85 Max LL.....45 Max PI.....15 Wet Ball Mill Max Amt.....55 Max Increase in passing No. 40.....20	As Shown on Plans
TYPE B Gravel Aggregate		Retained on % Sq. Sieve 1-3/4".....0-10 No. 4.....30-75	Retained on % Sq. Sieve 1-3/4".....0-5 No. 4.....30-75	As Shown

	No. 40.....70-85 Max LL.....35 Max PI.....12	No. 40.....65-85 Max LL.....35 Max PI.....12	On Plans
TYPE C Iron Ore Topsoil	Retained on % Sq. Sieve 2-1/2".....0 No. 40.....50-85 Max LL.....35 Max PI.....12	Retained on % Sq. Sieve 2-3/4".....0 No. 40.....45-85 Max LL.....35 Max PI.....12	As Shown on Plans
TYPE D Sand-Shell	Retained on % Sq. Sieve 1-3/4".....0-10 No. 4.....45-65 No. 40.....50-70 Max LL.....35 Max PI.....12	Retained % Sq. Sieve 1-3/4".....0 No. 40.....45-65 Max LL.....35 Max PI.....12	As Shown on Plans
TYPE E Shell with Sand and Caliche	Retained % Sq. Sieve 1-3/4".....0 No. 40.....45-65 Max LL.....35 Max PI.....10	Retained % Sq. Sieve 1-3/4".....0 No. 40.....45-65 Max LL.....35 Max PI.....12	As Shown on Plans
TYPE F Caliche	Retained % Sq. Sieve 1-3/4".....0 No. 4.....45-75 No. 40.....50-85 Max LL.....40 Max PI.....12	Retained % Sq. Sieve 1-3/4".....0 No. 40.....50-85 Max LL.....40 Max PI.....12	As Shown on Plans
TYPE G Crushed Blast Fur- nace Slag			As Shown on Plans

G. The limits establishing reasonable close conformity with the specified gradation and plasticity index are defined by the following:

1. The ENGINEER may accept the material, providing not more than 2 of 10 consecutive gradation tests performed are outside the specified limits on any individual or combination of sieves by no more than 5% and where no two consecutive tests are outside the specified limits.

2. The ENGINEER may accept the material providing not more than 2 of 10 consecutive plasticity index samples tested are outside the specified limit by no more than two points and where no two consecutive tests are outside he specified limit.

2.05 STOCKPILING:

A. When specified on the plans, the material shall be stockpiled prior to delivery on the road. The stockpile shall be not less than the height indicated and shall be made up of layers of material not to exceed the depth shown on the plans.

B. After a sufficient stockpile has been constructed as specified on the plans, the CONTRACTOR may proceed with loading from the stockpile for delivery to the road.

C. In loading from the stockpile for delivery to the road, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.

D. If the CONTRACTOR elects to produce the Type "A" material from more than one material or more than one source, each material shall be crushed separately and placed in separate stockpiles so that at least 75 percent of the material in the course aggregate stockpiles will be retained on the No. 4 sieve and at least 70 percent of the material in the fine aggregate stockpile will pass the No. 4 sieve.

E. The materials shall be combined in a central mixing plant in the proportions determined by the ENGINEER to produce a uniform mixture which meets all of the requirements of the specification. In the event that combinations of the materials produced fail to meet all of the specification requirements, the CONTRACTOR will be required to secure other materials which will meet specifications requirements.

F. The central mixing plant shall be either the batch or continuous flow type, and shall be equipped with feeding and metering devices which will add the materials into the mixer in the specified quantities.

G. Mixing shall continue until a uniform mixture is obtained.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE:

A. Type roadbed shall be excavated and shaped in conformity with the typical sections shown on the plans and to the lines and grades as established by the ENGINEER.

B. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material.

C. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material.

D. The surface of the subgrade shall be finished to line and grade as established and in conformity with the typical section shown on plans, and any deviation in excess of 1/2 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

E. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.

F. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or otherwise disposed on as directed, and any additional material required for the completion of the shoulders and slopes shall be secured from sources indicated on plans or as directed by the Engineer.

3.02 PLACEMENT OF FIRST COURSE - TYPE A, TYPE B, TYPE C, TYPE F, AND TYPE G

MATERIAL:

A. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section.

B. The material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the CONTRACTOR that the required amount of specified material shall be delivered in each 100- foot station.

C. Material deposited upon the subgrade shall be spread and shaped the same day.

D. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the materials shall be scarified and spread as directed by the Engineer.

E. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped to conform to typical sections as shown on plans.

F. All areas and "nests" of segregated coarse or fine material shall be corrected to removed and replaced with well graded material, as directed by the ENGINEER.

G. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and supplies in the amount directed by the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming or by other approved methods.

H. The course shall be compacted by method of compaction hereinafter specified as the "Ordinary Compaction" method or the "Density Control" method of compaction as indicated on the plans, or as directed by the ENGINEER.

1. When the "Ordinary Compaction" method is to be used, the following provisions shall apply:

a) The course shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on plans and to the established lines and grades.

b) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by

loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

c) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

2. When the "Density Control" method of compaction is to be used, the following provisions shall apply:

a) The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under "Density".

b) In addition to the requirements specified for density, the full depth of the flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment.

c) After each section of flexible base is completed, density tests shall be performed as required by the ENGINEER. If the material fails to meet the density requirements, it shall be reworked as necessary to meet the density requirements.

d) Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to the established lines and grades.

e) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

f) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

I. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the CONTRACTOR.

J. Where Type C material is used, the material shall be scarified, thoroughly wetted, mixed, manipulated, and bladed so as to secure a uniformly wetted material, and pulled in over the subgrade in courses and set under the action of blading and rolling. The work of mixing, blading, rolling, shaping, and subsequent maintenance shall be performed by the continuous use of sufficient number of satisfactory rollers and power maintainers with adequate scarifier attachments.

3.03 PLACEMENT OF FIRST COURSE - TYPE D MATERIAL:

A. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section, and corrections made if necessary.

B. All materials shall be delivered in approved vehicles of a uniform capacity.

C. The required amount of shell shall be uniformly spread across the section and allowed to dry sufficiently to insure proper slaking and mixing of the binder material. Immediately upon completion of the drying period, as determined by the ENGINEER, the specified amount of sand admixture as required to produce a combined material meeting the requirements hereinbefore specified, shall be spread uniformly across the shell.

D. The material shall then be sprinkled as required and thoroughly mixed by blading and harrowing, or other approved methods.

E. Failure to proceed with the placing of sand admixture or mixing and placing operations will be grounds for the suspension of placing of shell.

F. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.

G. The course shall be compacted by the method of compaction hereinafter specified as the "Ordinary Compaction" method or the "Density Control" method of compaction as indicated on the plans, or as directed by the ENGINEER.

1. When the plans indicate that the "Ordinary Compaction" method is to be used, the following provisions shall apply:

   a) After mixing, all material shall be windrowed, and then spread over the section in layers.

   b) The layer shall not exceed 2 inches in loose depth.

   c) If necessary to prevent segregation, the material shall be wetted in the window prior to spreading.

   d) After each lift is spread, it shall be sprinkled and rolled to secure maximum compaction as directed by the ENGINEER. Succeeding layers shall then be placed similarly until the course is completed.

   e) All areas and "nest of segregated coarse or fine material shall be corrected or removed and replaced with well graded material, as directed by the ENGINEER.

   f) The course shall then be sprinkled as required and rolled as directed until a uniform compaction is secured.

   g) Throughout this entire operation, the shape of the course shall be maintained by blading; and the surface, upon completion, shall be smooth and in conformity with the typical sections shown on plans, and to the established lines and grades.

   h) In that area on which pavement is to be place, any deviation in excess of 1/4 inch in cross section in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

   i) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

2. When the plans indicate that the "Density Control" method of compaction is to be used, the compaction method shall be the same

as prescribed for Type A, Type B, Type C, Type F and Type G material.

H. When indicated on the plans or permitted by the ENGINEER, Type D material may be mixed in a central mixing plant and delivered to the road as a combined mixture. When this method is used, the combined mixture shall meet the requirements for type D material as hereinbefore specified and the placing and compaction requirement shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G material.

3.04 PLACEMENT OF FIRST COURSE - TYPE E MATERIAL:

A. The construction methods for placing the first course of Type E material shall be the same as prescribed for Type D material except that after the shell and sand have been placed, the prescribed amount of caliche shall then be spread across the sand and shell.

B. The composite mixture shall then be sprinkled as required and thoroughly mixed by blading and harrowing or other approved methods.

C. Compaction of the first course of Type E material shall be the same as prescribed above for Type D material.

D. Failure to proceed with placing the sand and caliche admixture or mixing and placing operations will be grounds for the suspension of placing of shell.

E. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.

3.05 PLACEMENT OF SUCCEEDING COURSES - ALL MATERIAL TYPES:

A. Construction methods shall be the same as prescribed for the first course.

B. Prior to placing the surfacing on the completed base, the base shall be "dry cured" to the extent directed by the ENGINEER.

3.06 DENSITY CONTROL:

A. When the "Density Control" method of compaction is indicated on the plans, each course of flexible base shall be compacted to the percent density shown on the plans.

B. The testing will be as outlined in TX DOT Test Method Tex-114-E.

C. It is the intent of this specification to provide in the top 8 inches of the base material immediately below the finished surface of the roadway not less than 100 percent of the density as determined by the compaction ratio method.

D. Field density determination shall be made in accordance with TX DOT Test Method Tex-115-E.

3.07 TOLERANCES:

A. When tolerances are permitted by the plans, the limits establishing reasonable close conformity with percent density specified are defined by the following:

1. The ENGINEER may accept the work providing not more than 25 percent of the density tests performed each day are outside the specified density by no more than three pounds per cubic foot and where no two consecutive tests on continuous work are outside the specified limits.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Flexible base will be measured by the square yard of surface area of completed and accepted work based on the width of flexible base as shown on the plans.

1. The flexible base shall be measured for depth by the units of 2000 square yards and remaining fraction of square yards, with one measurement taken at a location selected by the ENGINEER.

2. In that unit where flexible base is deficient by more than 1/2 inch in thickness, the deficiency shall be corrected by scarifying, adding material as required, reshaping and recompacting by sprinkling and rolling.

3. No additional payment over the contract unit price will be made for any flexible base of a thickness exceeding that required by plans.

B. The CONTRACTOR shall schedule his operations in such a manner as to facilitate the measurement of the pay item.

C. The ENGINEER may accept the work provided no more than 2 out of 10 depth tests performed are deficient by not more 1/2 inch and where no two consecutive tests on continuous work are outside the specified depth.

4.02 PAYMENT:

A. The accepted quantities of flexible base of the type, grade, and compaction method specified will be paid at the contract unit price per square yard, complete in place.

B. All sprinkling, rolling, and manipulation required will not be paid for directly, but will be considered incidental work.

C. Passing "Density Control" tests shall be paid by the OWNER. Failing "Density Control" tests shall be paid by the CONTRACTOR.

D. The unit prices bid shall each be full compensation for shaping and fine grading the roadbed; for securing and furnishing all materials, including all royalty and freight involved; for furnishing scales and labor involved in weighing the material when required; for loosening, blasting, excavating, screening, crushing and temporary stockpiling when required; for loading all materials for all hauling and delivering. on the road; for spreading, mixing, blading, dragging, shaping and finishing and for all manipulation, labor, tools and incidentals necessary to complete the work.

END OF SECTION

SECTION 02612 HOT MIX ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Hot mix asphalt concrete (HMAC) pavement shall consist of a binder course, a leveling up course, a surface course or a combination of the courses as shown on the plans, or as directed by the ENGINEER.

B. HMAC pavement shall be composed of a compacted mixture of mineral aggregate and asphaltic material, constructed on previously completed and approved subgrade, subbase course, base course, or existing pavement.

C. HMAC pavement shall be in accordance with the specifications herein and in conformity with the lines, grades, quantities and typical sections in the contract and/or as directed by the ENGINEER.

1.02 QUALITY CONTROL:

A. HMAC pavement and its constituent part shall conform to the ASTM, AASHTO and/or Texas SDHPT test methods noted below.

PART 2 - PRODUCTS

2.01 ASPHALTIC MATERIALS:

A. Asphalt cement binders shall be uncracked petroleum asphalts and shall be carefully refined, by steam, vacuum, or solvent, from asphaltic or semi-asphaltic base crude petroleum at a temperature not to exceed 700 degrees F. Asphalt cements shall be free from thermal decomposition products and shall not be blended with any materials which have been subjected to cracking or produced from a crude petroleum source other than that of the original material. The asphalt cement shall not contain residues from non-asphaltic sources. Asphalt cement shall be homogeneous, free from water, and shall not foam when heated to 347 degrees F.

B. Paving asphalt shall be classified by penetration or viscosity and shall conform to the requirements set forth in one of the following tables as designated by the ENGINEER. The CONTRACTOR may supply asphalt meeting the requirements of one of the following tables provided that he obtains prior approval of the ENGINEER and with the provision that once approval has been obtained, that the CONTRACTOR will remain with that grade throughout the project.

TABLE 02612-1

Specification Designation	AASHTO Test Method	ASTM Test Method	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Flash Point (Open cup) Min.	T48	D92		450	450	450	425	350
Penetration of Orig. Sample at 77ºF	T49	D5	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Thin-Film Oven Loss, Hours at 325ºF, % Max	T179	D1754	0.75	0.75	0.75	0.75	1.00	1.00
Test of Residue from Thin-Film Oven Test: % of Orig. Pen., Min.	T49	D5	52	50	50	50	50	50
Ductility at 77ºF, cm. after Loss at 325ºF, Min.	T51	D113	50	50	100	100	100	100
Solubility in CC14 Min.	T44*	None	99.5	99.5	99.5	99.5	99.5	99.5
Reaction to Spot Test	T102**	None	-0-	-0-	-0-	-0-	-0-	-0-

* Procedure No. 1 with $CC1_4$ substituted for CS_2.

** Using 85% Standard Naphtha Solvent and 15% xylene.

TABLE 02612-2

TYPE-GRADE	0A-30 Min.	0A-30 Max.	0A-175** Min.	0A-175** Max.	0A-400 Min.	0A-400 Max.
Penetration at 32ºF, 200g., 60 sec	15	--	--	--	--	--
Penetration at 77ºF, 100g., 5 sec	25	35	150	200	--	--
Penetration at 115ºF, 50g., 5 sec	--	65	--	--	--	--
Ductility at 77ºF, 5 cm/min., cms: Original OA	2	--	70	--	--	--
Flash Point C.O.C., F	450	--	425	--	425	--
Softening Point, R. & B., F	185	--	95	130	--	--
Thin Film Oven Test, 1/8 in. Film 50 g., 5hrs., 325ºF, % Loss by wt	--	0.4	--	1.4	--	2.0
Penetration of Residue, at 77ºF, 100g., 5 sec. % of Original Pen	--	--	40	--	--	--
Ductility of Residue at 77ºF, 5 cm/min., cms	--	--	--	100	--	--
Solubility in Trichloroethylene, %	99.0	--	99.0	--	99.0	--
Spot Test on Original OA	Neg.		Neg.		Neg.	
Float Test at 122ºF, sec	--	--	--	--	120	150
Test on 85 to 115 Pen. Residue* Residue by Wt., %	--	--	--	--	75	--
Ductility, 77ºF, 5 cm/min: Original Res., cms	--	--	--	--	100	--
Subjected to Thin Film Test, cms	--	--	--	--	100	--

*Determined by Vacuum Distillation (by evaporation if unable to reduce by vacuum).

**For use with Latex Additive only.

TABLE 02612-3

PROPERTIES	AC-1.5		AC-3		AC-5		AC-10		AC-20		AC-40	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, 140ºF strokes	150	50	300	100	500	100	1000	200	2000	400	4000	800
Viscosity, 275ºF strokes	0.7	--	1.1	--	1.4	--	1.9	--	2.5	--	3.5	--
Penetration, 77ºF 100 g, 5 sec. . . .	250	--	210	--	135	--	85	--	55	--	35	--
Flash Point, C.O.C., F	425	--	425	--	425	--	450	--	450	--	450	--
Solubility in trichloroethylene, percent	99.0	--	99.0	--	99.0	--	99.0	--	99.0	--	99.0	--
Test on residues from thin film oven test: Viscosity, 140ºF stokes	--	450	--	900	--	1500	--	3000	--	6000	--	12000
Ductility, 77ºF, 5 cms per min, cms	100	--	100	--	100	--	70	--	50	--	30	--
Spot test. . . .	Negative for all grades											

C. A minimum of two percent, by weight, latex additive (solids basis) shall be - 175 Asphalt or to AC-5 Asphalt when specified in the contract. The latex additive shall be governed by the following specifications:

The latex is to be an anionic emulsion of butadiene-styrene low-temperature copolymer in water, stabilized with fatty-acid soap so as to have good storage stability, and possessing the following properties:

Monomer ratio, B/S.....70/30
Minimum solids content.....67%
Solids content per gal. @ 67%.....5.3 lbs
Coagulum on 80-mesh screen.....0.01% max
Type Anti-oxidant.....staining
Mooney viscosity of Polymer (M/L 4@212F).....100 min.
pH of Latex.....9.4 - 10.5
Surface tension.....28-42 dynes/cm²

The finished latex-asphalt blend shall meet the following requirements:

Viscosity at 140º F, stokes.....1500 max.

Ductility at 39.2º F. 1 cm. per., min. cm.....100 min.

D. Asphalt content shall be within the limits noted below:

Table 02612-4

HMAC Type	Percent of Mixture by Weight	Percent of Mixture by Volume
"A"	3.5 - 7.0	8.0 - 16.0
"B"	3.5 - 7.0	8.0 - 16.0
"C"	3.5 - 7.0	8.0 - 16.0
"D"	4.0 - 8.0	9.0 - 19.0
"F"	3.5 - 6.5	8.0 - 16.0

E. At the time of delivery of each shipment of asphalt, the vendor supplying the material shall deliver to the purchaser certified copies of the test report which shall indicate the name of the vendor, type and grade of asphalt delivered, date and point of delivery, quantity delivered, delivery ticket number, and results of the above-specified tests. The test report shall be certified and signed by an authorized representative of the vendor that the product delivered conforms to the specifications for the type and grade indicated.

F. Until the certified test reports and samples of the material have been checked by the ENGINEER to determine their conformity with the prescribed requirements, the material to which such report relates and any work in which it may have been incorporated as an integral component will be only tentatively accepted by the City. Final acceptance will be dependent upon the determination of the ENGINEER that the material involved fulfills the requirements prescribed therefor. The certified test reports and the testing required in connection with the reports will be at the expense to the City.

G. Unless otherwise specified in these specifications or in the Supplementary Specifications, the various grades of paving asphalt shall be applied at a temperature range of from 210ºF, the exact temperature to be determined by the ENGINEER.

H. Paving asphalt shall be heated in such a manner that steam or hot oils will not be introduced directly into the paving asphalt during heating. The CONTRACTOR shall furnish and keep on the site, at all times, an accurate thermometer suitable for determining the temperature of the paving asphalt.

I. HMAC asphalt shall be the grade having the highest penetration, within specified limits, to produce a mix having a maximum stability of the compacted mixtures.

J. Only one (1) grade of asphalt shall be required unless otherwise shown on the plans or as required by the ENGINEER.

2.02 AGGREGATES:

A. HMAC aggregate will be tested in accordance with the following test:

AASHTO T-30	Mechanic Testing
AASHTO T-27	Passing No. 200 Sieve
AASHTO T-89	Liquid Limit
AASHTO T-96	Los Angeles Abrasion
AASHTO T-104	Soundness (Magnesium Sulfate)
ASTM C-131	Resistance to Degradation
ASTM C-136	Sieve Analysis
ASTM C-2419	Sand Equivalence Value
SDHPT Tex-106-E	Method of Calculating Plasticity Index of Soils
SDHPT Tex-217-F	(I & II) Determination of Deleterious Materials and Decantation Test
SDHPT Tex-203-F	Quality Tests for Mineral Aggregates

B. Aggregates shall have an abrasion of not more than 40 for all course except the non-skid surface course, which shall have an abrasion of not more than 35.

C. When property proportioned, HMAC aggregate shall produce a gradation which will conform to the limitations for classification for HMAC type shown below, or as directed by the ENGINEER.

D. Course aggregate to be crushed limestone rock or crushed gravel with limestone filler. (Crushed gravel shall be per Highway Department Specifications.)

E. Binder Aggregate to be composed of crushed Limestone screenings.

1. Type "A" - Course Graded Base Course

	Percent Aggregate by Weight or Volume
Passing 2" sieve	100
Passing 1-3/4" sieve	95 to 100
Passing 1-3/4" sieve, retained on 7/8" sieve	16 to 42
Passing 7/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve	10 to 26
Passing No. 4 sieve, retained on No. 10 sieve	5 to 21
Total retained on No. 10 sieve	68 to 84
Passing No. 10 sieve, retained on No. 40 sieve	5 to 21
Passing No. 40 sieve, retained on No. 80 sieve	3 to 16
Passing No. 80 sieve, retained on No. 200 sieve	2 to 16
Passing No. 200 sieve	1 to 8

2. Type "B" - Fine Graded or Leveling-Up Course

	Percent Aggregate by Weight or Volume
Passing 1" sieve	100
Passing 7/8" sieve	95 to 100
Passing 7/8" sieve, retained on 3/8" sieve	21 to 53
Passing 3/8" sieve, retained on No. 4 sieve	11 to 42
Passing No. 4 sieve, retained on No.10 sieve	5 to 26
Total retained on No.10 sieve	58 to 74
Passing No. 10 sieve, retained on No. 40 sieve	6 to 32
Passing No. 40 sieve, retained on No. 80 sieve	4 to 21
Passing No. 80 sieve, retained on No. 200 sieve	3 to 21
Passing No. 200 sieve	1 to 8

3. Type "C" - Course Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 7/8" sieve	100
Passing 5/8" sieve	95 to 100
Passing 5/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No.4 sieve	11 to 37
Passing No.4 sieve, retained on No.10 sieve	11 to 32
Total retained on No. 10 sieve	54 to 74
Passing No. 10 sieve, retained on No. 40 sieve	6 to 32
Passing No.40 sieve, retained on No.80 sieve	4 to 27
Passing No.80 sieve, retained on No.200 sieve	3 to 27
Passing No. 200 sieve	1 to 8

4. Type "D" - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 1/2" sieve	100
Passing 3/8" sieve	85 to 100
Passing 3/8" sieve, retained on No. 4 sieve	21 to 53
Passing No.4 sieve, retained on No.10 sieve	11 to 32
Total retained on No. 10 sieve	54 to 74
Passing No. 10 sieve, retained on No. 40 sieve	6 to 32
Passing No. 40 sieve, retained on No. 80 sieve	4 to 27
Passing No. 80 sieve, retained on No. 200 sieve	3 to 27
Passing No. 200 sieve	1 to 8

5. Type "F" - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 3/8" sieve	100
Passing No. 4 sieve	95 to 100
Passing No. 4 sieve, retained on No. 10 sieve	58 to 73
Passing No. 10 sieve, retained on No. 40 sieve	6 to 26
Passing No. 40 sieve, retained on No. 80 sieve	3 to 13
Passing No. 80 sieve, retained on No. 200 sieve	2 to 11
Passing No. 200 sieve	1 to 8

2.03 PRIME COAT:

A. Prime coat, when specified on the plans, or as directed by the ENGINEER, shall be in accordance with Section 02610 - Prime Coat, and as specified herein.

B. Prime coat shall be applied to surfaces of bases at least 12 hours prior to placing the HMAC unless otherwise directed by the ENGINEER.

C. Asphalt prime shall be applied uniformly at the rate of 0.10 to 0.30 gallon per square yard or as directed by the ENGINEER. It shall be applied only when permitted by the ENGINEER and when the air temperature is not less than 40oF.

D. In order to prevent lapping at the junction of two applications, the distributor shall be promptly shut off. A hand spray shall be used to touch up all spots unavoidably missed by the distributor.

E. Immediately prior to application of the asphalt prime, an inspection will be made by the ENGINEER to verify that the base course has been constructed as specified. Also, all loose and foreign material shall be removed by light sweeping. Material so removed shall not be mixed with cover aggregate.

F. The surface to be primed shall be in a smooth an well-compacted condition, true to grade and cross section, and free from ruts and inequalities.

G. The pressure distributor used for applying prime coat material shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the prime material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a speed tachometer registering feet per minute and so located as to be visible to the truck driver to enable him to maintain the constant speed required for application at the specified rate.

H. The pressure distributor shall be equipped with a tachometer registering the pump speed, pressure gauge, and a volume gauge. The rates of application shall not

vary from the rates specified by the ENGINEER by more than 10%. Suitable means for accuracy indicating at all times the temperatures of the prime material shall be provided. The thermometer well shall be so placed as not to be in contact with a heating tube.

I. The distributor shall be so designed that the normal width of application shall be not less than 6 feet, with provisions for the application of lesser width when necessary. If provided with heating attachments, the distributor shall be so equipped and operated that the prime material shall be circulated or agitated through the entire heating process.

J. The asphalt prime coat should preferably be entirely absorbed by the base course and, therefore, require no sand cover. If, however, it has not been completely absorbed prior to the start of placing the asphalt concrete mixture and in the meantime it is necessary to permit traffic thereon, just sufficient sand shall be spread over the surface to blot up the excess liquid asphalt and prevent picking it up under traffic. Also, sand shall be used in amounts deemed necessary by the ENGINEER at intersections and such areas where traffic may pass over the prime coat. Prior to placing the asphalt concrete, loose or excess sand shall be swept from the base. If a sand cover is specified in the Supplementary Specifications or noted on the plans to cover asphalt prime, it shall be applied within 4 hours after the application of said prime coat, unless otherwise ordered by the ENGINEER.

K. Liquid asphalt shall be prevented from spraying upon adjacent pavements, structures, guard rails, guide posts, culvert markers, trees, and shrubbery that are not to be removed; adjacent property and improvements; and other facilities or that portion of the traveled way being used by traffic.

L. The CONTRACTOR shall protect the prime coat against all damage and markings, both from foot and other traffic. Barricades shall be placed where necessary to protect the prime coat. If, after prime coat has been applied to the satisfaction of the ENGINEER and has been accepted by him, it is disturbed by negligence of the part of the CONTRACTOR, it shall be restored at his expense to its condition at the time of acceptance. No material shall be placed until the prime coat is in a condition satisfactory to the ENGINEER.

2.04 TACK COAT:

A. If the asphalt concrete pavement is being constructed directly upon an existing hard-surfaced pavement, a tack coat shall be evenly and uniformly applied to such existing pavement preceding the placing of the asphalt concrete. The surface shall be free of water, all foreign material, or dust when the tack coat is applied. No greater area shall be treated in any one day than will be covered by the asphalt concrete during the same day. Traffic will not be permitted over tack coating.

B. Tack coat for HMAC shall consist of either rapid curing cut-back asphalt RC-2 diluted by addition of (not to exceed 15 percent by volume) an approved grade of gasoline and/or kerosene; emulsified asphalt, EA-11M diluted with 50 percent water, or a cut-back asphalt made by combining 50 to 70 percent of the asphaltic materials specified for the paving mixture with 30 to 50 percent gasoline and/or kerosene by volume.

C. Tack coat shall conform to the requirements of Section 02620 - Tack Coat, or as specified herein.

D. Application rate shall be 0.10 to 0.15 gallons per square yard as directed by the ENGINEER.

E. A similar tack coat shall be applied to the surface of any course if, in the opinion of the ENGINEER, the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course.

F. When required, the contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like shall be painted with a tack coat immediately before the adjoining asphalt concrete is placed. Asphalt tack coat shall be applied in controlled amounts as shown on the plans or determined by the ENGINEER. Surfaces where a tack coat is required shall be cleaned to the satisfaction of the ENGINEER before the tack coat is applied.

2.05 MINERAL FILLER:

A. Mineral filler, other than hydrated lime, shall consist of a thoroughly dry stone dust, portland cement or other mineral dust approved by the ENGINEER.

B. The mineral filler shall be free from foreign or other deleterious matter.

C. When tested by the method outlined in SDHPT Test Method Tex-200-F (Part 1 or 3), mineral filler shall meet the following gradations by weight:

Passing No. 30 Sieve	95-100%
Passing No. 80 Sieve	75%
Passing No. 200 Sieve	55%

2.06 HYDRATED LIME:

A. Hydrated lime shall conform with the requirements of ASTM C-207, Type N

B. Hydrated lime shall be furnished in amounts shown on the plans or as directed by the ENGINEER.

2.07 JOB MIX FORMULA:

A. A job mix formula based on representative samples, including filler if required, shall be determined by the ENGINEER, or submitted by the CONTRACTOR for approval of the ENGINEER.

B. The resultant job mix formula shall be within the master range for the specified type of HMAC.

C. When lime is added, it shall be included in the gradation for establishing job mix formula.

D. The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, and a single percentage of bituminous material to be added to the aggregate and shall provide for 3 to 5% air voids in the resultant design mix. During the mix design process the ENGINEER will consider other factors, in addition to air voids and Marshall stability, such as durability, water resistance and asphalt film thickness when developing the mix design.

E. After the job mix formula is established, mixtures for the project shall conform thereto within the following tolerances which may fall outside of the specified master range:

	Percent by Weight or Volume as Applicable
Passing 1-3/4" sieve, retained on 7/8" sieve.....	Plus or minus 5
Passing 7/8" sieve, retained on 3/8" sieve.....	Plus or minus 5
Passing 5/8" sieve, retained on 3/8" sieve.....	Plus or minus 5
Passing 3/8" sieve, retained on No. 4 sieve.....	Plus or minus 5
Passing No. 4 sieve, retained on No. 10 sieve.....	Plus or minus 5
Total retained on No. 10 sieve.....	Plus or minus 5
Passing No. 10 sieve, retained on No. 40 sieve.....	Plus or minus 3
Passing No. 40 sieve, retained on No. 80 sieve.....	Plus or minus 3
Passing No. 80 sieve, retained on No. 200 sieve.....	Plus or minus 3
Passing No. 200 sieve.....	Plus or minus 3
Asphaltic Material.....	Plus or minus 0.05 by wt or 1.2 by vol.
Hydrated Lime.....	Plus or minus 0.3
Mixing Temperature.....	Plus or minus 20ºF

F. Asphaltic mixture shall be tested in accordance with SDHPT Test Method Tex-200-4 (Part I or Part III) and shall have the following laboratory values:

	Surface Course	Base Course
Density - Minimum	95%	95%
Maximum	99%	99%
Optimum	97%	97%
Stability (Hveem)		
Minimum	30%	30%
Maximum	45%	45%
Stability (Marshall - 75 Blow Briquette)	1500 lbs.	1500lbs.
Voids	3 - 7%	4 - 7%
Voids Filled With Asphalt	75 - 85%	65 - 80%
Sand Equivalent	40	40

2.08 EQUIPMENT:

A. All equipment for the handling of all material, mixing, and placing of HMAC shall be in accordance with the provisions of Texas SDHPT Item 340.

2.09 STOCKPILING, STORAGE, PROPORTIONING AND MIXING:

A. Stockpiling, storage proportioning and mixing operations shall be in accordance with the Provisions of Texas SDHPT Item 340.

PART 3 - EXECUTION

3.01 WEATHER AND TEMPERATURE LIMITATIONS:

A. Asphaltic mixture, when placed with a spreading and finishing machine, or the tack coat shall not be placed when the air temperature is 50ºF and falling, but may be placed when the air temperature is 40ºF and rising.

B. Asphaltic mixture, when placed with a motor grader, shall not be placed when the air temperature is 60ºF and falling, but may be placed when the air temperature is 50ºF and rising.

C. Mat thicknesses of 1> inches or less shall not be placed when the temperature on which the mat is to be laid is below 50ºF.

D. No tack coat or asphaltic mixture shall be placed when the humidity, general weather conditions and temperature and moisture condition of the base, in the opinion of the ENGINEER, are unsuitable.

E. If, after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture is 50ºF or more below the temperature established by the ENGINEER, all or any part of the load may be rejected and payment will not be made for the rejected material.

3.02 EQUIPMENT:

A. Hauling Equipment:

1. Trucks used for hauling asphaltic mixtures shall have tight, clean, smooth metal beds which have been thinly coated with a minimal amount of paraffin oil, lime slurry, tine solution or other approved material to prevent mixture adhesion to the bed.

2. The dispatching of hauling equipment shall be arranged so that all material delivered may be placed and all rolling completed during daylight hours, unless otherwise directed by the ENGINEER.

3. All trucks shall be equipped with a cover of canvas, or other suitable material to protect the mixture from weather or on hauls where the temperature of the mixture will fall below specified level. Use of covers will be as directed by the ENGINEER.

B. Rollers:

1. Pneumatic Tire Roller. This roller shall consist of not less than seven pneumatic tire wheels, running on axles in such manner that the rear group of tires shall cover the entire gap between adjacent tires of the forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both a forward and a reverse direction with suitable provisions for moistening the surface of the tires while operating; and shall be approved by the ENGINEER.

2. Two Axle Tandem Roller. This roller shall be acceptable power-driver, steel-wheel, tandem roller weighing not less than eight tons. It must operate in forward and reverse directions; contain provision for moistening the surface of the wheels while in motion; and shall be approved by the ENGINEER.

3. Three Wheel Roller. This roller shall be an acceptable power-driven, all steel three wheel roller weighing not less than 10 tons. It must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the ENGINEER.

4. Vibratory Steel Wheel Roller. If approved for use by the OWNER, this roller shall have a minimum weight of six tons. The compactor shall be equipped with amplitude and frequency controls and shall be specifically designed to compact the material on which it is used. It shall be operated in accordance with the manufacturers recommendations.

C. Straight Edges:

1. The CONTRACTOR shall provide an acceptable 16-foot straight-edges for surface testing. Satisfactory templates shall be provided as required by the ENGINEER.

D. Spreading and Finishing Machine:

1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or a strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans.

2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. Design will be such that no part of the truck weight will be supported by the paver.

3. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture. The screed shall be adjustable for both height and crown and shall be equipped with a controlled heating device.

4. The bituminous paver shall be equipped with an automatic leveling device controlled from an external guide. The initial pass for each course shall be made using a paver equipped with a 40-foot minimum external reference, except that this requirement will not apply when asphalt concrete is placed adjacent to portland cement concrete pavement. Subsequent passes may utilize the matching device of one foot minimum length riding on the adjacent lay.

3.03 CONSTRUCTION METHODS:

A. Addition of Hydrated Lime:

1. Hydrated lime shall be added to the entire portion of asphalt concrete aggregate in an enclosed plug mill or other methods approved by the Engineer.

2. The hydrated lime shall be added to the aggregate such that loss of hydrated lime is minimal or nonexistent. Placement of the lime on an open conveyer belt will not be permitted. Placement of the lime on an enclosed belt that does not permit blowing or loss of lime is acceptable.

3. The CONTRACTOR shall provide appropriate weighing devices, approved by the ENGINEER, to assure that the proportionate amounts of hydrated lime are being added to the coarse aggregate, fine aggregate and filler (if required).

4. The addition of the hydrated lime to the aggregate shall be accomplished by Method A or B as follows:

Method A

The hydrated lime shall be added to the entire aggregate portion prior to stockpiling. The lime, aggregate and moisture will be mixed in a pugmill prior to the aggregate being stockpiled. Twenty-five (25) percent by weight of the hydrated lime shall be added to the coarse aggregate and seventy-five (75) percent by weight of the hydrated lime shall be added to the fine aggregate. If filler is required, the above percentages by weight will be adjusted by the ENGINEER to provide for addition of lime to all aggregate fractions to be incorporated into the PMBP. Minimum moisture content shall be 2 percent by weight for the coarse aggregate and 4 percent by weight for the fine aggregate, at the time the aggregate and lime are mixed.

OR

5. Method B
Hydrated lime shall be added to the combined aggregate materials in a pugmill immediately after leaving the cold feed and just prior to introduction into the dryer drum or dryer.

6. Minimum moisture content of the combined aggregates shall be 3 percent by weight, at the time the aggregate and lime are mixed.

7. The following parameters are applicable when utilizing Method A or Method B:

a) ENGINEER may increase the moisture content of the coarse and fine aggregates or the combination of coarse and fine aggregates to obtain proper coating of the aggregates with hydrated lime and to eliminate dust pollution. The CONTRACTOR will provide a method to positively determine the amount of moisture added to lime-aggregate mix.

b) The CONTRACTOR shall provide a method for determining the weight of the lime used in the plant mix bituminous pavement. The method to be used will be approved by the Materials Laboratory Bureau prior to the production of any plant mix bituminous pavement.

B. Spreading and Finishing:

1. The asphalt concrete mixture shall be laid on the approved surface, spread and struck off to the grade and elevation established. It shall be spread and compacted in layers as shown on the plans or as directed by the ENGINEER. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

2. The ENGINEER will determine a minimum placement temperature within a range from 220ºF to 300ºF which will produce the required density. The established placement temperature, which is measured immediately behind the laydown machine, shall not vary more than 20ºF.

3. A conventional paver or suitable equipment approved by the ENGINEER may be used to place asphalt concrete material on shoulders depressed from the traveled lanes in order to establish a uniform typical section. Approval of the equipment used will be based upon the results obtained.

4. The asphalt concrete may be dumped from the hauling vehicles directly into the paving machine or it may be dumped upon the surface being

paved and subsequently loaded into the paving machine; however, no asphaltic concrete shall be dumped from the hauling vehicles at a distance greater than 250 feet in front of the paving machine. When asphaltic concrete is dumped first upon the surface being paved, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphaltic concrete dumped shall be picked up and loaded into the paving machine.

5. To achieve, as far as practicable, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant. Sufficient hauling equipment shall be available to insure continuous operation.

6. The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other indirectly either through controlling the transverse slope or alternately when directed, by controlling the elevation of each end independently, including any screed attachments used for widening, etc. Failure of the control system to function properly shall be cause for the suspension of the asphaltic concrete operations.

7. When dumping directly into the paving machine from trucks, care shall be taken to avoid jarring the machine or moving it out of alignment.

8. All courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the ENGINEER deems the use of self-propelled paving machines impracticable.

9. Self-propelled paving machines shall spread the asphaltic concrete without segregation or tearing within the specified tolerances, true to the line, grade, and crown indicated on the plans. Pavers shall be equipped with hoppers and augers which will place the asphaltic concrete evenly in front of adjustable screeds without segregation. Screeds shall include any strike-off device operated by tamping or vibrating action which is effective without tearing, shoving or gouging the asphaltic concrete and which produces a finished surface of an even and uniform texture for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

10. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, fluted and compacted with hand tools. For such areas the mixture shall be dumped, spread and screed to give the required compacted thickness.

C. Compaction:

1. Rolling with the 3-wheel and tandem roller shall start longitudually at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels.

2. Alternate trips of the roller shall be slightly different in length.

3. Rolling with a pneumatic tired roller shall be as directed by the ENGINEER.

4. Rolling shall continue when no further compression can be obtained and all roller marks are eliminated.

5. The motion of the roller shall be slow enough at all times to avoid displacement of asphaltic materials. If displacement occurs, it shall be corrected immediately by use of rakes and fresh asphaltic mixtures, where required.

6. The roller shall not be allowed to stand on the surface course when it has not been fully compacted and allowed to cool.

7. To prevent adhesion of the surface course to the roller, the wheels shall be kept thoroughly moistened with water; however, excess water shall not be allowed.

8. All precautions shall be taken to prevent dripping of gasoline, oil, grease, or other foreign substances on the surface or base courses during rolling operations or while rollers are standing.

9. With the approval of the ENGINEER, a vibratory steel wheeled roller may be substituted for the 3-wheel roller and tandem roller.

10. Along forms, curbs, headers, walls and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

11. Any mixture that becomes loose, broken, mixed with dirt, segregated, or is in any way defective shall be removed and replaced with fresh hot bituminous mixture, which shall be compacted to conform with the surrounding area. Any area showing excess or deficiency of bituminous material shall be corrected immediately as directed by the ENGINEER.

D. In-Place Density:

1. In-place density shall be required for all mixtures except thin irregular depth leveling courses.

2. Each course, after final compaction, shall have a density of not less than 95 percent of the density developed in the laboratory test method outlined in Texas SDHPT Bulletin C-14.

3. Density shall be determined with a portable nuclear test device in conformity with ASTM D-2950.76.

4. Calibration of the portable nuclear device will be established by the ENGINEER from cut pavement samples tested in accordance with AASHTO T-166 (weight, volume method). The density readings of the cut pavement samples determined in accordance with AASHTO T-166 (weight, volume method), and the density readings of the pavement determined by the portable nuclear nuclear test device in conformity with ASTM D 2950 will be correlated by the ENGINEER.

5. Other methods of determining in-place density may be used as deemed necessary by the ENGINEER.

6. It is intended that acceptance density testing will be done while the bituminous mixture is hot enough to permit further compaction if necessary. If the density of an acceptance section does not meet the specified requirements, the CONTRACTOR shall continue the compaction effort until the optimum density is obtained, but rolling for any compactive effort will not be allowed when the temperature of the mix is below 175oF unless authorized in writing by the ENGINEER. Rerolling the paved surface after it has initially cooled will not be allowed.

7. If in-place density tests of the mixture produce a value lower than specified and in the opinion of the ENGINEER is not due to a change in the quality of the material, production may proceed with subsequent changes in the mix and/or construction procedures until in-place density equals or exceeds the specified density.

8. In-place density tests will be provided by the ENGINEER unless otherwise specified.

E. Joints:

1. Placing of the asphalt concrete shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the ENGINEER.

2. When plant mix bituminous pavement is placed over plant mix bituminous treated base or when plant mixed seal coat is placed over plant mix bituminous pavement, longitudinal joints shall be staggered at least 6 inches with relation to the longitudinal joints of the underlying course.

3. Transverse joints shall have a two foot or 12:1 minimum taper. Longitudinal joints shall have a one foot or 6:1 minimum taper. All transverse tapers shall be cut and squared off prior to commencing new work. Tapered longitudinal joints from previous operations shall be cleaned and tack coated if directed by the ENGINEER. All joints shall be completely bonded. The surface of each course at all joints shall be smooth and shall not show any deviations in excess of 3/16 of an inch when tested with a 10-foot straightedge in any direction.

4. When paving under traffic the CONTRACTOR shall plan his daily surfacing operations on a schedule which will result in not more than one (1) day's operation of exposed longitudinal joints. The longitudinal joints shall not have a height greater than two (2) inches and shall not be left exposed longer than 24 hours.

F. Surface Tolerance:

1. Upon completion, the pavement shall be true to grade and cross section. Except at intersections or any changes of grade, when a 16 foot straight edge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straight edge more than 1/16-inch per foot. Areas that are not within this tolerance shall be brought to grade immediately following the initial rolling. After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances or that retain water on the surface shall be corrected by removing the defective work and replacing with new material as directed by the ENGINEER at the expense of the CONTRACTOR.

G. Manholes and Valve Covers:

1. Manhole frames and valve covers shall be adjusted prior to placing the surface course.

H. Compacted Thickness of HMAC Surface and Base Courses:

1. Surface Courses. The compacted thickness or depth of the asphaltic concrete surface course shall be as shown on the plans. Where the plans require a depth or thickness of the surface course greater than two inches compacted depth, same shall be placed in multiple courses of equal depth, each of which shall not exceed two inches compacted depth. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any of the multiple courses, it shall be applied at the rate as directed.

2. Base Courses. The compacted thickness or depth of each base course shall be as shown on the plans. Where the plans require a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any of the multiple lifts, it shall be applied as hereinbefore specified and at the rate as directed.

I. Pavement Thickness Tests:

1. Pavement Thickness Test. Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the ENGINEER or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the OWNER. The cost for the initial pavement thickness test shall be at the expense of the ENGINEER. In the event a deficiency in the thickness of pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the CONTRACTOR's expense. The cost for the additional coring test shall be at the same rate charged by commercial laboratories.

J. Price Adjustment for Roadway Density

1. The payment of the unit price will be adjusted for roadway density as outlined in the following table. The adjustment will be applied on a lot by lot basis for each lift. The adjustment will be based on the average of five density tests. The price adjustment will be applied to the entire asphalt concrete mix which includes the HMAC aggregate, the asphalt cement and the lime.

Average Density % of Lab Density	Percent of Contract Price To Be Paid

Above 95%	100%
94.0 to 94.99	96%
93.0 to 93.99	91%
92.0 to 92.99	85%
Less than 92.00	*

*This lot shall be removed and replaced to meet specification requirements as ordered by the ENGINEER. In lieu thereof, the CONTRACTOR and the ENGINEER may agree in writing that for practical purposes, the lot shall not be removed and will be paid for at 50% of the contract price.

PART 4 - MEASUREMENT AND PAYMENT

4.01 INCIDENTAL WORK:

A. Prime coat, lime, and tack coat shall not be measured for direct payment, but shall be considered as subsidiary work pertaining to the placing of asphaltic mixtures of the type specified.

4.02 MEASUREMENT:

A. Hot-mix asphalt concrete material shall be measured by the ton of 2,000 pounds or by the square yard of the type or types used in the completed and accepted work.

B. Weight shall be determined by a certified scale approved by the OWNER and recorded serially numbered weight tickets, identifying the vehicle and presented to the ENGINEER's representative on the job.

4.03 PAYMENT:

A. Work performed and materials furnished, as prescribed by this item, measured as provided herein, shall be paid at the unit bid price per ton or square yard for the type or types of hot mix asphalt concrete pavement shown on the proposal.

B. Unit bid price shall be payment in full for quarrying; furnishing all materials; for all heating; mixing; hauling; cleaning existing base course or pavement; placing asphaltic mixtures; rolling and finishing; and for all labor, tools, equipment and incidentals necessary to complete the work, including the work and materials involved in the application of prime coat and tack coat.

END OF SECTION

SECTION 02660 CONCRETE CURB AND GUTTER AND VALLEY GUTTER

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of the construction of concrete curb, concrete curb and gutter, concrete gutter or valley gutter, or combination thereof in compliance with these specifications, lines, grades, and details shown on the plans, or as directed by the ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Concrete and manufactured curb and gutter materials shall be subject to inspection and tests at plants and construction sites for compliance with quality requirements.

B. Concrete curb and gutter or concrete valley gutter shall be constructed with concrete conforming to the provisions of Section 02614 - Portland Cement Concrete Paving, or Class "B" concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete.

C. Preformed expansion Joint Filler shall conform to the requirements of AASHTO M-33 or M-153.

D. Linseed Oil shall conform to the requirements of AASHTO D-260.

E. Mineral Spirits shall conform to the requirements of AASHTO D-235.

2.02 FOUNDATION:

A. Concrete curb and gutter or concrete valley gutter shall be placed on an approved foundation conforming to the requirements of the following City Of McAllen Specifications:

1. Section 02210 - Subgrade Preparation,

2. Section 02260 - Flexible Base,

3. Section 02230 - Roadway Excavation, Borrow, and Embankment.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. When required, excavation shall be made to the specified depth, and the base upon which the curb and gutter or valley gutter is to be placed shall be compacted to a firm, even surface conforming to the requirements of Subsection 2.02 above.

B. All soft and unacceptable material shall be removed an replaced with material approved by the ENGINEER in conformance with the requirements of Subsection 2.02 above.

3.02 FORMS:

A. Forms shall be of wood or metal, straight, free from warp, and of such construction that there will be no interference to the inspection of grade or alignment.

B. All forms shall extend for the entire depth of the curb and gutter and shall be braced and secured sufficiently so that no deflection from alignment or grade will occur during the placing of the concrete. Flexible forms shall be used in curved sections so that the top surface of the forms will form a smooth, continuous arc.

3.03 MIXING AND PLACING:

A. Concrete shall be proportioned, mixed, and placed in accordance with the requirements of Section 02614 and Section 03300.

B. Compaction of the concrete placed in forms shall be by vibration or other acceptable methods.

C. Unless otherwise provided, the exposed surfaces of curbs and gutters shall be finished by belting or with wooden floats. Forms shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb and gutter.

3.04 SECTIONS:

A. Curb and gutter shall be constructed in sections having a uniform length of 20 feet, unless otherwise directed by the ENGINEER. Sections shall be separated by open joints 1/8 inch wide except at expansion joints.

3.05 EXPANSION JOINTS:

A. Expansion joints shall be formed at the intervals shown on the plans using a performed expansion joints filler having a thickness of 3/4 inch.

B. When the curb and gutter is constructed adjacent to or on concrete pavement, expansion joints, shall be located opposite or at expansion joints in the pavement.

3.06 CURING

A. Immediately upon completion of the finishing, the curb and gutter shall be moistened and kept moist for 3 days, or the curb and gutter shall be cured by the use of membrane-forming material. The method and details of curing shall be subject to the approval of the ENGINEER.

3.07 SURFACE TREATMENT:

A. The surface of concrete curb and gutter or concrete valley gutter shall be treated with a solution of Linseed Oil and Mineral Spirits in accordance with the applicable requirements of Section 03300 - Cast-In-Place Concrete.

3.08 BACKFILLING:

A. After the concrete has set sufficiently, the spaces in front and back of the curb shall be refilled to the required elevation with material approved by the ENGINEER, and shall be thoroughly tamped in layers of not more than 6 inches.

3.09 SLIP-FORM CONCRETE CURB, CONCRETE CURB AND GUTTER OR CONCRETE VALLEY GUTTER:

A. Any concrete curb or concrete curb and gutter, except on structures, may be placed using a slip form machine provided that the finished concrete curb or concrete curb and gutter is true to line and grade and the concrete is dense and of the required surface texture.

B. The concrete shall be of a consistency that it will maintain the shape of the concrete curb or concrete curb and gutter section without support after slip forming.

C. The top and face of the finished concrete curb or concrete curb and gutter shall be true an straight and the top surface of the concrete curb or

concrete curb and gutter shall be of uniform width and free from humps, sags, or other irregularities.

D. The forming portion of the slip form machine shall be readily adjustable vertically during the forward motion of the slip form machine to provide a variable height of concrete curb or concrete curb and gutter grade when necessary. A grade line gauge or pointer shall be attached to the slip form machine in such a manner that a continual comparison can be made between the concrete curb or concrete curb and gutter grade as indicated by the offset guidelines.

E. Concrete shall be fed to the slip form machine at a uniform rate. The slip form machine shall be operated under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete free from surface pits larger than 3/16 inch in diameter and requiring no further finishing, other than light brushing with a wet brush. Finishing with a brush application of grout will not be permitted.

F. Transverse weakened plane and expansion joints shall be constructed at right angles to the line of the concrete curb, concrete curb and gutter, or concrete valley gutter.

G. Expansion joints may be constructed by sawing through the concrete curb or concrete curb and gutter section to its full depth. The width of the cut shall be such as to admit the joint filler with a snug fit.

H. The operations of sawing and inserting the joint filler shall be completed before curing the concrete. At the conclusion of the curing period the filler in each joint shall be checked for tightness of fit. The loose filler in any joint shall be mortared in place and cured.

I. Excavation shall be as per Subsection 2.02 above.

J. All remaining provisions of Subsection 2.02 above also apply, unless otherwise specified.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Curb and gutter, curb, and valley gutter shall be measured by the linear foot.

1. Curb shall be measured along the front face of the section at the finished grade elevation.

2. Combination curb and gutter will be measured along the face of the curb at the flowline of the gutter.

3. Valley gutter will be measured along the flowline of the gutter.

B. A deduction in length shall be made for drainage structures, such as catch basins or inlets, in the curb, gutter, or combination thereof.

C. There will be no direct measurement or payment of materials used to construct curb and gutter, curb or valley gutter.

D. Excavation or construction of embankment for foundation of curb, valley curb and gutter will not be measured for payment.

4.02 PAYMENT:

A. The accepted quantities of curb, valley gutter, and curb and gutter will be paid for at the contract unit bid price per linear foot for each kind and type specified complete in place.

B. Foundation preparation by excavating or constructing embankment to the required subgrade elevation is considered incidental to the completion of the work and no direct payment will be made therefor.

C. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK COVERED:

A. Mixing, placing, finishing and providing all related services necessary to construct all cast-in-place concrete work indicated on plans.

1.02 QUALITY ASSURANCE:

A. Comply with the latest published edition of the American Concrete Institute (ACI) and American Society of Testing and Materials (ASTM) standards and codes:

1. ACI 315 - Manual of Standard Practice of Detailing.

2. ACI 318 - Building Code Requirements for Reinforced Concrete.

3. ACI 347 - Recommended Practice for Concrete Formwork.

4. ASTM A36 - Structural Steel.

5. ASTM C33 - Concrete Aggregates.

6. ASTM C39 - Concrete Strength of Molded Concrete Cylinders.

7. ASTM C94 - Ready-Mixed Concrete.

8. ASTM C143- Slump of Portland Cement Concrete.

9. ASTM C150- Portland Cement.

10. ASTM C309- Liquid Membrance-Forming Compounds for Curing Concrete.

11. ACI 304 - Recommended Practice for Measuring, Mixing, Transportation and Placing Concrete.

12. ACI 301 - Specification for Structural Concrete for Building.

B. Submit compliance submittals as specified in Division 1, including but not limited to the following: bar schedule, bar details, shop drawings including size and location of openings, waterstops, joint systems and curing method.

C. Submit proposed concrete mix proportions to ENGINEER prior to placing concrete.

PART 2 - PRODUCTS

2.01 PORTLAND CEMENT:

A. Type I, Type II or Type III conforming to ASTM C150 as modified by Texas State Department of Highways and Public Transportation, 1982 Standard Specifications.

B. Type I or II cement may be used unless Type II is specified.

C. Except when Type II specified, Type III may be used when the anticipated air temperature for the succeeding 12 hours will not exceed 60o F.

D. Type III may be used in all pre-cast pre-stressed concrete except in piling when Type II cement is required for substructure concrete.

E. All cement used in a monolithic placement shall be of the same type.

F. May be either bagged or bulk. Partially set or caked cement will be rejected.

G. All types of cements shall be "low-alkali" cements.

2.02 WATER:

A. Clear, fresh, free from injurious amounts of oil, alkaline, acid or organic matter or other deleterious substances and shall not contain more than 1000 parts per million of chlorides as C1 nor more than 1000 parts per million of sulfates as SO_4.

B. Water of known potable quality requires no testing. Other sources shall meet the requirements of AASHTO T-26.

C. Water shall have a pH of not less than 4.5 or more than 8.5.

2.03 FINE AGGREGATE:

A. Natural sand, manufactured sand or a combination of the two, with or without mineral filler.

B. The sand, or mixture of sand, comprising a single fine aggregate, shall consist of clean, hard, durable, uncoated grains and shall be essentially free from clay lumps, salt or alkali, and other foreign material.

C. The maximum permissible percentage, by weight, of deleterious substances shall not exceed the following:

Material removed by decantation	3.0%
Other deleterious substances such as coal, shale, coated grains and soft flaky particles	3.0%

An additional loss of 2% by decantation may be allowed, provided this new additional loss is material of the same quality as specified for fine aggregate or mineral filler.

D. Gradation, percent of weight retained:

Sieve Size	% Retained
3/8 inch	0
No. 4	0 - 5
No. 8	0 - 20
No. 16	15 - 50
No. 30	35 - 75
No. 50	65 - 90
No. 100	90 - 100
No. 200	97 - 100

E. Fineness Modulus: for Grade 1 only - 2.3 minimum, 3.1 maximum.

F. Mineral filler:

1. May be added upon written authorization of ENGINEER.

2. Shall be stone dust or clean crushed sand, or other approved inert material.

3. Shall not exceed 5% of the fine aggregate.

4. Shall meet the following requirements:

Passing No. 30 sieve	95 to 100%
Passing No. 100 sieve	70 to 100%

2.04 COARSE AGGREGATE:

A. Crushed stone, gravel, crushed gravel, crushed blast furnace slag or a combination of these.

B. Gravel and crushed gravel shall consist of clean, hard durable particles, free from adherent coating, thin or elongated pieces, soft or disintegrated particles, dirt, organic or deleterious substances, salt or alkali, and other foreign material.

C. Crushed stone shall consist of the clean, dust free product resulting from crushing of stone. There shall be no adherent coatings, clay, loam organic or deleterious substances, salt or alkali, and other foreign material.

D. The maximum permissible percentage, by weight, of deleterious substances shall not exceed the following:

Material removed by decantation	1.0%
Shale, slate or other similar material	1.0%
Clay lumps	0.25%
Soft fragments	3.0%
Other deleterious substances, including friable, thin, elongated or laminated pieces	3.0%
The sum of all deleterious substances, exclusive of material removed by decantation, shall not exceed by weight	5.0%

E. Course aggregates shall have a percent wear of not more than 45 when tested in accordance with Test Method Tex-410-A.

F. Gradation, percent of weight retained on:

Grade No. 1 - Maximum Nominal Size 2 1/2 in. (63 mm)

Sieve	Percentage Retained
2 1/2 in.	0%
2 in.	0 - 20%
1 1/2 in.	15 - 50%
3/4 in.	60 - 80%
No. 4	95 -100%

Grade No. 2 - Maximum Nominal Size 1 1/2 in. (37.5 mm)

Sieve	Percentage Retained
2 in.	0%
1 1/2 in.	0 - 5%
3/4 in.	30 - 65%
3/8 in.	70 - 90%
No. 4	95 -100%

Grade No. 3 - Maximum Nominal Size 1 in. (25 mm)

Sieve	Percentage Retained
1 1/2 in.	0 - 5%
3/4 in.	10 - 40%
1/2 in.	40 - 75%
No. 4	95 - 100%

Grade No. 4 - Maximum Nominal Size 3/8 in. (9.5 mm)

Sieve	Percentage Retained
1/2 in.	0 - 5%
3/8	5 - 30%
No. 4	75 -100%

G. Gradation Requirements - maximum size of aggregate for structural concrete shall not exceed three inches, and shall be reduced in size to meet the following conditions:

1. One-sixth of the least dimension between forms of that part of the structure in which concrete is to be placed; and

2. Three-fourths of the clear space between reinforcement.

3. The maximum size aggregate is defined as the clear space between the sides of the smallest square openings through which 95 percent of the weight of the aggregate can be passed.

4. Unless otherwise noted or restricted by above Grade No. 2, gradation shall be used.

2.05 PIT-RUN AGGREGATE:

A. Pit-run aggregate is the natural gravel and sand obtained from pits without the addition of other fine or course aggregates, and shall consist of hard, durable, uncoated pebbles or stone particles mixed with sand.

B. Pit-run aggregate shall be free from lumps of clay and injurious amounts of dust, shale, soft or flaky particles, salt and alkali.

C. Pit-run aggregate shall be well graded from course to fine when tested by standard laboratory methods and shall meet the following minimum requirements for percentages by weight:

Retained on 1/4 in sieve 55% to 60%

D. Pit-run aggregate shall not be used for high-strength concrete of 3000 psi and above.

E. Pit-run aggregate may be used only for concrete cushion, cradle and protection for pipe.

2.06 ADMIXTURES:

A. Concrete admixtures shall comply with Section 03320.

2.07 REINFORCING STEEL:

A. Reinforcing steel shall comply with Section 03330.

2.08 CURING MATERIALS:

A. Liquid Membrane: white pigmented chlorinated rubber, ASTM C309.

B. Liquid Membrane: resin base, clear compound, permitting application of paint, Servicised Product Corp. - Code 2802 or equal.

C. Plastic Film: white pigmented, 0.00085" (minimum) thick.

D. Burlap: jute fabric, lean, free of impurities.

E. Surface Hardener: gray crystal, acidic fluosilicate base, slightly hygroscopic chemical surface hardener, SIKA Hardener, Sika Chemical Corp. or equal.

2.09 JOINT MATERIALS:

A. Joint Sealer: hot poured, non-extruding, elastic, ASTM D1190.

B. Preformed Expansion Joint Filler: non-extruding, bituminous fiber, ASTM D1751.

2.10 WATERSTOP:

A. Polyvinyl chloride or rubber, centerbulb.

B. Size to suit joints, minimum 6".

2.11 FORM MATERIALS:

A. Use plywood, metal, metal framed plywood faced or other acceptable panel-typed material.

B. Coat forms with non-bonding, non-staining commercial compounds.

2.12 MOISTURE BARRIER:

A. Polyethylene sheet, minimum 8 mil., ASTM E154.

2.13 CONCRETE MIX DESIGN AND CONTROL:

A. Submit not less than 10 days prior to the start of concreting operations, to the ENGINEER.

1. Mix design, using a course aggregate factor acceptable to the Engineer.

2. Sufficient samples of all materials to be incorporated into the mix for testing.

3. Full description of the source of supply of each material component.

B. Course aggregate factor:

1. Not more than 0.82 when voids less than 48%.

2. Not more than 0.85 when voids exceed 48%.

3. Not less than 0.68.

C. No changes or deviations from proportions or sources of supply without approval of ENGINEER.

D. No concrete may be placed on the job site until the mix design has been approved by ENGINEER in writing to the CONTRACTOR.

2.14 CONCRETE QUALITY:

A. Consistency:

1. Mortar shall cling to the course aggregate.

2. The aggregate shall not segregate during transport.

3. The concrete and mortar shall show no free water when removed from the mixer.

B. The consistency should allow the completion of all finishing operations with the addition of water to the surface.

C. The concrete shall be uniform, workable, cohesive, possess satisfactory finishing qualities and be of the stiffest consistency that can be placed and vibrated into a homogenous mass.

D. Excessive bleeding shall be avoided.

E. Slump requirements shall be as follows:

Structural Concrete	Avg. Slump	MaxSlump
(a) Cased Drilled Shafts and Thin-walled Sections (9 inches or less) . . .	4	5
(b) Slabs, Caps, Column, Pipers, Wall Sections Over 9 inches, etc.	3	4
(c) Slip Form Paving	1/2	2
(d) Underwater or Seal Concrete	5	6
(e) Rip-Rap, Curb, Gutter and Other Miscellaneous Concrete	(As Specified by ENGINEER)	

NOTE: No concrete shall be permitted with slump in excess of the maximum shown. Any concrete mix failing to meet the above consistency requirements, although meeting the slump requirements shall be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions.

F. The concrete shall comply with Table 1 below:

TABLE 1 - CLASSES OF CONCRETE

Class Of Concrete	Min.-Max. SX.Cement per C.Y.	Min. Comp. Strength 28-day psi	Min. Beam Strength 7-day psi ****	Max. Water Cement Ratio Item 2.1.1. (c)(4)	Coarse Aggr. No.
A	5.0	3000	500	6.5	2-3-4
B	4.0	2000	330	8.0	2-3-4
C*	6.0	3600	600	6.0	1-2-3**
D	3.0	1500	250	11.0	2-3-4
E	6.0	3000	500	7.0	2-3
F	6.5	4200	700	5.5	2-3
H***	6.5-8.0	As specified on plans	N.A.	5.5	3

*Entrained Air.
**No. 1 course aggregate may be used in foundations only (except cased drilled shafts).
***Prestressed Concrete.
****ASTM C 293 (Center Point)

2.15 GROUT

A. Non-Shrink:

1. Use pre-mixed non-shrink, Embeco Pre-Mixed Grout or Embeco Pre-Mixed Mortar by Master Builders Company or equal.

2. Keep water to a minimum for placing by the dry packing method.

B. Grout for Bonding:

1. 1 part cement to 1 1/2 parts sand by weight.

2. Keep water to a minimum.

PART 3 - EXECUTION

3.01 SUBGRADE:

A. Insure subgrade is true to line and grade and compacted as specified.

B. Fill and recompact any ruts or depressions.

C. Check cross section with a template.

D. Place moisture barrier or moisten subgrade prior to placing of concrete. Method to be approved by the ENGINEER.

3.02 FORMS:

A. Provide forms for all concrete work including footings and base slabs.

B. Construct forms so that completed concrete will conform to shapes, lines, grades and dimensions indicated and required.

C. Forms shall be true, plumb and level with reasonably tight joints. Adequately support and brace forms.

D. Place anchors, inserts, bolts, sleeves and other devices indicated or required for the various portions of all the work.

E. Oil temporary forms with non-staining form oil before reinforcing steel is placed.

F. Rough form finish as defined by ACI 301 permitted for concealed concrete.

G. Smooth form finish as defined by ACI 301 permitted for concealed concrete.

H. Provide 3/4 inch chamfer on exposed corners and edges, and 1-foot below ground level.

3.03 REMOVAL OF FORMS:

A. Do not remove forms or supports until concrete has acquired sufficient strength to safely support its own weight and the superimposed loads.

B. Remove formwork for columns, walls, beam sides and other parts not supporting the weight of the concrete as soon as the concrete has hardened sufficiently to resist damage from removal operations.

C. Formwork for slabs, beam soffits and other parts supporting the weight of the concrete shall remain in place until the concrete has reached its specified 28-day strength.

D. Protect concrete from damage prior to acceptance.

E. Prohibit traffic until concrete is at least 10 days old.

F. Cure areas previously covered by forms.

3.04 MIXING CONCRETE:

A. Maintain all equipment, tools, and machinery used for hauling materials and performing any part of the work to insure completion of the work underway without excessive delays for repairs or replacement.

B. Mixing shall be done in a mixer of adequate size and type to produce uniform distribution of the material throughout the mass.

C. The mixer shall have a plate affixed showing the manufacturer's recommended operating data and it shall be operated within the speed and capacity limits stated thereon.

D. The absolute volume of the concrete batch shall not exceed the rated capacity of the mixer.

E. The entire contents of the drum shall be discharged before any materials are placed.

F. Improperly mixed concrete will not be placed.

G. The mixing time shall be in accordance with the recommendations of the mixer manufacturer.

H. Transit Mix Concrete:

1. Sufficient transit mix equipment shall be assigned exclusively to the project as required for continuous operation.

2. Satisfactory evidence shall be furnished so that the delivery of concrete shall be continuous at regular and uniform intervals, without stoppage or interruption.

3. Concrete shall not be placed on the job after a period of 1 hours after the cement has been placed in the mixer, with mixer turning; 30 minutes without mixer tuning.

I. Continuous Volumetric Mix Concrete:

1. A mobile, continuous, volumetric mixer of the rotating puddle type may be used for when approved by ENGINEER.

2. Mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.

3. The mixers shall have adequate water supply and metering devices.

4. Calibration of these mixers will be required.

3.05 PLACING CONCRETE:

A. The minimum temperature of all concrete at the time of placement shall not be less than 50º F.

B. Clean transporting equipment, reinforcing and embedded items before placing concrete.

C. Batch trucks or paving equipment not permitted on prepared subgrade unless authorized by the ENGINEER based on actual job conditions.

D. Place no concrete until after inspections of forms by ENGINEER.

E. The maximum time interval between the addition of cement to the batch, and the placing of concrete in the forms shall not exceed the following:

Air or Concrete Temperature	Maximum Time
Nonagitated Concrete	
80º F or above (26.6º C)	15 minutes
35º F or 79º F (1.6 to 26.1º C)	30 minutes
Agitated Concrete	
90º F or above (32.2º C)	45 minutes
75º F to 89º F (23.9 to 31.6º C)	60 minutes
35º F to 74º F (1.6 to 23.3º C)	90 minutes

F. Prevent segregation during placing.

G. Consolidate flat work with one pass of mechanical vibrator moving parallel to centerlines. Unusual sections and widths may be hand puddled and finished.

H. Place concrete continuously so that each pour unit will be monolithic in construction and will terminate at expansion, contraction or construction

joint. Permit not more than 30 minutes between depositing adjacent batches.

I. Place slab concrete over membrane waterproofing before waterproofing has become damaged or dirty.

J. Concrete placement will not be permitted when impending weather conditions will impair the quality of the work.

K. Slope horizontal surfaces of exterior concrete for drainage.

L. Deposit concrete in forms in horizontal layers not deeper than 24 inches. Avoid inclined construction joints. Place each layer while preceding layer is still plastic to avoid cold joints.

M. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

N. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate placed layer of concrete and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. Limit vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

3.06 PLACING CONCRETE IN WATER:

A. Concrete shall be deposited in water only when specified on the plans or with written permission of the ENGINEER.

B. The forms or cofferdams shall be sufficiently tight to prevent any water current passing through the space in which the concrete is deposited.

C. Pump will not be permitted during the concrete placing, nor until it has set for at least 36 hours.

D. The concrete shall be placed with a tremie, closed bottom-dump bucket or other approved method.

E. The concrete shall not be allowed to fall freely though the water nor shall it be disturbed after it has been placed. Its surface shall be kept approximately level during placement.

F. The tremie shall consist of a water-tight tube 14-inches or less in diameter. It shall be constructed so that the bottom can be sealed and opened after it is in place and fully charged with concrete. It shall be supported so that it can be easily moved horizontally to cover all the work area and vertically to control the concrete flow. The lower end of the tremie shall be submerged in the concrete at all times.

G. Bottom-dump buckets used for underwater placing shall have a capacity of not less than one-half cubic yard. It shall be lowered gradually and carefully until it rests upon the concrete already placed and raised very slowly during the upward travel; the intent being to maintain still water at the point of discharge and to avoid agitating the mixture.

H. The placing operations shall be continuous until the work is complete.

I. Unless otherwise specified all concrete placed under water, except seal concrete, shall contain an additional sack of cement per cubic yard.

3.07 JOINTS:

A. CONTRACTOR:

1. Extend entirely across flat slabs at locations shown.

2. Location where not shown; maximum spacing is:

a. Driveways: 10'.
b. Sidewalks: 4'.
c. Other flat slabs: 20 times slab thickness.

3. Saw depth not less than 1/4 slab thickness.,

B. Expansion:

1. Install where shown on the plans.

2. Location where not shown: all structures and features which project through, into or against slab.

3. Install according to manufacturer's recommendations, set material securely before placing concrete.

4. Install 1 inch width unless shown otherwise.

C. Filling Joints:

1. Fill not later than 14 days after sawing.

2. Fill immediately following cleaning.

3. Fill to 1/8" of surface.

4. Remove excess while material is still pliable.

5. Refill low areas where necessary.

6. Omit filling sidewalk joints.

3.08 FINISHING EXTERIOR FLAT WORK:

A. Strike off and float as required.

B. Check surface with ten foot straight edge, maximum variance allowed - 1/8".

C. Drag concrete surface longitudinally with double thickness burlap drag after completion of straight edging unless noted otherwise.

D. Use edger on edges of slab.

E. Use hand finishing only when approved by ENGINEER.

3.09 FINISHING OTHER CONCRETE:

A. Interior floors: smooth, steel-trowled finish; use edger on exposed edges. Grind smooth defects which would telegraph through applied finish flooring.

B. Exterior walks and steps lightly broomed finish transverse to traffic flow; use edger on exposed edges.

C. Other Surfaces:

1. Remove fins, projections and loose material.

2. Clean surfaces of form oil.

3. Patch honeycomb, aggregate pockets, voids and holes as follows:

a. Chip out until sound concrete is exposed to minimum depth of 1 inch.

b. Prepare patching mortar with approximately two parts of normal Portland Cement, one part white cement, nine parts fine aggregate; vary proportions of aggregate as necessary to match color of adjacent concrete.

4. Fill holes left by form ties to within 1 inch of surface with non-shrink grout. Fill remainder with patching mortar specified hereinbefore.

5. Apply grout-cleaned finish to all exposed vertical surfaces. Wet surface and rub grout on surfaces with rubber or cork float. Scrape off excess grout and finish with brick rubbing or as approved by ENGINEER.

D. Coordinate required finish with ENGINEER.

3.10 CURING:

A. CONTRACTOR shall inform the ENGINEER fully of the methods and procedures proposed for curing; shall provide proper equipment and material in adequate amounts; and shall have approval of the proposed method, equipment and material prior to placing concrete.

B. All concrete shall be cured for a period of 4 curing days except as noted herein.

EXCEPTIONS TO 4-DAY CURING

Description	Required Curing
Upper Surfaces of Bridge Roadway, Median and Sidewalk Slabs and Top Slabs of Direct Traffic Culverts	8 Curing Days

A curing day is defined as a calendar day when the ambient temperature, taken in the shade away from artificial heat, is above 50 degrees Fahrenheit (10ºC) for at least 19 hours, or the ambient temperature is 50 degrees or less; and if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 40 degrees Fahrenheit (4.4ºC) for the entire 24 hours.

C. Form Curing: when forms are left in contact with the concrete, other curing methods shall not be required except for cold-weather protection.

D. Water Curing: all exposed surfaces of the concrete shall be kept wet continuously for the required curing time. The water used for curing shall meet requirements for concrete mixing water.

1. Wet Mat:

a. Cotton mats shall be used for this curing method. The mats shall not be placed in contact with the concrete until such time that damage shall not occur to the surfaces

b. Damp burlap blankets made from 9-ounce stock may be placed on the damp concrete surface for temporary protection prior to the application of the cotton mats.

c. The mats may be placed dry and wetted down after placement.

d. Mat curing, expect for continuous placements, shall commence not later than three hours after finishing of the roadway slab.

e. The mats shall be weighted down adequately to provide continuous contact with all concrete surfaces where possible.

f. The surfaces of the concrete shall be kept wet for the required curing time.

g. Surfaces which cannot be cured by contact shall be enclosed with mats, anchored positively to the forms, or to the ground, so that outside air cannot enter the enclosure. Sufficient moisture shall be provided inside the enclosure to keep all surfaces of the concrete wet.

2. Water Spray. This method shall be accomplished by overlapping sprays or sprinklers, so that all unformed surfaces are kept continuously wet.

3. Ponding. This method requires the covering of the surface with a minimum of two inches (5 cm) of clean granular material, kept wet at all times; or water to a minimum depth of one inch (2.5 cm). Satisfactory provisions shall be made to provide a dam to retain the granular material or water.

E. Membrane Curing:

1. Unless otherwise shown on the plans, Type 2 membrane curing compound may be used where permitted.

2. Membrane shall be applied in a single, uniform coating at the rate of coverage recommended by the manufacturer and as approved by the ENGINEER, but not less than nine gallons per 210-feet (.0038M3 63M) of area. Tests for acceptance shall be at this specified rate.

3. Membrane curing shall not be applied to dry surfaces; but shall be applied to horizontal surfaces just before free moisture has disappeared.

4. Formed surfaces and surfaces which have been given a first rub shall be dampened and shall be moist at the time of application of the membrane.

	STRUCTURE UNIT DESCRIPTION	REQUIRED Water for Complete Curing	REQUIRED Membrane for Interim Curing	PERMITTED Water for Complete Curing	PERMITTED Membrane for Interim Curing
1.	Upper surfaces of bridge roadway; median, and sidewalk slabs; top slabs of direct traffic culverts; top surface of any concrete unit upon which concrete is to be placed and bonded at a later interval (stub walls, risers, etc.). Other super-structure concrete (curbs wingwalls, parapet walls, etc.)	X	X (Resin Basin)		
2.	Top surface of precast and/or prestressed piling	X	X		
3.	All substructure concrete, culverts, box sewers, inlets, manholes, retaining walls, riprap.			*X	*X

*Polyethylene sheeting or burlap polyethylene mats fastened to prevent outside air from entering shall be considered equivalent to water or membrane curing per this item.

5. When membrane is used for complete curing, the film shall remain unbroken for the minimum curing period specified. Membrane which is damaged shall be corrected immediately by reapplication of membrane.

3.11 TESTING:

A. Furnish at least three cylinders or beams from each 40 cubic yard, or portion there of for test purposes unless otherwise directed by ENGINEER. Test one cylinder at 7 days, test second cylinder at 28 days and test third cylinder only if needed for confirmation of compression strength.

3.12 MISCELLANEOUS CONCRETE ITEMS:

A. Filling-in: fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Use non-shrink grout as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Equipment bases and foundations: provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment. Use non-shrink grout as shown on plans.

C. Steel pan stairs: provide concrete fill for steel pan stair treads and landing and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

D. Reinforced masonry: provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Cast-in-place concrete for the work shown on the plans shall be measured by the cubic yard as specified in the plans and contract.

4.02 PAYMENT:

A. The accepted quantities of cast-in-place concrete shall be paid for at the unit bid price per cubic yard.

B. The unit bid price shall be full compensation for furnishing, hauling, and mixing all concrete materials, including trial batches; placing, curing and finishing all concrete; for all grouting and joints; furnishing and placing all expansion and construction joints, except as provided in the plans; furnishing and placing metal flashing strips and waterstops; and for all forms and false-work, labor, tools, equipment and incidentals necessary to complete the work.

C. The preceding provisions for payment shall not be interpreted to provide payment for concrete in railing, piling, precast pre-stressed concrete units or other concrete items for which provision is otherwise made in the contract.

END OF SECTION

SECTION 19000 TRENCH PROTECTION SYSTEM

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of shoring, bracing, bank stabilization, bank sloping, providing trench boxes or trench shields or other equivalent means to protect employees from the effects of moving ground or cave-ins for all trenches 5-feet or more in depth.

B. All working shall be done in conformance with OSHA Safety and Health Standards (29 CFR 1926/1010 Chapter XVII Subpart P - Excavations, Trenching and Shoring).

1.02 DEFINITIONS APPLICABLE TO THIS SPECIFICATION

A. "Accepted engineering requirements (or practices)" - Those requirements or practices which are compatible with standards required a Registered Professional Engineer, or other duly licensed or recognized authority.

B. "Angle or repose" - The greatest angle above the horizontal plane at which a material will lie without sliding.

C. "Bank" - A mass of soil rising above a digging level.

D. "Belled excavation" - A part of shaft or footing excavation, usually near the bottom and bell-shaped; i.e., an enlargement of the cross section above.

E. "Braces (trench)" - The horizontal members of the shoring system whose ends bear against the uprights or stringers.

F. "Excavation" - Any manmade cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

G. "Faces" - See paragraph (k) of this section.

H. "Hard compact soil" - All earth materials not classified as running or unstable.

I. "Kickouts" - Accidental release or failure of a shore or brace.

J. "Sheet pile" - A pile, or sheeting, that may form one of the continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.

K. "Sides," "Walls," or "Faces" - The vertical or inclined earth surfaces formed as a result of excavation work.

L. "Slope" - The angle with the horizontal at which a particular earth material will stand indefinitely without movement.

M. "Stringers" (wales) - The horizontal members of a shoring system whose sides bear against the uprights or earth.

N. "Trench" - A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15-feet.

O. "Trench" - A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15-feet.

P. "Trench shield" - A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

Q. "Unstable soil" - Earth material, other than running, that because of its nature of the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

R. "Uprights" - the vertical members of a shoring system.

S. "Wales" - See paragraph (m) of this section.

T. "Walls" - See paragraph (k) of this section.

PART 2 – PRODUCTS

(OMITTED INTENTIONALLY)

PART 3 - EXECUTION

3.01 GENERAL PROTECTION REQUIREMENTS

A. Walkways, runways, sidewalks shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of one hundred and twenty-five (125) pounds per square foot.

B. If planks are used for raised walkways, runways, or sidewalks they shall be laid parallel to the length of the walk and fastened together against displacement.

C. Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.

D. Raised walkways, runways, and sidewalks shall be provided with plank steps on strong stringers. Ramps, used in lieu of steps, shall be provided with cleats to insure a safe walking surface.

E. All employees shall be protected with personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet, and other parts of the body as set forth in OSHA Standards.

F. Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with or made or reflectorized or high visibility material.

G. Employees subjected to hazardous dusts, gases, fumes, mists or atmospheres deficient in oxygen, shall be protected with approved respiratory protection as set forth in OSHA Standards.

H. No person shall be permitted under loads handled by power shovels, derricks, or hoists. To avoid injury from any spillage employees shall be required to stand away from any vehicle being loaded.

I. The CONTRACTOR shall provide daily inspections of excavations shall be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees.

3.02 SPECIFIC EXCAVATION REQUIREMENTS

A. Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., sewer, telephone, water, fuel, electric lines, etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

B. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.

C. The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.

D. Excavations shall be inspected by a competent person after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

E. The determination of the angle of repose and design of the supporting system shall be based on careful evaluation of pertinent factors such as: Depth of cut; possible variation in water content of the material while the excavation is open; anticipated changes in materials from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, overlying materials, or stored material; and vibration from equipment, blasting, traffic, or other sources.

F. Supporting systems, i.e., piling, cribbing, shoring, etc., shall be designed by a qualified person and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose. When tight sheeting or sheets piling is used, full loading due to ground water table shall be assumed, unless prevented by weep holes or drains or other means. Additional stringers, ties, and bracing shall be provided to allow for any necessary temporary removal of individual supports.

G. All slopes shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.

H. The angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas where erosion deep frost action and slide planes appear.

I. Clearances:

1. In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2-feet or more from the edge of the excavation.

2. As an alternative to the clearance prescribed in subparagraph (1.) of this paragraph, the CONTRACTOR may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the excavation.

J. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.

K. Support systems shall be planned and designed by a qualified person when excavation is in excess of 20-feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.

L. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots, and of proper dimensions.

M. Special precautions shall be taken in sloping or shoring the sides of excavations adjacent to previously backfilled excavation for a fill, particularly when the separation is less than the depth of the excavation. Particular attention also shall be paid to joints and seams of material comprising a face and the slope of such seams and joints.

N. Except in hard rock, excavations below the level of the base of footing of any foundation or retaining wall shall not be permitted, unless the wall in underpinned and all other precautions taken to insure the stability of the adjacent walls for the protection of employees involved in excavation work or in the vicinity thereof.

O. If the stability of adjoining building or walls is endangered by excavations, shoring, bracing, or underpinning shall be provided as necessary to insure their safety. Such shoring, bracing, or underpining shall be inspected daily

or more often, as conditions warrant, by a competent person the protection effectively maintained.

P. Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.

Q. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.

R. Blasting and the use of explosives are not allowed unless authorized in other portions of the specifications.

S. When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.

T. Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

U. If possible, dust conditions, shall be kept to a minimum by the use of water, salt, calcium chloride, oil, or other means.

V. In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls, as set forth in OSHA Standards shall be established to assure acceptable atmospheric conditions. When flammable gases are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

W. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.

X. Where ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.

Y. All ladders used on excavation operations shall be in accordance with the requirements of OSHA Standards.

3.03 SPECIFIC TRENCHING REQUIREMENTS

A. Banks more than 5-feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to Figure 19000-1 as a guide in sloping of banks. Trenches less than 5-feet in depth shall also be effectively protected when examination of the ground indicates hazardous ground movement may be expected.

B. Sides of trenches in unstable or soft material, 5-fet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. See Figure 19000-1 and Table 19000-1.

C. Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5-feet in depth and 8-feet or more in length. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2-foot horizontal. When the outside diameter of a pipe is greater than 6-feet, a bench of 4-feet minimum shall be provided at the toe of the sloped portion.

D. Materials used for sheeting and sheet piling, bracing, shoring, and under pinning, shall be in good serviceable conditions, and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the excavation.

E. Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.

F. Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier and securely fastened to shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.

G. Minimum requirements for trench timbering shall be in accordance with Table 19000-1. Braces and diagonal shores in wood shoring system shall be subjected to compressive stress in excess of values given by the following formula:

$$S = 1300 - \frac{20L}{D}$$

$$\text{Maximum ratio } \frac{L}{D} = 50$$

Where:

L = Length, unsupported, inches.
D = Least side of the timber in inches.
S = Allowable stress in pounds per square inch of cross-section.

H. When employees are required to be in trenches 4-feet deep or more, an adequate means to exit, such as a ladder or steps shall be provided and located so as to require no more than 25-feet of lateral travel.

I. Bracing or shoring of trenches shall be carried along with the excavation.

J. Cross braces or trench jacking shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling, or kickouts.

K. Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench. The CONTRACTOR shall provide a statement certified by a Registered Professional Engineer of the adequacy of trench boxes or shields.

L. Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil. Ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

3.05 CONSTRUCTION REQUIREMENTS

A. The CONTRACTOR unless provided for in the plans otherwise shall provide the minimum shoring shown in Table 19000-1 for the soil class noted in the plans. If approved by the ENGINEER, the CONTRACTOR may slope the excavation in accordance with Figure 19000-1.

B. Should the soil conditions differ from those specified or should ground water be encountered in the excavation the CONTRACTOR shall notify the ENGINEER immediately. The CONTRACTOR shall refrain from operating in that portion of the trench where changed conditions are noted until such time as an inspection of conditions takes place and the CONTRACTOR is notified of measures necessary for continued operation.

C. The CONTRACTOR shall prepare and submit a plan of operation. This plan of operation shall identify material, equipment, methods and installation and shall be inspected by a Registered Professional Engineer. The CONTRACTOR's ENGINEER shall certify the adequacy of the trench protection system and its adherence of OSHA Standards.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Providing shoring and trenching or other alternate means in accordance with this specifications shall be measured by the linear foot of trench for specified types or sizes of pipe or structure in ranges of depth to the invert elevation of the pipe or structure. Additional depth for foundations etc., shall be considered incidental to the price bid for the protection.

B. If the plans require sloping the excavation or the excavation is sloped in accordance with Figure 19000-1 after receiving permission from the ENGINEER, no payment will be made under this item.

C. The CONTRACTOR shall provide shoring systems for construction of structure 5' or greater in depth. There will be no direct payment for these systems but it shall be considered incidental to the price bid for the structure.

4.02 PAYMENT

A. The unit price bid for trench protection shall be full compensation for providing acceptable shoring or other alternate means, installing, inspecting, certifying and maintaining the shoring and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

END OF SECTION