



**Invitation for Bids for Construction of Belden Trail – Phase III for the
City of Brownsville**

CBT-12-0219

Addendum # 2

March 13, 2019 at 3:00 P.M.

**City of Brownsville
Purchasing Department
ADDENDUM # 2**

**Invitation for Bids for Construction of Belden Trail – Phase III for the City
of Brownsville
Date Issued: February 27, 2019**

ACKNOWLEDGEMENT OF RECEIPT

Please fax this page upon receipt and/or E-Mail

Please fill in the requested information below as acknowledgment that *you have received the* Addendum noted above. If your firm is interested in participating, this sheet must be completed and returned or faxed to:

Mr. Roberto C. Luna, Jr.
Purchasing Director - City of Brownsville - P.O. Box 911
City Hall 1001 E. Elizabeth St. 1ST FLOOR Suite No. 101
Brownsville, Texas 78520
Phone: (956) 548-6087 Fax: (956) 546-2711
Email: purchasing@cob.us

Name of Firm: _____

Address: _____

City, State _____ Zip: _____

Telephone Number: _____ Fax Number: _____

E-mail: _____

- () **YES**, Our Company does have an interest in responding.
- () **NO**, Our Company does not have an interest in responding.

Name: (Print) _____

Title: _____

Signature: _____

Date: _____



**Invitation for Bids for Construction of Belden Trail – Phase III for the
City of Brownsville**

CBT-12-0219

Addendum # 2

March 13, 2019 at 3:00 P.M.

ADDENDA: The undersigned hereby acknowledges receipt of the following addenda to the Specifications, all of the provisions and requirements of which Addenda have been taken into consideration in the preparation of the foregoing proposal.

1. Clarifications/Additional Information/Changes to the Original Bid Package:

From: Anna M Mandeia [<mailto:contact@excelsiorconstruction.us>]

Sent: Tuesday, February 12, 2019 12:27 PM

To: Purchasing <Purchasing@cob.us>

Subject: BID #CBT-0219 Belden Trail Phase 3

Questions Regarding BID #CBT-0219 Belden Trail Phase 3:

1. There is currently an asphalt path and wooden posts in place of the proposed new construction - Are the asphalt and posts supposed to be removed prior to construction of the new concrete sidewalk?

Answer: Subsidiary to the paving line item

2. If the answer to Question 1 is yes, what party is responsible for the demolition and removal of existing asphalt and posts? If the contractor is responsible for the demolition and removal of existing asphalt and posts, under what item number should the cost be listed in the Bid Unit Price Contract?

Answer: N/A

3. Are the posts to be reinstalled after construction of the new concrete sidewalk? If yes, under what item number should the cost be listed in the Bid Unit Price Contract?

Answer: New Bollard installation is included as a Bid Item

4. During the Pre-Bid Meeting on 01/31/2019, it was stated that an addendum would be released showing architectural details along with additional pages for the Bid Unit Price Contract? Are these items still to be released and when?

Answer: Yes

5. During the Pre-Bid Meeting on 01/31/2019, it was stated that the Engineer's Estimate would be released - Is this item still to be released and when?

Answer: Yes



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March 13, 2019 at 3:00 P.M.

6. What are the payment terms after award of this contract?

Answer: 30 Days

7. What inspections will occur before, during and after the proposed project?

Answer: Routine Construction Inspection

8. From R-Tank Specifications, is the Profile View available for Tanks 3, 4, 5 and 9?

Answer: Yes will be provided in drawings

9. Item #4 (8" PVC Schedule 40) from Bid Unit Price Contract - Is a plumbing permit required for this phase? If yes, what inspections will occur?

Answer: No, improvements are drainage not plumbing

10. Item #6 (1/2 HP Sump Pump) from Bid Unit Price Contract - Is an electrical permit required for this phase? If yes, what inspections will occur?

Answer: The Contractor will provide the pump and will test using a generator during final walkthrough, the City will provide the electrical drop post project.

11. Item #6 (1/2 HP Sump Pump) from Bid Unit Price Contract - Is the "pump well" a prefabricated unit or build in place? Is it installed/provided by Eco Services, another vendor or the responsibility of the contractor?

Answer: Build in place or Prefabricated can be used.

12. Item #8 (R-Tank System) from Bid Unit Price Contract - Which of the following components are vendor-installed: 1) R-Tank Modules, 2) maintenance ports, 3) tank inlets/outlets

Answer: Yes to all 3

Anna Mandeia

President

Excelsior

Design & Construction



**Invitation for Bids for Construction of Belden Trail – Phase III for the
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CBT-12-0219

Addendum # 2

March 13, 2019 at 3:00 P.M.

From: Anna M Mandeia [<mailto:contact@excelsiorconstruction.us>]
Sent: Thursday, February 14, 2019 2:46 PM
To: Alfonzo Mendoza <alfonzo.mendoza@cob.us>
Subject: Re: FW: BID #CBT-0219 Belden Trail Phase 3

Hello Mr. Mendoza,

Please provide further clarification for the following questions:

1. There is currently an asphalt path and wooden posts in place of the proposed new construction - Are the asphalt and posts supposed to be removed prior to construction of the new concrete sidewalk?
 - a. [Subsidiary to the paving line item](#)

The Bid Unit Price Contract released at the Pre-Bid meeting does not say anything about asphalt removal. Is this to be included in an addendum as a subsidiary to line items 1 & 2 (10ft Concrete Sidewalk & 4 ft Concrete Sidewalk)? Also there is no "Sidewalk Detail Sheet 8" in the IFB - Could you please clarify where Sheet 8 is located or is this an error as there are only 6 sheets of drawing from the COB Engineering department included in the IFB? Thank you.

Answer:

- **Asphalt removal will be subsidiary to Item1 & 2**
- **Sidewalk Detail: Detail 1, Pg. 4 of Engineering Drawings**

3. Are the posts to be reinstalled after construction of the new concrete sidewalk? If yes, under what item number should the cost be listed in the Bid Unit Price Contract?

- a. **New Bollard installation is included as a Bid Item**

The Bid Unit Price Contract released at the Pre-Bid meeting does NOT include "New Bollard Installation" as a bid item. Is this to be included in an addendum? Please clarify.

Answer:

- **Bollard installation are shown on Item 3 & 5 of the Architectural Bid Items. After further internal discussion, old bollards will be removed prior to Notice to Proceed by the City. Do not include pricing as a subsidiary item to the contract.**



**Invitation for Bids for Construction of Belden Trail – Phase III for the
City of Brownsville**

CBT-12-0219

Addendum # 2

March 13, 2019 at 3:00 P.M.

2. Engineer's estimated budget: **\$360,000.00**

3. Clarifications/Additional Information/Changes to the Original Bid Package:

Additional information – Updated bid form (Page 4, 5 and 6 of Addendum # 2), additional documentation from Architect (See attached documents).

Submitted,

(Name of Bidder)

(Signature)

(Print)

Date

END OF ADDENDUM # 2



BID # CBT-12-0219

BID PROPOSAL

Proposal of _____, (hereinafter called “Bidder) a corporation organized and existing under the laws of the State of Texas /a partnership/an individual doing business as _____ (cross out non-applicable references).

To City of Brownsville (hereinafter called “Owner”).

Gentlemen:

The Bidder, in compliance with your invitation for bids for the construction of **Belden 3 Trail & Construction Project** having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of material and labor, materials, and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and the process stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on or before date to be specified in written “NOTICE TO PROCEED” of the OWNER and to fully complete the project within one-hundred and fifty (150) consecutive calendar days thereafter as stipulated in the specifications. Bidder further agrees to pay liquidated damages, the sum of One Hundred Fifty (\$150.00) dollars for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.

Bidder acknowledges receipt of the following addenda:

Bid for Unit Price

Bidder’s Initials _____





BID # CBT-12-0219

Bidder agrees to perform all the Project work described in the specifications and show on the plans, for the unit prices shown on the attached "BID SHEETS". The unit prices area separated into materials that are to be incorporated into the project such as pipe, concrete, steel, etc. and services, labor equipment, etc.

The total amounts are to be shown in both words and figures. In case of discrepancy the amount in words will govern.

The following unit prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for.

Bidder agrees to perform all work described in the Contract Documents for the following unit price or lump sum:

Bid for Unit Price

3

Bidder's Initials _____





BID # CBT-12-0219

Bid Unit Price Contract
 Belden Trail 3 Improvement
 Brownsville, Texas

Item	Description	Estimated Qty.	Unit	Unit Price In Figures	Unit Price In Words	Total Amount
1	10ft Concrete Sidewalk, <i>including all materials, labor, installation, in accordance with Plans and Specifications, 3" Sand layer base Subsidiary to Line Item as per Sidewalk Detail Sheet 8, complete in place</i>	12,500	SF	\$ _____	_____	\$ _____
2	4ft Concrete Sidewalk, <i>including all materials, labor, installation, in accordance with Plans and Specifications, 3" Sand layer base Subsidiary to Line Item as per Sidewalk Detail Sheet 8, complete in place</i>	1000	SF	\$ _____	_____	\$ _____
3	Curb & Gutter, <i>including all materials, labor, installation, in accordance with Plans and Specifications</i>	500	LF	\$ _____	_____	\$ _____
4	8"Ø PVC Schedule 40, <i>including all materials, labor, installation, in accordance with Plans and Specifications</i>	1000	LF	\$ _____	_____	\$ _____

Bid for Unit Price

Bidder's Initials _____





BID # CBT-12-0219

Item	Description	Estimated Qty.	Unit	Unit Price In Figures	Unit Price In Words	Total Amount
5	ADA Sidewalk Ramp, including all materials, labor, installation, in accordance with Plans and Specifications	7	EA	\$ _____	_____	\$ _____
6	1/2 HP Sump Pump, including all materials, labor, installation, in accordance with Plans and Specifications, complete in place.	1	EA	\$ _____	_____	\$ _____
7	Concrete Flume, including all materials, labor, installation, in accordance with Plans and Specifications, 3000 psi concrete including saw cut as subsidiary item, complete in place	1	EA	\$ _____	_____	\$ _____
8	R-Tank System, including all materials, labor, in accordance specification of ECO Services Specification and Plan Detail, complete in place.	9	EA	\$ _____	_____	\$ _____
9	Focal Point System, including all materials, labor, in accordance specification of ECO Services Specification and Plan Detail, complete in place.	9	EA	\$ _____	_____	\$ _____

Bid for Unit Price

5

Bidder's Initials _____





BID # CBT-12-0219

Item	Description	Estimated Qty.	Unit	Unit Price In Figures	Unit Price In Words	Total Amount
10	Storm Water Pollution Prevention Plan (SWPPP) , as shown on the Drawings and outlined in the Specifications, complete in place.	1	LS	\$ _____	_____	\$ _____
11	Traffic Control , to remain in place until substantial project completion as shown on the Drawings and outlined in the Specifications, complete in place.	1	LS	\$ _____	_____ _____ _____	\$ _____
TOTAL BASE BID AMOUNT (Sum of Items 1 through 11)						

Bid for Unit Price

6

Bidder's Initials _____



BELDEN 3 ARCHITECTURAL BID ITEMS

	Unit	QTY
HardScape		
4" Colored and Textured Concrete	SF	1200
Pour in Place Rubber Surfacing	SF	768
6" Bollard	CT	112
Bollards Reflective Marker	CT	32
6" Removable Wooden Bollard	CT	16
Trail Stop Signs	CT	8
Two Way Cycle Track Signs	CT	40
Trail Crossing Sign	CT	10
Do Not Enter Sign	CT	0
911 Locator Sign	CT	4
Trail Monument Sign	CT	2
Trail Map Sign	CT	3
Solid White Paint for Trail / Ped	LF	-
Solid White Paint for Striping	LF	-
Zebra / Cycle Line Separators	CT	7
4" Round Ceramic Buttons (alt)	CT	7
White Bicycle Rider with Helmet Pavement Marking	CT	3
White Mini Straight Arrow Pavement Marking	CT	2
Pine Beam Bench Small	CT	8
Pine Beam Bench Large	CT	3
Trash Can	CT	2
Bike Rack	CT	6
Landscape		
Bermuda Grass	SF	21520
Seed Mix	SF	0
Structured Planting	SF	same area as mulch
Mulch	SF	2000
Texas Huisache	CT	12
Wild Mexican Olive	CT	7
Anachio Orchid	CT	9
Live Oak	CT	2
Montezuma Cypress	CT	1
Thornless Mesquite	CT	2
Gulf Muhly	CT	200
Texas Sage	CT	31
Lantana	CT	13
Queen Anne Lace	SF	722
Trailing White Lantana	CT	22



BID # CBT-12-0219

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,
_____ as Principal, and
_____ as Surety, as hereby held and firmly
bound unto City of Brownsville as OWNER in the penal sum of
_____ for the payment of which, well
and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors,
administrators, successors and assigns.

Signed, this _____ day of _____, 20_____.

The Condition of the above obligation is such that whereas the Principal has submitted to The City of Brownsville a certain bid, attached hereto and hereby made a part hereof to enter into a contract in writing, for the Construction of the Belden 3 Trail & Construction Project

NOW, THEREFORE,

- (a) If said Bid shall be rejected or in the alternate.
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers the day and year first set forth above.

Principal (L.S.)

Surety

By:

SEAL





BID # CBT-12-0219

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____ a

(Name of Contractor)

(Address of Contractor)

_____ hereinafter called Principal,
(Corporation Partnership, or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City Of Brownsville

(Name of Owner)

1001 East Elizabeth Street, P.O. Box 911, Brownsville, Texas 78520

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____ Dollars, \$(_____) in lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by the presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, date the ____ day of _____, 20____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good an default, then this obligation shall be void: otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed





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there under or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 4 counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20____.

ATTEST:

	_____		_____
			(Firm Name)
By	_____	By	_____
	_____		_____
	(Title)		(Title)

(Seal if Corporation)

	(Address)

	(City, State, Zip Code)

ATTEST:

	(Surety Name)

(Seal)

_____	By	_____
(Witness as to Surety)		(Attorney-in-Fact)

	(Address)

	(City, State, Zip Code)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.



BID # CBT-12-0219

PAYMENT BOND

KNOW ALL MEN THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____ hereinafter called Principal, and
(Corporation, Partnership or Individual)

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

City Of Brownsville

(Name of Owner)

1001 East Elizabeth Street, P.O. Box 911, Brownsville, Texas 78520

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____ dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____ 20____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUBCONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed there under or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.



PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 4 counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20____.

ATTEST:

By _____ _____ (Title)	By _____ _____ (Title)
------------------------------	------------------------------

(SEAL if Corporation)

(Firm Name)

(Address)

(City, State, Zip Code)

ATTEST:

(SEAL)

(Surety Name)

_____ (Witness as to Surety)	By _____ (Attorney-in-Fact)
---------------------------------	--------------------------------

(Address)

(City, State, Zip Code)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, _____, the duly authorized and acting legal representative of **The City Of Brownsville**, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

DATE: _____

City Attorney,
City of Brownsville



BID # CBT-12-0219

NOTICE OF AWARD

To: _____

PROJECT Description: Belden 3 Trail & Construction Project

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____ and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$ _____.

You are required by the Information for Bidders to execute the Agreement within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as a forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this _____ day of _____, 2018

City Of Brownsville
(Owner)

By _____
Carlos Lastra, P.E.

Title: Engineering Director

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by

_____ this the _____ day of _____, 2018.

By _____

Title _____





BID # CBT-12-0219

GENERAL CONDITIONS

ARTICLE 1- DEFINITIONS

Wherever used in these General Conditions or in the other CONTRACT DOCUMENTS the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

ADDENDA- Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the CONTRACT DOCUMENTS.

AGREEMENT- The written Agreement between OWNER and CONTRACTOR covering the Work to be performed; other CONTRACT DOCUMENTS are attached to the Agreement and made a part thereof as provided therein.

APPLICATION FOR PAYMENT- The form accepted by the ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to include such supporting documentation as is required by the CONTRACT DOCUMENTS.

BID- The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

BONDS- Bid, performance and payment bonds and other instruments of security.

CHANGE ORDER- A document recommended by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion or revisions in the Work, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

CONTRACT DOCUMENTS- The Agreement, Addenda (which pertain to the CONTRACT DOCUMENTS), CONTRACTOR'S Bid (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all amendments, modifications and supplements issued pursuant to paragraphs 3.4 and 3.5 on or after the Effective Date of the Agreement.

CONTRACT PRICE- The moneys payable by OWNER to CONTRACTOR under the CONTRACT DOCUMENTS as stated in the Agreement.

CONTRACT TIME- The number of days (computed as provided in paragraph 17.2) or the date stated in the Agreement for the completion of the Work.





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CONTRACTOR- The person, firm or corporation with whom OWNER has entered into the Agreement.

DEFECTIVE- An adjective which when modifying the word Work refers to work that is unsatisfactory, faulty or deficient, or does not conform to the CONTRACT DOCUMENTS, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the CONTRACT DOCUMENTS, or has been damaged prior to ENGINEER'S recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.8 or 14.10).

DRAWING- The drawings which show the character and Scope of Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the CONTRACT DOCUMENTS.

EFFECTIVE DATE OF THE AGREEMENT- The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

ENGINEER- The person, firm or corporation named as such in the Agreement.

FIELD ORDER- A written order issued by ENGINEER which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Time.

GENERAL REQUIREMENTS- Those described in Pages TS-1 through TS-7 of the Specifications.

LAW AND REGULATIONS; LAW OR REGULATIONS- Laws, rules, regulations, ordinances, codes and/or orders.

NOTICE OF AWARD- The written notice by OWNER or ENGINEER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

NOTICE TO PROCEED- A written notice given by OWNER or ENGINEER to CONTRACTOR fixing the date on which the Contract Time will commence to run and on which the CONTRACTOR shall start to perform CONTRACTOR'S obligations under the CONTRACT DOCUMENTS.

OWNER- The public body or authority, corporation, association, firm or person with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.





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PARTIAL UTILIZATION- Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work.

PROJECT- The total construction of which the Work to be provided under the CONTRACT DOCUMENTS may be the whole, or a part as indicated elsewhere in the CONTRACT DOCUMENTS.

RESIDENT PROJECT REPRESENTATIVE- The authorized representative of ENGINEER, who is assigned to the site or any part thereof.

SHOP DRAWINGS- All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for CONTRACTOR to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by Supplier and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

SPECIFICATIONS- The portions of the CONTRACT DOCUMENTS consisting of written technical description of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

SUB-CONTRACTOR- An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Sub-Contractor for the performance of a part of the Work at the site.

SUBSTANTIAL COMPLETION- The Work (or a specified part thereof) which has progressed to the point where, in the opinion of ENGINEER as evidenced by ENGINEER'S definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the CONTRACT DOCUMENTS, so that the Work, (or specified part) can be utilized for the purpose for which it is intended; or if there be no such certificate issued, when final payment is due in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.

SUPPLEMENTAL GENERAL CONDITIONS- The part of the CONTRACT DOCUMENTS which amends or supplements these General Conditions.

SUPPLIER- A manufacturer, fabricator, supplier, distributor, material-man or vendor.

UNDERGROUND FACILITIES- All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following service or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems





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or water.

UNIT PRICE WORK- Work to be paid for on the basis of unit prices.

WORK- The entire completed construction or the various separately identifiable parts thereof required to be furnished under the CONTRACT DOCUMENTS. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the CONTRACT DOCUMENTS.

WORK DIRECTIVE CHANGE- A written directive to CONTRACTOR, issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraphs 4.2 and 4.3 or to emergencies under paragraph 6.22. A Work Directive Change may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Work Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time as provided in paragraph 10.2.

WRITTEN AMENDMENT- A written amendment of the CONTRACT DOCUMENTS, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly Work-related aspects of the CONTRACT DOCUMENTS.

ARTICLE 2- PRELIMINARY MATTERS

DELIVERY OF BONDS:

2.1. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as Contract may be required to furnish in accordance with paragraph 5.1.

COPIES OF DOCUMENTS:

2.2. OWNER shall furnish to CONTRACTOR up to five copies (unless otherwise specified in the Supplementary Conditions) of the CONTRACT DOCUMENTS as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

COMMENCEMENT OF CONTRACT TIME; NOTICE TO PROCEED:

2.3. The Contract Time will commence to run on the thirtieth day after the Effective Date of the Agreement, or if a Notice to Proceed is given, on the day indicated in the Notice to Proceed.





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A Notice to Proceed may be given at any time within thirty days after the Effective Day of the Agreement. In no event will the Contract Time commence to run later than the seventy-fifth day after the day of Bid Opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

STARTING THE PROJECT:

2.4 CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

BEFORE STARTING CONSTRUCTION:

2.5 Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error or discrepancy which CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the CONTRACT DOCUMENTS, unless CONTRACTOR has actual knowledge thereof or should reasonably have known thereof.

2.6 Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER FOR review:

2.6.1 An estimated progress schedule indicating the starting and completion dates of the various stages of the Work;

2.6.2 A preliminary schedule of Shop Drawings submissions; and

2.6.3 A preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis of progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by CONTRACTOR at the time of submission.

2.7 Before any Work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates (and other evidence of insurance requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with paragraphs 5.3 and 5.4.

PRE-CONSTRUCTION CONFERENCE:

2.8 Within twenty days after the Effective Date of the Agreement, but before





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CONTRACTOR starts the Work at the site, a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to discuss the schedules referred to in paragraph 2.6, to discuss procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

FINALIZING SCHEDULES:

2.9 At least ten days before submission of the First Application for Payment a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to finalize the schedules submitted in accordance with paragraph 2.6. The finalized progress schedule will be acceptable to ENGINEER as providing an orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on ENGINEER responsibility for the progress or scheduling of the Work nor relieve CONTRACTOR from full responsibility therefore. The finalized schedule of Shop Drawing submissions will be acceptable to ENGINEER as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to ENGINEER as to form and substance.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

INTENT:

3.1. The CONTRACT DOCUMENTS comprise the entire Agreement between OWNER and CONTRACTOR concerning the WORK. The CONTRACT DOCUMENTS are complementary; what is called for by one is as binding as if called for by all. The CONTRACT DOCUMENTS will be construed in accordance with the law of the place of the Project.

3.2 It is the intent of the CONTRACT DOCUMENTS to describe a functionally complete Project (or part thereof) to be constructed in accordance with the CONTRACT DOCUMENTS. Any Work, materials or equipment that may reasonably be inferred from the CONTRACT DOCUMENTS as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment such works shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard specifications, manual or code (whether or not specifically incorporated by reference in the CONTRACT DOCUMENTS) shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees from those set forth in the CONTRACT DOCUMENTS, nor shall it be effective to assign to ENGINEER, or any of ENGINEER'S consultants, agents or employees, any duty or authority





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to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraphs 9.15 or 9.16. Clarifications and interpretations of the CONTRACT DOCUMENTS shall be issued by ENGINEER as provided in paragraph 9.4.

3.3 If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the CONTRACT DOCUMENTS, CONTRACTOR shall so report to ENGINEER in writing at once and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from ENGINEER; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy on the CONTRACT DOCUMENTS unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS:

3.4 The CONTRACT DOCUMENTS may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- 3.4.1. A formal Written Amendment,
- 3.4.2. A Change Order (Pursuant to paragraph 10.4), or
- 3.4.3. A Work Directive Change (Pursuant to paragraph 10.1).

As indicated in paragraphs 11.2 and 12.1, Contract Price and Contract Time may only be changed by a Change Order or Written Amendment.

3.5. In addition, the requirements of the CONTRACT DOCUMENTS may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

- 3.5.1. A Field Order (Pursuant to paragraph 9.5),
- 3.5.2. ENGINEER'S approval of a Shop Drawing or sample (pursuant to paragraphs 6.26 and 6.27), or
- 3.5.3. ENGINEER'S written interpretation or clarification (pursuant to paragraph 9.4).

REUSE OF DOCUMENTS:

3.6 Neither CONTRACTOR nor any Sub-Contractor or Supplier or other person or





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organization performing or furnishing any of the Work under a direct or indirect contract with OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not reuse any of them on extensions of the Project of any other project without written consent of the OWNER.

ARTICLE 4 - AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

AVAILABILITY OF LANDS:

4.1 OWNER shall furnish, as indicated in the CONTRACT DOCUMENTS, the lands upon which the Work is to be performed, Rights-of-Way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the CONTRACT DOCUMENTS. If CONTRACTOR believes that any delay in OWNER'S furnishing these lands, Rights-of-Way or easements entitles CONTRACTOR to an extension of the Contract Time, CONTRACTOR may make a claim therefore as provided in Article 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

PHYSICAL CONDITIONS:

4.2.1. Explorations and Reports: Reference is made to the Supplementary conditions for identification of those reports of explorations and tests of sub-surface conditions at the site that have been utilized by ENGINEER in preparation of the CONTRACT DOCUMENTS. CONTRACTOR may rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to sub-surface conditions at the site.

4.2.2. Existing Structures: Reference is made to the Supplementary Conditions for identification of those drawings of physical conditions in or relating to existing surface and sub-surface structures (except Underground Facilities referred to in paragraph 4.3) which are at or contiguous to the site that have been utilized by ENGINEER in preparation of the CONTRACT DOCUMENTS. CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings, but not for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

4.2.3. Report to Differing Conditions: If CONTRACTOR believes that:





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4.2.3.1 Any technical data on which CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is inaccurate, or

4.2.3.2. Any physical condition uncovered or revealed at the site differ materially from that indicated, reflected or referred to in the CONTRACT DOCUMENTS,

CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.22), notify OWNER and ENGINEER in writing about the inaccuracy or difference.

4.2.4. ENGINEER'S Review: ENGINEER will promptly review the pertinent conditions, determine the necessity of obtaining additional explorations or tests with respect thereto and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER'S findings and conclusions.

4.2.5. Possible Document Change: If ENGINEER concludes that there is a material error in the CONTRACT DOCUMENTS or that because of newly discovered conditions a change in the CONTRACT DOCUMENTS is required, a Work directive Change or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the inaccuracy or difference.

4.2.6. Possible Price and Time Adjustments: In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference.

If OWNER and CONTRACTOR are unable to agree as to the amount or length thereof, a claim may be made thereof, as provided in Articles 11 and 12.

PHYSICAL CONDITIONS - UNDERGROUND FACILITIES:

4.3.1. Shown or Indicated: The information and data shown or indicated in the CONTRACT DOCUMENTS with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

4.3.1.1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and,

4.3.1.2. CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the CONTRACT DOCUMENTS, for coordination of the Work with the owners of such





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Underground Facilities during construction, for safety and protection thereof as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

4.3.2. Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the CONTRACT DOCUMENTS and which CONTRACTOR could not reasonable have been expected to be aware of, CONTRACTOR shall, promptly after becoming aware thereof and before performing and Work affected thereby (except in an emergency as permitted by paragraph 6.22), identify the owner of such Underground Facility and give written notice thereof to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility to determine the extent to which the CONTRACT DOCUMENTS should be modified to reflect and document the consequences of the existence of the Underground Facility, and the CONTRACT DOCUMENTS will be amended or supplemented to the extent necessary. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the CONTRACT DOCUMENTS and which CONTRACTOR could not reasonably have been expected to be aware of. If the parties are unable to agree as to the amount or length thereof, CONTRACTOR may make a claim thereof as provided in Articles 11 and 12.

REFERENCE POINTS:

4.4. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER'S judgement are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the General Requirements), shall protect and preserve the established reference points and shall make no changes or relocations without written approval of OWNER.

CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 5 - BOND AND INSURANCE

PERFORMANCE AND OTHER BONDS:

5.1. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to Contract Price as security for the faithful performance and payment of all CONTRACTOR'S obligations under the CONTRACT DOCUMENTS. These Bonds shall





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remain in effect at least until one year after the date when final payment becomes due, except as otherwise provided by Law or Regulations or by the CONTRACT DOCUMENTS. CONTRACTOR shall also furnish such other Bond as are required by the Supplementary Conditions. All Bonds shall be in the forms prescribed by law or Regulation or by the Contract Documents and be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

5.2 If the surety on any Bond furnished CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1, CONTRACTOR shall within five days thereafter substitute another Bond and Surety, both of which must be acceptable to OWNER.

CONTRACTOR'S LIABILITY INSURANCE:

5.3. CONTRACTOR shall purchase and maintain such comprehensive general liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR'S performance and furnishing of the Work and CONTRACTOR'S other obligations under the CONTRACT DOCUMENTS, whether it is to be performed or furnished by CONTRACTOR, by any Sub-Contractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

5.3.1. Claims under worker's or workmen's compensation, disability benefits and other similar employee benefit acts;

5.3.2. Claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR'S employees;

5.3.3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR'S employees;

5.3.4. Claims for damages insured by personal injury liability coverage which are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, (b) by any other person for any other reason;

5.3.5. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting there from;

5.3.6. Claims arising out of operation of Laws or Regulations for damages because of bodily





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injury or death of any person or for damage to property; and

5.3.7. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of motor vehicle.

The insurance required by this paragraph 5.3 shall include the specific coverages and be written for not less than the limits of liability and coverages provided in the Supplemental General Conditions, or required by law, whichever is greater. The comprehensive general liability insurance shall include completed operations insurance. All of the policies of insurance so required to be purchased and maintained (or the certificates or other evidence thereof) shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days' prior to a written notice been given to OWNER and ENGINEER by certified mail. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective work in accordance with paragraph 13.12. In addition, CONTRACTOR shall maintain such completed operations insurance for at least two years after final payment and furnish OWNER with evidence of continuation of such insurance at final payment and one year thereafter.

CONTRACTUAL LIABILITY INSURANCE:

5.4. The comprehensive general liability insurance required by paragraph 5.3 will include contractual liability insurance applicable to CONTRACTOR'S obligations under paragraphs 6.30 and 6.31.

OWNER'S LIABILITY INSURANCE:

5.5. (Deleted)

PROPERTY INSURANCE:

5.6. – 5.10 (Deleted)

WAIVER OF RIGHTS:

5.11.1. CONTRACTOR waives all rights against OWNER for all losses and damages caused by any of the perils covered by the policies of insurance provided under the Supplemental General Conditions and any other property insurance applicable to the Work, and also waives all such rights against the Sub-Contractors, ENGINEER, ENGINEER'S Consultants and all other parties named as insured in such policies for losses and damages so caused. As required by paragraph 6.11, each sub-contract between CONTRACTOR, and a Sub-Contractor will contain similar waiver provisions by the Sub-Contractor in favor of OWNER, CONTRACTOR, ENGINEER, ENGINEER'S Consultants and all other parties named as





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insured. None of the above waivers shall extend to the rights that any of the insured parties may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

5.11.2. CONTRACTOR intends that any policies provided under the Supplemental General Conditions shall protect all of the parties insured and provide primary coverage for all losses and damages caused by the perils covered thereby. Accordingly, all such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights or recovery against any of the parties named as insured or additional insured and if the insurers require separate waiver forms to be signed by ENGINEER or ENGINEER'S consultant or any Sub- Contractor, CONTRACTOR will obtain the same.

RECEIPT AND APPLICATION OF PROCEEDS:

5.12. (Delete)

5.13. (Delete)

ACCEPTANCE OF INSURANCE:

5.14. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.3 and 5.4 on the basis of its not complying with the CONTRACT DOCUMENTS, OWNER shall notify CONTRACTOR in writing thereof within ten days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.7. CONTRACTOR shall each provide to OWNER, such additional information in respect of insurance provided by each as the OWNER may reasonably request. Failure by OWNER to give such notice of objection within the time provided shall constitute acceptance of such insurance purchased by the CONTRACTOR as complying with the CONTRACT DOCUMENTS.

PARTIAL UTILIZATION- PROPERTY INSURANCE:

5.15 If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10. The insurers of CONTRACTORS providing the property insurance shall consent to such use or occupancy by endorsement on the policy or policies, but the property insurance shall not be canceled or lapse on account of any such partial use or occupancy.

ARTICLE 6- CONTRACTOR'S RESPONSIBILITIES





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SUPERVISION AND SUPERINTENDENCE:

6.1. CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skill and expertise as may be necessary to perform the Work in accordance with the CONTRACT DOCUMENTS. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of others in the design or selection or a specific means, method, technique, sequence or procedure or construction which is indicated in and required by the CONTRACT DOCUMENTS. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the CONTRACT DOCUMENTS.

6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR'S representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

LABOR, MATERIALS AND EQUIPMENT:

6.3. CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the CONTRACT DOCUMENTS. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons of the Work or property at the site or adjacent thereto, and except as otherwise indicated in the CONTRACT DOCUMENTS, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without OWNER'S written consent after prior written notice to ENGINEER.

6.4. Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing start-up, and completion of Work.

6.5. All materials and equipment shall be of good quality and new, except, as otherwise provided in the CONTRACT DOCUMENTS. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable Supplier, except as otherwise provided in the CONTRACT DOCUMENTS; but no provision of any such instructions will be effective to assign to ENGINEER, or any of ENGINEER'S





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consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.15 or 6.16.

ADJUSTING PROGRESS SCHEDULE:

6.6 CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.9) adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

SUBSTITUTES OR "OR-EQUAL" ITEMS:

6.7.1. Whenever materials or equipment are specified or described in the CONTRACT DOCUMENTS by using the name of a proprietary item or the name of a particular Supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by ENGINEER if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. The procedure for review by ENGINEER will include the following as supplemented in the General Requirements. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice CONTRACTOR'S achievement of Substantial Completion on time, whether or not acceptance of the substitutes for use in the Work will require a change in any of the CONTRACT DOCUMENTS (or in the provisions of any other direct contract with OWNER for Work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment or any license fee of royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims or other contractors affected by the resulting change, all of which shall be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish at CONTRACTOR'S expense additional data about the proposed substitute.

6.7.2. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the CONTRACT DOCUMENTS, CONTRACTOR may furnish or





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utilize a substitute means, method, sequence, technique or procedure of construction acceptable to ENGINEER, if CONTRACTOR submits sufficient information to allow ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the CONTRACT DOCUMENTS. The procedure for review by ENGINEER will be similar to that provided in paragraph 6.7.1, as applied by ENGINEER and as may be supplemented in the General Requirements.

6.7.3. ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. ENGINEER will be sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER'S prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute. ENGINEER will record time required by ENGINEER and ENGINEER'S consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the CONTRACT DOCUMENTS occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER'S consultants for evaluating each proposed substitute.

CONCERNING SUB-CONTRACTORS, SUPPLIERS AND OTHER:

6.8.1. CONTRACTOR shall not employ any Sub-Contractor, Supplier or other person or organization (including those acceptable to OWNER and ENGINEER as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Sub-Contractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

If the Supplementary Conditions require the identity of certain Sub-Contractors, Suppliers or other persons or organizations (including those who are to furnish the principal items or materials and equipment) to be submitted to OWNER in advance of the specified date prior to the Effective Date of the Agreement for acceptance by OWNER and ENGINEER and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER'S or ENGINEER'S acceptance either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in bidding documents or the CONTRACT DOCUMENTS) of any such Sub-Contractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be increased by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER or ENGINEER of any such Sub-Contractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.





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6.9. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Sub-Contractor's, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct and indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR'S own acts and omissions. Nothing in the CONTRACT DOCUMENT shall create any contractual relationship between OWNER or ENGINEER and any such Sub-Contractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Sub-Contractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.10. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Sub-Contractors or Suppliers or delineating the Work to be performed by any specified trade.

6.11 All Work performed for CONTRACTOR by a Sub-Contractor will be pursuant to an appropriate agreement between CONTRACTOR and Sub-Contractor which specifically binds the Sub-Contractor to the applicable terms and conditions of the CONTRACT DOCUMENTS for the benefit of OWNER and ENGINEER and contains waiver provisions as required by paragraph 5.11.

PATENT FEES AND ROYALTIES:

6.12. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the CONTRACT DOCUMENTS for use in the performance of the Work and if to the actual knowledge of OWNER and ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the CONTRACT DOCUMENTS. CONTRACTOR shall indemnify, hold harmless and defend at its cost, OWNER and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees and court and arbitration costs) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the CONTRACT DOCUMENTS, and shall defend all such claims in connection with any alleged infringement of such rights.

6.13. Unless otherwise provided in the Supplemental General Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or if there are not Bids on the





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Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

LAWS AND REGULATIONS:

6.14.1. CONTRACTOR shall give all notices and comply with all laws and Regulations applicable to furnishing and performing of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR'S compliance with any Law or Regulations.

6.14.2 If CONTRACTOR observes that the Specification of Drawings are at variance with any Laws or Regulations, CONTRACTOR shall give ENGINEER prompt written notice thereof, any necessary changes will be authorized by one of the methods indicated in paragraph 3.4.

If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such Laws or Regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom; however, it shall not be CONTRACTOR'S primary responsibility to made certain that the Specifications and Drawings are in accordance with such Laws and Regulations.

6.15. CONTRACTOR shall pay all sales, consumer use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

USE OF PREMISES:

6.16. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project site and land and areas identified in and permitted by the CONTRACT DOCUMENTS and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against OWNER or ENGINEER by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim by at law. CONTRACTOR shall, to the fullest extent permitted by Law and Regulations, indemnify and hold OWNER and ENGINEER harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of Engineers, Architects, Attorneys and other professional and court and arbitration costs) arising directly, indirectly or consequently out of any action, legal or equitable, brought by any such other party against OWNER or ENGINEER to the extent based





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on a claim arising out of work done by CONTRACTOR under the CONTRACT DOCUMENTS. It is the expressed intention of the parties hereto, both OWNER and CONTRACTOR, that the indemnity provided for in this paragraph is indemnity by CONTRACTOR to indemnify and protect OWNER from the consequences of OWNER'S own negligence, whether that negligence is the sole or a concurring cause of the injury, death or damage.

6.17. During the progress of the Work, CONTRACTOR shall keep the premises free from such accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore to original condition all property not designated for alteration by the CONTRACT DOCUMENTS.

6.18. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

DOCUMENTS:

6.19. CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Directive Changes, Field Orders and Written Interpretations and Clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these Record Documents, Samples and Shop Drawings will be delivered to ENGINEER for OWNER.

SAFETY AND PROTECTION:

6.20. CONTRACTOR shall be responsible for initiation, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1. All employees on the Work and other persons and organizations who may be affected thereby;

6.20.2 All the Work and materials and equipment to be incorporated therein, whether in storage on or off the site.





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6.20.3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damages, injury or loss to any property referred to in paragraphs 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, and Sub-Contractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omission of OWNER or ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR). CONTRACTOR'S duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion.

6.21. CONTRACTOR shall designate a responsible representative at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR'S superintendent unless otherwise designated in writing by CONTRACTOR to OWNER.

EMERGENCIES:

6.22. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the CONTRACT DOCUMENTS have been caused thereby. If ENGINEER determines that a change in the CONTRACT DOCUMENTS is required because of the action taken in response to any emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variations.

SHOP DRAWINGS AND SAMPLES:

6.23. After checking and verifying all field measurements and complying with applicable procedures specified in the General Requirements, CONTRACTOR shall submit to





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ENGINEER for review an approval in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.9), or for other appropriate action if so indicated in the Supplementary Conditions, five copies (unless otherwise specified in General Requirements) of all Shop Drawings, which bear a stamp written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the CONTRACT DOCUMENTS with respect to the review of the submission. All submissions will be identified as ENGINEER may require. The data shown on the Shop Drawings will be completed with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to enable ENGINEER to review the information as required.

6.24. CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by the CONTRACT DOCUMENTS. All samples will have been checked by and accompanied by a specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the CONTRACT DOCUMENTS with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

6.25.1. Before submission of each Shop Drawing or sample CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the CONTRACT DOCUMENTS.

6.25.2. At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the CONTRACT DOCUMENTS, and in addition, shall cause a specific notation to be made on each Shop Drawing submitted to ENGINEER for review and approval of each such variation.

ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, ENGINEER'S review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the CONTRACT DOCUMENTS and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the CONTRACT DOCUMENTS) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called by ENGINEER or previous submittals.





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6.27. ENGINEER'S review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the CONTRACT DOCUMENTS unless CONTRACTOR has in writing called ENGINEER'S attention to each such variation at the time of submission as required by paragraph 6.25.2 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of paragraph 6.25.1.

6.28. Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to ENGINEER'S review and approval of the pertinent submission will be the sole expense and responsibility of CONTRACTOR.

CONTINUING THE WORK:

CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as CONTRACTOR and OWNER may otherwise agree in writing.

INDEMNIFICATION:

6.30. To the fullest extent permitted by Laws and Regulations CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and their consultants, agents and employees from and against all claims, damages, losses and expense, direct, indirect or consequential (including but not limited to fees and charges of Engineers, Architects, Attorneys and other professional and court and arbitration costs) arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting there from and (b) is caused in whole or in part by any negligent act or omission of OWNER, CONTRACTOR, and Sub-Contractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a partly indemnified hereunder or arises by or is imposed by Law and Regulations regardless of the negligence of any such party. It is the expressed intention of the parties hereto, both OWNER and CONTRACTOR, that the indemnity provided for in this paragraph is indemnity by CONTRACTOR to indemnify and protect OWNER from the consequences of OWNER'S own negligence, whether that negligence is the sole or concurring cause of the injury, death or damage.

6.31. In any and all claims against OWNER or ENGINEER or any of their consultants, agents or employees by any employee or Contractor, any Sub-Contractor, and person or





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organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.30 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any Sub-Contractor or other person or organization under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

6.32. The obligations of CONTRACTOR under paragraph 6.30 shall not exceed to the liability of ENGINEER, ENGINEER'S consultants, agents or employees arising out of the preparation or approval or maps, drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

ARTICLE 7-OTHER WORK RELATED WORK AT SITE:

7.1. OWNER may perform other work related to the Project at the site by OWNER'S own forces, have other work performed by utility owners or let other direct contracts therefore which shall contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the CONTRACT DOCUMENTS, written notice thereof will be given to CONTRACTOR prior to starting any such other work; and if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the extent thereof, CONTRACTOR may make a claim therefore as provided in Articles 11 and 12.

7.2. CONTRACTOR shall afford each utility owner and other contractor who is a party to such a direct contract (or OWNER, if OWNER is performing the additional work with OWNER'S employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work, and shall properly connect and coordinate the Work with theirs. CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

7.3. If any part of CONTRACTOR'S Work depends for proper execution or results upon the work of any such other contractor or utility owner (or OWNER), CONTRACTOR shall inspect and promptly report to ENGINEER in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. CONTRACTOR'S failure to report will constitute and acceptance of the other work as fit and





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proper for integration with CONTRACTOR'S work except for latent or non-apparent defects in the other work.

COORDINATION:

7.4. If OWNER contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified in the Supplementary Conditions, and the specific matters to be covered by such authority and responsibility will be itemized, and the extent of such authority and responsibilities will be provided, in the Supplementary Conditions. Unless otherwise provided in the Supplementary Conditions, neither OWNER nor ENGINEER shall have any authority or responsibility in respect of such coordination.

ARTICLE 8-OWNER'S RESPONSIBILITIES

8.1. OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.2. In case of termination of the employment or ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the CONTRACT DOCUMENTS shall be that of the former ENGINEER. Any dispute in connection with such appointment shall be subject to arbitration.

OWNER shall furnish the data required of OWNER under the CONTRACT DOCUMENTS promptly and shall make payments to CONTRACTOR promptly after they are due as provided in paragraphs 14.4 and 14.14.

8.4. OWNER'S duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER'S identifying and making available to CONTRACTOR copies of reports of explorations and tests of sub-surface conditions at the site and existing structures which have been utilized by ENGINEER in preparing the Drawings and Specifications.

8.5. (Delete)

8.6 OWNER is obliged to execute Change Orders as indicated in paragraph 10.4.

8.7. OWNER'S responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.

8.8. In connection with OWNER'S right to stop Work or suspend Work, see paragraph 13.10 and 15.1. Paragraph 15.2 deals with OWNER'S right to terminate services on





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CONTRACTOR under certain circumstances

ARTICLE 9-ENGINEER'S STATUS DURING CONSTRUCTION

OWNER'S REPRESENTATIVE:

9.1. ENGINEER will be OWNER'S representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction are set forth in the CONTRACT DOCUMENTS and shall not be extended without written consent of OWNER and ENGINEER.

VISITS TO SITE:

9.2. ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the CONTRACT DOCUMENTS. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER'S efforts will be directed toward providing for OWNER a greater degree of confidence that the complete Work will conform to the CONTRACT DOCUMENTS. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defects and deficiencies in the Work.

PROJECT REPRESENTATION:

9.3. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in observing the performance of the Work. The duties, responsibilities and limitations of authority of any such Resident Project Representative and assistants will be as provided in the Supplemental Conditions. If OWNER designates another agent to represent OWNER at the site who is not the ENGINEER'S agent or employee, the duties, responsibilities and limitations of authority of such other person will be provided in Supplemental Conditions.

CLARIFICATIONS AND INTERPRETATIONS:

9.4. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the CONTRACT DOCUMENTS (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the CONTRACT DOCUMENTS. If CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree to the





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amount or extent thereof, CONTRACTOR may make a claim therefore as provided in Article 11 or Article 12.

AUTHORIZED VARIATIONS IN WORK:

9.5. ENGINEER may authorize minor variations in the Work from the requirements of the CONTRACT DOCUMENTS which do not involve an adjustment in the Contract Price of the Contract Time and are consistent with the overall intent of the CONTRACT DOCUMENTS. These may be accomplished by a Field Order and will be binding on OWNER, and also on CONTRACTOR who shall perform the Work involved promptly. If CONTRACTOR believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount thereof, CONTRACTOR may make a claim therefor as provided in Article 11 or 12.

REJECTING DEFECTIVE WORK:

9.6. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or complete.

SHOP DRAWINGS, CHANGE ORDERS AND PAYMENTS:

9.7. In connection with ENGINEER'S responsibility for Shop Drawings and samples, see paragraphs 6.23 through 6.29 inclusive.

9.8. In connection with ENGINEER'S responsibility as to Change Orders, see Articles 10, 11, and 12.

9.9. In connection with ENGINEER'S responsibility in respect of Applications for Payment, etc, see Article 14.

DETERMINATIONS FOR UNIT PRICES:

9.10. (Delete)

DECISIONS ON DISPUTES:

9.11. ENGINEER will be the initial interpreter of the requirements of the CONTRACT DOCUMENTS and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the CONTRACT DOCUMENTS pertaining to the performance and furnishing of the Work and claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract





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Time will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter will be delivered by the claimant to ENGINEER and the other party to the Agreement promptly (but in no event later than thirty days) after the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within sixty days after such occurrence unless ENGINEER allows and additional period of time to ascertain more accurate data in support of the claim.

9.12. When functioning as interpreter and judge under paragraphs 9.10 and 9.11, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. Then rendering of a decision by ENGINEER pursuant to paragraphs 9.10 and 9.11 with respect to any such claim, dispute or other matter (except and which have been waived by the making or acceptance of final payments as provided in paragraph 14.16) will be a condition precedent to any exercise by OWNER or CONTRACTOR or such rights or remedies as either may otherwise have under the CONTRACT DOCUMENTS or by Laws or Regulations in respect of any such claim, dispute or other matter.

LIMITATIONS ON ENGINEER'S RESPONSIBILITIES:

9.13 Neither ENGINEER'S authority to act under this Article 9 or elsewhere in the CONTRACT DOCUMENTS nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Sub-Contractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.

9.14. Whenever in the CONTRACT DOCUMENTS the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper", or "satisfactory" or adjectives of the effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction review or judgment will be solely to evaluate the Work for compliance with the CONTRACT DOCUMENTS (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraphs 9.15 and 6.16.

9.15. ENGINEER will not be responsible for CONTRACTOR'S means, methods, technique, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR'S failure to perform or furnish the Work in accordance with the CONTRACT DOCUMENTS.





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9.16. ENGINEER will not be responsible for the acts or omissions of the CONTRACTOR or of any Sub-Contractor, any Supplier or any other person or organization performing or furnishing any of the Work.

ARTICLE 10-CHANGES IN THE WORK

Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized, be a written amendment, a Change Order or a Work Directive Change. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the CONTRACT DOCUMENTS (except as otherwise specifically indicated).

10.2. If OWNER and CONTRACTOR are unable to agree as to the extent if any of an increase or decrease in the Contract Price or an extension or shortening of the Contract Time that should be allowed as a result of a work directive change, a claim may be made therefore as provided in Article 11 or Article 12.

10.3. CONTRACTOR shall not be entitled to any increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the CONTRACT DOCUMENTS as amended modified and supplemented as provided in paragraphs 3.4 and 3.5, except in the case of any emergency as provided in paragraph 6.22 and except in the case of uncovering Work as provided in paragraph 13.9.

10.4. OWNER and CONTRACTOR shall execute appropriate Change Orders (or Written Amendments) covering:

10.4.1. Changes in the Work that are ordered by OWNER pursuant to paragraph 10.1, are required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under paragraph 13.14, or are agreed to by the parties;

10.4.2. Changes in the Contract Price or Contract Time which are agreed to by the parties; and

10.4.3. Changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 9.11, provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the CONTRACT DOCUMENTS and applicable laws and regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.

10.5. If notice of any change affecting the general scope of the Work of the provisions of the CONTRACT DOCUMENTS (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice





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will be CONTRACTOR'S responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11-CHANGE OR CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any claim for an increase or decrease in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Price shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.

11.3. The value of any Work covered by a Change Order of any claim for an increase or decrease in the Contract Price shall be determined in of the following ways:

11.3.1. (Delete)

11.3.2. By mutual acceptance of a lump sum, which at the discretion of OWNER may be based in whole or in part on the same unit costs outlined in the Bid included in the CONTRACT DOCUMENTS which may include an allowance for overhead and profit.

ARTICLE 12-CHANGE OF CONTRACT TIME

12.1. The Contract Time may only be changed by a Change Order or a Written Amendment. Any Claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire





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adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event.

All claims for adjustment in the Contract Time shall be determined by ENGINEER in accordance with paragraph 9.11 if OWNER and CONTRACTOR cannot otherwise agree. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

12.2. The Contract Time will be extended in an amount to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefore as provided in paragraph 1.1. Such delays shall include, but not be limited to, acts or neglect by OWNER or others performing additional work as contemplated by Article 7, or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God.

12.3. All time limits stated in the CONTRACT DOCUMENTS are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs) for delay by either party.

ARTICLE 13 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTIONS, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

WARRANTY AND GUARANTEE:

13.1. CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all Work will be in accordance with the CONTRACT DOCUMENTS and will not be defective. Prompt notice of all defects shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 13.

ACCESS TO WORK:

13.2. ENGINEER and ENGINEER'S representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide proper and safe conditions for such access.

TESTS AND INSPECTION:

13.3. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

13.4. If laws and Regulations of any public body having jurisdiction require any Work (or part





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thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval.

CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER'S or ENGINEER'S acceptance of a supplier or materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR'S purchase thereof for incorporation in the Work. The cost of all inspections, tests and approvals other than those which are required by the CONTRACT DOCUMENTS shall be paid by OWNER (unless otherwise specified).

13.5. All inspections, tests or approvals other than those required by Laws or regulations of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR (or by ENGINEER if so specified).

13.6. If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR'S expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR'S intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.7. Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from CONTRACTOR'S obligations to perform the Work in accordance with the CONTRACT DOCUMENTS.

UNCOVERING WORK:

13.8. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER'S observation and replaced at CONTRACTOR'S EXPENSE.

13.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, a ENGINEER'S request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, (including but not limited to fees and charges of engineers, architects, attorneys and other professionals), and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim thereof, may make a claim therefore as provided in





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Article 11. If, however, such work is not found to be defective, CONTRACTOR shall be allowed to increase in the Contract Price or an extension of the contract time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefore as provided in Articles 11 and 12.

OWNER MAY STOP THE WORK:

13.10. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the CONTRACT DOCUMENTS, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this rights for the benefit of CONTRACTOR or any other party.

CORRECTION OR REMOVAL OF DEFECTIVE WORK:

13.11. If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct al defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with non-defective Work. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

ONE-YEAR CORRECTION PERIOD:

13.12. If within one year after the date of issue of the Certificate of Acceptance or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the CONTRACT DOCUMENTS or by any specific provision of the CONTRACT DOCUMENTS, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER'S written instructions, either correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with non-defective work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected pr the rejected work removed and replaced, and all direct, indirect and consequential costs and replacement (including but not limited to fees and charges of engineers, architect, attorneys, and other professionals) will be paid by CONTRACTOR.

ACCEPTANCE OF DEFECTIVE WORK:





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13.13. If, instead of requiring correction of removal and replacement of defective Work, OWNER (and, prior to ENGINEER'S recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall bear all direct, indirect and consequential costs attributable to OWNER's evaluation of and determination to accept such defective Work (such cost to be approved by ENGINEER as to reasonableness and to include but not be limited to fees and charges of engineers, architects, attorneys and other professionals).

If any such acceptance occurs prior to ENGINEER'S recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the CONTRACT DOCUMENTS with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefore as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

OWNER MAY CORRECT DEFECTIVE WORK:

13.14. If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct and to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the CONTRACT DOCUMENTS, or if CONTRACTOR fails to comply with any other provision of the CONTRACT DOCUMENTS, OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR'S services related thereto, take possession of CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER'S representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of OWNER in Exercising such rights and remedies will be charged against CONTRACTOR in an amount approved as to reasonableness by ENGINEER, and charged against CONTRACTOR in an amount approved as to reasonableness by ENGINEER, and a Change Order will be issued incorporating the necessary revisions in the CONTRACT DOCUMENTS with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, OWNER may make a claim therefore as provided in Article 11. Such direct, indirect and OWNER consequential costs will include but not be limited to fees and charges of engineers, architects, and other professionals, all court and arbitration costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR'S defective Work. CONTRACTOR shall not be allowed





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an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER'S rights and remedies hereunder.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

SCHEDULE OF VALUES:

14.1 The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application of Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

APPLICATION FOR PROGRESS PAYMENT:

14.2 At least twenty days before each progress payment is scheduled (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the CONTRACT DOCUMENTS. If Payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that OWNER has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect OWNER'S interest therein, all of which will be satisfactory to OWNER. The amount of retainage with respect to progress payments will be 10% (ten percent). The retainage shall be held by the owner until all the work has been satisfactorily completed and accepted in writing. At that time the retainage may be released and included in the Final Payment.

CONTRACTOR'S WARRANTY OF TITLE:

14.3. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT:

14.4 ENGINEER will, within ten days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing ENGINEER'S reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and re-submit the Application twenty (20) days after the presentation of the Application for





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Payment with ENGINEER'S recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7) become due and when due will be paid by OWNER to CONTRACTOR.

14.5 ENGINEER'S recommendation of any payment requested in an application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER'S on-site observations of the Work in progress as an experienced and qualified design professional and on ENGINEER'S review of the Application for Payment and the accompanying data and schedules that the work has progressed to the point indicated that to the best of the ENGINEER'S knowledge, information and belief, the quality of the Work is in accordance with the CONTRACT DOCUMENTS (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent test called for in the CONTRACT DOCUMENTS, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated the recommendation); and that CONTRACTOR is entitled to payment of the amount recommended.

However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that exhaustive or continuous on-site inspection have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to ENGINEER in the CONTRACT DOCUMENTS or that there may be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or OWNER to withhold payment to CONTRACTOR.

14.6 ENGINEER'S recommendation of final payment will constitute an additional representation by ENGINEER to OWNER that the conditions precedent to CONTRACTOR'S being entitled to final payment as set forth in paragraph 14.13 have been fulfilled.

14.7. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER'S opinion, it would be incorrect to make such representation to OWNER. ENGINEER may also refuse to recommend any such payment, or because of tests, nullify any such payments previously recommended, to such extent as may be necessary in ENGINEER'S opinion to protect OWNER from loss because:

14.7.1 The Work is defective, or completed Work has been damaged requiring correction or replacement;

14.7.2. The Contract Price has been reduced by Written Amendment or Change Order,

14.7.3. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.14.

14.7.4. ENGINEER'S actual knowledge of the occurrence of any of the events enumerated in





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paragraphs 15.2.1 through 15.2.9 inclusive.

OWNER may refuse to make payment of the full amount recommended by ENGINEER because claims have been made against OWNER on account of CONTRACTOR'S performance of furnishing of the Work or Liens have been filed in connection with the Work or there are other items entitling OWNER to a set-off against the amount recommended, but OWNER must give CONTRACTOR immediate written Notice (with a copy to ENGINEER) stating the reasons for such action.

SUBSTANTIAL COMPLETION:

14.8 When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER considers The Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion.

There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within fourteen days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefore. If, after consideration of OWNER'S objections, ENGINEER considers the Work substantially complete, ENGINEER will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties. Unless OWNER and CONTRACTOR agree otherwise in writing and to inform ENGINEER prior to ENGINEER'S issuing the definitive certificate of Substantial completion, ENGINEER'S aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

14.9. OWNER shall have the right to exclude CONTRACTOR from the Work after the date





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of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

PARTIAL UTILIZATION:

14.10. Use by OWNER of any finished part of the Work, which has specifically been identified in the CONTRACT DOCUMENTS, or which OWNER, ENGINEER and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER without significant interference with CONTRACTOR'S performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, the provisions of paragraphs 14.8 and 14.9 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.10.2 OWNER at any time may request CONTRACTOR in writing to permit OWNER to take over operation of any such part of the Work although it is not substantially complete. A copy of such request will be sent to ENGINEER and within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If CONTRACTOR does not object in writing to OWNER and ENGINEER that such part of the Work is not ready for separate operation by OWNER, ENGINEER will finalize the list of items to be completed or corrected and will deliver such list to OWNER and CONTRACTOR together with written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work which will become binding upon OWNER and CONTRACTOR at the time when OWNER takes over such operation (unless they shall have otherwise agreed in writing and so informed ENGINEER). During such operation and prior to Substantial Completion of such part of the Work, OWNER shall allow CONTRACTOR reasonable access to complete or correct items on said list and to complete





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other related Work.

14.10.3 No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.15 in respect of property insurance.

FINAL INSPECTION:

14.11 Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

FINAL APPLICATION FOR PAYMENT:

14.12 After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds certificates of inspection, marked-up record documents (as provided in paragraph 6.19) and other documents-all as required by the CONTRACT DOCUMENTS, and after ENGINEER has indicated that the Work is acceptable (subject to the provisions of paragraph 14.16), CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the CONTRACT DOCUMENTS, together with complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER'S property might in any way be responsible, have been paid or otherwise satisfied; and consent of the surety, if any, to final payment. If any Sub-Contractor or Supplier fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

FINAL PAYMENT AND ACCEPTANCE:

If, on the basis of ENGINEER'S observation of the Work during construction and final inspection, and ENGINEER'S review of the final Application for Payment and accompanying documentation, all required by the CONTRACT DOCUMENTS, ENGINEER is satisfied that the Work has been completed and CONTRACTOR'S other obligations under the CONTRACT DOCUMENTS have been fulfilled, ENGINEER will, within ten days after receipt of final Application for Payment, indicate in writing ENGINEER'S recommendation of payment and present the Application to OWNER for payment.





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Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.16. otherwise, the ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and re-submit the Application. Thirty days after presentation to OWNER of the Application and accompanying documentation, in appropriate form and substance, and with ENGINEER'S recommendation and notice of acceptability the amount recommended by ENGINEER will become due and will be paid by OWNER to CONTRACTOR.

14.14 If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR'S final Application for payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

CONTRACTOR'S CONTINUING OBLIGATION:

14.15. CONTRACTOR'S obligation to perform and complete the Work in accordance with the CONTRACT DOCUMENTS shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by OWNER to CONTRACTOR under the CONTRACT DOCUMENTS, nor any use or occupancy of the Work or any part thereof by OWNER, nor any act of acceptance by OWNER nor any failure to do so, nor any review and approval of a Shop Drawing or sample submission, nor the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13, nor any correction of defective Work by OWNER will constitute an acceptance of Work not in accordance with the CONTRACT DOCUMENTS or release of CONTRACTOR'S obligation to perform the Work in accordance with the CONTRACT DOCUMENTS.

WAIVER OF CLAIMS:

14.16. The making and acceptance of final payment will constitute:

14.16.1 A waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11 or from failure to comply with the CONTRACT DOCUMENTS or the terms of any special guarantees specified therein; however it will constitute a waiver by OWNER of





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any rights in respect of CONTRACTOR'S continuing obligations under the CONTRACT DOCUMENTS; and

14.16.2 A waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15- SUSPENSION OF WORK AND TERMINATION

OWNER MAY SUSPEND WORK:

15.1 OWNER may at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume Work on the date so fixed. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if CONTRACTOR makes an approved claim therefore as provided in Articles 11 and 12.

OWNER MAY TERMINATE:

15.2 Upon the occurrence of any one or more of the following events:

15.2.1. If CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other Federal or State law in effect at the time relating to bankruptcy or insolvency;

15.2.2. If a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other Federal or State law in effect at the time relating to bankruptcy or insolvency;

15.2.3. If CONTRACTOR makes a general assignment for the benefit of creditors;

15.2.4. If a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose or enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR'S creditors;

15.2.5. If CONTRACTOR admits in writing as inability to pay its debts generally as they become due;

15.2.6. If CONTRACTOR persistently fails to perform the work in accordance with the





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CONTRACT DOCUMENTS (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment of failure to supply sufficient skilled workers or suitable materials or equipment of failure to adhere to the progress schedule established under paragraph 2.9 as revised from time to time);

15.2.7. If CONTRACTOR disregards Law or Regulations of any public body having jurisdiction;

15.2.8. If CONTRACTOR disregards the authority of ENGINEER; or

15.2.9. If CONTRACTOR otherwise violates in any substantial way any provisions of the CONTRACT DOCUMENTS; OWNER (and the surety, if there be one) seven days written the extent notice and to permitted by Laws and Regulations, terminate the CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion) incorporated in the Work all materials and equipment stored elsewhere and finish the Work as Owner may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished.

If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the Work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs), such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER will be approved as to reasonableness by ENGINEER and incorporated in a Change Order, but when exercising any rights to remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

15.3 Where CONTRACTOR'S services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter occur. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.4. Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expense, which will include, but not be limited to, direct, indirect and consequential costs (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs.

CONTRACTOR MAY STOP WORK OR TERMINATE:





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15.5. If, through no act or fault of CONTRACTOR, the Work is suspended for a period or more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted, or OWNER fails for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' written notice to OWNER and ENGINEER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of the obligations under paragraph 6.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

ARTICLE 16 - ARBITRATION

Deleted

ARTICLE 17 - MISCELLANEOUS

GIVING NOTICE:

17.1 Whenever any provision of the CONTRACT DOCUMENTS requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.2.1. When any period of time is referred to in the CONTRACT DOCUMENTS by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.2.2. A calendar day of twenty-four hours measured from midnight to the next midnight shall constitute a day.

GENERAL:

17.3. Should OWNER or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provision of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the





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provisions of any applicable statute of limitations or repose.

17.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligation imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws and Regulations, by special warranty or guarantee or by other provisions of the CONTRACT DOCUMENTS, and the provisions of this paragraph will be as effective as if repeated specifically in the CONTRACT DOCUMENTS in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the CONTRACT DOCUMENTS will survive final payment and termination or completion of the Agreement.

17.5 STANDARD WORK HOURS: The standard work hours for the OWNER is 8:00 am to 5:00 pm, Monday through Friday. Should the Contractor elect to work on Saturday, Sundays or holidays, he shall be responsible for paying overtime charges for the OWNERS personnel involved. These charges will be at cost and will be calculated either at time and a half or double time, as applicable to the particular day being worked. Pre-approval shall be obtained from the Engineer or Engineer’s representative by completing and signing a OWNER’S Form entitled “CONSTRUCTION INSPECTORS OVERTIME COMPENSATION AUTHORIZATION”, prior to commencing any overtime work.

Any work done outside the standard workday, without prior authorization, shall be considered under unauthorized work. The Contractor is required to pay the overtime wages of the OWNER Inspectors that work overtime Mondays through Fridays at time in a half. The Contractor is responsible for the overtime wages of the ONWER inspectors that work Holidays at double time. Minimum hours will be billed to contractor for callouts or for insufficient notice of two (2) hours.

17.6 INDEMNIFICATION

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER, ENGINEER, ENGINEER’S SUBCONSULTANTS AND THE OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, AND OTHER CONSULTANTS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OR ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) CAUSED BY, ARISING OUT OF, OR RESULTING FROM, THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, COST, LOSS OR DAMAGE: (i) IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE, OR DEATH, OR TO





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INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE RESULTING THEREFROM, AND (ii) IS CAUSED IN WHOLE OR IN PART BY ANY NEGLIGENT ACT OR OMISSION OF CONTRACTOR, ANY SUBCONTRACTOR, ANY SUPPLIER, ANY PERSON, OR ORGANIZATION DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM TO PERFORM OR FURNISH ANY OF THE WORK, OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT CAUSED IN PART BY ANY NEGLIGENCE OR OMISSION OF A PERSON OR ENTITY INDEMNIFIED HEREUNDER OR WHETHER LIABILITY IS IMPOSED UPON SUCH INDEMNIFIED PARTY BY LAWS AND REGULATIONS REGARDLESS OF THE NEGLIGENCE OF ANY SUCH PERSON OR ENTITY. CLAIMS, COSTS, LOSSES, DAMAGES, SUITS AND CAUSES OF ACTION, AND ANY AND ALL LIABILITY, COSTS, EXPENSES, SETTLEMENTS, DAMAGES, AND JUDGEMENTS INCURRED IN CONNECTION THEREWITH (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS, AND ALL COURT OR ARBITRATION OR OTHER DISPUTES RESOLUTION COSTS) WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, INCLUDING THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR STATUTE OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO FAULT) OR PROPERTY, OF EVERY KIND OR CHARACTER... (iii) IS CAUSED IN WHOLE OR IN PART BY ANY NEGLIGENT ACT OR OMISSION, OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, VIOLATION OF THE TEXAS DECEPTIVE TRADE PRACTICES ACT, OR STRICT LIABILITY WITHOUT REGARD TO FAULT OF CONTRACTOR.... REGARDLESS OF WHETHER OR NOT CAUSED IN PART BY ANY NEGLIGENCE OR OMISSION, OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, VIOLATION OF THE TEXAS DECEPTIVE TRADE PRACTICES ACT, OR STRICT LIABILITY WITHOUT REGARD TO FAULT OF A PERSON OR ENTITY INDEMNIFIED HEREUNDER.... CONTRACTOR'S OBLIGATIONS OF INDEMNIFICATION UNDER THIS PARAGRAPH 6.20.1 SHALL NOT BE LIMITED BY THE AMOUNT OF ANY INSURANCE.

VIDEOTAPING: The Contractor shall videotape the entire job site, including access to the job site, prior to commencing work. A copy of the videotape shall be provided to the City at the Pre-Construction Conference. The videotape will be held for historical purposes and for resolving complaints/claims from affected property owners. Failure to provide such a tape shall render the contractor liable for claims. Acceptable format is standard VHS tape. Beta format is not acceptable.

Monthly videotaping by the contractor during construction is recommended to protect the contractor's interest against claims and as a basis for extras.





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SPECIAL CONDITIONS

1. COMPLETION TIME AND LIQUIDATED DAMAGES

The project as indicated in the Plans and Specifications shall be completed within the number of consecutive calendar days stated in the Contract beginning the date of the notice to commence work. Contractors shall submit a monthly request for time extensions, and such requests shall include justification in conformance with the Contract. The time set forth in the Proposal for the completion of the work is an essential element of the contract. The Contractor and Owner understand and agree that a breach of this Contract as to completion on time will cause damage to the Owner. The parties agree that for each and every calendar day the work or an portion thereof shall remain uncompleted after the expiration of the time limits, the amount per day given in the following schedule will be deducted from the money due or to become due the Contractor, not as penalty, but as liquidated damages and added expense of engineering and overhead.

The Contractor shall within the (10) days from the beginning of any delay notify the Engineer, in writing, of the causes of delay. The Engineer shall ascertain the facts, and the extent of delay and his findings of the facts thereon shall be final and conclusive.

2. CONTRACT DRAWINGS

The Contractor will be furnished three (3) complete sets of drawings by the Engineer for use during construction of the project. Only Plans and Specifications marked "Approved for Construction" and bearing signature of the Engineer on said mark shall be used as construction drawings. Any additional set of construction plans can be provided to contractor upon payment of \$50.00.

3. DISPOSAL OF RUBBISH

It shall be the responsibility of the Contractor to dispose of all rubbish, brush, fencing, trees or other objectionable materials by burning, removal form the site or whatever means necessary to effect such disposal.

4. UTILITY SERVICES FOR CONSTRUCTION

Contractor will be responsible for furnishing water or any other utility services required for construction of project.





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5. TESTING, INSPECTION AND CONTROL

Testing and inspection of materials required by these specifications shall be by a commercial testing laboratory. The laboratory shall be selected by the Owner and laboratory services and field testing required by the Technical Specifications for control of work, such as testing of concrete cylinders made on the job shall be paid for by the Contractor. Additional laboratory services as dictated below shall be paid for by the Contractor:

- A. The cost of laboratory services required to establish mix design for Portland Cement Concrete and Asphaltic concrete mixture, testing of aggregates, fixing gradations, the preparations and testing of design cylinders or specimens and other such services required to establish mix design, or to redesign the mix when required due to change in source of materials.
- B. The Contractor shall furnish all materials and test specifications for testing as selected by the Testing Agency.
- C. Mills test will be required for reinforcing steel, and cement, and mill certificates will be acceptable when it is definite that the test sheets apply to the material being supplied.
- D. Any tests or inspections performed exclusively for the Contractor's convenience and for retests caused by initial nonconformance of the materials with the Contract Documents.

The testing mentioned in this section will be performed at a frequency required by the specification or at a frequency determined by the Engineer or the Engineer's representative. The Engineer shall require sufficient testing to ensure that the requirements of the specifications are met by the Contractor.

6. LICENSE, FEES AND PERMITS

It shall be the Contractor's responsibility to make necessary applications and obtain all permits required by all agencies, including, but not limited to, the City, County, State, and Federal government for this project.

7. TRAFFIC

It shall be the responsibility of the Contractor to provide for the safety and convenience of traffic so as to comply with all existing traffic regulations and ordinances as may apply.

8. UNDERGROUND OBSTACLES





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Pipelines and other existing underground installations and structures in the vicinity of the work are shown on the drawings according to the best information available to the Owner. The Owner does not guarantee the accuracy of such information. The Contractor shall make every effort to locate all underground pipelines, conduits and structures by contacting owners of underground utilities and by prospecting in advance of trench excavation. The repair of existing utilities cut by the Contractor shall be made at the expense of the Contractor, and shall be scheduled so as to cause the least possible inconvenience to the public. Any delay or extra cost to the Contractor caused by pipelines or other underground structures or obstructions not shown by the Plans, or found in location of different from those indicated, shall not constitute a claim for extra work, additional payment or damages.

9. RECORD DRAWINGS

Upon completion of the project and before final payment is made to the Contractor, the Contractor shall deliver one (1) complete set of record drawings and said drawings shall be neat, accurate and orderly and produced to the satisfaction of the Engineer.

10. OTHER CONTRACTS

Other contracts may be underway concurrently in this area. Contractor shall afford other contractors and utility companies reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

11. MATERIALS AND WORKSHIP

When materials are specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal product of another manufacturer, but to set a definite standard of quality or performance and to establish an equal basis for the evaluation of bids.

12. REPAIR TO ROADS

The Contractor shall be responsible for repairing any damage to City or County Roads and road owned by the Owner which are used by the Contractor in connection with operations under this Contract. Said repair work shall be at the Contractor's expense. Any debris, mud and related sources caused by contractor will need to be hauled off and cleaned.





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13. PUBLIC UTILITIES

- A. All poles, wires, cables, conduits, pipelines, or other structures within the work area, belonging to municipalities or public utility corporations, shall be protected by the Contractor.
- B. The Contractor will conduct the work along any section of this project which is crossed by, or adjacent to, a public utility such as high lines, sewer lines, etc., in a manner so that no damages result to these utilities. The Contractor will be held solely responsible for damages to such utilities as a result of careless or negligent operations.

14. PRE-CONSTRUCTION CONFERENCE

Upon award of a Contract to the successful bidder, the Contractor shall meet with the Engineer at an designated location and at a time set by the Engineer. A schedule of procedure for a sequence of construction shall be agreed upon at this conference.

15. LINES AND GRADES

Special attention is directed to Part 2, Paragraph 2.06, Page G-2, of the General Conditions of Agreement. Special care should be taken by the Contractor to avoid disturbance of Engineer's horizontal and vertical control points. The protection of construction stakes (horizontal and vertical control points), is the Contractor's responsibility and re-staking or re-establishment of these points or stakes will be done by the Engineer at the Contractor's expense. Survey Party time for re-staking will be charged at hourly rates in accordance with the Engineer's schedule of hourly rates which is in effect at the time of the re-staking.

16. STAKING FOR CONSTRUCTION

General

The staking services that the Engineer will furnish and the responsibility of the Contractor respecting the uses of and maintenance of all stakes is outlined under this section.

No stakes will be furnished until the right-of-way or easements are acceptable condition other than clearing stakes.





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Notification

The Contractor shall notify the Engineer, in writing, at least three (3) full working days in advance of the date when specific staking services are desired, giving the specific location and/or limiting stations. The Contractor shall notify the Engineer five (5) days prior to start-up so as to allow the Engineer to set his control. The Engineer shall be notified of any change of sequence which is established at pre-construction conferences.

Control Stakes

Stakes which constitute reference points for all construction work will be conspicuously marked with flagging tape in accordance with the code in these Specifications. It will be the responsibility of the Contractor to inform his employees and his subcontractors of their importance, and the necessity for their preservation. The cost of replacing such controls, should it become necessary for any reason whatsoever, shall be at the Contractor's expense. If the removal of a control stake is required by the construction operations of the Contractor or his subcontractors, advance notice in writing, of **at least three (3) full working days shall be given to the Engineer**, who will reference and remove said stake or stakes at no cost to the Contractor.

The Contractor shall employ competent grade setters to control the grading operations from the information provided on the reference stakes.

No additional stakes will be furnished, except as requested in writing by the Contractor and paid for by him. This applies to all re-staking for whatever reason, as well as for additional staking which the Contractor may request. Charges for the additional staking will be deducted from next progress payment that is issued to the Owner by the Engineer.

17. INSURANCE REQUIREMENTS

The Contractor, at his expense, shall take out and keep in force throughout the term of this Contract, the following insurance coverage in the amounts specified below to cover all of his operations in connection with the work to be performed under the Technical Specifications. The insurance certificates shall be submitted to the Owner for acceptance prior to move-in and beginning work





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MINIMUM INSURANCE REQUIRMENTS

<u>INSURANCE TYPE</u>	<u>LIMITS OF LIABILITY</u>
<u>Workman’s Compensation</u>	As provided by Texas Workman’s Compensation Act.
<u>General Liability</u>	
Comprehensive Form	Bodily Injury
Premises-Operations	\$300,000/Person
Products/Completed	\$500,000/Occurance
Operations Hazard	Property Damage
Contractual Insurance	\$100,000/Occurance
Independent Contractors	\$300,00/Aggregate
Personal Injury	Personal Injury
	\$500,000
<u>Automobile Liability</u>	
Comprehensive	Bodily Injury
Owned	\$300,000/Person
Hired	\$500,000/Occurance
Non-owned	Property Damage
	\$300,000/Occurance
<u>Excess Liability</u>	
Umbrella Form	\$100,000

The remaining term of all policies shall extend at least to the least to the completion date of this Contract; if the expiration date shall occur prior to final completion of all operations hereunder, Contractor shall, not less than fifteen (15) days prior to expiration date, furnish evidence of renewal of or extension of such insurance. All such evidence of insurance shall provide for ten (10) days prior notice to be given to Owner in the event of cancellations.

The Contractor agrees to indemnify and to hold the Owner and the Engineer harmless from and against any and all damages, claims, demands, suits, judgments and costs including attorney’s fees and expenses for or on account of damage to property of any person, firm corporation, or Government agency, or death of or injury to any person or persons (including property and employees of the Owner, the Contractor, and employees of the Contractor) directly or indirectly arising out of, or caused by or in connection with the





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performance of or failure to perform any work provided for hereunder by the Contractor, his subcontractors, or their or the Contractor's agents, servants, or employees. The Contractor will be held accountable for all insurance coverage's including those of subcontractors, and provide that all the above mentioned policies will be with insurance carriers.

18. UNBALANCING OF BIDS AND USAGE OF SPECIAL ITEMS

The Contractor's attention is directed to the fact that unbalancing of unit bid prices for any reason shall be considered justification for rejection of the bid. The Contractor may not decrease these bid prices, however, he may increase the bid prices as he may see fit. In instances where subsurface seepage of water above trench bottom requires the drying up of trench bottom, the use of washed gravel or shell in trench bottom will be permitted.

19. ARBITRATION

Arbitration under this agreement shall be subject to the provisions of the Texas General Arbitration Act, Articles 224 to 238-6, V.A.C.S. To any extent that the provisions of Section 16 of the General Conditions are in conflict with or inconsistent with any provision of such Act, the provisions of such Act shall control. Both the Owner and Contractor shall concur on Arbitration as a method of settling any particular dispute.

20. PARTIAL PAYMENTS

Article 14.2 APPLICATION FOR PROGRESS PAYMENT (Standard General Conditions of the Construction Contract) is hereby supplemented with the following:

On or before the last Monday of each month, the CONTRACTOR shall prepare and submit to the Engineer for approval or modification a statement showing as completely as practicable the total value of the work done by the Contractor up to and including the last day of the preceding month; said statement shall also include the value of all sound materials delivered on the site of the work that are to be fabricated into the work.

The OWNER shall then pay the CONTRACTOR on or before the 2nd Monday of the following month the total amount of the approved statement, less 10 percent of the amount thereof, which 10 percent shall be retained until final payment, and further less all previous payments and all further sums that may be retained by the OWNER under the terms of this Agreement. It is understood, however, that in case the whole work be near the completion and some unexpected and unusual delay occurs due to not fault or neglect on the part of the CONTRACTOR, the OWNER may-upon written recommendation of the ENGINEER-pay a reasonable and equitable portion of the retained percentage to the CONTRACTOR, or the CONTRACTOR at the OWNER'S option, may be relieved of the obligation to fully complete the work and, thereupon, the CONTRACTOR shall receive payment of the balance due him under the contract subject only to the conditions stated under "Final Payment".





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ITEM 100
PREPARING RIGHT OF WAY

100.1. Description.

This item shall govern for the preparation of the right-of-way for construction operations by the removal and disposal of all obstructions from the right-of-way and from designated easements, where removal of all obstructions is not otherwise shown on the plans and specifications.

Such obstruction shall be considered to include remains of houses, foundations, floor slabs, concrete, brick, lumber, plaster, septic tank drain fields, basements, abandoned utility pipes or conduits, equipment, fences, retaining walls, outhouses and shacks.

This Item shall also include the removal of trees and shrubs and other landscape features not designated for preservation, stumps, brush, roots, vegetation, logs, curb and gutter, driveways, paved parking areas, miscellaneous stone, sidewalks, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and debris, whether above or below ground except live utility facilities.

100.2. Construction Methods.

(1) General. All areas, as shown on the plans, shall be cleared of all structures and obstructions as defined above. Those trees, shrubs and other landscape features protected from abuse, marring, or damage during construction operations. Continual parking and/or servicing of equipment under the branches of trees marked for preservation will not be permitted. When trees and shrubs are designated for preservation and require pruning, they shall be trimmed as directed by the Engineer and all exposed cuts over 2 inches in diameter shall be treated with a material approved by the Engineer.

Culverts, storm sewers, manholes and inlets shall be removed in proper sequence for maintenance of traffic to the following depths:

- (a) In areas to receive embankment: 2 feet below natural ground, except when permitted by plans, trees and stumps may be cut off as close to natural ground as practicable on areas which are to be covered by at least three feet of embankment.
 - (b) In areas to be excavated: 2 feet below the lower elevation of the excavation.
 - (c) All other areas: 1 foot below natural ground.
- (2) Disposal of Material. Unless otherwise shown herein, all materials and





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debris removed shall become the property of the Contractor, including all merchantable timber, shall be removed from the right-of-way and disposed of in a manner of satisfactory to the Engineer, except that gravel, brick stone, or broken concrete, when approved by the Engineer, may be used in the roadway embankment. This material shall conform to the requirements of specifications on “embankment”.

(a) Stake or National Forest or Park.

The provisions shown on the plans for removal of timber shall apply.

No timber shall be cut or deface outside of the right-of-way lines or material pit limits as indicated on the plans or by the Engineer.

(b) Burning of Brush. When burning of brush is permitted under applicable laws and by the Engineer, the following should govern:

- (i) When construction is on new location, the brush shall be piled and burned on the center of the work area.
- (ii) Where construction is on existing location through which the traveling public is to be routed during construction, brush shall be burned as near the center of the work area as is practical without creating a hazard to traffic.
- (iii) In the event there are material pits which require clearing and grubbing, the brush shall be placed in the center of the pit before burning.

(3) Backfill. Holes remaining after removal of all obstructions, objectionable materials, trees, stumps, etc., shall be backfilled with approved material, compacted and restored to approximately its original contours by balding, bulldozing, or by other methods, as approved by the Engineer. In areas to be immediately excavated, the backfilling of holes may not be required when approved by the Engineer.

Before backfilling, the remaining ends of all abandoned storm sewers, culverts, sanitary sewers, conduits, and water or gas pipes over 3 inches in diameter, shall be plugged with an adequate quantity of concrete to form a tight closure.





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100.3 Measurement and Payment

There will be no separate measurement or payment for “Preparing of Right of Way” on this project. All costs associated with preparing right-of-way shall be subsidiary to the various construction pay items of the contract.

Preparing-Right-of-Way

PRW-3



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**ITEM 110
EXCAVATION**

110.1. Description. Excavate areas as shown on the plans or as directed. Remove materials encountered to the lines, grades, and typical sections shown on the plans and cross-sections.

110.2. Construction. Accept ownership of unsuitable or excess material and dispose of material in accordance with local, state, and federal regulations at locations outside the right of way.

Maintain drainage in the excavated area to avoid damage to the roadway section. Correct any damage to the sub grade caused by weather, at no additional cost to the Department.

Shape slopes to avoid loosening material below or outside the proposed grades. Remove and dispose of slides as directed.

A. **Rock Cuts.** Excavate to finish subgrade. Manipulate and compact subgrade in accordance with Article 132.3.D, "Compaction Methods," unless excavation is to clean homogenous rock at finish subgrade elevation. If excavation extends below finish sub grade, use approved embankment material compacted in accordance with Article 132.3.D to replace undercut material at no additional cost.

B. **Earth Cuts.** Excavate to finish subgrade. In areas where base or pavement structure will be placed on subgrade, scarify subgrade to a uniform depth at least 6 in. below finish subgrade elevation. Manipulate and compact subgrade in accordance with Article 132.3.D, "Compaction Methods."

If unsuitable material is encountered below subgrade elevations, take corrective measures as directed. Drying required deeper than 6 in. below subgrade elevation will be paid for in accordance with

Article 9.4, "Payment for Extra Work." Excavation and replacement of unsuitable material below subgrade elevations will be performed and paid for in accordance with the applicable bid items. However, if Item 132, "Embankment," is not included in the Contract; payment for replacement of unsuitable material will be paid for in accordance with Article 9.4.

C. **Subgrade Tolerances.** For turnkey construction, excavate to within 1/2 in. in cross-section and 1/2 in. in 16 ft. measured longitudinally. For staged construction, excavate to within 0.1 ft. in cross-section and 0.1 ft. in 16 ft. measured longitudinally.

110.3. Measurement. This Item will be measured by the cubic yard in its original position

Excavation

EXC-1

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as computed by the method of average end areas.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Limits of measurement for excavation in retaining wall areas will be as shown on the plans.

Shrinkage or swelling factors will not be considered in determining the calculated quantities.

110.4. **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 "Excavation (Roadway)," "Excavation (Channel)," "Excavation (Special)," or "Excavation (Roadway and Channel)." This price is full compensation for authorized excavation; drying; undercutting subgrade and reworking or replacing the undercut material in rock cuts; hauling; disposal of material not used elsewhere on the project; scarification and compaction; and equipment, labor, materials, tools, and incidentals.

When a slide not due to the Contractor's negligence or operation occurs, payments for removal and disposal of the slide material will be in accordance with Article 9.4, "Payment for Extra Work." Excavation in backfill areas of retaining walls will not be measured or paid for directly but will be subsidiary to pertinent Items.





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ITEM 162
SODDING FOR EROSION CONTROL

162.1. Description. Provide and install grass sod as shown on the plans or as directed.

162.2. Materials. Use live, growing grass sod of the type specified on the plans. Use grass sod with a healthy root system and dense matted roots throughout the soil of the sod for a minimum thickness of 1 in. Do not use sod from areas where the grass is thinned out. Keep sod material moist from the time it is dug until it is planted. Grass sod with dried roots is unacceptable.

- A. **Block Sod.** Use block sod free from noxious weeds, Johnson grass, other grasses, or any matter deleterious to the growth and subsistence of the sod.
- B. **Mulch Sod.** Use mulch sod from an approved source, free from noxious weeds, Johnson grass, other grasses, or any matter deleterious to the growth and subsistence of the sod.
- C. **Fertilizer.** Furnish fertilizer in accordance with Article 166.2, "Materials."
- D. **Water.** Furnish water in accordance with Article 168.2, "Materials."
- E. **Mulch.** Use straw mulch consisting of oat, wheat or rice straw or hay mulch of either Bermudagrass or prairie grasses. Use straw or hay mulch free of Johnson grass and other noxious and foreign materials. Keep the mulch dry and do not use molded or rotted material.
- F. **Tacking Methods.** Use a tacking agent applied in accordance with the manufacturer's recommendations or a crimping method on all straw or hay mulch operations. Tacking agents must be approved before use, or may be specified on the plans.

162.3. Construction. Cultivate the area to a depth of 4 in. before placing the sod. Plant the sod specified and mulch, if required, after the area has been completed to lines and grades as shown on the plans. Apply fertilizer uniformly over the entire area in accordance with Article 166.3, "Construction," and water in accordance with Article 168.3, "Construction." Plant between the average date of the last freeze in the spring and 6 weeks prior to the average date for the first freeze in the fall according to the Texas Almanac for the project area.

A. Sodding Types.

- 1. **Spot Sodding.** Use only Bermudagrass sod. Create furrows parallel to the roadway, approximately 5 in. deep and on 18-inch centers. Sod a continuous row not less than 3 in. wide in the 2 furrows adjacent to the roadway. Place 3-inch squares of sod on 15-inch centers in the remaining furrows. Place sod so that the root system will be completely covered by the soil. Firm all sides of the sod with the soil without covering the sod with soil.





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2. **Block Sodding.** Place sod blocks over the prepared area. Roll or tamp the sodded area to form a thoroughly compacted, solid mat filling all voids in the sodded area with additional sod. Keep sod along edges of curbs, driveways, walkways, etc., trimmed until acceptance.
3. **Mulch Sodding.** Mow sod to no shorter than 4 in., and rake and remove cuttings. Disk the sod source in 2 directions, cutting the sod to a minimum of 4 in. Excavate the sod material to a depth of no more than 6 in. Keep excavated material moist or it will be rejected. Distribute the mulch sod uniformly over the area to a depth of 6 in. loose, unless otherwise shown on the plans, and roll with a light roller or other suitable equipment.

Add or reshape the mulch sod to meet the requirements of Section 162.3.B, "Finishing."

- B. **Finishing.** Smooth and shape the area after planting to conform to the desired cross sections. Spread any excess soil uniformly over adjacent areas or dispose of the excess soil as directed.
- C. **Straw or Hay Mulch.** Apply straw or hay mulch for "Spot Sodding" and "Mulch Sodding" uniformly over the area as shown on the plans. Apply straw mulch at 2 to 2-1/2 tons per acre. Apply hay mulch at 1 1/2 to 2 tons per acre. Use a tacking method over the mulched area.

162.4. Measurement. "Spot Sodding," "Block Sodding," and "Straw or Hay Mulch" will be measured by the square yard in its final position. "Mulch Sodding" will be measured by the square yard in its final position or by the cubic yard in vehicles as delivered to the planting site.

162.5. 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 "Spot Sodding," "Block Sodding," "Straw or Hay Mulch," or "Mulch Sodding." This price is full compensation for securing a source, excavation, loading, hauling, placing, rolling, finishing, furnishing materials, equipment, labor, tools, supplies, and incidentals. Fertilizer will not be paid for directly but will be subsidiary to this Item.

Unless otherwise specified on the plans, water, except for that used for maintaining and preparing the sod before planting will be measured and paid for in accordance with Item 168, "Vegetative Watering."



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GEO-GRID TX-5

PART 1. GENERAL

1.01 SUMMARY

- A. SECTION INCLUDES- These specifications cover the requirements for constructing a Stabilized Aggregate Layer (SAL) in conjunction with other components and/or activities typical of paved or unpaved roadways or parking lots (i.e. subgrade preparation, asphalt, etc.) The work includes all materials, labor, equipment, storage, private lab testing, sampling, handling, excavation, disposal, tools, removal, placement, hauling, shaping, compacting, surveying, finishing to grade, curing, fees, permits, test-rolling and/or proof rolling the aggregate including all appurtenances and incidentals necessary to complete the work. This specification is for stabilization of the pavement section aggregate base layer only. The properties and performance of the SAL have been considered in and are integral to the structural design of the pavement structure; thus no modification of the pavement structure shall be made other than alternative stabilization methods described herein and in accordance with the requirements for submission of alternatives described them.
- B. These specifications include provisions for means of providing a SAL.

Mechanically Stabilized Layer- This work shall consist of Mechanical Stabilization to reinforce the aggregate base layer. Mechanically Stabilized Aggregate includes, but is not limited to, the confinement of the aggregate material by use of a geogrid reinforcement system whereby the design requirements of the project are achieved.

1.02 DEFINITIONS

- A. Stabilized Aggregate Layer (SAL)- A SAL is a layer of a defined thickness of unbound aggregate or base course materials that have been modified or improved through mechanical or chemical methods whereby the resulting layer behaves as a composite layer and has improved properties and performance capabilities.
- B. Mechanically Stabilized Layer (MSL)- A composite layer of a defined thickness comprised of unbound aggregate or base course materials combined with one or more layers of a polymeric geogrid grid structure that has been formed by a regular network or integrally connected multi-directional tensile elements of





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appropriate orientation, size and shape with triangular apertures of appropriate size and shape to allow interlocking with the unbound aggregate or base course materials. The combinations of the two materials creates an improved or modified composite layer with significantly improved properties and performances capabilities.

- C. Paved Application- Use of a SAL beneath or within the aggregate base course of a flexible (asphalt) pavement system to improve the stiffness of the system. The goal of this application may be to reduce the amount of aggregate or asphalt material required (reducing initial cost), increase the life of the pavement (reduce life-cycle cost), or a combination of the two.

1.04A SYSTEM DESCRIPTION-OPTION A

- A. Mechanically Stabilized Layer- This work shall consist of Mechanical Stabilization to reinforce the aggregate base layer. Mechanically Stabilized Aggregate includes, but is not limited to, the confinement of the aggregate material by use of a geogrid reinforcement system whereby the design requirements of the project are achieved.

1.05A DESIGN & PERFORMANCE

- A. The design of the pavement shall be in accordance with the 1993 American Association of State highway and Transportation Officials (AASHTO) guide for Design of Pavement Structures.
- B. The Mechanically Stabilized Layer within the pavement structure shall have a thickness of 8 inches (203 mm) or as shown on the contract plans.
- C. The design of the pavement shall be based on the following perimeters:
 - a. Design traffic= 100,000 ESALs
 - b. Mechanically Stabilized Layer SN=1.75
- D. The MSL shall be incorporated into the pavement design by utilizing modified layer coefficients. Modified layer coefficients shall be calibrated and validated with the results of full scale laboratory, field and/or accelerated pavement testing where actual geogrids are tested in-soil and in representative conditions.
- E. In-air index testing of geogrid properties, or explanations of performance based on in-air index testing of geogrid properties are not sufficient to understand the

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GG-2

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complex mechanisms involved in soil/geogrid interaction and/or the performance of MSLs. Therefore, no acceptance of alternated based on material property comparisons or explanations of performance based on in-air testing of geogrid properties will not be allowed.

- F. Any submittal of an alternative MSL must be submitted at least 2 weeks in advance of the bid date and must be accompanied with the following:
1. A design signed and sealed by a professional engineer registered to practice in the country, state or province in which the project is located.
 2. A written statement from the alternative MSL design engineer-of-record that the design is based on the AASHTO 1993 Pavement Design Guide and utilized modified layer coefficient that have been properly calibrated and validated for the geogrid reinforcement utilized in the MSL in accordance with the Section.

1.06A SUBMITTALS

- A. Submit representative geogrid product sample.
- B. Submit geogrid product data sheet and certification from the Manufacturer that the geogrid product supplied meets the requirements of sub-part 2.02A of this Section.
- C. Submit Manufacturer's installation instructions and general recommendations.

1.07A QUALITY ASSURANCE

- A. Pre-Construction Conference- Prior to the start of construction of the MSL, the Contractor shall arrange a meeting at the site with the geogrid material supplier and where applicable, the geogrid installer. The Owner and the Engineer shall be notified at least 3 days in advance of the time of the meeting. A representative of the geogrid supplier shall be available on an "as needed" basis during construction.

1.08A DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection





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1. Prevent excessive mud, wt concrete, epoxy, or other deleterious materials form coming in contact with an affixing to the geogrid materials.
2. Store at temperatures above -20 degrees F (-29 degrees C)
3. Rolled materials may be laid flat or stood on end.
4. Geogrid materials should not be left directly exposed to sunlight for a period longer than the period recommended by the manufacturer.

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PART 2 PRODUCTS

2.01A MANUFACTURERS

- A. An approved source of geogrid is the Tensar Corporation, Morrow, GA or their designated representative.

2.02A MATERIALS

- A. Structural Soil Reinforcement Geogrid- The geogrid component of the SAL shall be TriAX TX5 and shall be integrally formed and produced from a punched sheet of polypropylene which is then oriented I three substantially equilateral directions so that the resulting ribs shall have a high degree of molecular orientation, which continues at least in part though the mass of the integral node.
- B. The resulting geogrid structure shall have apertures that are triangular in shape, and shall have ribs with a depth-to-width ration grater than 1.0.
- C. The geogrid shall have the nominal characteristics shown in the table below, and shall be certified in writing by the manufacturer to be TX5.

PROPERTIES	LONGITUDINA	DIAGONAL	TRANSVERSE	GENERAL
Rib pitch, mm (in)	40 (1.60)	40 (1.60)		
Mid-rib depth, mm (in)	-	1.3 (0.05)	1.2 (0.05)	
Mid-rib width, mm (in)	-	0.9 (0.04)	1.2 (0.05)	
Rib Shape				rectangular
Aperture shape				triangular





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PART 3 EXECUTION

3.01A EXAMINATION

- A. The Contractor shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the Contractor to be free of flaws or damage occurring during manufacturing, shipping or handling.

3.02A PREPARATION

- A. The subgrade soil shall be prepared as indicated on the construction drawings or as directed by the Engineer.
- B. The geogrid shall be installed in accordance with these plans and specifications and any installation guidelines provided by the manufacturer or as directed by the Engineer.
- C. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or backfill as required by fill properties, fill placement procedures or weather conditions or as directed by the Engineer.

3.04A GRANULAR FILL PLACEMENT OVER GEOGRID

- A. Granular fill material shall be placed in lifts and compacted as shown on plans. Granular fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.
- B. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 5 mph). Sudden braking and sharp turning movements shall be avoided.

3.05A INSPECTION

- A. The owner or Owner's representative may randomly inspect geogrid before, during and after (using test pits) installation.

Geo-Grid TX-5

GG-6

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- B. Any damaged or defective geogrid (i.e. frayed coatings, separated junctions, separated layers, tears, etc.) will be repaired/replaced in accordance with Section 3.06.

3.06A REPAIR

- A. Any roll of geogrid damaged before, during and after installation shall be replaced by the Contractor at no additional cost to the Owner.
- B. Proper replacement shall consist of replacing the affected area adding 3ft (1m) of geogrid beyond the limits of the affected area.

3.07A PROTECTION

- A. Follow the Manufacturer's recommendations regarding protection from exposure to sunlight.

PART 4 BASIS OF PAVEMENT

4.01 UNIT OF MEASURE

Stabilized Aggregate Layer shall be paid for by the square yard (square meter). The unit price bid per square yard (square meter) shall included all materials, labor, equipment, storage, private lab testing, sampling, handling, excavation, disposal, tools, removal, placement, hauling, shaping, compacting, surveying, finishing to grade, curing, fees, permits, and proof-rolling the SAL including all appurtenances and incidentals necessary to complete the work. Test rolling and-or Proof rolling shall be considered incidental to the contract and will not be measured or paid for separately.

Geo-Grid TX-5

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Payment will be made under:

PAY ITEM	PAY UNIT
Geo-Grid TX-5	Square Yard

Geo-Grid TX-5

GG-8

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ITEM 421

HYDRAULIC CEMENT CONCRETE

421.1. Description. Furnish hydraulic cement concrete for concrete pavements, concrete structures, and other concrete construction.

421.2. Materials.

A. Cement. Furnish cement conforming to DMS-4600, "Hydraulic Cement."

B. Supplementary Cementing Materials (SCM).

1. **Fly Ash.** Furnish fly ash conforming to DMS-4610, "Fly Ash."

2. **Ultra-Fine Fly Ash (UFFA).** Furnish UFFA conforming to DMS-4610, "Fly Ash."

3. **Ground Granulated Blast-Furnace Slag (GGBFS).** Furnish GGBFS conforming to DMS-4620, "Ground Granulated Blast-Furnace Slag," Grade 100 or 120.

4. **Silica Fume.** Furnish silica fume conforming to DMS-4630, "Silica Fume."

5. **Metakaolin.** Furnish metakaolin conforming to DMS-4635, "Metakaolin."

C. Chemical Admixtures. Furnish admixtures conforming to DMS-4640, "Chemical Admixtures for Concrete." Do not use calcium chloride.

D. Water. Furnish mixing and curing water that is free from oils, acids, organic matter, or other deleterious substances. Water from municipal supplies approved by the Texas Department of Health will not require testing. When using water from other sources, provide test reports showing compliance with Table 1 before use.

Water that is a blend of concrete wash water and other acceptable water sources, certified by the concrete producer as complying with the requirements of both Table 1 and Table 2, may be used as mix water. Test the blended water weekly for 4 weeks for compliance with Table 1 and Table 2 or provide previous test results. Then test every month for compliance. Provide water test results upon request.





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Table 1

Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (Cl)	ASTM D 512	
Prestressed concrete		500
Bridge decks & superstructure		500
All other concrete		1,000
Sulfate (SO ₄)	ASTM D 516	1,000
Alkalies (Na ₂ O + 0.658K ₂ O)	ASTM D 4191 & ASTM D 4192	600
Total solids	AASHTO T 26	50,000

Table 2

Acceptance Criteria for Questionable Water Supplies

Property	Test Method	Limits
Compressive strength, min % control at 7 days	ASTM C 109 ¹	90
Time of set, deviation from control, Min.	ASTM C 191 ¹	from 60 early to 90 later

1. Base comparisons on fixed proportions and the same volume of test water compared to the control mix using city water or distilled water.

Do not use mix water that has an adverse effect on the air-entraining agent, on any other chemical admixture, or on strength or time of set of the concrete. When using white hydraulic cement, use mixing and curing water free of iron and other impurities that may cause staining or discoloration.

E. Aggregate. Supply aggregates that meet the definitions in Tex-100-E. Provide coarse and fine aggregates from sources listed in the Department's Concrete Rated Source Quality Catalog (CRSQC). Provide aggregate from non-listed sources only when tested and approved by the Engineer before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources. Do not combine approved material with unapproved material.

1. Coarse Aggregate. Provide coarse aggregate consisting of durable particles of gravel, crushed blast furnace slag, recycled crushed hydraulic cement concrete, crushed stone, or combinations thereof that are free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material, either free or as an adherent coating. Provide coarse aggregate of uniform quality throughout.

Provide coarse aggregate that, when tested in accordance with Tex-413-A, has:

- at most 0.25% by weight of clay lumps,
- at most 1.0% by weight of shale, and
- at most 5.0% by weight of laminated and friable particles.

Wear must not be more than 40% when tested in accordance with Tex-410-A.

Unless otherwise shown on the plans, provide coarse aggregate with a 5-cycle magnesium sulfate soundness of not more than 18% when tested in accordance with Tex-411-A. Crushed recycled hydraulic cement concrete is not subject to the 5-cycle soundness test.

The loss by decantation as tested in accordance with Tex-406-A, plus the allowable weight of clay lumps, must not exceed 1.0% or the value shown on the plans, whichever is smaller. In the case of aggregates made primarily from crushing stone, if the material finer than the No. 200 sieve is established to be the dust of fracture and essentially free from clay or shale as established by Tex-406-A, Part III, the limit may be





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increased to 1.5%. When crushed limestone coarse aggregate is used in concrete pavements, the decant may exceed 1.0% but not more than 3.0% if the material finer than the No. 200 sieve is determined to be at least 67% calcium carbonate in accordance with Tex-406-A, Part III.

Unless otherwise specified, provide aggregate conforming to the gradation requirements shown in Table 3 when tested in accordance with Tex-401-A.

**Table 3
Coarse Aggregate Gradation Chart**

Aggregate Grade No. ¹	Nominal Size	Percent Passing on Each Sieve								
		2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8
1	2"	100	80-100	50-85		20-40			0-5	
2 (467)	1-1/2"		100	95-100		35-70		10-30	0-5	
3	1-1/2"		100	95-100		60-90	25-60		0-5	
4 (57)	1"			100	95-100		25-60		0-10	0-5
5 (67)	3/4"				100	90-100		20-55	0-10	0-5
6 (7)	1/2"					100	90-100	40-70	0-15	0-5
7	3/8"						100	70-95	0-25	
8	3/8"						100	95-100	20-65	0-10

1. Corresponding ASTM C 33 gradation shown in parentheses.

- Fine Aggregate.** Provide fine aggregate consisting of clean, hard, durable particles of natural or manufactured sand or a combination thereof with or without mineral filler. Provide fine aggregate free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material, and containing no more than 0.5% clay lumps by weight in accordance with Tex-413-A.

Provide fine aggregate that does not show a color darker than standard when subjected to the color test for organic impurities in accordance with Tex-408-A.

Unless otherwise shown on the plans, use fine aggregate with an acid insoluble residue of at least 60% by weight when tested in accordance with Tex-612-J in all concrete subject to direct traffic.

Unless otherwise shown on the plans, when necessary, blend the fine aggregate to meet the acid insoluble residue requirement. When blending, use the following equation:

$$\text{Acid Insoluble (\%)} = \{(AI)(PI)+(A2)(P2)\}/100$$

where:

AI = acid insoluble (%) of aggregate 1

A2 = acid insoluble (%) of aggregate 2

PI = percent by weight of *AI* of the fine aggregate blend

P2 = percent by weight of *A2* of the fine aggregate blend

Provide fine aggregate or combinations of aggregates, including mineral filler, conforming to the gradation requirements shown in Table 4 when tested in accordance with Tex-401-A unless otherwise specified.





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Table 4
Fine Aggregate Gradation Chart (Grade 1)

Sieve Size	Percent Passing
3/8 in.	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-65
No. 50	10-35 ¹
No. 100	0-10
No. 200	0-3 ²

1. 6-35 when sand equivalent value is greater than 85.
2. 0-6 for manufactured sand.

Unless otherwise shown on the plans, provide fine aggregate with a sand equivalent of at least 80 in accordance with Tex-203-F.

For all classes of concrete except Class K, provide fine aggregate with a fineness modulus between 2.30 and 3.10 as determined by Tex-402-A. For Class K concrete, provide a fine aggregate with a fineness modulus between 2.60 to 2.80 unless otherwise shown on the plans.

3. **Mineral Filler.** Provide mineral filler consisting of stone dust, clean crushed sand, or other approved inert material with 100% passing the No. 30 sieve and 65 to 100% passing the No. 200 sieve when tested in accordance with Tex-401-A.
- F. **Mortar and Grout.** When required or shown on the plans, provide mortar and grout consisting of 1 part hydraulic cement, 2 parts sand, and sufficient water to provide the desired consistency. Provide mortar with a consistency such that the mortar can be easily handled and spread by trowel. Provide grout of a consistency that will flow into and completely fill all voids.

421.3. Equipment.

- A. **Concrete Plants and Mixing Equipment.** Except for volumetric mixers (auger/mixer), each plant and truck mixer must be currently certified by the National Ready Mixed Concrete Association (NRMCA) or have an inspection report signed and sealed by a licensed professional engineer showing that concrete measuring, mixing, and delivery equipment meets all requirements of ASTM C 94. A new certification or signed and sealed report is required every time a plant is moved. Plants with a licensed engineer's inspection require reinspection every 2 years. Provide a copy of the certification or the signed and sealed inspection report to the Engineer. When equipment or facilities fail to meet specification requirements, remove them from service until corrected.
 1. **Scales.** Check all scales prior to beginning of operations, after each move, or whenever their accuracy or adequacy is questioned, and at least once every 6 mo. Immediately correct deficiencies, and recalibrate. Provide a record of calibration showing scales in compliance with ASTM C 94 requirements. Check batching accuracy of volumetric water batching devices and admixture dispensing devices at least every 90 days. Perform daily checks as necessary to ensure measuring accuracy.
 2. **Volumetric Mixers.** Provide volumetric mixers with rating plates defining the capacity and the performance of the mixer in accordance with the Volumetric Mixer Manufacturers Bureau or equivalent. Provide volumetric mixers that comply with ASTM C 685. Provide test data showing mixers meet the uniformity test requirements of Tex-472-A.
 3. **Agitators and Truck and Stationary Mixers.** Inspect and furnish inspection reports on truck mixers and agitators annually. If an inspection within 12 mo. is not practical, a 2-mo. grace period (for a maximum of 14 mo. between inspections) is permitted. Include in the report the condition of blades and fins and their percent wear from the original manufacturer's design. Repair mixing equipment exhibiting 10% or more





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wear before use. Provide truck mixers and agitators equipped with means to readily verify the number of revolutions of the drum, blades, or paddles.

Provide stationary and truck mixers capable of combining the ingredients of the concrete within the specified time or the number of revolutions specified into a thoroughly mixed and uniform mass and capable of discharging the concrete so that at least 5 of the 6 requirements of Tex-472-A are met.

As directed, to resolve issues of mix uniformity and mixer performance, perform concrete uniformity tests on mixers or agitators in accordance with Tex-472-A.

Perform the mixer or agitator uniformity test at the full rated capacity of the equipment and within the maximum mixing time or maximum number of revolutions. Remove from service all equipment that fails the uniformity test.

Inspect and maintain mixers and agitators. Keep them reasonably free of concrete buildup, and repair or replace worn or damaged blades or fins.

Ensure all mixers have a plate affixed showing manufacturer's recommended operating speed and rated capacity for mixing and agitating.

- B. Hauling Equipment.** Provide hauling equipment capable of maintaining the mixed concrete in a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

When using non-agitating equipment for transporting concrete, provide equipment with smooth, mortar-tight metal containers equipped with gates that prevent accidental discharge of the concrete.

- C. Testing Equipment.** Unless otherwise shown on the plans or specified, in accordance with the pertinent test procedure, furnish and maintain:

- test molds,
- curing facilities,
- maturity meters if used, and
- wheelbarrow or other container acceptable for the sampling of the concrete.

Provide strength-testing equipment in accordance with the Contract controlling test unless shown otherwise.

421.4. Construction.

- A. Classification and Mix Design.** Furnish mix designs using ACI 211, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete," or other approved procedures for the classes of concrete required in accordance with Table 5. Do not exceed the maximum water-to-cementitious-material ratio.

A higher-strength class of concrete with equal or lower water-to-cementitious-material ratio may be substituted for the specified class of concrete.

To account for production variability and ensure minimum compressive strength requirements are met, over-design the mix in accordance with Table 6.

- 1. Cementitious Materials.** Use cementitious materials from prequalified sources; otherwise, request sampling and testing for approval before use. Unless otherwise specified or approved, limit cementitious material content to no more than 700 lb. per cubic yard. When supplementary cementing materials are used, "cement" is defined as "cement plus supplementary cementing material."

Use Type III cement only in precast concrete or when specified or permitted.

For monolithic placements, use cement of the same type and from the same source.

When sulfate-resistant concrete is required, use mix design options 1, 2, 3, or 4 given in Section 421.4.A.6, "Mix Design Options," using Type I/II, II, V, IP, or IS cement. Do not use Class C fly ash in sulfate-resistant concrete.

Do not use supplementary cementing materials when white hydraulic cement is specified.





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**Table 5
Concrete Classes**

Class of Concrete	Design Strength, Min. 28-day f'_c (psi)	Maximum W/C Ratio ¹	Coarse Aggregate Grades ^{2,3}	General Usage ⁴
A	3,000	0.60	1-4, 8	Inlets, manholes, curb, gutter, curb & gutter, conc. retards, sidewalks, driveways, backup walls, anchors
B	2,000	0.60	2-7	Riprap, small roadside signs, and anchors
C ⁵	3,600	0.45	1-6	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, concrete traffic barrier (cast-in-place)
D	1,500	0.60	2-7	Riprap
E	3,000	0.50	2-5	Seal concrete
F ⁵	Note 6	0.45	2-5	Railroad structures; occasionally for bridge piers, columns, or bents
H ⁵	Note 6	0.45	3-6	Prestressed concrete beams, boxes, piling, and concrete traffic barrier (precast)
S ⁵	4,000	0.45	2-5	Bridge slabs, top slabs of direct traffic culverts
P	See Item 360	0.45	2-3	Concrete pavement
DC ⁵	5,500	0.40	6	Dense conc. overlay
CO ⁵	4,600	0.40	6	Conc. overlay
LMC ⁵	4,000	0.40	6-8	Latex-modified concrete overlay
SS ⁵	Note 7	0.45	4-6	Slurry displacement shafts, underwater drilled shafts
K ⁵	Note 6	0.45	Note 6	Note 6
HES	Note 6	0.45	Note 6	Note 6

1. Maximum water-cement or water-cementitious ratio by weight.
2. Unless otherwise permitted, do not use Grade 1 coarse aggregate except in massive foundations with 4-in. minimum clear spacing between reinforcing steel bars. Do not use Grade 1 aggregate in drilled shafts.
3. Unless otherwise approved, use Grade 8 aggregate in extruded curbs.
4. For information only.
5. Structural concrete classes.
6. As shown on the plans or specified.
7. Cementitious material content shall be minimum 658 lb/cy of concrete.





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**Table 6
Over Design to Meet Compressive Strength Requirements¹**

No. of Tests ^{2,3}	Standard Deviation, psi				
	300	400	500	600	700
15	470	620	850	1,120	1,390
20	430	580	760	1,010	1,260
30 or more	400	530	670	900	1,130

1. When designing the mix, add the tabulated amounts to the minimum design strength in Table 5.

2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi of the specified strength may be used.

3. If less than 15 prior tests are available, the overdesign should be 1,000 psi for specified strength less than 3,000 psi, 1,200 psi for specified strengths from 3,000 to 5,000 psi and 1,400 psi for specified strengths greater than 5,000 psi.

- Aggregates.** Limit the use of recycled crushed hydraulic cement concrete as a coarse or fine aggregate to Class A, B, D, E, and P concrete. Limit recycled crushed concrete fine aggregate to a maximum of 20% of the fine aggregate.

When white hydraulic cement is specified, use light-colored aggregates.

- Chemical Admixtures.** Use only preapproved concrete chemical admixtures from the list of prequalified concrete admixtures maintained by the Construction Division. Submit non-preapproved admixtures for testing to the Engineer for approval. Do not use high-range water-reducing admixtures (Type F or G) or accelerating admixtures (Type C or E) in bridge deck concrete.
- Air Entrainment.** Air-entrain all concrete except for Class B in accordance with Table 7 unless otherwise shown on the plans. Use moderate exposure values unless otherwise specified. If the air content is more than 1-1/2 percentage points below or 3 percentage points above the required air, the load of concrete will be rejected. If the air content is more than 1-1/2 but less than 3 percentage points above the required air, the concrete may be accepted based on strength tests.

**Table 7
Air Entrainment**

Nominal Maximum Aggregate Size, in.	% Air ¹	
	Moderate Exposure	Severe Exposure
3/8 (Grades 7 & 8)	6	7-1/2
1/2 (Grade 6)	5-1/2	7
3/4 (Grade 5)	5	6
1 (Grade 4)	4-1/2	6
1-1/2 (Grades 2 & 3)	4-1/2	5-1/2
2 (Grade 1)	4	5

1. For specified concrete strengths above 5,000 psi a reduction of 1 percentage point is permitted.

- Slump.** Unless otherwise specified, provide concrete slump in accordance with Table 8 using the lowest slump possible that can be placed and finished efficiently without segregation or honeycombing.

Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected.

When approved, the slump of a given concrete mix may be increased above the values shown in Table 8 using chemical admixtures, provided that the admixture-treated concrete has the same or lower water-cement or water-cementitious-material ratio and does not exhibit segregation or excessive bleeding. Request approval for the mix design sufficiently in advance for proper evaluation by the Engineer.





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**Table 8
Slump Requirements**

Concrete Designation	Recommended Design and Placement Slump, in.	Maximum Acceptable Placement Slump, in.
Drilled shafts	See Item 416	See Item 416
Thin walled section (9 in. or less)	4	6-1/2
Approach slabs, concrete overlays, caps, columns, piers, wall sections (over 9 in.)	3	5
Bridge slabs	4	5-1/2
Prestressed concrete members ¹	4	6-1/2
Concrete traffic barrier, concrete bridge railing	4	6-1/2
Dense concrete overlay	3/4	2
Latex-modified conc. for bridge deck overlays	3	7-1/2
Concrete placed underwater	6	8-1/2
Concrete pavement (slip-formed)	1-1/2	3
Concrete pavement (formed)	4	6-1/2
Riprap, curb, gutter, slip-formed, and extruded concrete	As approved	As approved

1. If a high-range water reducer (HRWR) is used, maximum acceptable placement slump will be 9 in.

6. **Mix Design Options.** For structural concrete identified in Table 5 and any other class of concrete designed using more than 520 lb. of cementitious material per cubic yard, use one of the mix design Options 1–8 shown below.

For concrete classes not identified as structural concrete and designed using less than 520 lb. of cementitious material per cubic yard, use one of the mix design Options 1–8 shown in Table 5, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3, and 4 unless sulfate-resistant concrete is required.

- a. **Option 1.** Replace 20 to 35% of the cement with Class F fly ash.
- b. **Option 2.** Replace 35 to 50% of the cement with GGBFS.
- c. **Option 3.** Replace 35 to 50% of the cement with a combination of Class F fly ash, GGBFS, or silica fume. However, no more than 35% may be fly ash, and no more than 10% may be silica fume.
- d. **Option 4.** Use Type IP or Type IS cement. (Up to 10% of a Type IP or Type IS cement may be replaced with Class F fly ash, GGBFS, or silica fume.)
- e. **Option 5.** Replace 35 to 50% of the cement with a combination of Class C fly ash and at least 6% of silica fume, UFFA, or metakaolin. However, no more than 35% may be Class C fly ash, and no more than 10% may be silica fume.
- f. **Option 6.** Use a lithium nitrate admixture at a minimum dosage of 0.55 gal. of 30% lithium nitrate solution per pound of alkalis present in the hydraulic cement.
- g. **Option 7.** When using hydraulic cement only, ensure that the total alkali contribution from the cement in the concrete does not exceed 4.00 lb. per cubic yard. of concrete when calculated as follows:

$$\text{lb. alkali per cu. yd.} = \frac{(\text{lb. cement per cu. yd.}) \times (\% \text{ Na}_2\text{O equivalent in cement})}{100}$$





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In the above calculation, use the maximum cement alkali content reported on the cement mill certificate.

- h. Option 8.** For any deviations from Options 1–7, perform the following:
 - Test both coarse and fine aggregate separately in accordance with ASTM C 1260, using 440 g of the proposed cementitious material in the same proportions of hydraulic cement to supplementary cementing material to be used in the mix.
 - Before use of the mix, provide the certified test report signed and sealed by a licensed professional engineer demonstrating that the ASTM C 1260 test result for each aggregate does not exceed 0.10% expansion.

- B. Trial Batches.** Perform all preliminary trial batches and testing necessary to substantiate the proposed mix designs, and provide documentation including mix design, material proportions, and test results substantiating that the mix design conforms to specification requirements.

Make all final trial batches using the proposed ingredients in a mixer that is representative of the mixers to be used on the job. Make the batch size at least 50% of the mixer’s rated capacity. Perform fresh concrete tests for air and slump, and make, cure, and test strength specimens for compliance with specification requirements. Test at least 3 sets of design strength specimens with 2 specimens per set in accordance with Tex-418-A or Tex-448-A for each test age. Before placing, provide the Engineer the option of witnessing final trial batches, including the testing of the concrete. If not provided this option, the Engineer may require additional trial batches, including testing, before the concrete is placed.

Establish 7-day compressive strength target values using the following formula for each concrete mix to be used:

$$\text{Target value} = \text{Minimum design strength} \times \frac{7\text{-day avg. trial batch strength}}{28\text{-day avg. trial batch strength}}$$

When there are changes in aggregates or in type, brand, or source of cement, SCM, or chemical admixtures, reevaluate the mix as a new mix design. A change in vendor does not necessarily constitute a change in materials or source. When only the brand or source of cement is changed and there is a prior record of satisfactory performance of the cement with the ingredients, new trial batches may be waived by the Engineer.

When the maturity method is specified or permitted, establish the strength–maturity relationship in accordance with Tex-426-A. When using the maturity method any changes in any of the ingredients, including changes in proportions, will require the development of a new strength–maturity relationship for the mix.

C. Storage of Materials.

- 1. Cement, Supplementary Cementing Materials, and Mineral Filler.** Store all cement, supplementary cementing materials, and mineral filler in weatherproof enclosures that will protect them from dampness or absorption of moisture.

When permitted, small quantities of sacked cement may be stored in the open, on a raised platform, and under waterproof covering for up to 48 hours.

- 2. Aggregates.** Handle and store concrete aggregates in a manner that prevents contamination with foreign materials. If the aggregates are stored on the ground, clear the sites for the stockpiles of all vegetation, level the sites, and do not use the bottom 6-in. layer of aggregate without cleaning the aggregate before use.

When conditions require the use of 2 or more grades of coarse aggregates, maintain separate stockpiles and prevent intermixing. Where space is limited, separate the stockpiles using physical barriers. Store aggregates from different sources in different stockpiles unless the Engineer authorizes pre-blending of the aggregates. Minimize segregation in stockpiles. Remix and test stockpiles when segregation is apparent.

Sprinkle stockpiles to control moisture and temperature as necessary. Maintain reasonably uniform moisture content in aggregate stockpiles.





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- 3. Admixtures.** Store admixtures in accordance with manufacturer’s recommendations and prevent admixtures from freezing.
- D. Measurement of Materials.** Except for volumetric mixers, measure concrete materials by weight. Measure mixing water, consisting of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates, and water introduced in the form of admixtures, by volume or weight. Measure ice by weight. Measure cement and supplementary cementing materials in a weigh hopper and on a separate scale from those used for other materials. Measure the cement first when measuring the cumulative weight. Measure concrete chemical admixtures in powdered form by weight. Measure concrete chemical admixtures in liquid form by weight or volume. Measure batch materials within the tolerances of Table 9.

**Table 9
Measurement Tolerances – Non-Volumetric Mixers**

Material	Tolerance (%)
Cement, wt.	±1
Mineral admixture, wt.	±1
Cement + SCM (cumulative weighing), wt.	±1
Water, wt. or volume	±3
Fine aggregate, wt.	±2
Coarse aggregate, wt.	±2
Fine + coarse aggregate (cumulative weighing), wt.	±1
Chemical admixtures, wt. or volume	±3

When measuring cementitious materials at less than 30% of scale capacity, ensure that the quantity measured is accurate to not less than the required amount and not more than 4% in excess. When measuring aggregates in a cumulative weigh batcher at less than 30% of the scale capacity, ensure that the cumulative quantity is measured accurate to ±0.3% of scale capacity or ±3% of the required cumulative weight, whichever is less.

For volumetric mixers, base tolerances on volume–weight relationship established by calibration, and measure the various ingredients within the tolerances of Table 10.

Correct batch weight measurements for moisture.

When approved, under special circumstances, measure cement in bags of standard weight. Weighing of sacked cement is not required. Do not use fractional bags except for small hand-mixed batches of approximately 5 cu. ft. or less and when an approved method of volumetric or weight measurement is used.

**Table 10
Measurement Tolerances – Volumetric Mixers**

Material	Tolerance
Cement, wt. %	0 to +4
SCM, wt. %	0 to +4
Fine aggregate, wt. %	±2
Coarse aggregate, wt. %	±2
Admixtures, wt. or volume %	±3
Water, wt. or volume %	±1

- E. Mixing and Delivering Concrete.** Mix and deliver concrete by means of one of the following operations:
- central-mixed,
 - shrink-mixed,
 - truck-mixed,
 - volumetric mixer-mixed, or
 - hand-mixed.





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Operate mixers and agitators within the limits of the rated capacity and speed of rotation for mixing and agitation as designated by the manufacturer of the equipment.

For shrink-mixed and truck-mixed concrete, when there is a reason to suspect the uniformity of concrete delivered using a truck mixer or truck agitator, conduct slump tests of 2 individual samples taken after discharging approximately 15% and 85% of the load as a quick check of the probable degree of uniformity. Take the 2 samples within an elapsed time of at most 15 min. If the slumps of the 2 samples differ by more than the values shown in Table 11, investigate the causes and take corrective actions including adjusting the batching sequence at the plant and the mixing time and number of revolutions. Delivery vehicles that fail to meet the mixing uniformity requirements must not be used until the condition is corrected.

**Table 11
Slump Tolerance¹**

Average Slump	Slump Tolerance²
4 in. or less	1.0 in.
4 to 6 in.	1.5 in.

1. Do not apply these tolerances to the required slumps in Table 8.
2. Maximum permissible difference in results of test of samples from 2 locations in the concrete batch.

Re-tempering or adding concrete chemical admixtures is only permitted at the job site when concrete is delivered in a truck mixer. Do not add water after the introduction of mixing water at the batch plant except on arrival at the job site, with approval, to adjust the slump of the concrete. When this water is added, do not exceed the mix design water-cementitious-material ratio. Turn the drum or blades at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. Do not add water or chemical admixtures to the batch after any concrete has been discharged.

Maintain concrete delivery and placement rates sufficient to prevent cold joints.

Before unloading, furnish the delivery ticket for the batch of concrete containing the information required on Department Form 596, "Concrete Batch Ticket."

When the concrete contains silica fume, adjust mixing times and batching operations as necessary to ensure the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix will be verified by the Construction Division, Materials and Pavements Section, using cylinders made from trial batches. If uniform dispersion is not achieved, make necessary changes to the batching operations until uniform and complete dispersion of the silica fume is achieved.

1. **Central-Mixed Concrete.** Provide concrete that is mixed completely in a stationary mixer. Mix concrete for a period of 1 min. for 1 cu. yd. and 15 sec. for each additional cu. yd. of rated capacity of the mixer unless mixer performance test data demonstrate that shorter mixing times can be used to obtain a uniform mix in accordance with Tex-472-A. Count the mixing time from the time all the solid materials are in the drum. Charge the mixer so that some water will enter before the cement and aggregate. Ensure that all water is in the drum by the end of the first 1/4 of the specified mixing time. Adjust the mixing time if necessary to achieve a uniform mix. Concrete mixed completely in a stationary mixer must be delivered to the project in a truck mixer, truck agitator, or non-agitating delivery vehicle. When a truck mixer or truck agitator is used for transporting concrete, use the manufacturer's designated agitating speed for any turning during transportation. Non-agitating delivery vehicles must be clean and free of built-up concrete with adequate means to control concrete discharge. Deliver the concrete to the project in a thoroughly mixed and uniform mass, and discharge the concrete with a satisfactory degree of uniformity. Resolve questions regarding the uniformity of the concrete by testing when directed by the Engineer in accordance with Tex-472-A.
2. **Shrink-Mixed Concrete.** Provide concrete that is first partially mixed in a stationary mixer and then mixed completely in a truck mixer. Partially mix for the minimum time required to intermingle the ingredients in the stationary mixer, and then transfer to a truck mixer and mix the concrete at the manufacturer's





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designated mixing speed for an adequate amount of time to produce thoroughly mixed concrete. Deliver the concrete to the project in a thoroughly mixed and uniform mass, and discharge the concrete with a satisfactory degree of uniformity.

3. **Truck-Mixed Concrete.** Mix the concrete in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer to produce a uniform concrete mix. Deliver the concrete to the project in a thoroughly mixed and uniform mass and discharge the concrete with a satisfactory degree of uniformity. Additional mixing at the job site at the mixing speed designated by the manufacturer is allowed as long as concrete is discharged before the drum has revolved a total of 300 revolutions after the introduction of the mixing water to the cement and the aggregates.
 4. **Volumetric Mixer-Mixed Concrete.** Unless otherwise specified or permitted, perform all mixing operations in accordance with manufacturer's recommended procedures. Provide an accurate method of measuring all ingredients by volume, and calibrate equipment to assure correct measurement of materials within the specified tolerances.
 5. **Hand-Mixed Concrete.** When permitted, for small placements of less than 2 cu. yd., mix up to a 2-sack batch of concrete by hand methods or in a small motor-driven mixer. For such placements, proportion the mix by volume or weight.
- F. Placing, Finishing, and Curing Concrete.** Place, finish, and cure concrete in accordance with the pertinent Items.
- G. Sampling and Testing of Concrete.** Unless otherwise specified, all fresh and hardened concrete is subject to testing as follows:
1. **Sampling Fresh Concrete.** Provide all material to be tested. Fresh concrete will be sampled for testing at the discharge end if using belt conveyors or pumps. When it is impractical to sample at the discharge end, a sample will be taken at the time of discharge from the delivery equipment and correlation testing will be performed and documented to ensure specification requirements are met at the discharge end.
 2. **Testing of Fresh Concrete.**
 - a. **Air Content.** Tex-414-A or Tex-416-A.
 - b. **Slump.** Tex-415-A.
 - c. **Temperature.** Tex-422-A.
 - d. **Making and Curing Strength Specimens.** Tex-447-A.
 3. **Testing of Hardened Concrete.** Only compressive strength testing will be used unless otherwise specified or shown on the plans.
 - a. **Compressive Strength.** Tex-418-A.
 - b. **Flexural Strength.** Tex-448-A.
 - c. **Maturity.** Tex-426-a.
 4. **Certification of Testing Personnel.** Contractor personnel performing testing must be either ACI-certified or qualified by a Department-recognized equivalent written and performance testing program for the tests being performed. Personnel performing these tests are subject to Department approval. Use of a commercial laboratory is permitted. All personnel performing testing using the maturity method must be qualified by a training program recognized by the Department before using this method on the job.
 5. **Adequacy and Acceptance of Concrete.** The Engineer will sample and test the fresh and hardened concrete for acceptance. The test results will be reported to the Contractor and the concrete supplier. For any concrete that fails to meet the required strengths as outlined below, investigate the quality of the materials, the concrete production operations, and other possible problem areas to determine the cause. Take necessary actions to correct the problem including redesign of the concrete mix. The Engineer may suspend all concrete operations under the pertinent Items if the Contractor is unable to identify, document,





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and correct the cause of the low strengths in a timely manner. Resume concrete operations only after obtaining approval for any proposed corrective actions.

- a. **Structural Concrete.** For concrete classes identified as structural concrete in Table 5, the Engineer will make and test 7-day and 28-day specimens. Acceptance will be based on the design strength given in Table 5.

The Engineer will evaluate the adequacy of the concrete by comparing 7-day test results to the target value established in accordance with Section 421.4.B, "Trial Batches."

- b. **All Other Concrete.** For concrete classes not identified as structural concrete in Table 5, the Engineer will make and test 7-day specimens. The Engineer will base acceptance on the 7-day target value established in accordance with Section 421.4.B, "Trial Batches."
6. **Test Sample Handling.** Unless otherwise shown on the plans or directed, remove forms and deliver department test specimens to curing facilities, in accordance with pertinent test procedures. Clean and prepare forms for reuse.

421.5. Measurement and Payment. The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.





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**ITEM 465
MANHOLES AND INLETS**

465.1. Description.

Construct manholes and inlets, complete in place or to the stage detailed, including furnishing and installing frames, grates, rings and covers. Drainage junction boxes are classified as manholes.

465.2. Materials.

Furnish materials in accordance with the following:

- Item 420, “Concrete Structures”
- Item 421, “Hydraulic Cement Concrete”
- Item 440, “Reinforcing Steel”
- Item 471, “Frames, Grates, Rings, and Covers.”

Precast manholes, inlets, risers, and appurtenances are acceptable unless otherwise shown. Alternate designs for precast items must be acceptable to the Engineer and not deviate from the functional dimensions given. Alternate designs are to be designed and sealed by a licensed professional engineer.

A. Concrete.

Furnish Class A concrete for cast-in-place manholes and inlets unless otherwise shown on the plans. Furnish Class A concrete or concrete meeting ASTM C 478 for precast manholes and inlets. Air-entrained concrete will not be required in precast concrete members.

B. Mortar.

Furnish mortar composed of 1 part hydraulic cement and 2 parts clean sand. Hydrated lime or lime putty may be added to the mix to a maximum of 10% by weight of the total dry mix.

C. Bricks.

Furnish first-quality, sound, perfectly shaped bricks. Provide clay or shale bricks that are homogeneous and thoroughly and uniformly hard-burned and that meet ASTM C 32, Grade MS or MM. Provide concrete bricks meeting ASTM C 55, Type I (Grade S-I). The maximum allowable water absorption of completely dry bricks is 16% by weight when submerged in water for 24 hr.

D. Concrete Blocks.

Provide concrete blocks that meet ASTM C 139.

E. Cast Iron or Aluminum.

Provide supports and steps conforming to the shape and dimensions shown on the plans that meet the requirements of ASTM A 48, Class 35B, for gray iron castings or ASTM A 536, Grade 65-45-12, for ductile iron castings. Steps may also be aluminum meeting ASTM B 221, Alloy 6005-T5. Provide steps in accordance with ASTM C 478, Section 16, “Steps and Ladders.”





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F. Timber.

Provide sound timber for temporary covers when used with Stage I construction (see Section 465.3, "Construction") that is a minimum of 3 in. nominal thickness and reasonably free of knots and warps.

G. Other Materials.

Commercial-type hardware of other materials may be used with prior approval.

465.3. Construction.

A. General. All types of manholes and inlets may be built either in 1 stage or in 2 stages, described as Stage I and Stage II. Build manholes and inlets designed to match the final roadway surface in stages. Construct Stage II after the pavement structure is substantially complete unless otherwise approved by the Engineer.

Construct the Stage I portion of manholes and inlets as shown on the plans or as specified in this Item. Furnish and install a temporary cover as approved by the Engineer.

For Stage I construction of cast iron or steel inlet units, furnish and install the sewer pipe and a temporary plug for the exposed end of the sewer pipe from the storm sewer to a point below the top of curb indicated on the plans.

For Stage II, construct the remaining wall height and top of manhole or inlet and furnish and install any frames, grates, rings and covers, manhole steps, curb beams, or collecting basins required.

Construct precast manholes and inlets in accordance with Item 420, "Concrete Structures," or ASTM C 478. Construct cast-in-place manholes and inlets in accordance with Item 420. Forms will be required for all concrete walls. Multi-project fabrication plants (as defined in Item 424, "Precast Concrete Structures (Fabrication)") that produce manholes and inlets will be approved by the Construction Division in accordance with DMS-7340, "Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Manholes and Inlets." The Construction Division maintains a list of approved multiproject plants. Outside wall forms for cast-in-place concrete may be omitted with the approval of the Engineer if the surrounding material can be trimmed to a smooth vertical face. The outside form for concrete bases supporting brick walls may be omitted. Cast steps into the concrete walls when the concrete is placed, or drill and grout steps in place after concrete placement. Mortar steps into joints for brick walls. Use a full bed of mortar for brick work so the brick will thoroughly bond to the mortar. Construct full mortar joints no more than 1/2 in. wide for brick walls. Furnish a header course or bond course (laid perpendicular to the preceding courses) every fifth course of brick.

B. Manholes and Inlets for Precast Concrete Pipe Sewers. Construct manholes and inlets for precast concrete pipe sewers as soon as is practicable after sewer lines into or through the manhole or inlet locations are completed. Neatly cut all sewers at the inside face of the walls of the manhole or inlet and point up with mortar.





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- C. **Manholes and Inlets for Monolithic Pipe Sewers.** Construct bases for manholes and inlets on monolithic pipe sewers either monolithically with the sewer or after the sewer is constructed.
- D. **Manholes for Box Sewers.** Cast bases for manholes for box sewers as an integral part of the sewer. Construct manholes before backfilling, or cover the manhole opening temporarily and backfill the sewer as a whole.
- E. **Inverts.** Shape and route floor inverts passing out or through the manhole or inlet as shown on the plans. Shape by adding and shaping mortar or concrete after the base is cast or by placing the required additional material with the base.
- F. **Finishing Complete Manholes and Inlets.** Complete manholes and inlets in accordance with the plans. Backfill to original ground elevation in accordance with Item 400, "Excavation and Backfill for Structures."
- G. **Finishing Stage I Construction.** Complete Stage I construction by constructing the walls to the elevations shown on the plans and backfilling to required elevations in accordance with Item 400, "Excavation and Backfill for Structures."
- H. **Stage II Construction.** Construct subgrade and base course or concrete pavement construction over Stage I manhole or inlet construction, unless otherwise approved by the Engineer. Excavate to expose the top of Stage I construction and complete the manhole or inlet in accordance with the plans and these Specifications, including backfill and cleaning of all debris from the bottom of the manhole or inlet.
- I. **Inlet Units.** Install cast iron or steel inlet units in conjunction with the construction of concrete curb and gutter. Set the inlet units securely in position before placing concrete for curb and gutter. Form openings for the inlets and recesses in curb and gutter as shown on the plans. Place and thoroughly consolidate concrete for curb and gutter adjacent to inlets and around the inlet castings and formed openings and recesses without displacing the inlet units.

465.4. Measurement.

All manholes and inlets satisfactorily completed in accordance with the plans and specifications will be measured by each manhole or inlet, complete, or by each manhole or inlet completed to the stage of construction required by the plans. Extension to inlets will be measured by each extension separately from the inlet.

465.5. Payment.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for as follows:

- A. **Complete Manholes.** Payment for complete manholes will be made at the unit price bid for "Manhole (Complete)" of the type specified.
- B. **Complete Inlets.** Payment for inlets will be made at the unit price bid for "Inlet (Complete)," of the type specified.





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- C. Inlet Extensions.** Payment for inlet extensions will be made at the unit price bid for “Inlet Extension” of the type specified.
- D. Manholes Stage I.** Payment for Manholes, Stage I, will be made at the unit price bid for each “Manhole (Stage I)” of the type specified.
- E. Manholes Stage II.** Payment for Manholes, Stage II, will be made at the unit price bid for each “Manhole (Stage II)” of the type specified.
- F. Inlets Stage I.** Payment for Inlets, Stage I, will be made at the unit price bid for each “Inlet (Stage I)” of the type specified.
- G. Inlets Stage II.** Payment for Inlets, Stage II, will be made at the unit price bid for each “Inlet (Stage II)” of the type specified.

These price are full compensation for concrete, reinforcing steel, brick, mortar, aluminum and castings, frames, grates, rings and covers, excavation, and backfill and for all other materials, tools, equipment, labor, and incidentals.





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ITEM 471 FRAMES, GRATES, RINGS, AND COVERS

471.1. Description. Furnish and install frames, grates, rings and covers for inlets, manholes, and other structures.

471.2. Materials.

- A. Welded Steel Grates and Frames.** Provide welded steel grates and frames as an assembly conforming to the member size, dimensions, and details shown on the plans. Fabricate these assemblies in accordance with Item 441, "Steel Structures." Use steel that meets ASTM A 36 or equal.
- B. Frame, Grate, Ring, and Cover Castings.** Provide clean castings conforming to the shape and dimensions shown on the plans. Ensure that the castings are free from sand and blow holes or other defects and that surfaces of the castings are reasonably smooth. Remove runners, risers, fins, and other cast-on pieces from the castings, and grind these areas smooth. Cast or machine the bearing surfaces between manhole rings and covers and between grates and frames with such precision that uniform bearing is provided throughout the perimeter area of contact. Matchmark pairs of machined castings for proper identification at installation.
Provide steel castings conforming to ASTM A 27. Furnish Grade 70-36 unless otherwise specified. Provide gray iron castings conforming to ASTM A 48, Class 35B. Provide ductile iron castings conforming to ASTM A 536. Use Grade 65-45-12 unless otherwise specified. Frame, grate, ring, and cover castings must meet the proof-load testing requirements of AASHTO M 306. Use commercial type frames, rings, risers or appurtenances only with prior approval of the Engineer.
- C. Documentation.** Furnish mill test reports or manufacturer's certification to the Engineer for each lot or shipment of steel and iron materials. For castings, also furnish a manufacturer's certification stating that the casting meets the proof-load testing requirements of AASHTO M 306.





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471.3. Construction. Construct and install frames, grates, rings, and covers in accordance with the details shown on the plans. Weld in accordance with Item 448, “Structural Field Welding.” Tack-weld grates and covers to the frame or ring when directed by the Engineer.

Galvanize steel castings and welded steel grates and frames in accordance with Item 445, “Galvanizing.” Galvanizing is not required for iron castings unless used in conjunction with structural steel shapes or shown on the plans.

Provide galvanized bolts and nuts in accordance with Item 445,
“Galvanizing.”

471.4. Measurement. Frames, grates, rings, and covers, when a part of the complete manhole or inlet, will not be measured for payment but will be considered subsidiary to Item 465, “Manholes and Inlets.” Frames, grates, rings, and covers, when not a part of a Manhole (complete) or Inlet (complete), will be measured by the each.

471.5. Payment. When payment is required in accordance with

“Measurement,” payment for frames, grates, rings, and covers will be made at the unit price bid for “Grate,” “Frame,” “Grate and Frame,” “Frame and Cover,” or “Ring and Cover.” This price is full compensation for equipment, materials, labor, tools, and incidentals.



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ITEM 481

PVC PIPE FOR DRAINS

481.1. Description. Furnish and install polyvinyl chloride (PVC) pipe for drains.

481.2. Materials. Furnish PVC pipe meeting the requirements of ASTM D 1785, Schedule 40, and furnish PVC fittings meeting the requirements of ASTM D 2466. PVC pipe and fittings meeting the requirements of ASTM D 3034, Type SDR 35 may be used for installations encased in concrete or buried in soil.

Furnish a manufacturer's certification stating the material meets the appropriate ASTM specification.

Furnish pipe marked with:

- manufacturer's name or trademark and code;
- nominal size;
- PVC cell classification (example: 12454-B);
- schedule, size, or other legend (example: SDR-35 PVC Sewer Pipe); and
- specification designation (example: ASTM D 1785).

Furnish fittings marked with:

- manufacturer's name or trademark;
- nominal size;
- material designation (example: PVC);
- schedule, size, or other legend (example: Schedule 40); and
- specification designation (example: ASTM D 3034).

Furnish solvent meeting the requirements of ASTM D 2564 for solvent-welding of fittings.

Provide fittings, hangers, clamps, straps, anchors, and guard plates in accordance with the details shown on the plans.

481.3. Construction. Excavate and backfill for pipe installation in accordance with Item 400, "Excavation and Backfill for Structures." Install pipe as shown on the plans or as directed. Solvent-weld all fittings, including splice fittings, to provide a watertight fit. Do not splice straight sections of pipe at intervals shorter than 20 ft. unless at the end of a run or otherwise approved.

Unless otherwise shown on the plans, degrease all exposed PVC pipe and fittings, and apply an acrylic water-based primer followed by a coating of the same color used for adjacent concrete surfaces.





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481.4. Measurement. This Item will be measured by the foot along the centerline of the installed pipe of the nominal size shown on the plans.

481.5. 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 “PVC Pipe” of the sizes and types specified. This price is full compensation for furnishing and installing the PVC pipe and for fittings, hangers, clamps, straps, anchors, guard plates, painting, equipment, labor, tools, and incidentals. Excavation and backfill will not be paid for directly but will be considered subsidiary to this Item.



CONCRETE CURBS AND GUTTERS, DRIVEWAYS, AND SIDEWALKS

PART 1 GENERAL

1.01 DESCRIPTION

This guide specification covers the requirements for concrete sidewalks, driveways, and concrete curbs and gutters. Concrete shall be composed of portland cement concrete in accordance with the lines and grades established by the Engineer and in conformance with the details shown on the plans.

1.02 PRODUCTS

CONCRETE: Concrete shall conform to the details in the plans except as otherwise specified. Concrete shall have a minimum compressive strength of 3000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches. In climates where freezing is not a factor but where air entrainment is used in local commercial practice to improve the workability and place ability of concrete, concrete having air content percent of 4-1/2 plus or minus 1-1/2 percent may be specified as Contractor's option to non air-entrained concrete. Mixtures may have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer. The desired slump will be inserted. Suggested limits are 3 inches plus or minus 1 inch for hand placed concrete or for slip formed concrete. The concrete slump shall be 3 inches where determined in accordance with ASTM C 143.

JOINT FILLER STRIPS & SEALANTS: Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard. Joint sealant, cold-applied shall be a rubberized asphalt sealant or equal approved by the engineer.

1.03 CONSTRUCTION METHODS

Placing During Warm Weather: The temperature of the concrete as placed shall not exceed 100 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory



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placing temperature. In no case shall the placing air temperature exceed 103 degrees F.

FORM WORK: Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 -12 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

FORM SETTING: Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory. Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope [as indicated] 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 18 hours after finishing has been completed.

CONCRETE PLACEMENT AND FINISHING: Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the





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sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished. **All slab edges, including those at formed joints, shall be sealed with a rubberized asphalt sealant to control water damage to the subgrade and control of weed and grass growth in the edges and joints.**

Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

Expansion Joints: The Expansion joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. Isolation-joint filler will be required between curbs that abut the sidewalk longitudinally. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of performed filler material conforming to ASTM D 1752 or building paper. Isolation joints shall be formed with 3/4 inch fiber board with 3/4 inch joint tack strips. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

CURING AND PROTECTION: Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the





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concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

Protection: Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

FIELD QUALITY CONTROL: The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

Strength Testing: The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 150 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. At least one concrete cylinder should be made to determine an early 7 day strength so further construction can be conducted. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

Slump Test: One slump tests shall be made on randomly selected batches of each class of concrete for every 150 cubic yards, or fraction thereof, of concrete placed during each shift. All slump tests are to be done on the middle third of the concrete within the concrete truck. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.





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Additional tests can be requested by the engineer or the testing laboratory at any time of the concrete job.

Surface Evaluation: The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks. Exposed surfaces of the finished work will be inspected by the Engineer and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

1.04 MEASUREMENT & PAYMENT

Sidewalks: The quantities of sidewalks to be paid for will be the number of linear foot of each width of sidewalk constructed as indicated. Payment of the quantities of sidewalks measured as specified will be at the contract unit price per square foot of the thickness specified.

Curbs and Gutters: The quantities of curbs and gutters to be paid for will be the number of linear foot of each cross section constructed as indicated, measured along the face of the curb at the gutter line. Payment of the quantities of curbs and gutters measured as specified will be at the contract unit price per linear foot of each cross section.

Driveways: The quantities of driveways to be paid for will be the number of square feet of driveway constructed as indicated. Payment of the quantities of driveway measured as specified will be at the contract unit price per square foot of the thickness specified.

Valley Gutters: The quantities of valley gutters to be paid for will be the number of square feet of valley gutter constructed as indicated. Payment of the quantities of valley gutter measured as specified will be at the contract unit price per square foot of the thickness specified.

END OF SECTION





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REMOVING EXISTING PAVEMENTS AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removing concrete paving, asphaltic concrete pavement, and base courses.
- B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.
- C. Removing pipe culverts and sewers.
- D. Removing existing inlets and manholes.
- E. Removing miscellaneous structures of concrete or masonry.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for removing and disposing of asphaltic surfacing and of unreinforced/reinforced concrete base under asphaltic surfacing, regardless of the thickness encountered, is on a square yard basis measured between lips of gutters.
 - 2. Payment for removing and disposing of concrete base under surfacing with curbs, regardless of the thickness encountered, is on a square yard basis measured from back-to-back of curbs. Payment includes removal of all concrete base, asphaltic surfacing, concrete pavement, esplanade curbs, curb and gutters, and paving headers.
 - 3. Payment for removing and disposing of reinforced concrete pavement, regardless of its thickness, is on a square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
 - 4. Payment for removing and disposing of monolithic curbs and gutters, and concrete curbs, is on a linear foot basis measured along the face of the curb.
 - 5. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on a square yard basis.





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6. Payment for removing and disposing of concrete sidewalks and driveways is on a square yard basis.
7. Payment for removing and disposing of miscellaneous concrete and masonry is on a cubic yard basis of the structure in place.
8. Payment for removing and disposing of pipe culverts and sewers is on a linear foot basis for each diameter and each material type of pipe removed.
9. Payment for removing and disposing of existing inlets is on a unit price basis for each inlet removed.
10. Payment for removing and disposing of existing manholes is on a unit price basis for each manhole removed.
11. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section.
12. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for the Contractor's convenience.

1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate removal work with utility companies.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PREPARATION

- A. Obtain advance approval from Public Works Director for dimensions and limits of removal work.
- B. Identify known utilities below grade. Stake and flag locations.





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3.02 PROTECTION

- A. Protect the following from damage or displacement:
 - 1. Adjacent public and private property.
 - 2. Trees, plants, and other landscape features designated to remain.
 - 3. Utilities designated to remain.
 - 4. Pavement and utility structures designated to remain.
 - 5. Bench marks, monuments, and existing structures designated to remain.

3.03 REMOVALS

- A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.
- B. Minimize amount of earth loaded during removal operations.
- C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of 2 inches.
- D. Where street and driveway saw cut locations coincide or fall within 3 feet of existing construction or expansion joints, break out to existing joint.
- E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
- F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch-thick masonry plug in pipe end prior to backfill.

3.04 BACKFILL

- A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.05 DISPOSAL





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- A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with local and state laws and the responsibility of the Contractor.

- B. Remove from the site debris resulting from work under this section in accordance with local and state laws and the responsibility of the Contractor.

END OF SECTION





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TRENCH SAFETY SYSTEM

DESCRIPTION

This section covers excavation and supporting systems for trenches to protect the safety of workers, provide suitable means for constructing utility lines, and to protect public or private property, including existing utilities.

EXISTING STRUCTURES

Where existing buildings, other utilities, streets, highways, or other structures are in close proximity to the trench, adequate protection shall be provided by the use of sheeting and shoring to protect the structure, street, or highway from possible damage. In the case of utilities, the Contractor may elect to remove the utility provided that the removal and subsequent replacement meets with the approval of the Engineer, the Utility Owner, or whoever had jurisdiction of the structure. In all cases, it shall be the responsibility of the Contractor to protect public and private property and any person or persons who might, as a result of the Contractor's work, be injured.

EXCAVATION, TRENCHING, AND SHORING

The Contractor shall include in his bid price and be solely responsible for trench safety, provisions meeting the requirements of the United States Department of Labor Occupational Safety and Health Administration. The following regulations, and contained in Subpart P, Part 1926 of the Code of Federal Regulations, shall be complied with along with all other applicable Subparts and Regulations not herein contained:

A. EXCAVATION, TRENCHING, AND SHORING

(1) GENERAL PROTECTION REQUIREMENTS

- (a) Walkways, runways, and 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.





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- (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 Subpart E of this part.
- (f) Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with or made of reflectorized or high visibility material.
- (g) Employees subjected to hazardous dusts, gases, fumes, mists, or atmosphere deficient in oxygen, shall be protected with approved respiratory protections as set forth in Subpart D of this part.
- (h) No person shall be permitted under loads handled by power shovels, derricks, or hoists. To avoid any spillage, employees shall be required to stand away from any vehicle being loaded.
- (i) 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.

(2) 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 is so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact locations shall be determined and when it is uncovered, proper support shall be provided for the existing





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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 grounds, 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 material, 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 will back of the angle of repose. When tight sheeting 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.





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- (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.
 - (1) In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least two (2) feet or more from the edge of the excavation.
 - (2) As an alternative to the clearance prescribed in the subparagraph (1) of this paragraph, the employer may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other material from falling into the excavation.
- (i) Sides, slopes, and faces of all excavating shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means.
- (j) Support systems shall be planned and designed by a qualified person when excavation is in excess of twenty (20) feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.
- (k) 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 paper dimensions.
- (l) Special precautions shall be taken in sloping or shoring the side of excavations adjacent to a previously backfilled excavations or 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.
- (m) Except in hard rock, excavation below the level of the base of footing of any foundation or retaining wall shall not be permitted, unless the wall is underpinned and all other precautions taken to insure the stability of the adjacent walls for protection of employees involved in excavation work or in the vicinity thereof.
- (n) If the stability of adjoining building or walls is endangered by excavations, shoring, bracing, or undermining shall be provided as necessary to insure their safety. Such shoring bracing, or





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- underpinning shall be inspected daily or more often, as conditions warrant, by a competent person and the protection effectively maintained.
- (o) 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.
 - (p) 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.
 - (q) Blasting and the use of explosives shall be performed in accordance with Subpart U of this part.
 - (r) When mobile equipment is utilized or allowed adjacent to an excavation, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.
 - (s) 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 wells, pits, shafts, etc., shall be backfilled.
 - (t) If possible, dust conditions shall be kept to a minimum by the use of water, salt, calcium chloride, oil, or other means.
 - (u) In the locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls, as set forth in Subpart D and E of this part, 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 apparatus, a safety harness and line, basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.
 - (v) Where employees or equipment are required or permitted to cross over excavations, walkways or ridges with standard guardrails shall be provided.
 - (w) Where ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.
 - (x) All ladders used on excavation operations shall be in accordance with the requirements of Subpart L of this part.





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(3) SPECIFIC TRENCHING REQUIREMENTS

- (a) Banks more than five (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 Table P-1 as a guide in sloping of banks. Trenches less than five (5) feet in depth shall be also be effectively protected when examination of ground indicates hazardous ground movement may be expected.
- (b) Sides of trenches in unstable or soft material, five (5) feet 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 Tables P-1, P-2 (following paragraph 91) of this Section.
- (c) Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than five (5) feet in depth and eight (8) feet or more in length. In lieu of shoring, the sides of the trench above the five (5) foot level may be sloped to preclude collapse, but shall not be steeper than a one (1) foot rise to each one-half (1/2) foot horizontal. When the outside diameter of a pipe is greater than six (6) feet, a bench of four (4) foot minimum shall be provided at the toe of the sloped portion.
- (d) Materials used for sheeting and sheet piling bracing, shoring, and underpinning, shall be in good serviceable condition, 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 hole which is above the bell. A lifeline, suitable for instant rescue and securely fastened to a shoulder harness shall be worn by each employee entering the shafts. This lifeline shall be





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individually manned and separate from any line used to remove materials excavated from the bell-footing.

- (1) Minimum requirements for trench timbering shall be in accordance with Table P-2.
- (2) Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of values given by the following formula:

$$S = 1300 - \frac{20L}{D}$$

$$\text{Maximum Ration } \frac{L}{D} = 50$$

Where:

L - Length, unsupported, in inches

D - Least side of the timber in inches

S - Allowable stress in pounds per square inch of cross section

- (g) When employees are required to be in trenches four (4) feet deep or more, an adequate means of exit, such as ladder or steps shall be provided and located so as to require no more than twenty-five (25) feet of lateral travel
- (h) Bracing or shoring of trenches shall be carried along with the excavation.
- (i) Cross braces or trench jacks shall be palce in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling, or kickouts.
- (j) 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 of shoring required for the trench.





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- (k) 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.

TABLE P-1

<u>SOIL TYE</u>	<u>APPROXIMATE ANGE OF REPOSE FRO SLOPING OF SIDES OF EXCAVATIONS</u>
Solid Rock Shales, Or Cemented Sand & Gravel	90 degrees
Compacted Angular Gravels	60 degrees 26 ft. (1/2:1)
Recommended Slope for Average Soils	45 degrees (1:1)
Compacted Sharp Sand	30 degrees 41 ft. (1-1/2:1)
Well Rounded Loose Sand	26 degrees 34 ft. (2:1)

Note: Clays, silts, loams or non-homogeneous soils require shoring and bracing. The presence of ground water requires special treatment.

(4) DEFINITIONS APPLICABLE TO THIS SUBPART

- (a) “Accepted engineering requirements (or practice)”- Those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognized authority.
- (b) “Angle of repose”-The greatest angle above the horizontal plane at which a material will lie without sliding.
- (c) “Bank”-A mass of soil piling above digging level.





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- (d) “Belled Excavation”-A part of a 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 man made cavity or depression in the earth’s surface, including its sides, walls, or faces, formed conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, and excavation may become a trench.
- (g) “Faces”- See paragraph (k) of this section.
- (h) “Kickouts”- Accidental release or failure of a short or brace.
- (i) “Sheet pile”-A pile or sheeting, that may form one of a 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.
- (j) “Sides”, “Walls” or “Faces”-The vertical or inclined earth surfaces formed as a result of excavation work .
- (k) “Slope”-The angle with the horizontal at which a particular earth material will stand indefinitely without moving.
- (l) “Stringers” (“wales”-The horizontal members of a shoring system whose sides bear against the uprights or earth.)
- (m) “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 fifteen (15) feet.
- (n) “Trench Jack”- Screw or hydraulic type jacks used as cross bracing in a trench shoring system.
- (o) “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.





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- (p) “Unstable Soil”- Earth material, other than running, that because of its nature or 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.

- (q) “Uprights:- The vertical members of a shoring system.

- (r) “Wales”- See paragraph (m) of this section.

- (s) “Walls” – See paragraph (k) of this section.

Additional information may be obtained from

U.S. Department of Labor
Occupational Safety and Health Administration
525 Griffin Square Building, Room 602
Dallas, Texas 75202

Phone:214-767-4731





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TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Testing laboratory services and Contractor responsibilities related to those services.

1.2 REFERENCES

1. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
2. ASTM D 3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
3. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
4. ASTM E 329 - Specification for Minimum Requirements for Agencies Engaged the Testing and/or Inspection of Materials Used in Construction.
5. ISO/TEC Guide 25 - General Requirements for the Competence of Calibration and Testing Laboratories.

1.3 SELECTION AND PAYMENT

1. The Owner will select, employ, and pay for services of an independent testing laboratory to perform inspection and testing identified in Part 3 of individual Specification sections.
2. The Contractor shall employ and pay for services of an independent testing laboratory or laboratories to perform inspection and testing identified in Part 2 of individual Specification sections.
3. Employment of a testing laboratory by the Owner shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.





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4. The Contractor will have the cost of retesting deducted from the estimate for payment whenever failed work must be removed and replaced and retested.

1.4 QUALIFICATION OF LABORATORY

1. Meet laboratory requirements of ASTM E 329 and applicable requirements of ASTM C 1077, ASTM D 3666, and ASTM D 3740.
2. Meet the ISO/TEC Guide 25 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.
3. Where a laboratory subcontracts any part of the testing services, such work shall be placed with a laboratory complying with the requirements of this Section.

1.5 LABORATORY REPORTS

1. The testing laboratory shall provide and distribute copies of laboratory reports to the following: the Owner, the Engineer, and the Contractor. Other copies of the reports may be required to be submitted to other parties. The testing laboratory will be informed of any other persons that required laboratory reports.
2. One copy of each laboratory report distributed or faxed to the Contractor shall be kept at the site field office for the duration of the project.
3. Before close of business on the working day following test completion and review, reports which indicate failing test results shall be transmitted immediately via fax from the testing laboratory to the Owner, Contractor, and Engineer.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

1. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Laboratory may not approve or accept any portion of the Work.
3. Laboratory may not assume any duties of the Contractor.
4. Laboratory has no authority to stop the Work. The laboratory's representative shall immediately inform the Engineer and the Owner of any conflicts with the Contractor or Contractor's construction methods.





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1.7 CONTRACTOR RESPONSIBILITIES

1. Provide safe access to the Work and to manufacturer's facilities for the Owner, Engineer, and testing laboratory personnel.
2. Provide to the testing laboratory a copy of the construction schedule and a copy of each update to the construction schedule.
3. Notify the Engineer and the testing laboratory during normal working hours of the day previous, but not less than 18 hours prior notice, to the expected time for operations requiring inspection and testing services. If the Contractor fails to make timely prior notification, then the Contractor shall not proceed with the operations requiring inspection and testing services.
4. Notify the Engineer 24 hours in advance if the Specification requires the presence of the Engineer for sampling or testing.
5. Request and monitor testing as required to provide timely results and to avoid delay to the Work. Provide samples to the laboratory in sufficient time to allow the required test to be performed in accordance with specified test methods before the intended use of the material.
6. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested; to obtain and handle samples at the site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01.1 CONDUCTING TESTING

- 1 Laboratory sampling and testing specified in individual Specification sections shall conform to the latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by the Engineer.
2. The requirements of this section shall also apply to those tests for approval of materials, for mix designs, and for quality control of materials as performed by the testing laboratories employed by the Contractor.

END OF SECTION





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TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

1. Requirements for signs, signals, control devices, flares, lights and traffic signals, as well as construction parking control, designated haul routes and bridging of trenches and excavations.

2. Requirement for and qualifications of flagmen.

1.02 SUBMITTALS

1. A traffic control plan responsive to the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and sealed by a Registered Professional Engineer is incorporated into the Drawings. If the Contractor proposes to implement traffic control without modification to the plan provided, he shall submit a letter confirming that decision. If the Contractor proposes to implement traffic control different than the plan provided, he shall submit a traffic control plan in conformance with the TMUTCD and sealed by a Registered Professional Engineer.

2. For both the traffic control plan and flagmen use, submit schedules of values within 30 days following the Notice to Proceed. Refer to Section 01292 - Schedule of Values.

C. The Contractor shall provide such information and records regarding the use of qualified flagmen to verify that the Contractor's use of "peace officers" as flagmen is in compliance with the Contract Documents and Texas law, including but not limited to, Article 4413 (29bb), commonly referred to as the Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

D. The Contractor shall provide such information and records regarding the use of qualified flagmen to verify that the Contractor's use of "certified flagmen" as flagmen is in compliance with the Contract Documents and applicable City ordinance.

E. Make submittals in accordance with Section 01330 - Submittal Procedures.

1.03 UNIT PRICES

Traffic Control

TCR-1

Bidder's Initials _____





BID #TSD44-0613

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- A. Traffic Control and Regulation. Measurement is on a lump sum basis for traffic control and regulation, including submittal of a traffic control plan if different from the plan shown on the Drawings, provision of traffic control devices, and provision of equipment and personnel as necessary to protect the work and the public. The amount invoiced shall be determined based on the schedule of values submitted for traffic control and regulation.
- B. Flagmen. Measurement is on a lump sum basis for flagmen as required for the Project. The amount invoiced shall be determined based on the schedule of values submitted for flagmen.
- C. Refer to Section 01270 - Measurement and Payment for unit price procedures.

1.04 FLAGMEN

- A. Use flagmen, qualified as described under paragraph 1.04.B, Uniformed Peace Officers, or paragraph 1.04.C, Certified Flagmen, to control, regulate, and direct the even flow or movement of vehicular or pedestrian traffic when construction operations encroach on public traffic lanes.
- B. Uniformed Peace Officer: A person who has full-time employment as a peace officer and who receives compensation as a flagman for private employment as an individual employee or independent contractor. Private employment may be either an employee-employer relationship or on an individual basis. A flagman may not be in the employ of another peace officer and may not be a reserve peace officer.
 - 1. A peace officer is defined as:
 - a. Sheriffs and their deputies;
 - b. Constables and deputy constables;
 - c. Marshals or police officers of an incorporated city, town, or village; or
 - d. As otherwise provided by Article 2.12, Code of Criminal Procedure, as amended.
 - 2. A person who has full-time employment as a peace officer is one who is actively employed in a full-time capacity as a peace officer working, on average, a minimum of 32 paid hours per week, being paid at a rate of pay not less than the prevailing minimum hourly wage rate as set by the federal Wage and Hour Act and entitled to the full benefits of participation in any retirement plan, vacation, holidays, and insurance benefits. A reserve peace officer does not qualify, under this definition, as a peace officer.





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PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

1. Comply with Texas State Manual on Uniform Traffic Control Devices.
2. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

PART 3 EXECUTION

3.01 PUBLIC ROADS

1. Abide by laws and regulations of governing authorities when using public roads. If the Contractor's work requires that public roads be temporarily impeded or closed, approvals shall be obtained from governing authorities and permits paid for before starting any work. Coordinate activities with the City.
2. Contractor shall maintain at all times a 10-foot-wide all-weather lane adjacent to work areas which shall be kept free of construction equipment and debris and shall be for the use of emergency vehicles, or as otherwise provided in the traffic control plan.
3. Contractor shall not obstruct the normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by the City.
4. Contractor shall maintain local driveway access to residential and commercial properties adjacent to work areas at all times.
5. Cleanliness of Surrounding Streets:
 1. Keep streets used for entering or leaving the job area free of excavated material, debris, and any foreign material resulting from construction operations.





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3.02 CONSTRUCTION PARKING CONTROL

1. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and City's operations.
2. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
3. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

1. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.04 HAUL ROUTES

1. Utilize haul routes designated by authorities or shown on the Drawings for construction traffic.
2. Confine construction traffic to designated haul routes.
3. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.05 TRAFFIC SIGNS AND SIGNALS

1. Install traffic control devices at approaches to the site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
2. Install and operate 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 traffic signs and signals as Work progresses to maintain effective traffic control.





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3.06 BRIDGING TRENCHES AND EXCAVATIONS

1. Whenever necessary, bridge trenches and excavation to permit an unobstructed flow of traffic.
2. Secure bridging against displacement by using adjustable cleats, angles, bolts or other devices whenever bridge is installed:
 1. On an existing bus route;
 2. When more than five percent of daily traffic is comprised of commercial or truck traffic;
 3. When more than two separate plates are used for the bridge; or
 4. When bridge is to be used for more than five consecutive days.
3. Install bridging to operate with minimum noise.
4. Adequately shore the trench or excavation to support bridge and traffic.
5. Extend steel plates used for bridging a minimum of one foot beyond edges of trench or excavation. Use temporary paving materials (premix) to feather edges of plates to minimize wheel impact on secured bridging.
6. Use steel plates of sufficient thickness to support H-20 loading truck or lane that produces maximum stress.

3.07 REMOVAL

1. Remove equipment and devices when no longer required.
2. Repair damage caused by installation.
3. Remove post settings to a depth of 2 feet.

PART 4 PAYMENT

4.02 UNIT PRICES





BID #TSD44-0613

BID #TSD44-0613

- A. Unless indicated in the Unit Price Schedule as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items of which this work is a component.

END OF SECTION

Traffic Control

TCR-6

Bidder's Initials _____





BID #CBT-12-0219

VIDEOTAPE

The Contractor shall videotape the entire job site, including access to job site, prior to commencing work. A copy of the videotape will be provided to the City at the pre-construction conference. The videotape will be held for historical purposes and for resolving complaints/claims from affected property owners. Failure to provide such tape shall render the contractor liable for claims. Acceptable format is standard VHS tape or DVD.

Monthly videotaping by the contractor during construction is recommended to protect contractor's interest against claims and as a basis for extras.

Video Tape

VT-1

Bidder's Initials _____



SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of the following:
 - 1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 - 2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
 - 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reason for pruning.
 - 4. Description of pruning to be performed.
 - 5. Description of maintenance following pruning.
- D. Qualification Data: For qualified arborist and tree service firm.
- E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- F. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes pre-construction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Enforcing requirements for protection zones.
 - c. Arborist's responsibilities.
 - d. Field quality control.

1.6 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.

3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Topsoil: Stockpiled topsoil from location shown on Drawings.
- C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood.
 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 3. Color: Natural.
- D. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements.
1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts; with 1-5/8-inch- OD top rails and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 6 feet.
 - b. Polymer-Coating Color: Dark green.
 2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.
 - a. Height: 4 feet.
 - b. Color: High-visibility orange, non-fading.
 3. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.
- E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with non-fading lettering and as follows:
1. Size and Text: As shown on Drawings.
 2. Lettering: 3-inch- high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation- control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.**
- B. **For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.**
1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
 2. Provide one new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
 - a. Species: Species selected by Architect.
 3. Plant and maintain new trees as specified in Division 32 Section "Plants."
- C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10

feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of

3.2 PREPARATION

- A. **Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.**
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
 - 1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to pre-approval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as shown on Drawings
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and

cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as shown on Drawings
 - 1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
 - 2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
 - a. Type of Pruning: Cleaning.
 - b. Specialty Pruning: Restoration.
 - 3. Cut branches with sharp pruning instruments; do not break or chop.
 - 4. Do not apply pruning paint to wounds.
- B. Chip removed branches and spread over areas identified by Architect.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.
 - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 015713

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes providing temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction. Temporary measures include the following.
 - 1. Silt fences and straw bales.
 - 2. Sediment barriers and check dams.
 - 3. Stabilized construction entrance.
 - 4. Construction of temporary swales and sedimentation basins as required.
 - 5. Seeding, sodding, and hydromulching.
- B. Comply with all local, state, and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System (NPDES) regulations from the Federal Clean Water Act.
- C. Should any provisions of this section be at variance with erosion control plan prepared by the civil engineer, the civil engineer's directive shall take precedence.

1.2 NOTICE OF INTENT

- A. Contractor and Owner shall jointly submit an EPA Notice of Intent (NOI) prior to construction.
- B. Contractor shall prepare the report, coordinate with Owner, and file in accordance with regulations.

PART 2 - PRODUCTS

2.1 SILT FENCE

- A. Filter Fabric: Non-woven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The filter fabric shall be supplied in rolls a minimum of 36 inches (0.9 meter) wide.
 - 1. Acceptable Products: Lundin "Silt Buster", Mirafi "Envirofence" or acceptable substitution.
- B. Wire Fence Support: Welded wire fabric 2 x 4 - W1.0 x W1.0 (50 x 100 - MW7 x MW7).
- C. Fence Posts: Painted or galvanized steel Tee or Y-posts with anchor plates, not less than 5 feet (1.5 meters) in length with a minimum weight of 1.3 pounds per foot (1.9 k/m). Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702.

2.2 STRAW BALES

- A. Standard rectangular hay bales bound by baling wire.

2.3 SEDIMENT TRAPS

- A. Standard manufacture designed to fit the intended inlet.

2.4 STABILIZED CONSTRUCTION ENTRANCE

- A. Aggregate: Graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448 and TEX 401-A coarse-aggregate; with 0 percent being retained by a 5-inch sieve and 100 percent being retained by a 3-inch sieve.

2.5 GRASS

- A. Materials and seeding and sodding shall conform to applicable Division 32 section.

2.6 FERTILIZER

- A. Use commercial grade fertilizers to insure germination and growth. Analysis by weight shall be 16-4-8 or 15-5-10 for Nitrogen, Phosphoric Acid and Potash.

2.7 WATER

- A. Use clean potable water for maintaining the grass.

PART 3 - EXECUTION

3.1 GENERAL

- A. Keep disturbed areas to a minimum required to adequately perform the work. At all times maintain the site in such a manner that minimizes erosion of the site. The execution of work under this section shall be in conformance with the NPDES rulings and the site Storm Water Pollution Prevention Plan.

3.2 SILT FENCES

- A. Silt fence shall be a minimum of 24 inches (0.6 meter) high. Posts shall be embedded a minimum of 12 inches (300 mm) in the ground, placed a maximum of 8 feet (2.4 meters) apart and set on a slight angle toward the anticipated runoff source.
 - 1. When directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.
- B. Securely attach filter fabric to posts and wire support fence, with the bottom 12 inches (300 mm) of filter fabric buried in a trench a minimum of 6 inches (150 mm) deep and 6 inches (150 mm) wide to prevent sediment from passing under the fence.
 - 1. When silt fence is constructed on impervious material, a 12-inch (300-mm) flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss.
 - 2. No horizontal joints will be allowed in the filter fabric.
 - 3. Vertical joints shall be overlapped a minimum of 12 inches (300 mm) with the ends sewn or otherwise securely tied.
- C. Silt fence shall be maintained for the duration of the project, and repaired, replaced, and/or relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6 inches (150 mm).

3.3 EROSION CONTROL BARRIERS

- A. Provide erosion control barriers at intervals along swales and ditches as shown on the Drawings or as necessary to meet the requirements of the Storm Water Pollution Prevention Plan.
- B. Barriers: Silt fence or hay bales placed as indicated on the Drawings.
- C. Maintain barriers in good working condition and replace when damaged.

3.4 STABILIZED CONSTRUCTION ENTRANCE

- A. Remove trees, brush, stumps, obstructions, and other objectionable material and disposed of in a manner that will not interfere with the excavation, grading, and construction of the entrance as indicated on the Drawings.
 - 1. Stabilized construction entrance shall not drain onto the public right-of-way and shall not allow surface water runoff to exit the construction site.
 - 2. When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right of way.
 - a. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin.
 - 3. Sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence or other methods approved by the Engineer or designated representative.
- B. The entrance shall be maintained in a condition that will prevent tracking or disposition of sediment onto public right of way. Provide periodic top dressing with additional stone as conditions demand, as well as the repair and/or cleanout of any measures used to trap sediment. Sediment that is spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

3.5 TEMPORARY AND PERMANENT SWALES

- A. Description:
 - 1. Provide temporary and permanent drainage swales as required to carry drainage away from the work area to an approved outfall point.
 - 2. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least 2 feet deep with a slope of 0.1 percent.
 - 3. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.
 - 4. Swales shall have erosion control barriers as required.
 - 5. All permanent swales shall be sodded to a minimum width of 10 feet on either side of the centerline of the swale.

- B. Maintenance:
 1. During the course of construction maintain temporary swales constructed for this contract so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, place temporary swales to remain in good working condition.
 2. Work with other contractors at the site in maintaining existing swales and ditches.
 3. Where necessary for access to the work areas, install adequately sized culverts and maintain to provide the access without disturbing the site drainage.
 4. Take care not to rut and damage sodded swales. Immediately repair damaged swales.
 5. Keep sodded swales mowed.

- 3.6 DRAINAGE SWALES
 - A. Immediately hydromulch drainage ditches upon final grading.
 - B. Repair erosion of the banks of the drainage ditches immediately and re-stabilize.
 - C. Place sediment barriers at intervals along the ditch as shown on the plans or as necessary to help trap sediment on the site. Daily remove sediment and other debris trapped by the barriers.
 - D. Maximum Ditch Side Slopes: 3 feet horizontal to 1 foot vertical.
 - E. Maintenance of the ditches during construction shall include but not be limited to mowing, re-grading, sediment removal, re-hydromulching, bank repair and debris removal.
 - F. Sediment removed from the ditches may be respread on the site as directed by the Owner.

- 3.7 FILL AND CUT SLOPES
 - A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's soils engineer.
 - B. When cut slopes exceed 2:1 for depths over 3 feet, proper bracing and shoring per OSHA requirements shall be used and maintained.
 - C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulching, sodding, seeding, or other method as approved.

- 3.8 SEDIMENTATION BASINS
 - A. Description:
 1. Provide sedimentation ponds where indicated.
 2. Route drainage from cleared areas through the sedimentation basin.
 3. Operate and maintain the pond during construction.
 - B. Maintenance:
 1. Maintain the pond and the outfall and sediment retarding structure in good working condition throughout the time the pond is to be in operation.
 2. When sediment and debris fill the pond to over one third (1/3) its designed capacity, clean out the pond.
 3. Stockpile, in its' own separate area, the sediment from the clearing operation, or remove from the site, as required. Make adequate drainage provisions such that drainage from the sediment stockpile drains back into the sediment pond. When approved by the Owner, sediment removed from the pond may be spread over the site.

- 3.9 SEEDING
 - A. Seed disturbed portions of the site and stockpile areas within 14 days if the phasing of the construction operations are anticipated to leave those portions of the areas unworked for 21 days or more.
 - B. Maintain seeded areas until the project is accepted by the Owner. Maintain by watering, fertilizing, reseeding, mowing and erosion repair as may be required. Cut grass when the average height of the grass reaches 6 inches. Clippings may be mulched back into the seeded areas.

END OF SECTION

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 FORMWORK FOR CONCRETE

- A. Related accessories

1.3 REFERENCES

- A. ACI 318 - Building Code Requirements for Structural Concrete
- B. ACI 347 - Guide to Formwork for Concrete
- C. ACI SP-4: Formwork for Concrete
- D. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
- D. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- E. ASTM 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

1.4 SYSTEM DESCRIPTION

- A. Concrete Formwork: For surfaces of cast-in-place concrete to be unexposed or to receive rubbed finish.
- B. Form footings and slabs on grade, earth forming is not allowed.
- C. Design/Performance Requirements: Design, engineering and construction of formwork and shoring is the responsibility of the Contractor.
 - 1. Design formwork with sufficient strength to withstand forces due to placement and vibration and sufficient rigidity to maintain specified tolerances.
 - 2. Design loads, lateral pressure, and allowable stresses in accordance with ACI 347.

1.5 SUBMITTALS

- A. Product Data: Proprietary materials and items, including forming accessories, water stops, joint systems, and others
- B. Shop Drawings:
 - 1. Show form construction including jointing, special form joints and reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 2. Prepare, sign, and seal by a professional engineer registered in the State of Florida.
- C. Structural Calculations (Threshold Buildings):
 - 1. Prepare and submit complete design calculations, plans, and details for shoring and re-shoring procedures, indicating conformance to specified performance and design criteria; signed, and sealed by a professional engineer registered in the State of Florida.
 - 2. Submit calculations for review information only, will not check for accuracy

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Concrete Forms for Beams, Columns, and Slabs:
 - 1. New or properly reconditioned material designed to conform to requirements of ACI SP-4 and to support wet concrete without deflection.
 - 2. Plywood Panels: PS-1 B-B plywood, Class 1, EXT-APA, sanded, mill oiled, and edge sealed.
- B. Structural Concrete Forms for Joists: New or properly reconditioned removable 18-gauge steel or fiberglass pan forms with tapered end closures.
- C. Cylindrical Column Forms:
 - 1. Metal, fiberglass reinforced plastic, or paper or fiber tubes.
 - 2. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection.
 - a. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

2.2 RELATED MATERIALS

- A. Vapor Retarder: Related section 07 26 00.
- B. Form Coatings: Colorless commercial formulation form release and sealer compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Adjustable length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal, 1½" break back, and maximum hole left 1¼" diameter.
- D. Bevels and Rustications: Wood strips milled to shapes indicated or formed rigid plastic strips.
- F. Flashing Reglets shall be 16-oz. copper with release tape sealed slots and alignment splines at end joints.
- G. Construction Joints shall be 24-ga. galvanized steel keyway form type with knockout holes spaced 6" o. c. to receive doweling.
- H. Carton Forms: Fiberboard void boxes capable of supporting min. load of 600 lbs./sq ft
- I. Form Joint System for Architectural Concrete Forms:
 - 1. Gaskets shall be closed cell foam tape - Source Product/Mfg. - No. 4016 by 3M.
 - 2. Caulk: Rubberized, non-staining silicone compound GE Product/Mfg. - No. 1201.
 - 3. Tape: 1 or 2 mil Mylar - source Product/Mfg. - No. 371 by 3M.
- J. Mastic Water stop: Preformed plastic or butyl resin strips. Source Products/Mfg:
 - 1. Synko-Flex/Synko-Flex Products Co.
 - 2. ConSeal CS-102/Concrete Sealants
- K. Joint Fillers: Pre-molded mastic strips, asphalt impregnated, ASTM D1751.
- L. Fasteners and Anchorages: Nails, spikes, bolts, lag bolts, and other types sized as required to maintain formwork in place.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and measurements required before proceeding with formwork.
- B. Coordinate the installation of joint materials, reinforcing steel, and vapor retarders with placement of forms.

3.2 INSTALLATION TOLERANCES

- A. Allowable tolerances for Structural Concrete Forms shall comply with ACI 301 and 347.
- B. Allowable tolerances for camber in slabs and beams shall comply with ACI 301.
- C. Allowable tolerances for plumbness in elevator shafts shall comply with requirements of ANSI/ASME A17.1.

3.3 ERECTION

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that may occur before permanent bracing can support such loads.
- B. Construction:
 - 1. Construct formwork so finished concrete members and structures are of correct size, shape, alignment, elevation, and position.
 - 2. Build formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
 - 3. Provide openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required.
 - 4. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
 - 5. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
 - 6. Provide temporary openings at bottoms of forms to facilitate cleanout and inspection.
 - a. Close openings with tight fitting panels and neat joints so that joints will not be apparent in exposed concrete surfaces.
- C. Chamfer exposed corners and edges as indicated, or if not indicated, provide ¾" x ¾".
- D. Provide openings in concrete formwork to accommodate work of other trades.
 - 1. Determine size and location of openings, recesses, and chases from trades providing such items.
 - 2. Accurately place and securely support items built into forms.
- E. Thoroughly clean forms and adjacent surfaces to receive concrete.
 - 1. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.
 - 2. Retighten forms and bracing after concrete placement to eliminate mortar leaks and maintain proper alignment.
- F. Construction Joints:
 - 1. Locate and install formed construction joints at rustications or, if not indicated, locate so as not to impair strength and appearance of the structure, and as approved by the A/E.

2. Provide keyways at least 1½" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
 3. Place construction joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints, except as otherwise indicated.
- G. Isolation Joints in Slabs-on-Ground: Construct continuous joint filler at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundations walls, grade beams, and elsewhere as indicated.
- H. Water stops: Provide mastic water stops in construction joints of below grade walls and in joints between below grade slabs and walls.
 1. Install water stops to form continuous diaphragm in each joint.
 2. Fabricate field joints in water stops in accordance with manufacturer's printed instructions.
- I. Form Coatings: Apply after erecting forms and sealing the joints but prior to placing reinforcing steel, anchoring devices, and embedded items.
 1. Seal surfaces of wood rustications with two coats of form sealer.
 2. Spray-apply one coat of release agent to formwork faces except concrete surfaces scheduled to receive special finishes or special coatings.
 3. Coat steel forms with a nonstaining, rust- preventative form oil to protect against rusting.
 - a. Ruststained steel formwork is not acceptable.
- J. Embedded Items: Set and build into work anchorage devices and other embedded items required for other work attached to, or supported by, cast-in-place concrete.
- K. Reglets: Install to receive top edge of foundation sheet waterproofing, and to receive thruwall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- L. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E1643 and manufacturer's written instructions.
- 3.4 RE-USE OF FORMS
- A. Clean reused forms of concrete matrix residue, repair, and patch as required returning forms to acceptable surface condition.
 - B. Recoat contact surfaces of forms with a form-coating compound as specified.
- 3.5 SHORES AND SUPPORTS
- A. Comply with ACI 347 for shoring and re-shoring in multistory construction, for beams, girders, raised slabs, and as herein specified.
 - B. Space all shoring in such a manner as to prevent any floor or member from excessive loading or inducing stress in any of the concrete members.
 1. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
- 3.6 REMOVAL OF FORMS AND SHORING
- A. Remove formwork and shoring progressively and in accordance with ACI 301 and ACI 347 to prevent unbalanced loads on the structure.
 - B. Do not remove shoring and formwork until members have acquired strength as specified by the engineer of record.
 1. Re-shore structural members as original shores are removed as specified by the engineer of record.
 - C. In the event the Contractor wishes to remove formwork at an earlier time than specified, the Contractor shall pay for and have testing laboratory obtain two additional concrete test cylinders to confirm strength requirement for early form removal.

END OF SECTION

SECTION 032000

CONCRETE REINFORCEMENT

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete
- 1.2 REFERENCES
- A. ACI 301 Structural Concrete for Buildings
 - B. ACI 318 Building Code Requirements For Reinforced Concrete
 - C. ACI SP66 American Concrete Institute Detailing Manual
 - D. ASCE 7 - American Society of Civil Engineers - Wind Loads
 - E. ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - F. ASTM A184 Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
 - G. ASTM A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - H. ASTM A496 Standard Specification for Steel Wire Deformed for Concrete Reinforcement
 - I. ASTM A497 Standard Specification for Steel Welded Wire Reinforcement Deformed for Concrete
 - J. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - K. ASTM A706/A706M Standard Specification for LowAlloy Steel Deformed and Plain Bars for Concrete Reinforcement
 - L. ASTM A767 /A767M Standard Specification for ZincCoated (Galvanized) Steel Bars for Concrete Reinforcement
 - M. ASTM A775 /A775M Standard Specification for EpoxyCoated Reinforcing Steel Bars
 - N. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of EpoxyCoated Reinforcing Bars
 - O. AWS D1.4 - Structural Welding Code-Reinforcing Steel
 - P. CRSI Concrete Reinforcing Steel Institute - Manual of Standard Practice
 - Q. CRSI - Placing Reinforcing Bars
- 1.3 SUBMITTALS FOR REVIEW
- A. Section 01 33 00 - Submittals Procedures
 - B. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
- 1.4 SUBMITTALS FOR INFORMATION
- A. Section 01 33 00 - Submittals Procedures
 - B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - C. Submit certified copies of mill test report of reinforcement materials analysis.
- 1.5 DESIGN REQUIREMENTS
- A. Design shall comply with the ASCE 7 – Wind Loads, and ACI 318. B.
Do not weld reinforcing steel.
- 1.6 QUALITY ASSURANCE
- A. Perform work in accordance with ACI 301. Maintain one copy of document on site.
 - B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas.
 - C. Submit under provisions of Section 01 40 00 Manufacturer's Certificates, certifying welders employed on the work, verifying AWS qualification within the previous 12 months.

PART 2 - PRODUCTS

- 2.1 REINFORCEMENT
- A. Reinforcing Steel: ASTM A615, Grade 60; deformed carbon steel bars, unfinished
 - B. Stirrup and Tie Steel: ASTM A615, Grade 40 or 60; deformed carbon steel bars, unfinished
 - C. Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets and rolls; unfinished
 - D. Steel Wire: ASTM A82, plain, cold drawn, steel

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REINFORCEMENT

- 2.2 ACCESSORIES
- A. Tie Wire: Minimum 16 gage annealed type or patented system.
 - B. Chairs, Bolsters, Bar Supports, Spacers: Size and shape for strength and reinforcement support during concrete placement, include load bearing pad on bottom to prevent vapor barrier puncture.
 - C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.
- 2.3 FABRICATION
- A. Fabricate concrete reinforcing in accordance with ACI 318.
 - B. Weld reinforcement in accordance with AWS D1.4.
 - C. Locate reinforcing splices not shown on plans, at point of minimum stress and review with A/E.

PART 3 - EXECUTION

- 3.1 PLACEMENT
- A. Place support and secure reinforcement against displacement, without deviating from the required position.
 - B. Do not displace or damage vapor barrier.
 - C. Accommodate placement of formed openings.
 - D. Conform to applicable code for concrete cover over reinforcement.
- 3.2 FIELD QUALITY CONTROL
- A. Architect, Owner, or Building Department may request field inspections.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1- GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete footings.
- B. Hike and Bike trail.
- C. Control, expansion, and contraction joint devices associated with concrete work, including joint sealants.
- D. Sign pole base.

1.2 REFERENCES

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete
- C. ACI 301 – Specifications Structural Concrete for Buildings
- D. ACI 302 - Guide for Concrete Floor and Slab Construction.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
- F. ACI 305R - Hot Weather Concreting.
- G. ACI 306R - Cold Weather Concreting.
- H. ACI 308 - Standard Specification for Curing Concrete
- I. ACI 318 - Building Code Requirements for Structural Concrete
- J. ACI 347 - Guide to Formwork for Concrete
- K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- L. ASTM C33 - Standard Specification for Concrete Aggregates
- M. ASTM C39C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete
- O. ASTM C150 - Standard Specification Portland Cement
- P. ASTM C260 - Standard Specification Air Entraining Admixtures for Concrete
- Q. ASTM C330 - Standard Specification Light Weight Aggregates for Structural Concrete
- R. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete
- S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for Use in Concrete
- T. ASTM C948 – Standard Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete
- U. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- V. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
- W. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
- X. ASTM D1751 - Standard Specification Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- Y. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- Z. ASCE 7 – Minimum Design Loads for Buildings and other Structures.

1.3 RELATED SECTIONS

- A. 31 20 00 Earth Moving
- B. 31 31 16 Termite Control
- C. 03 11 00 Concrete Formwork
- D. 07 26 00 Vapor Retarders

1.4 SUBMITTALS FOR REVIEW and INFORMATION

- A. Section 01 33 00 Submittals Procedures
- B. Product Data: Provide data on joint devices, attachment accessories, admixtures, curing compound, sealers, and integral coloring.
- C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.
- D. Samples: Submit two 12" long samples of expansion/contraction joint and control joint.
- E. Shop Drawings:

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1. Submit drawings indicating the locations of all joints in the concrete; construction joints, expansion joints, and contractions joints.
 2. Include concrete placement schedule, method, sequence, quantities, location, and boundaries.
- 1.5 SUBMITTALS AT PROJECT CLOSEOUT
- A. Section 01 77 00 Contract Closeout: Procedures for submittals
 - B. Accurately record actual locations of embedded utilities and components concealed from view.
- 1.6 LEED SUBMITTALS (Not Used)
- 1.7 DESIGN REQUIREMENTS
- A. Provide expansion joints, control joints, construction joints, and isolation joints to prevent uncontrolled stress cracks in the structure and according to the latest engineering standards.
- 1.8 QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 301.
 - B. Mix and deliver ready mixed concrete in accordance with ASTM C94/C94M.
 - C. Maintain one copy of each document on site.
 - D. Acquire cement and aggregate from same source for all work.
 - E. Conform to ACI 305R when concreting during hot weather.
 - F. Conform to ACI 306R when concreting during cold weather.
- 1.9 MOCK-UP
- A. Comply with the requirements of section 01 40 00 Quality Control, Requirements for mock-up.
 - B. Construct and erect a field sample for architectural concrete surfaces receiving special treatment or finish as result of formwork.
 - C. Sample Panel: Sufficient size to indicate special treatment or finish required.
 - D. If requested by A/E, cast concrete against sample panel.
 1. Obtain acceptance of resultant surface finish prior to erecting formwork.
 - E. Use the approved sample panel for basis of quality for the finished work.
 1. Keep sample panel exposed to view for duration of concrete work.
 - F. Locate where directed.
 - G. Mock-up may not remain as part of the Work.

PART 2 - PRODUCTS

- 2.1 CONCRETE MATERIALS
- A. Cement: ASTM C150, Type I - Normal, Portland type
 - B. Fine and Coarse Aggregates: ASTM C33
 - C. Lightweight Aggregate: ASTM C330
 - D. Water: Clean and not detrimental to concrete
 - E. Glass Fiber Reinforcement: ASTM C948
- 2.2 ADMIXTURES
- A. Air Entrainment: ASTM C260
 - B. Chemical: ASTM C494
 1. Water Reducing - Type A
 2. Retarding - Type B
 3. Accelerating - Type C
 4. Water Reducing and Retarding - Type D
 5. Water Reducing and Accelerating - Type E
 6. Water Reducing, High Range - Type F
 7. Water Reducing, High Range and Retarding - Type G
 8. Flowing Concrete - ASTM C1017/C1017M
 - C. Fly Ash: ASTM C618
- 2.3 ACCESSORIES
- A. Bonding Agent: Polymer resin emulsion, Polyvinyl Acetate, Latex emulsion, 2-component-modified epoxy resin, Non-solvent two-component polysulfide epoxy, Mineral filled polysulfide polymer epoxy, Mineral filled polysulfide polymer epoxy-resin, and Versamid cured epoxy.
 - B. Vapor Barrier: Flexible, sandwich of heavy paper, reinforced fibers, and two layers of inert polyethylene, formed into one layer under heat and pressure. (Perm rating of 0.1)
 - C. Non-Shrink Grout: 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.

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- 2.4 JOINT DEVICES AND FILLER MATERIALS
- A. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt
 - B. Joint Filler: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95% if not compressed more than 50% of original thickness
 - C. Construction Joint Devices: Integral galvanized steel; formed to tongue and groove profile, with removable top strip exposing sealant trough, ribbed steel spikes with tongue to fit top screed edge.
 - D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric filler strip with a Shore A hardness of 35 to permit plus or minus 25% joint movement with full recovery; extruded aluminum cover plate, of longest manufactured length at each location, flush mounted; color as selected.
 - E. Sealant and Primer: Type, as specified in Section 07 92 00
 - F. Sealant: Cold applied
- 2.5 CONCRETE MIX
- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94/C94M
 - B. Select proportions for normal weight concrete in accordance with ACI 301 Method 3
 - C. Select aggregate proportions for lightweight concrete in accordance with ASTM C330
 - D. Use accelerating admixtures in cold weather only when approved by A/E
 - 1. Use of admixtures will not relax cold weather placement requirements.
 - E. Use set retarding admixtures during hot weather only when approved by A/E
 - F. Add air-entraining agent to normal weight concrete mix for work exposed to exterior

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Verify site conditions under provisions of Section 01 31 00.
 - B. Verify requirements for concrete cover over reinforcement.
 - C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- 3.2 PREPARATION
- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
 - B. In locations where doweling new concrete to existing work, drill holes in existing concrete; insert steel dowels and pack solid with non-shrink grout.
 - C. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.
 - D. Remove all foreign matter and water from forms or structural excavations.
- 3.3 FORMWORK
- A. Conform to ACI 347
 - B. Form foundations, earth forms not allowed, unless Engineer of record and the Soil's report can provide information to building official showing the soil conditions are conducive to earth forms.
- 3.4 PLACING CONCRETE
- A. Place concrete in accordance with ACI 301.
 - B. Notify A/E minimum 24 hours prior to commencement of operations
 - C. Ensure reinforcement, inserts, embedded parts, formed expansion, and contraction joints are not disturbed during concrete placement.
 - D. Treat for termites per section 31 31 16.
 - E. Install vapor retarder under interior slabs on grade, lap joints minimum 6", and seal watertight by taping edges and ends.
 - F. Repair vapor retarder damaged during placement of concrete reinforcing.
 - 1. Repair with vapor retarder material; lay over damaged areas minimum 6" and seal watertight.
 - G. Separate slabs on grade from vertical surfaces with joint filler.
 - H. Place joint filler in floor slab pattern placement sequence.
 - 1. Set top to required elevations.
 - 2. Secure to resist movement by wet concrete.
 - I. Extend joint filler from bottom of slab to within 1/4" of finished slab surface.
 - 1. Conform to Section 07 92 00 for finish joint sealer requirements.
 - J. Install joint devices in accordance with manufacturer's instructions.
 - K. Install construction joint devices in coordination with floor slab pattern placement sequence.
 - 1. Set top to required elevations.
 - 2. Secure to resist movement by wet concrete.
 - L. Install joint device anchors.
 - 1. Maintain correct position to allow joint cover to be flush with floor and wall finish.
 - M. Install joint covers in one-piece length, when adjacent construction activity is complete.

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- N. Apply sealants in joint devices in accordance with Section 07 92 00.
 - O. Maintain records of concrete placement.
 - 1. Record date, location, quantity, air temperature, and test samples taken.
 - P. Place concrete continuously between predetermined expansion, control, and construction joints.
 - Q. Do not interrupt successive placement; do not permit cold joints to occur.
 - R. Place floor slabs in checkerboard or saw cut pattern indicated.
 - S. Saw cut joints within 24 hours after placing.
 - 1. Use $\frac{3}{16}$ " thick blade, cut into $\frac{1}{4}$ depth of slab thickness.
 - T. Screed floors and slabs on grade level, maintaining surface flatness of maximum $\frac{1}{8}$ " in 10'.
- 3.5 CONCRETE FINISHING
- A. As specified in drawings
- 3.6 CURING AND PROTECTION
- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 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 in accordance with ACI 308.
 - D. Ponding: Maintain 100% coverage of water over floor slab areas continuously for 4 days.
 - E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
- 3.8 FIELD QUALITY CONTROL
- A. Architect, Owner, or Building Department may request field inspections as needed.
 - B. Provide free access to Work and cooperate with appointed firm.
 - C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
 - D. The Owner may perform tests of cement and aggregates to ensure conformance with specified requirements.
 - E. Take three concrete test cylinders for every 150 cu yards or less of each class of concrete placed.
 - F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - G. Take one slump test for each set of test cylinders taken.
- 3.9 PATCHING
- A. Contractor shall allow A/E to inspect concrete surfaces immediately upon removal of forms.
 - B. Excessive honeycomb or embedded debris in concrete is not acceptable; notify A/E upon discovery.
 - C. Patch imperfections in accordance with ACI 301.
- 3.10 DEFECTIVE CONCRETE
- A. Defective concrete is concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
 - B. A/E shall determine the repair or replacement of defective concrete.
 - C. Do not patch, fill, touch-up, repair or replace-exposed concrete except upon express direction of A/E for each individual area.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members, support members, sag-rods, and struts
- B. Base plates, shear stud connectors, and expansion joint plates
- C. Grouting under base plates

1.2 REFERENCES

- A. AISC - Code of Standard Practice for Steel Buildings and Bridges
- B. AISC - LRFD Manual of Steel Construction
- C. AISC – ASD/LRFD Steel Construction Manual
- D. AISC - Specifications for Structural Steel Buildings
- E. ASCE 7 - American Society of Civil Engineers – Wind Loads
- F. ASTM A36/A36M, Standard Specification for Carbon Structural Steel
- G. ASTM A53 Standard Specification for Pipe, Steel, Black and HotDipped, Zincoated Welded and Seamless
- H. ASTM A108 Standard Specification for Steel Bars, Carbon, and Alloy, ColdFinished
- I. ASTM A123/A123M Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
- J. ASTM A153/A153M Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
- K. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel.
- L. ASTM A307 Standard Specification for Carbon Steel and Studs, 60 000 PSI Tensile Strength
- M. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- N. ASTM A449 Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
- O. ASTM A490 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
- P. ASTM A500 Standard Specification for ColdFormed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
- Q. ASTM A501 Standard Specification for HotFormed Welded and Seamless Carbon Steel Structural Tubing.
- R. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
- S. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
- T. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts
- U. ASTM A568/A568M - Standard Specification for Steel, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled Sheet and Cold-Rolled Sheet, General Requirements for
- V. ASTM A992/A992M – Standard Specification for Structural Steel Building
- W. ANSI/AWS A2.4 Symbols for Welding, Brazing and Nondestructive Examination
- X. AWS D1.1/D1.1M Structural Welding Code
- Y. FM - Roof Assembly Classifications
- Z. SSPC (Steel Structures Painting Council) - Paint Manual
- AA. UL - Fire Resistance Directory
- BB. Texas Department of Insurance windstorm

1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 - Submittals Procedures
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.
 - 2. Connections
 - 3. Cambers and loads
 - 4. Indicate welded connections with AWS A2.4 welding symbols, along with net weld lengths.
 - 5. Indicate grade of steel.
 - 6. State of Texas Professional Engineer shall date, sign, and seal the required Shop Drawings.

1.4 SUBMITTALS FOR INFORMATION

- A. Section 01 33 00 - Submittals Procedures
- B. Manufacturer's Mill Certificate: Certify that Products meet or exceed specified requirements.
- C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.
- D. Welders' Certificates: Certify welders employed on the Work, verifying AWS qualifications within the previous 12-months.

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- 1.5 QUALITY ASSURANCE
- A. Fabricate structural steel members in accordance with AISC Code of Standard Practice.
 - B. Maintain one copy of each document on site.
 - C. Fabricator: Company specializing in performing the work of this section with minimum five years documented experience.
 - D. Erector: Company specializing in performing the work of this section with minimum 5-years documented experience.
 - E. State of Texas Professional Structural Engineer experienced in design of connection details shall design all connections not detailed on the plans from the Architect/Engineer of record.
- 1.6 REGULATORY REQUIREMENTS
- A. Structural steel design and construction shall comply with FBC, ASCE 7 – Wind loads, and American Institute of Steel Construction, AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings, 9th Edition."
 - B. Conform to UL, FM, and Warnock Hersey Assembly.
- 1.7 DELIVERY, STORAGE AND PROTECTION
- A. Section 01 60 00 - Materials Equipment and approved equals: Transport, handle, store and protect product

PART 2 - PRODUCTS

- 2.1 MATERIALS
- A. Structural Steel Members: ASTM A36 and A992/A992M, Grade 50
 - B. Structural Tubing: ASTM A500, Grade B. ASTM A501
 - C. Pipe: ASTM A53, Type E or S, Grade B
 - D. Shear Stud Connectors: ASTM A108, Grade 1015, headed, uncoated
 - E. Bolts, Nuts, and Washers: ASTM A307, A325 and A490 galvanized to ASTM A153/A153M for galvanized members
 - F. Anchor Bolts: ASTM A307 and A36
 - G. Welding Materials: AWS D1.1; type required for materials being welded
 - H. Sliding Bearing Plates: Teflon coated
 - I. Grout: Use non-shrink type, premixed compound consisting of nonmetallic aggregate, cement, water reducing, and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
 - J. Shop and TouchUp Primer: SSPC Paint 15, Type 1, provide a uniform dry film thickness of 1.5 mils
 - K. Touchup Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic
- 2.2 FABRICATION
- A. Continuously seal joined members by intermittent welds and plastic filler.
 - 1. Grind exposed welds smooth.
 - B. Fabricate connections for bolt, nut, and washer connectors.
 - C. Develop required camber of members.
- 2.3 FINISH
- A. Prepare structural component surfaces in accordance with SSPC SP2.
 - B. Shop prime structural steel members
 - 1. Do not prime surfaces receiving fireproofing or field welds.
 - 2. Do not prime surfaces in contact with concrete.
 - 3. Do not prime surface of high strength bolts.
 - C. Galvanize structural steel members to ASTM A123/A123M; provide minimum 1.25 oz/sq ft galvanized coating.
 - D. All structural or miscellaneous steel exposed to earth or weather shall be hot dipped galvanized (G90).
- 2.4 SOURCE QUALITY CONTROL AND TESTS
- A. Provide shop testing and analysis of structural steel sections.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions prior to beginning work
- 3.2 ERECTION
- A. Allow for erection loads, and sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
 - B. Field-weld components and shear studs indicated on shop drawings.

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- C. Field-connect members with threaded fasteners; torque to required resistance.
 - D. Do not field cut or alter structural members without approval of A/E.
 - E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
 - F. Grout under base plates. Trowel grouted surface smooth, splay neatly to 45°.
 - G. Provide nuts and lock washers for the connection of the kitchen hood hangers.
 - H. Do not hang ceilings, pipes, etc. from metal deck.
 - 1. Attach anchors to the top chord of steel truss/joist.
 - 2. Loads approved by structural engineer of record as shown on the structural drawings may be attached to the bottom cord of the truss or joist.
 - I. Provide protection of structural steel from corrosion – base plates, anchor angles embedded in concrete or soil.
 - J. Attach structural steel trusses to supports with either welds or bolts.
- 3.3 ERECTION TOLERANCES
- A. Maximum Variation From Plumb: ¼" per story, noncumulative
 - B. Maximum Offset from True Alignment: ¼"
- 3.4 FIELD QUALITY CONTROL
- A. The District may require field inspection, testing of bolt torque, welds and torque of fasteners.

END OF SECTION

**SECTION
051213**

**ARCHITECTURALLY EXPOSED STRUCTURAL STEEL
FRAMING**

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 architecturally exposed structural-steel framing.
 - 1. Requirements in Division 05 Section "Structural Steel Framing" also apply to AESS framing.

1.3 DEFINITIONS

- A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.
- B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.
- C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.
- D. Category 3 AESS: AESS above 20 feet (6 m) vertically and horizontally of a walking surface and is visible to a person standing on that walking surface

1.4 SUBMITTALS

- A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Indicate exposed surfaces and edges and surface preparation being used.
 - 6. Indicate special tolerances and erection requirements.
- B. Mock-ups: Provide mock-ups of small sections of AESS applications, showing quality of welding and finishing operations to be expected on the actual in-place construction.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

- 1.8 COORDINATION
- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: TBD

2.2 PRIMER

- A. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.
- D. Shop Primer for Galvanized Steel: Water-based galvanized metal primer complying with MPI#134.

2.3 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
- B. In addition to special care used to handle and fabricate AESS, comply with the following:
1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
 2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
 3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
 4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
 5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
 6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
 7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AES S.
 8. Fabricate Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
 9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AES S.
- C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.
1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet 6 m under any lighting conditions.
 2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.
- D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 1 AESS.
- E. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
 - 2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
 - 3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.
 - 4. Provide continuous welds of uniform size and profile where AESS is welded.
 - 5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch for Category 1 and Category 2 AESS.
 - 6. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch for Category 1 and Category 2 AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
 - 7. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
 - 8. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
 - 9. Make fillet welds for Category 1 and Category 2 AESS oversize and grind to uniform profile with smooth face and transition.
 - 10. Make fillet welds for Category 1 and Category 2 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.5 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - 3. Galvanize [lintels] [shelf angles] attached to structural-steel frame and located in exterior walls.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
 - 6. AESS related to residential buildings.
- B. Surface Preparation for Non-galvanized Steel: Clean all surfaces, including surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
 - 2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
 - 1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
 - 2. Erect Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
- B. Do not use thermal cutting during erection.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
 - 2. Orient bolt heads all in same direction.
- B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
 - 1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
 - 2. Remove erection bolts in Category 1 and Category 2 AESS, fill holes, and grind smooth.
 - 3. Fill weld access holes in Category 1 and Category 2 AESS and grind smooth.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Division 05 Section "Structural Steel Framing." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

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. Bicycle racks.
 - 2. Trash cans.
 - 3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Use performance requirements and design criteria indicated.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Pipe: ASTM A 53, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A 653, structural steel, Grade 33, with G90coating; 0.108-inch nominal thickness.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.
- G. Lag Screws: ASME B18.2.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.
- J. Lock Washers: Helical, spring type, ASME B18.21.
- K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- M. Post-Installed Anchors: chemical anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- F. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.
- 2.6 MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
 - B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
- 2.7 LOOSE BEARING AND LEVELING PLATES
- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 - B. Galvanize plates.
 - C. Prime plates with zinc-rich primer.
- 2.8 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Finish metal fabrications after assembly.
 - C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- 2.9 STEEL AND IRON FINISHES
- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
 - E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 - F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

- 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
 - B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- 3.3 INSTALLING BEARING AND LEVELING PLATES
- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
 - B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- 3.4 ADJUSTING AND CLEANING
- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 - B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
 - C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

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. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Plywood backing panels.

B. Related Requirements:

1. Section 061063 "Exterior Rough Carpentry" for elevated decks and other exterior construction made of wood.
2. Section 061323 "Heavy Timber Construction."
3. Section 061600 "Sheathing."
4. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
5. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

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- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire- test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when

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tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
 - C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
 - D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.
 - E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 - F. Application: Treat items indicated on Drawings, and the following:
 1. Framing for raised platforms.
 2. Concealed blocking.
 3. Roof construction.
 4. Plywood backing panels.
- 2.4 DIMENSION LUMBER FRAMING
- A. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 1. Application: Exposed exterior and interior framing indicated to receive a finish as specified on drawings.
 2. Species and Grade: As indicated above for load-bearing construction of same type.
 - B. Verify with structural engineer.
- 2.5 ENGINEERED WOOD PRODUCTS
- A. Engineered Wood Products, General: Products shall contain no urea formaldehyde.
 - B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
 - C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Boise Cascade Corporation.
 - b. Finnforest USA.
 - c. Georgia-Pacific.
 - d. Jager Building Systems Inc.
 - e. Louisiana-Pacific Corporation.
 - f. Pacific Woodtech Corporation.
 - g. Roseburg Forest Products Co.
 - h. Standard Structures Inc.
 - i. Stark Truss Company, Inc.
 - j. West Fraser Timber Co., Ltd.
 - k. Weyerhaeuser Company.
 - D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Louisiana-Pacific Corporation.
 - b. Weyerhaeuser Company.
- 2.6 MISCELLANEOUS LUMBER
- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
 - B. For items of dimension lumber size, provide Construction or No. 2 as indicated:
 - C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 - D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

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2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by 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. Simpson Strong-Tie Co., Inc.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.
- F. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32- mm-) wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.062 inch (1.6 mm).
- G. I-Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32- mm-) wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
 - 1. Thickness: 0.062 inch (1.6 mm).
- H. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: 2 inches (50 mm).
 - 2. Thickness: 0.062 inch (1.6 mm).
- I. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.
- J. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.
- K. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches (32 mm).
 - 2. Thickness: 0.062 inch (1.6 mm).
 - 3. Length: As indicated.
- L. Rafter Tie-Downs: As indicated.
- M. Rafter Tie-Downs (Hurricane or Seismic Ties): As indicated.
- N. Floor-to-Floor Ties: As indicated.
- O. Hold-Downs: As indicated.
- P. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch (14 mm) deep by 0.034 inch (0.85 mm) thick with hemmed edges.
- Q. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.
- R. Verify with structural engineer.

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2.09 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- D. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives shall 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."
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.
- F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- K. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPAM4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two- Family Dwellings.

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- N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
 - O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with indicated fastener patterns where applicable.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
- 3.2 WOOD, BLOCKING, AND NAILER INSTALLATION
- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
 - C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
 - D. Provide permanent grounds of dressed, pressure-preserved-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.
- 3.3 WOOD FURRING INSTALLATION
- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
 - B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63- mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.
 - C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38- mm actual-) size furring vertically at 16 inches (406 mm) o.c.
- 3.4 WALL AND PARTITION FRAMING INSTALLATION
- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide as indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
 - B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
 - C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4- inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
 - 2. For load-bearing walls, provide jambs as indicated.
- 3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION
- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19- by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.

- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
 - C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- (19- by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
 - D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.
- 3.6 TIMBER FRAMING INSTALLATION
- A. Install timber with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
 - B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch (13-mm) air space at sides and ends of wood members.
 - C. Install wood posts using metal anchors indicated.
 - D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.
- 3.7 PROTECTION
- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
 - B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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MISCELLANEOUS CARPENTRY

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. Wood blocking and nailers.
 2. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal 38 mm actual or greater but less than 5 inches nominal 114 mm actual in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. WCLIB: West Coast Lumber Inspection Bureau.
 3. WWPAA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 6. For adhesives, documentation including printed statement of VOC content.
 7. For composite wood products, documentation indicating that product contains no added formaldehyde.
- B. Sustainable Submittals:
1. Product Data for adhesives, documentation including printed statement of VOC content.
 2. Product Data for composite wood products, documentation indicating that product contains no urea formaldehyde.
 3. Product date indicating the location of manufacture and harvesting.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide No. 2 grade lumber and any of the following species:
 - 1. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 2 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

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2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. Table R602.3 (1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061516

WOOD ROOF DECKING

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes solid-sawn wood roof decking
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
- 1.3 QUALITY ASSURANCE

PART 2 - PRODUCTS

- 2.1 WOOD ROOF DECKING, GENERAL
 - A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- 2.2 SOLID-SAWN WOOD ROOF DECKING
 - A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.
 - B. Roof Decking Nominal Size: As indicated.
 - C. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.
 - D. Moisture Content: Provide wood roof decking with 19 percent maximum moisture content at time of dressing.
 - E. Face Surface: Rough sanded or wire brushed.
 - F. Edge Pattern: Square edge.
 - G. Verify with structural engineer
- 2.3 ACCESSORY MATERIALS
 - A. Fastener Material: Hot-dip galvanized steel.
 - B. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 079200 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Construction Chemicals - Construction Systems.
 - b. Bostik, Inc.
 - c. Pecora Corporation.
 - d. Tremco Incorporated.
 - 2. Sealants shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install solid-sawn wood roof decking to comply with AITC 112.
 - 1. Locate end joints for lay-up indicated.
- 3.2 PROTECTION
 - A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION

SECTION 062013

EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Exterior wood.
 - 2. Plywood soffits.
- 1.2 SUBMITTALS
 - A. Product Data: For each type of process and factory-fabricated product.
 - B. Samples: For each type of product involving selection of colors, profiles, or textures.
 - C. Compliance Certificates:
 - 1. For lumber that is not marked with grade stamp.
 - 2. For preservative-treated wood that is not marked with treatment-quality mark.
 - D. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.

PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
 - A.
 - B. Lumber: DOC PS 20.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - a. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
 - C. Softwood Plywood: DOC PS 1.
- 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS
 - A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 3. Application: All exterior lumber and plywood.
- 2.3 PLYWOOD SOFFITS
 - A. Plywood Type: Exterior, APA-rated siding.
 - B. Thickness: 3/4 inch.
 - C. Face Species: Pine.
 - D. Surface: Smooth.
- 2.4 MISCELLANEOUS MATERIALS
 - A. Fasteners for Exterior Finish Carpentry: Provide nails, staples or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 - 2. For applications not otherwise indicated, provide stainless-steel fasteners.
 - B. Insect Screening for Soffit Vents: Stainless steel, 18-by-18-inch mesh.
 - C. Continuous Soffit Vents: Aluminum hat channel shape with stamped louvers, 2 inches wide and in lengths not less than 96 inches.
 - 1. Net Free Area: 6 sq. in./linear ft..
 - 2. Finish: Mill finish.
 - D. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 079200 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.
- 2.5 FINISH
 - A. Exterior carpentry to be either stained and sealed, or sealed as directed by the Architect.

EXTERIOR FINISH
CARPENTRY

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

END OF SECTION

SECTION 074113

METAL ROOF PANELS

PART 1 - GENERAL

- .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.
- .2 SUMMARY
 - A. Section Includes:
 1. R metal roof panels including flashings and accessories
- .3 DEFINITIONS
 - A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.
 - B. See ASTM D 1079 and glossary of NRCA'S "The NRCA Roofing and Waterproofing Manual" for definition of terms related to metal roofing work in this Section.
 - C. Roofing System Manufacturer: Any of the manufactures whose systems are specified under "Acceptable Roofing System Manufacturers", herein called "manufacturer".
- .4 PERFORMANCE REQUIREMENTS
 - A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 1. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft.
 2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
 - E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
 - F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.
 - G. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592-95:
 1. Varies with building height as per IBC 2012 & the latest edition of ASCE - 7 based up a 130 MPH wind speed.
 2. Design Wind Loads: As indicated on structural drawings or as otherwise determined using design wind loads applicable to Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure."
 3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than L/240 of the span.
 - H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - I. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.
 - J. Energy Performance: Provide roof panels with solar reflectance index not less than 29 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- .5 SUBMITTALS
 - A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.
 - B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:1:10:
 - Flashing and trim.
 - C. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
 - D. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional

- engineer responsible for their preparation.
- E. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
 - F. Qualification Data: For qualified Installer.
 - G. Field quality-control reports.
 - H. Warranties: Samples of special warranties.
- .6 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
 - C. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.
 - D. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - 2. Combustion Characteristics: ASTM E 136.
- .7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
 - B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
 - D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.
- .8 PROJECT CONDITIONS
- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.
 - B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.
- .9 COORDINATION
- B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, purlins and rafters, parapets, walls, and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.
- 10 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - Structural failures including rupturing, cracking, or puncturing.
 - Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
 - B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
 - C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Weathertight Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

- .1 PANEL MATERIALS
- A. Metallic-Coated Steel Sheet: 24 gauge (min.) G-90 (ASTM-A525) Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or

polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil/0.013 mm.

a. Color: As selected by Architect from manufacturer's full range.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: 7/8 inch.

C. Cold-Rolled Furring Channels: Minimum 1/2-inch- wide flange.

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: 3/4 inch.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
4. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

D. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements.

E. Stainless Steel Fasteners for Miscellaneous Metal Framing: Of type, size, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

.4 MISCELLANEOUS MATERIALS

A. Stainless Steel Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

.5 R PANEL METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Manufacturers: Subject to compliance with requirements, Roof Panel, by Building Components, INC, (Contact: 11919 N Garden, Houston, TX 77071 (800-417-0224).

2. Panel Coverage: 36 inches.
3. Panel Height: 1.25 inches.

.6 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, pre-painted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

.7 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise

from movements within panel assembly.

- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- C. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- D. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

.3 METAL ROOF PANEL INSTALLATION, GENERAL

- A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
- B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
 - 1. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
- C. Install metal roof panels as follows:
 - 1. Commence metal roof panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
 - 2. Field cutting of metal panels by torch is not permitted.
 - 3. Install panels perpendicular to purlins.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Provide metal closures at rake edges rake walls and each side of ridge caps.
 - 6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
 - 7. Install ridge caps as metal roof panel work proceeds.
 - 8. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
 - 9. Install metal flashing to allow moisture to run over and off metal roof panels.
- D. Fasteners:
 - 1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and stainless-steel fasteners for surfaces exposed to the interior.
- E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt

underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
 - G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
 1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- .4 METAL ROOF PANEL INSTALLATION
- A. R Panel Roof Panels: Fasten metal roof panels with fasteners recommended by manufacturer.
- .5 ACCESSORY INSTALLATION
- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- .7 ERECTION TOLERANCES
- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- .8 FIELD QUALITY CONTROL
- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
 - B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
 - C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- .9 CLEANING
- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
 - B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures per manufacturer's requirements.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES

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. Roof-edge flashings.
 - 2. Roof-edge drainage systems.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install copings roof-edge flashings tested according to SPRI ES-1 and capable of resisting pressure as required by code.
 - 1. Design Wind Speed: As indicated on the Structural Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 2. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Retain first paragraph below for Work that involves custom fabrication or if manufacturer's product data are inadequate.
- C. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for roof edge flashings.
- G. Maintenance Data: For roofing specialties to include in maintenance manuals.
- H. Installer Qualifications: Submit evidence that Installer's existing company has minimum of 5-years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:
 - 1. Project name.
 - 2. Owner's name.
 - 3. Owner's Representative name, address, and telephone number.
 - 4. Description of work.
 - 5. Sheet metal members installed.
 - 6. Project supervisor.
 - 7. Total cost of sheet metal work and total cost of project.
 - 8. Completion date

- 1.5 **QUALITY ASSURANCE**
- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge flashing, including gutter and downspout , approximately 10 feet long, including supporting construction, seams, attachments, underlayment, and accessories.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - B. Pre-installation Meeting
 - 1. Conduct meeting at Project site.
 - 2. Review requirements for sheet metal Work, including:
 - a. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Site use, access, staging, and set-up location limitations.
 - c. Approved mockup procedures.
 - d. Forecast weather conditions.
 - e. Surface preparation and substrate condition and pretreatment.
 - f. Installation procedures.
 - g. Special details.
 - h. Testing and inspection requirements.
 - i. Site protection measures.
 - j. Governing regulations if applicable.
 - 3. Contractor's site foreman, waterproofing manufacturer's technical representative, waterproofing Installer, sheet metal fabricator, sheet metal Installer, Owner's Representative, and Architect/ Engineer shall attend.
- 1.6 **DELIVERY, STORAGE, AND HANDLING**
- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
 - B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.
- 1.7 **WARRANTY**
- A. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 **EXPOSED METALS**
- A. Aluminum .050" thickness Z275.
 - 1. Surface: Smooth, flat finish.
 - 2. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- 2.2 **CONCEALED METALS**
- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 Z275 coating designation.
- 2.3 **UNDERLAYMENT MATERIALS**
- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.

- 2.4 MISCELLANEOUS MATERIALS
- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
 - B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
 - D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- 2.5 ROOF-EDGE FLASHINGS
- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hickman Company, W. P.
 - b. Johns Manville.
 - c. Metal-Fab Manufacturing, LLC.
 - 2. Fascia Cover: Fabricated from the following exposed metal:
 - a. Aluminum: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high-performance organic finish, thermo-cured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2604. .
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Fascia Accessories: Fascia extenders with continuous hold-down cleats Soffit trim.
- 2.6 ROOF-EDGE DRAINAGE SYSTEMS
- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Fabricate from the following exposed metal:
 - a. Aluminum: Conforming to ASTM B202-92a (UNS Alloy Designation A93003-H14 or A933004-H34), .050" minimum thickness. Exposed aluminum sheet metal shall have a high-performance organic finish, thermocured and containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2604. .
 - 2. Gutter Profile: As indicated.
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
 - 5. Gutter Accessories: Continuous screened leaf guard with sheet metal frame.
 - 6. Scupper Profile: As indicated.
- 2.7 GENERAL FINISH REQUIREMENTS
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
 - B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
 - C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - D. Proceed with installation only after unsatisfactory conditions have been corrected.

- 3.2 UNDERLAYMENT INSTALLATION
- A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under copper sheet metals roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- 3.3 INSTALLATION, GENERAL
- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
 - B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
 - C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.
 - F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- 3.4 ROOF-EDGE FLASHING INSTALLATION
- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
 - B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
- 3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION
- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
 - B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
 - 2. Install continuous leaf guards on gutters with non-corrosive fasteners, removable for cleaning gutters.
- 3.6 INSTALLATION OF SEALANT MATERIALS
- A. All surfaces to receive the joint sealants shall be examined by the contractor. Any surfaces, which are found to be unsuitable for installation of the joint sealants, shall be brought to the attention of the Architect for resolution. Application or installation of the material constitutes acceptance of the surface of the substrate.

- B. All surfaces to receive sealants shall be clean, dry, and free of any loose materials, dirt, dust, laitance, rust, oil, frost, and other contaminants.
 - 1. The surfaces shall be blast cleaned with oil free compressed air to remove the dust of cleaning.
 - 2. The surfaces shall be cleaned with sealant manufacturer's approved solvents.
- C. Use appropriate primers on concrete, masonry and metal surfaces to receive joint sealants in accordance with the recommendations of the sealant manufacturer.
- D. The contractor shall make test applications at the beginning of the sealant work, in all types of prepared joints or surface applications, to determine if preparation steps have been adequate for optimum sealant adhesion. These test applications will be reviewed by the Architect prior to the start of the work.
- E. Install all materials in accordance with the manufacturer's printed instructions, as well as the following:
 - 1. Install bond breakers and backer rods in locations and of the type recommended by the sealant manufacturer to prevent bond of sealant to surfaces where such bond might impair the performance of the sealant. Backer rods shall typically be installed under 25% compression of rod material unless otherwise recommended by sealant manufacturer.
 - 2. Application of joint sealant materials shall be made by cartridge-type caulking guns.
 - 3. Compounds shall not be installed when surface and ambient temperatures are below 40oF unless specifically approved by the Architect. Compounds also shall not be installed when surface and ambient temperatures are above 100° F.
 - 4. Run sealant beads sufficiently slow enough to be certain that the entire cavity is filled from bottom up. Air pockets or voids along the edges are not acceptable.
 - 5. Tool sealant surfaces to the shapes shown, or if none is shown, to flush or slightly concave surface. Tooling of sealants with soap, detergent or other lubricant is not allowed.
- F. All surfaces adjacent to sealants shall be protected, unless otherwise approved by the Architect. Use pressure sensitive tape to prevent staining of adjacent surfaces, or spillage and migration of sealant out of the joints.
- G. Do not place dissimilar sealant materials in contact with each other. Follow sealant manufacturer's recommendations for separation of dissimilar materials.
- H. All sealant material to be covered shall be allowed to fully cure in accordance with manufacturer's recommendations

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 079200

JOINT SEALANTS

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. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Preformed joint sealants.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than three pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Sustainable Submittal:
 - 1. Product data for sealants and sealant primers, including printed statement of VOC content.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- F. Field-Adhesion Test Reports: For each sealant application tested.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

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4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion for silicone sealants.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant (S-GP): ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 795.
 - c. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
 - d. Pecora Corporation; 864.
- B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant (S-S): ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.

- 2.3 URETHANE JOINT SEALANTS
- A. Multi-component, Non-sag, Urethane Joint Sealant (U-MC): ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol II.
 - b. Polymeric Systems, Inc.; PSI-270.
 - c. Tremco Incorporated.
- B. Multi-component, Self-Leveling, Traffic-Grade, Urethane Joint Sealant (U-TB): ASTM C 920, Type M, Grade SL, Class 50, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polymeric Systems, Inc.; PSI-270.
 - b. Tremco Incorporated; Dymeric 240 FC.
 - c. Pecora; Dynatread.
- 2.4 LATEX JOINT SEALANTS
- A. Latex Joint Sealant (AL): Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. May National Associates, Inc.
 - d. Pecora Corporation; AC-20+.
 - e. Tremco Incorporated; Tremflex 834.
- 2.6 MISCELLANEOUS MATERIALS
- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
- D. Backer Rod:
1. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing
 2. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance
 3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- F. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

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- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 - 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Sealant Schedule:
 - 1. Exterior locations:
 - a. Joints and perimeter of penetrations in horizontal pedestrian and vehicle traffic surfaces: Designation U-TB.
 - b. Joints in Division 07 Section 07 "Sheet Metal Flashing and Trim." Designation S-GP.

END OF SECTION

SECTION 099100

PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.
- B. Section Includes:
 - 1. Complete exterior surface preparation and finishing for field application of latex based coatings.
 - 2. Examine specifications for various other trades and their provisions regarding their painting. Surfaces that are left unfinished by other sections of the specifications shall be painted or finished as a part of this Section.
 - 3. Colors, including deep tones, will be selected by the Architect. Number of colors to be used on job will be determined by Architect.

1.2 SURFACES NOT TO RECEIVE FIELD FINISHING

- A. Do not paint copper, bronze, chrome plated items, nickel, stainless steel, Monel metal, lead, face brick, prefinished wall, ceiling, and floor coverings, items with factory applied final finish (except where exposed on roofs and in finished spaces), elevator shafts, crawl spaces, chases, and plenums above suspended ceilings unless otherwise specified or scheduled.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.4 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years experience.
- B. Applicator: Company specializing in commercial painting and finishing with 2 years experience.
- C. Product Labels: Include manufacturer's name, type of paint, stock number, color and label analysis on label of containers.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for flame spread/fuel contribution/smoke development rating requirements for finishes.
- B. Comply with applicable city, county, state, and federal requirements and ordinances regarding maximum VOC (Volatile Organic Compound) content of all coatings.

1.6 TESTS

- A. Provide periodic testing with Wet Film Thickness gage to verify that proper thickness of finish coatings are being applied.

1.7 SUBMITTALS

- A. Submit product data as requested.
- B. Provide product data describing physical performance criteria and composition on all finishing products.
- C. Submit color selection samples as requested.
- D. Submit 2 samples, 12 by 12 inches in size illustrating range of colors and textures selected for each surface finishing product scheduled.
- E. Submit manufacturer's application instructions as requested.
- F. Submit certification from manufacturer of coatings listing all products proposed for each. Certify that each product meets current applicable regulations and ordinances regarding maximum VOC content.

1.8 FIELD SAMPLES

- A. Provide field samples as requested.
- B. Provide field sample panel, 96 inches long by 96 inches wide, illustrating each coating color, texture, and finish intended for use.
- C. Locate where directed.
- D. Accepted sample may remain as part of the Work.

- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to site under provisions of Section 016000.
 - B. Store and protect products under provisions of Section 016000.
 - C. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
 - D. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
 - E. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
 - F. Take precautionary measures to prevent fire hazards and spontaneous combustion.
- 1.10 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply materials when surface and ambient temperatures are outside the ranges required by paint manufacturer.
 - B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
 - C. Do not apply exterior coatings during rain or snow, or when relative humidity is above 75 percent, unless required otherwise by manufacturer's instructions.
 - D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
 - E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
 - F. Provide lighting level of 80 ft candles measured mid- height at substrate surface.
- 1.11 EXTRA STOCK
- A. Provide a 5 gallon container of each color to Owner.
 - B. Label each container with color, color number, texture, and room locations, in addition to the manufacturer's label.
 - C. Furnish under provisions of Section 017800.
- 1.12 SCAFFOLDS AND PROTECTION
- A. Provide adequate safe ladders, scaffolds, and stages necessary to complete work.
 - B. Protect completed finish and paint work, and protect adjacent finish surfaces from paint splatter, spills and stains. Use adequate drop cloths and masking procedures during progress of work.
- 1.13 PRECAUTIONS
- A. Do not store paints, oils, thinners and other flammable items inside the building and shall be stored in approved containers when not in actual use during the painting job. The fire hazard shall be kept at a minimum.
 - B. Precaution shall be taken to protect the public and construction workers during the progress of the work.
 - C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 1. Sherwin-Williams.
 2. P.P.G. Industries.
 3. ICI Dulux.
 4. Benjamin Moore.
 5. Kelley Moore.
 6. Glidden Professional.
 - B. Materials selected for coating systems for each type surface shall be product of a single manufacturer unless otherwise specified. Secondary products such as linseed oil, turpentine and shellacs shall be first quality products of a reputable manufacturer.
- 2.2 MATERIALS
- A. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.
 - B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
 - C. Patching Materials: Latex filler.

PAINTING

- 2.3 FINISHES
A. Color and Sheen: As scheduled, or as selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Architect any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums
1. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.
- D. Test shop applied primers for compatibility with subsequent cover materials.
- E. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

- A. Correct minor defects and clean surfaces which affect work of this Section. Remove existing coatings which exhibit loose surface defects.
- B. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- C. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- D. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- E. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- F. Exterior Wood Scheduled to receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- G. Shop Finished Items: Finish in accordance with AWI standards and guide lines.

3.3 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.4 APPLICATION

- A. The intent of these Specifications is to produce the highest quality appearance of paint and finish surfaces. Employ skilled mechanics only. The proper preparation of all surfaces will be strictly enforced and wherever finished surfaces show any defects due to improper preparation, workmanship, etc., the defects shall be removed and the work refinished at the expense of the Contractor.
- B. Apply products in accordance with manufacturer's instructions. Final finish coats shall have visual evidence of solid hiding and uniform appearance, and shall be free and smooth of brush marks, streaks, sags, runs, laps, or skipped areas.
- C. Do not apply finishes to surfaces that are not dry.
- D. Apply each coat to uniform finish and thickness.
- E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand lightly between coats on wood and metal items to achieve required finish.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime back surfaces of exterior woodwork scheduled to be painted with primer paint.
- J. Edges of paint adjoining other materials or colors shall be sharp and clean with no overlapping.

3.5 CLEANING/TOUCH-UP

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- D. Spot painting will be allowed to correct soiled or damaged paint surfaces only when touch-up spot will blend into surrounding finish and is invisible to normal viewing (as determined by the Architect). Otherwise, re-coat entire section to corners or to a visible stopping point.

3.6 V.O.C. (VOLATILE ORGANIC COMPOUND) COMPLIANCE

- A. Products listed in following schedule and/or substitutes proposed for use by Contractor must be formulated to meet all applicable ordinances and regulations regarding maximum V.O.C. content. Utilize products which have been specially formulated to need such requirements.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents: Provisions established in Conditions of the Contract, Division 01 - General Requirements, and the Drawings are collectively applicable to this Section.
- B. Section Includes
 - 1. Identifying devices where shown on the Drawings complete and as specified including the following:
 - a. Directional and traffic signs.
 - 2. Coordination for installation of signage provided by others.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- B. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, accessories, layout, and installation details.
- C. Samples for Verification:
 - 1. Physical: Submit samples of one completed sign for review and approval. Approved sample may be incorporated into Project.
 - 2. Color: Submit manufacturer's standard color selection chart. Do not proceed until colors have been selected.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.
- B. Manufacturer shall have a minimum of five years experience in the manufacturing of signs specified.
- C. Codes and Standards: City of Brownsville standards

PART 2 - PRODUCTS

2.1 DIRECTIONAL SIGNS

- A. Screen Printed Signs:
 - 1. Extruded aluminum panels with anodic finish and white screen printed copy.
 - 2. Size and Configuration: As indicated on Drawings.
 - 3. Copy: As indicated on Drawings.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

- A. Deliver and store identifying devices in protective wrappings until ready for installation. Install letters in protective wrappings and remove wrappings just prior to substantial completion.

3.2 INSTALLATION

- A. Install signs plumb, level and square and in proper planes with other work, at heights required by accessibility codes and standards.
- D. Attach as recommended by sign manufacturer.

3.3 EXTERIOR INSTALLATION - DIRECTIONAL SIGNS A. Mount posts in 12 inch round by 2'-6" deep concrete footing.

3.4 DAMAGE

- A. Any identifying device which is scratched or defaced will be rejected.

3.5 CLEANING

- A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION

SIGNAGE

SECTION 313116

TERMITE CONTROL

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. Soil treatment with termiticide.

1.3 SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.
- B. Qualification Data: For qualified Installer.
- C. Product Certificates: For termite control products, from manufacturer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.6 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dagnet FT Prevail.
 - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

2.2 METAL MESH BARRIER SYSTEM

- A. Stainless-Steel Mesh: 0.025-by-0.018-inch mesh of 0.08-inch- diameter, stainless-steel wire, Type 316.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following: Termimesh USA Inc.

TERMITE
CONTROL

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.5 INSTALLING METAL MESH BARRIER SYSTEM

- A. Install metal mesh barrier system to provide a continuous barrier to entry of subterranean termites, according to manufacturer's written instructions.
 - 1. Fit mesh tightly around pipes and other penetrations and terminate at deck and framing perimeters.
 - 2. Install mesh under the perimeter of deck edges and joints.

END OF SECTION

SECTION 316329

DRILLED PIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings, Bidding Requirements, Contract Forms, Conditions of the Contract and Division 1 - General Requirements apply to the work of this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all labor, materials, services, equipment and appliances required in conjunction with drilled pier foundations complete, including, but not limited to the following:
 - 1. Layout of drilled piers.
 - 2. Excavation of drilled piers.
 - 3. Temporary steel casings - if required.
 - 4. Furnishing and placing reinforcing steel.
 - 5. Furnishing steel dowels into supported members.
 - 6. Furnishing and placing concrete.
 - 7. Removal of spoil (excavated material) resulting from drilled pier excavations.
- B. The extent of drilled piers is shown on the drawings, including locations, diameters of shafts, elevation of top of bearing stratum for bidding purposes, top of pier elevations, reinforcement, and details of construction.
- C. Related work specified in other sections:
 - 1. Testing Laboratory Services: Section 01 41 00.
 - 2. Concrete Reinforcement: Section 03 20 00.
 - 3. Cast-in-Place Concrete: Section 03 30 00.

1.3 PIER DRILLER QUALIFICATIONS

- A. Pier drilling contractor shall be required to submit proof of qualifications requirements including: A. Minimum of 5 previous projects of similar scope and nature or larger.
- B. Verify having been in business for a minimum of three years.

1.4 DUTIES OF OTHER PERSONS OR AGENCIES

- A. Structural Engineer: The Structural Engineer must approve, in writing, any changes in pier construction which involve or require changes in structural design of elements above the piers, or any changes in foundation dimensions or type which may be recommended by the Geotechnical Engineer. The Structural Engineer shall furnish to the Contractor, as promptly as practical after receipt of data on deviations from these Specifications, designs for such supplementary construction and/or reconstruction as may, in the Structural Engineer's judgment, be necessary.
- B. Foundation Inspector: The Foundation Inspector (s) shall keep field notes of all pay items completed each day, of all advisories or recommendations to the Owner, and of job and weather conditions; and shall keep a log of each pier hole drilled, recording soil or rock strata, water entry and flow, caving, sloughing, squeezing ground, drilling difficulties, casing insertion, bottom clean-out and water removal, depth and size of hole, details of rebar placement and centering, concreting, casing withdrawal (including casing abandoned or casing left in place under the Contract), and any other construction details covered in his instructions. He shall submit a report of these observations at the end of the day. He shall check the Contractor's pier logs and daily summary of pay items completed against his own records, and shall indicate his approval by initialing these records. His inspection reports shall be transmitted daily by a means that assures their reaching the Geotechnical Engineer at the beginning of the following work day, and any advisories that record unsatisfactory construction practices or rejected work shall be reported to the Geotechnical Engineer by the Foundation Inspector (s), by personal contact or by telephone, immediately. The Foundation Inspector (s) shall check as-drilled and as-built pier locations by direct measurement from batter boards furnished and preserved by the Contractor
- C. A Concrete Inspection Agency shall be designated as the agency for testing concrete delivered to the site and placed in the foundations. Refer to Section 03 30 00 - Cast -in-place Concrete, for required testing.

1.5 QUALITY ASSURANCE

- A. Testing laboratory services:
 - 1. Refer to section 01 41 00 for additional information concerning laboratory services in conjunction with drilled pier work.
 - 2. The contractor shall engage and pay for the services of a recognized independent testing agency to design the concrete mix in conjunction with drilled piers. Refer to Section 03 30 00.

DRILLED
PIERS

- B. Drilling Log:
Keep an exact log of each pier regardless of soil conditions indicating:
1. Pier number.
 2. Pier location.
 3. Depth drilled through overburden.
 4. Depth drilled in bearing stratum.
 5. Elevation of ground surface.
 6. Top elevation of concrete.
 7. Top elevation and length of casing.
 8. Diameter of shaft.
 9. Diameter and type of bell (if bells are required).
 10. Estimated inflow of water, source, and depth in bottom of hole when concrete is placed.
 11. Description of bearing stratum.
 12. Pumping required.
 13. Number and size of vertical reinforcing bars.
 14. Size and spacing of transverse reinforcing bars (loops or spirals).
 15. Number and size of steel dowels into supported members.
- C. Allowable Tolerances:
1. The piers shall be installed as indicated on the Drawings and in accordance with these Specifications. No pier shall be off center from its design locations more than 2" at the top of the pier. No vertical pier shall be out of plumb more than 1% of its length. All piers and shafts shall be at least as large in diameter as indicated on the Drawings.
 2. If any of the above tolerances are exceeded, additional construction (including costs of engineering and redesign) as required by the Structural Engineer shall be paid for by the Contractor.
- 1.6 JOB CONDITIONS
- A. Scheduling:
1. Schedule pier drilling so that piers will be filled with concrete immediately after drilling.
 2. Fill each pier with concrete the same day it is drilled.

PART 2 - PRODUCTS

2.1 DRILLING EQUIPMENT

The equipment used shall be adequate to drill the sizes indicated to depths necessary for a stable foundation, giving consideration to subsurface conditions reported by the Geotechnical Investigation.

2.2 MATERIALS

- A. Concrete Reinforcement: As specified in Section 03 20 00.
- B. Cement, Aggregates and Admixtures: As specified in Section 03 30 00.

2.3 MIXES

- A. As specified in Section 03 30 00.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. It is not the intent of these Specifications to unnecessarily restrict the Contractor in his construction methods, techniques or equipment.
- B. If the construction procedures used are observed to cause loss of ground or produce other conditions detrimental to the construction or to other property or structures, the Contractor shall be required to use other and more appropriate procedures or to demonstrate that by changing some aspect of the procedure in question he can complete the construction safely and without the objectionable effects.
- C. The Contractor shall correct, at his own expense, any subsidence, structural damage, or other objectionable conditions caused by his operations

3.2 DRILLING

- A. Drill piers with power auger foundation drilling rig designed for that purpose. Drill piers vertically, to diameters shown on drawings.
- B. If caving or substantial amounts of ground water are encountered, use casings, if required, to prevent caving and exclude water.

3.3 PROTECTIVE CASING

- A. Protective steel casing, at least as large in inside diameter as the nominal shaft size and of sufficient wall thickness to resist crushing by hydrostatic and earth pressures, shall be installed in each pier hole when needed, in the judgement of the Foundation Inspector (s), to prevent caving or fall-in.

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PIERS

- B. Casing left in place at the decision of the Structural Engineer is pay item; that left in place by the Contractor without approval by the Structural Engineer is not a pay item. Any casing found to be crushed or deformed by earth or water pressure shall be removed and replaced by suitable casing of heavier weight, which shall be left permanently in place as a pay item, but the crushed or deformed casing shall not be a pay item.
 - C. The decision as to whether or not protective casing will be left in place permanently shall be made by the Structural Engineer.
- 3.4 CASING REMOVAL
- A. An initial "jerk" of 2" to 4" shall be allowed to start the lift; thereafter, while being removed from the pier hole, the casing must be kept plumb and must be pulled with a smooth, vertical motion (no rotation permitted), without jerks. Vibration of the casing during pulling is not approved. A positive head of not less than 3' of concrete above the pressure at the bottom of the casing from the outside water table shall be established before the casing is lifted, and shall be maintained as the casing is pulled out.
 - B. Where cutoff elevation is below ground level, the Contractor shall be required to maintain protective casing to the ground surface if necessary to prevent detrimental caving or intrusion of shallow soils into the shaft.
 - C. Dowels shall be placed and positioned after the casing has been pulled and the top surface of the concrete has been established
- 3.5 WATER IN THE EXCAVATION
- Any water above an average depth of 2" above the bottom of the excavation shall be pumped or removed before placement of concrete shall be permitted. In cases where water cannot be held below this level long enough for concrete to be placed in the normal manner, the Contractor may, with the approval of the Geotechnical Engineer, place concrete by one of the following methods:
- A. Use of a submersible pump in the bottom of a straight hole or in a sump excavated in the bottom of a bell, with concrete being placed to cover the intake pipe before the pump is lifted.
 - B. Use of a tremie pipe of "elephant's trunk".
 - C. Use of pumped-in concrete discharging through a pipe below the water and below the surface of the concrete in the hole.
- 3.6 OBSTRUCTIONS
- For the purpose of this Contract, an obstruction shall be defined as any rock, cobble or other object that cannot be removed or drilled through by normal procedures and tools.
- 3.7 PLACING REINFORCING STEEL AND CONCRETE
- A. Do not place steel or concrete until pier holes have been inspected and approved by the Foundation Inspector.
 - B. Reinforcing steel shall be installed as indicated on the Drawings. All steel shall be free from excessive rust, mud or any foreign material which would hinder bonding of concrete and steel. Reinforcement cages shall be straight and shall conform to the design dimensions. Adequate provision shall be made to ensure that the reinforcement steel will remain in place throughout placement of concrete and that specified concrete cover for the reinforcement steel is attained and maintained. The use of precast concrete spacer blocks or "Centraligner" pier sleds by Pieresearch, Arlington, TX (or equal) is recommended for this purpose. As a minimum, provide 4-#5 x 3'-0" long vertical steel dowels into supported members, unless otherwise noted. Dowels to be bent bars if necessary due to space constrains.
 - C. Promptly after approval of the excavated pier hole has been given by the Foundation Inspector, concrete shall be placed in a manner that will not cause segregation of the particles or permit infiltration of water or any other occurrence which would tend to decrease the strength of the concrete or the capacity of the finished pier. No concrete shall be placed in a drilled pier excavation unless the Concrete Inspector and the Geotechnical Engineer or the Foundation Inspector are present.
 - D. Concrete may be placed in a dry hole by dumping in free-drop from the surface, provided that a hopper or other device approved by the Testing Laboratory is used to force the concrete to drop straight down without hitting the sides of the holes or the reinforcement before striking the bottom.
 - E. Concrete shall be placed continuously for the entire depth of the pier. In case placement has to be interrupted for any reason, the surface shall be roughened and cleaned to assure bond.
 - F. Concrete placed in drilled pier excavations shall be taken to prevent over vibration.
 - G. Maintain min. 3" clearance between bottom of excavation and reinforcement.
- 3.8 DISPOSAL OF SPOIL
- All material removed from pier holes shall be removed from the ground around the pier before concrete placement is started and later disposed of off-site. The Contractor shall be responsible for avoidance and cleanup of street spillage to the satisfaction of the local authorities.

DRILLED
PIERS

3.9 METHOD OF PAYMENT

The Proposal shall include a Base Bid for drilling piers to the depths indicated on the Drawings. The Proposal shall include unit prices per foot including drilling, reinforcing, concrete, and all related work for depths greater or less than those indicated. Adjustment of the Contract price shall be made on the basis of the cumulative total of the greater and lesser depths required multiplied by the 1 unit price for each size (either extra or credit) as applicable.

END OF SECTION

**SECTION
321313**

**CONCRETE
PAVING**

PART 1 - GENERAL

- 1.1 SUMMARY
- A. Section Includes Concrete Paving Including the Following:
1. Walks
 2. Hike and bike Trail
- 1.2 ACTION SUBMITTALS
- A. Product Data: For each type of product.
- B. Samples: For each type of product, ingredient, or admixture requiring color selection.
- C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- 1.3 QUALITY ASSURANCE
- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- 1.4 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

PART 2 - PRODUCTS

- 2.1 CONCRETE, GENERAL
- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
- 2.2 STEEL REINFORCEMENT
- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- C. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.
- 2.3 CONCRETE MATERIALS
- A. Regional Materials: Concrete shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I.
 2. Fly Ash: ASTM C 618, Class C or Class F.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Water: Potable and complying with ASTM C 94/C 94M.
- 2.4 CURING MATERIALS
- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing

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approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
 - 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. BASF Construction Chemicals - Construction Systems.
 - b. Sika Corporation.
 - c. W.R. Meadows, Inc.

2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent.
- D. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Maximum W/C Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
 - 4. Solar Reflectance Index: Not less than 29.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces

perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-third of the concrete thickness:
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- B. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:
 - 1. Elevation: 1/2 inch (12 mm).
 - 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long; unlevelled straightedge not to exceed 1/2 inch (13 mm).
 - 4. Joint Spacing: 2 inches (50 mm).
 - 5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - 6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.10 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

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- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections

END OF
SECTION

SECTION 321316
DECORATIVE CONCRETE PAVING

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 colored stamped and stained concrete paving.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.
- C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.
- D. Other Action Submittals:
 - 1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- E. Qualification Data: For qualified ready-mix concrete manufacturer.
- F. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- G. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.
- E. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- F. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- G. 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 mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
 - 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less.
- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615, Grade 60; deformed.
- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length, with ends square and free of burrs.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type I.
 - a. Fly Ash: ASTM C 618, Class C or F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C 94.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A, colored.
- F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, non-fading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. QC Construction Products.
 - c. Scofield, L. M. Company.
 - d. Solomon Colors, Inc.

2.4 SURFACE COLORING MATERIALS

- A. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, non-fading mineral oxides interground with cement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation; Quartz Tuff.
 - b. Euclid Chemical Company (The), an RPM company; Surfex.
 - c. L&M Construction Chemicals, Inc.; QUARTZPLATE FF.
 - d. QC Construction Products; QC Color Hardener.
 - e. Scofield, L. M. Company; LITHOCHROME Color Hardener.
- B. Pigmented Powder Release Agent: Factory-packaged, dry combination of surface-conditioning and dispersing agents interground with color pigments that facilitates release of stamp mats. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

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- a. Bomanite Corporation; Release Agent.
- b. QC Construction Products; QC Release Powder I.
- c. Scofield, L. M. Company; LITHOCHROME Antiquing Release.

2.5 STAMPING DEVICES

- A. As specified

2.6 STAIN MATERIALS

- A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bomanite Corporation; Chemical Stain.
 - b. H&C Concrete Care Products; Infusion Reactive Concrete Stain.
 - c. QC Construction Products; QC Patina Stain.
 - d. Scofield, L. M. Company; Lithochrome Chemstain Classic.

2.7 CURING AND SEALING MATERIALS

- A. Curing Paper: Non-staining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.
- B. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.
 - 1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
 - 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
- C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.
- D. Clear Acrylic Sealer: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 15 percent solids by volume.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bomanite Corporation; Bomanite Hydrocoat.
 - b. H&C Concrete Care Products; Shield-Crete Clear Glaze.
 - c. QC Construction Products; QC VOC 100 WB.
 - d. Scofield, L. M. Company; CEMENTONE Clear Sealer.

2.8 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4500 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete as required for placement and workability.
- F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 requirements as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.
 - 2. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

- 2.10 CONCRETE MIXING
- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
 - B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving."
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 PREPARATION
- A. Remove loose material from compacted subbase surface immediately before placing concrete.
 - B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.
- 3.3 EDGE FORMS AND SCREED CONSTRUCTION
- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
 - B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
- 3.4 STEEL REINFORCEMENT
- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
 - C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- 3.5 JOINTS
- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
 - B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of Insert dimension unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from center of dowels.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from sub-base surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

- 3.8 INTEGRALLY COLORED CONCRETE FINISH
- A. Integrally Colored Concrete Finish: After final floating, apply the following finish:
1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
- 3.9 PIGMENTED MINERAL DRY-SHAKE HARDENER
- A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:
1. Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
 2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
 3. After final power floating, apply the following finish:
 - a. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
- B. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft.
- 3.10 STAMPING
- A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.
1. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft.
 2. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft..
 3. After application of release agent, accurately align and place stamp mats in sequence.
 4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
 5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
- B. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.
1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 2. Accurately align and place stamp tools in sequence and tamp into concrete to produce ired imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
 3. Carefully remove polyethylene film immediately after tool stamping.
- 3.11 CONCRETE PROTECTION AND CURING
- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after application. Maintain continuity of coating, and repair damage during curing period.
1. Cure integrally colored concrete with a curing compound.
 2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.
- E. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- F. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

3.12 STAINING

- A. Newly placed concrete paving shall be at least 30 days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
 - 1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
 - a. Do not use acidic solutions to clean surfaces.
 - 2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
- C. Scoring: Score decorative jointing in paving surfaces 1/16 inch deep with diamond blades to match pattern indicated. Rinse until water is clear. Score before staining.
 - 1. Joint Width: 3/8 inch
- D. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
- E. Reactive Stain: Apply reactive stain to paving surfaces according to manufacturer's written instructions and as follows:
 - 1. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 - 2. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.

3.13 SEALER

- A. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat using same application methods and rates.
 - 1. Begin sealing dry surface no sooner than 14 days after concrete placement.
 - 2. Allow stained concrete surfaces to dry before applying sealer.

3.14 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inc
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/2 inch.
 - 4. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 5. Vertical Alignment of Dowels: 1/4 inch.
 - 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 7. Joint Spacing: 3 inches.
 - 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 9. Joint Width: Plus 1/8 inch, no minus.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 - F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - G. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
 - H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - I. Prepare test and inspection reports.
- 3.16 REPAIRS AND PROTECTION
- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
 - B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
 - C. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
 - D. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

**SECTION 321373
CONCRETE PAVING JOINT SEALANTS**

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Cold-applied joint sealants.
 - 2. Hot-applied joint sealants.
 - 3. Joint-sealant backer materials.
 - 4. Primers.
- 1.2 PREINSTALLATION MEETINGS
 - A. Preinstallation Conference: Conduct conference at Project site.
- 1.3 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - B. Samples: For each kind and color of joint sealant required.
 - C. Paving-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- 1.4 INFORMATIONAL SUBMITTALS
 - A. Product certificates.

PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
 - A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- 2.2 COLD-APPLIED JOINT SEALANTS
 - A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.
 - 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. Crafco Inc.
 - b. Dow Corning Corporation.
 - B. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
 - 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. Pecora Corporation.
- 2.3 HOT-APPLIED JOINT SEALANTS
 - A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I.
 - 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. Crafco Inc.
 - b. W.R. Meadows, Inc.
- 2.4 JOINT-SEALANT BACKER MATERIALS
 - A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
 - B. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

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2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Cleaning of Joints: Clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer.
- D. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- E. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- F. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- H. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- I. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

END OF SECTION

SECTION 321723

PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the application of pavement marking as indicated on the drawings and as specified herein.

1.2 APPLICABLE PUBLICATIONS

- A. City of Brownsville standards.
- B. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specifications apply to this section.

1.3 SUBMITTALS (NOT USED)

1.4 PROJECT CONDITIONS

- A. The Contractor shall provide adequate public protection at all times, by erecting fences, barricades, and etc., as necessary.
- B. All work shall be in accordance with the Texas Manual on Uniform Traffic Control Devices latest edition.
- C. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Materials shall consist of paint and glass beads. Paint for stripping shall conform to City of Brownsville standards. Glass reflective beads for traffic paint shall conform to City of Brownsville standards.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. The pavement surface to receive the striping shall be thoroughly cleaned of all dirt, organic growth, oil, grease, or other materials that will prevent adhesion of the paint to the roadway surface.
- D. Paints shall be applied by brush, spray, or flow methods to clean and dry surfaces with surface temperature 50 F or above.
 - 1. Paint shall have net film thickness of 0.015 inches with a uniform cross section.
 - 2. Paint shall be applied no sooner than 14 days after seal coat has been applied.
 - 3. Paint shall be applied in one (1) coat.
 - 4. Paint shall be applied as shown on drawings.
 - 5. Glass spheres or reflectorized granules shall be applied, before the paint sets or dries, evenly at a rate of 6 pounds of glass spheres or 1.7 pounds of reflectorized granules per gallon of paint.

END OF SECTION

PAVEMENT MARKINGS

SECTION 328400

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SCOPE:

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of underground sprinkler irrigation system complete, as shown on drawings and/or specified herein. When the term "Contractor" is used in this section, it shall refer to the irrigation Subcontractor.

1.2 QUALITY ASSURANCE:

The following Codes, Regulations, Reference Standards, and Specifications apply to work included in this section: ASTM: D2241, D2464, D2466, and D2564.

1.3 WARRANTY AND MAINTENANCE:

A. The Contractor shall warranty material and workmanship for one year after final acceptance including repair and replacement of defective materials, workmanship, and repair of backfill settlement.

B. Maintenance during warranty shall include, but not necessarily be limited to, the following:

1. Adjustment of sprinkler height and plumb to compensate for settlement and/or plant growth.
2. Backfilling of all trenches.
3. Adjustment of head coverage (arc of spray) as necessary.
4. Unstopping heads plugged by foreign material.
5. Adjustment of controller as necessary to insure proper sequence and watering time.
6. All maintenance necessary to keep the system in good operating order. Repair of damage caused by vandals, other contractors or weather conditions shall be considered extra to these specifications. Warranty and maintenance after final acceptance does not include alterations as necessitated by re-landscaping, re-grading, addition of trees or the addition, and/or changes in sidewalks, walls, driveways, etc. Maintenance shall continue for one month after final acceptance.

1.4 SUBMITTALS:

- A. The Contractor shall submit shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit, fittings, and all other types of fixtures and equipment proposed to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity, and manufacturer's installation recommendation, if applicable, for each proposed item.
- B. No partial submittal will be accepted and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Landscape Architect.
- C. Shop drawings shall include dimensions, elevations, construction, details, arrangements, and capacity of equipment, as well as manufacturer's installation recommendations.

1.5 "APPROVED EQUAL" SUBSTITUTIONS:

Several items in this section and on the plans are specified by a manufacturer's brand name and catalog number, followed by the phrase "or approved equal". This is not intended to unduly restrict competitive procurements or bidding, but is done to assure a minimum standard of quality which is believed to be best for the item specified and to match existing equipment.

1.6 CODES/PERMITS:

- A. All work under this section shall comply with the provisions of these Specifications, as illustrated on the accompanying drawings, or as directed by the Owner and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this Project.
- B. Installation of equipment and materials shall be done in accordance with requirements of the National Electrical Code, City Plumbing Code, and standard plumbing procedures. The drawings and these Specifications are intended to comply with all the necessary rules and regulations; however, some discrepancies may occur, the Contractor shall immediately notify the Landscape Architect in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these Contract documents.
- C. The Contractor shall give all necessary notices, obtain all permits, and pay all costs in connection with his work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Owner.

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- D. The Contractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules, and regulations whether or not shown on the drawings and/or specified.
- E. The installation of the irrigation system shall be made by an individual or firm duly licensed under Article No. 8751 VTCS, Titled "Licensed Irrigators Act", S.B. No. 259 as passed by the 66th Texas Legislature.

1.7 EXISTING UTILITIES:

- A. Locations and elevations of various utilities included with the scope of this work have been obtained from the most reliable sources available and should serve as a general guide without guarantee to accuracy. The Contractor shall examine the Site and verify to his own satisfaction the locations and elevation of all utilities and availability of utilities and services required. The Contractor shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at his own expense, and to the satisfaction of the Owner, for damage to any utility shown or not shown on the plans.
- B. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action.
- C. Contractor shall make necessary adjustments in the layout as may be required to connect to existing stub-outs, should such stub-outs not be located exactly as shown and as may be required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Owner prior to final acceptance.

1.8 RECORD DRAWINGS:

- A. Record dimensioned locations and depths for each of the following:
 - 1. Point of connection.
 - 2. Sprinkler pressure line routing (provide dimensions for each 100 lineal feet (maximum) along each routing, and for each change in directions).
 - 3. Gate valves.
 - 4. Sprinkler control valves (buried only).
 - 5. Control wire routing.
 - 6. Other related items as may be directed by the Landscape Architect.
- B. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs, or pavements).
- C. Record all changes which are made from the Contract drawings, including changes in the pressure and non-pressure lines.
- D. Record all required information on a set of blackline prints of the Contract drawings. Do not use these prints for any other purpose.
- E. Maintain information daily. Keep Contract drawings at the Worksite at all times and available for review by the Owner's representative.
- F. When record drawings have been approved by the Owner's Representative, transfer all information to a set of reproducible mylars using permanent India ink. Changes using ball-point pen are not acceptable. Make dimensions accurately at the same scale used on original Drawings, or larger. If photo reduction is required to facilitate controller chart housing, notes or dimension must be a minimum 1/4 inch isize.
- G. Reproducible mylars will be furnished by the Owner cost for printing and handling.

1.9 CONTROLLER CHARTS:

- A. Do not prepare charts until record drawings have been approved by the Owner's representative. B. Provide one controller chart for each automatic controller installed.
 - 1. Chart may be a reproduction of the record drawing, if the scale permits fitting within the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - 2. Chart shall be blackline print of the actual system, showing the area covered by that controller.
- C. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage.
- D. Following approval of charts by the Owner's representative, they shall be hermetically sealed between two layers of 20 mil. thick plastic sheet.
- E. Charts must be completed and approved prior to final acceptance of the irrigation system.

1.10 OPERATING AND MAINTENANCE MANUALS:

- A. Provide individual bound manuals detailing operating and maintenance requirements for irrigation systems.

- B. Manuals shall be delivered to the Owner's representative for review and approval no later than 10 days prior to completion of work. Revise manual as required.
- C. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate, and maintain the equipment.
- D. Provide the following in each manual:
 - 1. Index sheet, stating Irrigation Contractor's name, address, telephone number, and name of person to contact.
 - 2. Duration of guarantee period.
 - 3. Equipment list providing the following for each item:
 - a. Manufacturer's name.
 - b. Make and model number.
 - c. Name and address of local manufacturer's representative.
 - d. Spare parts list in detail.
 - e. Detailed operating and maintenance instructions of major equipment.
 - 4. Recommended programs for watering by season.

1.11 CHECKLIST:

- A. Provide a signed and dated checklist, and deliver to the Owner's representative prior to final acceptance of the work.
- B. Use the following format:
 - 1. Plumbing permits: if none required, so note.
 - 2. Material approvals: approved by and date.
 - 3. Pressure line tests: by whom and date.
 - 4. Record Drawings: received by and date.
 - 5. Controller charts: received by and date.
 - 6. Materials furnished: received by and date.
 - 7. Operation and maintenance manuals: received by and date.
 - 8. System and equipment operation instructions: received by and date.
 - 9. Manufacturer's warranties if required: received by and date.
 - 10. Written guarantee: received by and date.
 - 11. Lowering of heads in lawn areas: if incomplete, so state.

1.12 ELECTRIC POWER:

Electric power shall be provided within five feet of each controller location by the G.C. The irrigation contractor shall provide final hardwire connection.

1.13 WATER FOR TESTING:

Unless noted otherwise on the plans or elsewhere, furnish all water necessary for testing, flushing, and jetting.

1.14 BORINGS, SLEEVES AND ELECTRICAL CONDUITS:

Sleeves and electrical conduits are the responsibility of the Irrigation Contractor to install prior to paving or related construction and should be installed as noted on the drawings and specifications. Contractors shall be responsible for locating all sleeves and conduits at no additional cost to the Authority. Borings under existing paving will be required where noted on the drawings and shall be provided at no additional cost to the Owner. Borings shall be a minimum of 18 inch depth and new pipes shall be incased in Class 200 sleeves.

1.15 SPARE PARTS:

The Contractor shall supply the Owner with five spray heads, one for each head designated on the plan. The Contractor shall supply one additional key and hose swivel for the quick coupler.

PART 2 -- PRODUCTS

2.1 GENERAL:

Unless otherwise noted on the plans, all materials shall be new and unused. The irrigation equipment catalog numbers used for reference in these Specifications are to establish minimum quality standards and may be substituted with an "approved equal" as outlined in Paragraph 1.5 of this section.

2.2 POLYVINYL CHLORIDE PIPE (PVC PIPE):

PVC pipe manufactured in accordance with ASTM Standards noted herein.

- A. Marking and Identification: PVC pipe shall be continuously and permanently marked with following information: Manufacturer's name, size, type of pipe, and material, SDR number, Product Standard number, and the NSF (National Sanitation Foundation) Seal.
- B. PVC pipe fittings: Shall be of the same material as the PVC pipe specified and compatible with PVC

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- C. PVC Pipe: Shall be Class 200 solvent weld, SDR-21, PS 22-70 for all sizes 3/4 inch to 3 inches. All 1/2 inch pipe shall be solvent weld SDR- 13.5, Class 315. Mainline pipe size 4" and larger shall be PVC o-ring gasket type with ductile iron fittings by Harco Industries.
- D. Flexible PVC Risers (Nipples): All flexible PVC nipples shall be made from virgin PVC material, and shall comply with ASTM D2287, shall be tested at 200 P.S.I. static pressure for 2 hours and have a quick burst rating of a minimum 400 P.S.I. Flexible PVC pipe nipples shall be factory assembled only.
- E. Pipe sleeves: Shall be Class 200 solvent weld, SDR-21, PSD 22-70 for all sizes 3/4 inch to 2 inches; all 1/2 inch pipe shall be solvent weld SDR-13.5, Class 315; and located as shown on drawings.

2.3 SWING JOINTS:

Swing joints shall be O-ring seal type, Lasco or approved equal.

2.4 WIRE AND SPLICES:

- A. All valve wire shall be single strand solid copper, minimum 14 gauge with type UF insulation which is Underwriters Laboratory approved for direct underground burial when used in a National Electrical Code Class II Circuit (30 volts AC or less) as per Articles 725 and 300. Voltage drop shall be taken into consideration.
- B. All connectors shall be UL listed, rated 600 volt, for PVC insulated wire. No wire splices shall be buried.
- C. All wire connectors shall have a two-piece PVC housing which, when filled with resin epoxy and pressed together, forms a permanent, one-piece, moisture-proof wire splice.

2.5 QUICK COUPLING VALVES:

- A. Quick coupling valves shall be composed of a bronze cast body with a purple, (NP) cover.
- B. The valve shall accept a single lug 3/4 inch bronze valve key for operation.
- C. Provide one coupler and one hose swivel ell for every five quick coupling valves shown on the plans.

2.6 MANUAL VALVES:

A. Manual valves 2-1/2 inches and smaller shall be all brass, globe type with composition disc rated at 150 pounds W.O.G. Manual valve size 4" and larger shall be Kennedy cast iron type. B. All valves shall have wheel handles unless cross handles are called for on the plan.

2.7 VALVE BOXES:

- A. A box shall be provided for all valves.
- B. Valve boxes shall be made of high-strength plastic suitable for turf irrigation purposes.
- C. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve.
- D. Extension sections will be used as appropriate to the depth of piping.
- E. All valve box covers shall bolt down or have locking mechanisms and shall be colored green or black as selected by the Contracting Officer.

2.8 POP-UP SPRAY, BUBBLERS AND ROTARY HEADS:

- A. Sprinkler heads are specified on the drawings. Spray heads shall have a minimum 4 inch pop-up.
- B. The sprinkler body and all related parts shall be plastic cycolac or polycarbonate. They shall have a spring retraction for positive return action of the pop-up nozzle.
- C. The spring for retraction and the adjustable nozzle screw shall be made of corrosion resistant materials.

2.9 DRIPPERLINE WITH PRESSURE COMPENSATING EMITTERS

Dripperline shall be of nominal sized one-half (1/2") inch low density, ultra-violet-resistant, linear polyethylene tubing with internal pressure-compensating, continuous self-cleaning, integral drippers at a specified interval. The tubing shall be brown in color throughout and shall conform to an outside diameter (O.D.) of 0.66" and an inside diameter (I.D.) of 0.56". The dripperline shall be capable of a discharge rate of 0.4, 0.6, or 0.9 gallons per hour (GPH) between operating pressures of 7 - 70 psi for each individual dripper. The individual continuous self-cleaning, pressure compensating drippers shall be welded to the inside of the tubing wall. The drippers shall be constructed of three individual pieces:

- A. A black-colored dripper containing a filtration system on the inlet side, compensation cell, and recessed chamber with a water outlet,
- B. A hard plastic diaphragm retainer with color denoting discharge rate, with chamfered edges and a recessed groove in the center extending the full length of the diaphragm and,
- C. A flexible elastomer diaphragm that allows pressure to build up within the chamber to purge sediment or other debris that may not have been captured by the disc filter. Dripper spacings shall be

available in the following on-center intervals - 12", 18", and 24".

2.9.1 BARBED INSERT FITTINGS

All barbed insert fittings shall be constructed of molded, ultra-violet-resistant, black colored plastic having a nominal inside dimension (I.D.) of 0.24". Each fitting shall have a minimum of two ridges or barbs per outlet with a raised barb nearest the fitting outlet. All fittings shall be of one manufacturer and shall be available in one of the following end configurations: barbed insert fittings, male pipe threads (MPT) with barbed insert fittings, or female pipe threads (FPT) with barbed insert fittings.

2.10 ELECTRIC CONTROLLER:

- A. Electric irrigation controller shall be capable of operating the number of stations as indicated on the drawings. The system is designed to operate two section valves at a time, per controller unless otherwise noted. The controller is specified on the drawings.
- B. Power source shall be 110v A.C. Output for operation of companion solenoid actuated valves shall be 24 volts 60 Cycle AC.
- C. Operation of the controller shall be full automatic, incorporating one 24 hour clock and 14 day calendar per controlled number of electric valves shown on the plan to start the sprinkling cycle any hour or hours of the day or night of any day or days over a repeating 14 day period.
- D. The controller shall be capable of repeating watering cycles as required with a maximum delay between the ending of one cycle and the beginning of the next not to exceed 2 hours. Control shall provide optional semi-automatic operation whereby the automatic cycle may be started independent of the clock and manual operation whereby any station may be operated by hand independent of all timing mechanism. The choice of automatic day or hour programming shall be available to the operator on the face of the control panel without the use of tools.
- E. The automatic controller shall be equipped with rainproof housing.

2.11 ELECTRIC REMOTE CONTROL VALVES:

- A. Electric remote control valves shall have plastic bodies and covers and shall be globe-type diaphragm valves of normally closed design. The valves are specified on the drawings.
- B. Operation shall be accomplished by means of integrally mounted heavy-duty 24-V DC solenoid complying with National Electrical Code, Class II Circuit. Solenoid coil shall be potted in epoxy resin within a plastic coated stainless steel housing. Solenoids shall be completely waterproof, suitable for direct underground burial.
- C. A flow stem adjustment shall be included in each valve.

2.12 BACKFLOW PREVENTER (DOUBLE CHECK VALVE):

- A. A double gate valve, double check assembly shall be located and sized as shown on the plans. The double check valve is specified on the drawings.
- B. Construction shall be all brass for sizes 3/4 inch to 2 inches.
- C. This assembly shall be installed in a box and shall conform to the City Plumbing Codes.

2.13 TEMPERATURE SENSORS & RAIN SENSORS:

- A. Rain and freeze sensors shall be as manufactured by Hunter Industries, as noted on the plans.

PART 3 -- EXECUTION

3.1 INSTALLATION, GENERAL:

- A. Design Pressure: This irrigation system has been designed to operate with a minimum static inlet water pressure as indicated on the drawings. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is 5% less than above, the Contractor shall notify the Owner's Representative.
- B. Contractor Responsibility: The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or water pressure exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the Owner's Representative in writing. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.
- C. Staking: Before installation is started, place a stake or flag where each sprinkler is to be located, in accordance with drawing. Staking shall be approved by the Landscape Architect before proceeding.
- D. Piping Layout: Piping layout is diagrammatic. Route piping around existing trees and root zones in such a manner as to avoid damage to plantings. Do not dig within the ball of newly planted trees or shrubs.
- E. In areas where trees are present, trenches will be adjusted on site to provide a minimum clearance of four times the trunk diameter of the tree (at its base) between any tree and any trench.

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- F. All material and equipment shall be delivered to the Worksite in unbroken reels, cartons or other packaging to demonstrate that such material is new and of a quality and grade in keeping with the intent of these Specifications.

3.2 EXCAVATION AND TRENCHING:

- A. The Contractor shall perform all excavation to the depth indicated in these Specifications and Contract drawings. The banks of trenches shall be kept as nearly vertical as practicable. Trenches shall be wide enough to allow a minimum of 4" between parallel pipelines or electrical wiring. Where rock excavation is required, or where stones are encountered in the bottom of the trench that would create a concentrated pressure on the pipe, the rock or stones shall be removed to a depth of six (6) inches minimum below the trench depth indicated. The over depth rock excavation and all excess trench excavation shall be backfilled with loose, moist earth or sand, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the trench bottom, such shall be removed to a depth and length required, and the trench backfilled to trench bottom grade as hereinafter specified, with coarse sand, fine gravel or other suitable material.
- B. Bottom of trench grade shall be continued past ground surface deviations to avoid air pockets and low collection points in the line. The minimum cover specifications shall govern regardless of variations in ground surface profile and the occasional deeper excavation required at banks and other field conditions. Excavation shall be such that a uniform trench grade variation will occur in all cases where variations are necessary.
- C. Trench excavation shall comprise the satisfactory removal and disposition of all materials, and shall include all shoring and sheeting required to protect the excavation and to safeguard employees.
- D. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance back from edge of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted as directed by the Owner's Representative. When excavated material is of a rocky nature and the topsoil or any other layer of excavated material is suitable for pipe bedding and backfill in the vicinity of the pipe, such material shall be separately stockpiled for use in such bedding and pipe backfill operations, unless satisfactory imported material is used.
- E. All excavations and backfill shall be unclassified and covered in the basic bid. No additional compensation will be allowed for rock encountered.
- F. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original conditions in a manner acceptable to the Owner's Representative

3.3 PIPE INSTALLATION:

- A. Sprinkler Mains: Sprinkler mains are that portion of piping from water source to electric valves. This portion of piping is subject to surges since it is a closed portion of the sprinkler system. Sprinkler mains shall be installed in a trench with a minimum of 18 inches of cover.
- B. Lateral Piping: Lateral piping is that portion of piping from electrical valve to sprinkler heads. This portion of piping is not subject to surges since it is an "open end" portion of the sprinkler system. Lateral piping shall be installed in a trench with a minimum of 12 inches of cover.

3.4 PVC PIPE AND FITTING ASSEMBLY:

- A. Solvent: Use only solvent recommended by manufacturer to make solvent-welded joints following standards noted herein. Thoroughly clean pipe and fittings of dirt, dust, and moisture with an approved PVC primer before applying solvent.
- B. PVC to Metal Connection: Work metal connections first. Use a non-hardening pipe dope such as Permatex No. 2 or "Teflon" tape on threaded PVC to metal joints. Use only light wrench pressure.
- C. Threaded PVC Connections: Where required, use threaded PVC adapters into which pipe may be welded.
- D. Remove lumber, rubbish, and rocks from trenches. Provide firm, uniform bearing for entire length of each pipeline to prevent uneven settlement. Wedging or blocking of pipe will not be permitted. Remove foreign matter or dirt from inside of pipe before welding, and keep piping clean during and after laying pipe.
- E. PVC pipe shall not be installed where there is water in the trench, nor shall PVC pipe be laid when temperature is 40 deg. F or below or when rain is imminent. PVC pipe will expand and contract as the temperature changes. Therefore, pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction.

3.5 HYDROSTATIC TESTS:

Pressure Test: After the pipe is laid, the joints completed, and the trench partially backfilled, leaving the joints exposed for examination, the newly laid piping or any valved section of main pressure line piping shall, unless otherwise specified, be subjected for four hours to a hydrostatic pressure test of normal city water pressure. Each valve shall be opened and closed during the test. Enclosed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or

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remade, as necessary. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this pressure test shall be repeated until the test results are satisfactory. All replacement and repair shall be at contractor's cost.

3.6 CONTROL WIRE INSTALLATION:

- A. All control wire less than 500 feet in length shall be continuous without splices or joints from the controller to the valves. Connections to the electric valves shall be made within 18 inches of the valve using connectors specified in Paragraph 2.4 of this section, unless otherwise approved by the Owner's Representative in writing.
- B. All control wires shall be installed at least 18 inches deep. Contractor shall obtain the Owner's Representative's approval for wire routing when installed in a separate ditch. Control wires may be installed in a common ditch with piping; however, wires must be installed a minimum of 4 inches below or to one side of piping.
- C. All wire passing under existing or future paving, sidewalk, construction, etc., shall be encased in PVC Schedule 40 conduit extending at least 2 feet beyond edges of paving, sidewalks, or construction.

3.7 POP-UP SPRAY, BUBBLER HEADS:

- A. Provide heads and nozzles as specified and install in locations as shown on the Contract Drawings.
- B. Pop-up spray heads shall be installed on "flex" pvc as detailed on the Contract drawings. Rotary heads shall be installed on a double swing joint connected to the lateral pipe as detailed on the drawings.
- C. Heads shall be installed with underside of flange flush with the finished grade.
- D. Contractor will be required to adjust heads as necessary after establishment of grass or other plant material.

3.8 DRIP EQUIPMENT:

- A.. Dripperline can be installed in one of the four following methods:
 - Over-excavation: Over-excavate the entire area to a depth of 2" to 4" below finish grade. Plant all specimen trees and shrubs 15 gallon size and larger, then place dripperline at the row spacing interval indicated on the plans.
 - Pipe Pulling: Where ground disruption is to be minimized, pneumatic tire, pipe-pulling machinery shall be used. Potholes shall be used at the ends of each run for making connection to supply and exhaust headers of rigid PVC pipe or polyethylene pipe.
 - Trenching: Hand or mechanically trench to the pipe depth indicated on the plans or in these specifications and backfill flush with finish grade. Avoid mechanically trenching within the dripline of existing trees. Hand-trench around existing tree roots when roots of 2" and larger are encountered. Remove all rock 1½" and larger when excavating and remove from site. Do not backfill trenches with rock that will come in direct contact with tubing or rigid PVC piping.
- B. Placement of Rigid PVC Piping: Install pipe in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Install pipes at temperatures over 40° F. Pipe markings shall face upward out of the trench whenever possible.
- C. Dripperline: Dripperline can be installed with the water outlets facing up, down, or sideways. In irregular areas, some water outlets could end up too close to fixed improvements and may have to be capped off with a dripper plug ring.
- D. Cover: Install underground piping horizontally and as evenly as possible to a maximum depth of 4", unless otherwise specified. (Typical pipe depth is 2" shrub beds, 4" in turf unless periodic aeration is anticipated, and then pipe depth should be lowered to 6".)
- E. Barbed Insert Fittings: Connect dripperline to barbed insert fittings by pushing the tubing on and over both barbs of the fitting until the tubing has seated against another piece of tubing or has butted against another portion of the barbed fitting. For water pressures in excess of the 30 psi, or the maximum stated system pressure for the dripperline, whichever is less, use stainless steel clamps as noted in paragraph 3.2.4, "Pipe Clamping" on all barbed fittings.
- F. Clamping: When design-operating pressure exceeds 30 psi, or maximum stated system pressure for the dripperline, whichever is less, stainless steel pipe clamps shall be used. Slip clamps over tubing before slipping tubing over barbed insert fitting. Place clamp between the first and second ridge of the barbed fittings and crimp the "ear" of the clamp tightly. Crimp the "ear" twice to ensure proper seating.

3.8 QUICK COUPLING VALVES:

- A. Quick coupling valves shall be installed with the underside of flange flush with the finished grade.
- B. Quick coupling valves shall be installed on a swing joint assembly as detailed on the drawings.
- C. Under the warranty, the Contractor shall return after grass is established and adjust valves and valve boxes to proper grade.

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3.9 MANUAL VALVES:

- A. Manual valves shall be sized and located where shown on the Contract drawings.
- B. Valve boxes shall be adjusted to be flush with finished grade. The Contractor will be required to adjust after establishment of grass.
- C. Valve boxes shall be properly supported and of sufficient construction that tractors and mowers crossing over the boxes will not push boxes down and crush the pipe, valve, or box.

3.10 VALVE AND VALVE BOX PLACEMENT:

- A. All manual, electric, and quick coupling valves shall be in boxes as specified in Paragraph 2.7 of this section, and shall be set with a minimum of six (6) inches of space between their top surface and the bottom of the valve box. The base of the box shall be filled with pea gravel as
- B. Valves shall be fully opened and fully closed to ensure that all parts are in operating condition
- C. Valve boxes shall be set plumb, vertical, and concentric with the valve stem.
- D. Any valve box which has moved from this required position so as to prevent the use of the operating wheel of the valve shall be reset by the Contractor at his own expense.

3.11 ELECTRIC CONTROLLER:

- A. Electric controller shall be located as shown on the plans and shall be capable of operating the number of stations indicated.
- B. The system is designed to operate two sections at a time, per controller, unless otherwise noted on the plans in strict accordance with the manufacturer's published installation instructions.

3.12 ELECTRIC REMOTE CONTROL VALVES:

- A. Remote control valves shall be located and sized as shown on the plans. All electrical connections shall be made when the weather is dry with connection kits as specified in Paragraph 2.4 of this section in strict accordance with manufacturer's recommended procedures. All remote control valves shall be installed in a horizontal position, in accordance to the manufacturer's published installation instructions.
- B. It shall be the responsibility of the Contractor to furnish and install the proper size wire on each of the low voltage circuits from the master control center to the various electric remote control valves.
- C. Consideration shall be given to each circuit for allowance of voltage drop and economy consistent with accepted practices of electrical installation. Under no circumstances shall the voltage of any branch circuit be reduced more than proper due to length of run exceeding the maximum allowable for the wire size used.

3.13 BACKFILL AND COMPACTION:

- A. After system is operating and required tests and inspections have been made, the trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, gravel, soft shale, or other approved materials, free from large clods of earth or stone. Rock, broken concrete, or pavement, and large boulders shall not be used as backfill material. The backfill shall be thoroughly compacted and evened with the adjacent soil level.
- B. Compact trenches in areas to be planted by thoroughly flooding the backfill. Compact all other areas by flooding or hand tamping. The jetting process may be used in areas when flooding.
- C. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to a minimum of 90% density.
- D. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for compaction, then refilled and compacted with the surface restored to the required grade and left in a completed surface condition as described above.
- E. Specifically tamp backfill under heads and around the flange of heads for one foot (1') by a suitable means after trench backfill has dried from flooding to prevent heads loosening in the ground.

3.14 FINAL ADJUSTMENT:

- A. After installation has been completed, make final adjustment of sprinkler system prior to Owner's Representative's final inspection.
- B. Completely flush system to remove debris from lines by removing nozzle from heads on ends of lines and turning on system.
- C. Check sprinklers for proper operation and proper alignment for direction of throw.
- D. Check each section for operating pressure and balance to other sections by use of flow adjustment on top of each valve.
- E. Check nozzling for proper coverage. Prevailing wind conditions may indicate that arc or angle of spray should be other than as shown on drawings. In this case, change nozzles to provide correct coverage and furnish record data to Owner's Representative with each change.

- F. After system is thoroughly flushed and ready for operation, each section of sprinklers shall be adjusted to control pressure at heads. Use the following method, one section at a time:
 - 1. Remove last head on section and install a temporary riser above grade. Install tee with pressure gauge attached on top of riser and re-install head with nipple onto tee.
 - 2. Correct operating pressure at last head of each section as follows: Spray Heads - 30-35 psi.
 - 3. After replacing head, at grade, tamp thoroughly around head.
 - 4. Drip zone valve pressure regulating devices shall be set at not to exceed 40 psi.
- 3.15 CLEAN-UP:
- A. The Worksite shall be thoroughly cleaned of all waste materials and all unused or salvaged materials, equipment, tools, etc.
 - B. After completion of the work, areas disturbed shall be leveled and the Worksite shall be raked clean and left in an orderly condition.

END OF SECTION

SECTION 329200

TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Seeding.

1.2 DEFINITIONS

- A. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Certification of grass seed.
1. Certification of each seed mixture for turfgrass sod.
- B. Product certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 3. Pesticide Applicator: State licensed, commercial.

PART 2 - PRODUCTS

2.1 Seedmix

- A. Species: grass species as follows:
1. See Schedule

2.2 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 100 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.3 MULCHES

- A. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.4 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. General: Prepare soil for seeding as specified.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. As specified and per suppliers recommendations.

3.3 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Regrade, and replant bare or eroded areas and mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

END OF SECTION

SECTION 329300

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plants.
 - 2. Tree-watering devices.
 - 3. Landscape edgings.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- C. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- D. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include supplying nursery, grower, and tree liner seed source for all trees. Include nursery for all other planting material.
- B. Samples of each type of mulch and edging.
- C. Photos: For all plant material, within 6 weeks of intended planting time.

1.5 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

1.7 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Balled-and-burlaped trees and shrubs shall be stored on site in a vertical orientation.
- B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- C. Handle planting stock by root ball. Any visible, fresh scarring to the bark or cambium layer will result in rejection of material.
- D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.9 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures including plantings falling or blowing over.
2. Warranty Periods: From date of planting completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 9 months.
 - c. Annuals: 3 months.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- C. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 1. Size: 5-gram tablets.
 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

- A. Organic Mulch: Shredded hardwood.
- B. Mineral Mulch: Crushed stone or gravel.
 1. Size Range: 3/4 inch (19 mm) maximum, 1/4 inch (6.4 mm) minimum.
 2. Color: Readily available natural gravel color range.

2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 LANDSCAPE EDGINGS

- A. As specified

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil to 9 inch depth.
- B. Placing Planting Soil: Blend planting soil in place .
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate approximately three times as wide as ball diameter.
 - 3. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
- B. Backfill Soil: Subsoil removed from excavations may not be used as backfill soil unless otherwise indicated. Topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

3.3 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set each plant plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
 - 1. Backfill: Planting soil. For trees, use excavated soil for backfill.
 - 2. Balled and Burlapped Stock: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Balled and Potted and Container-Grown Stock: Carefully remove root ball from container without damaging root ball or plant.
 - 4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Three for each caliper inch of plant.
 - 6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.4 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.5 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

- B. Use planting soil for backfill.
 - C. Dig holes large enough to allow spreading of roots.
 - D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
 - E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
 - F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- 3.6 PLANTING AREA MULCHING
- A. Mulch backfilled surfaces of planting areas and other areas indicated.
 1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 2-inch (50-mm) Insert dimension average thickness, with 24-inch (600-mm) radius around trunks or stems. Do not place mulch within 3 inches (75 mm) of trunks or stems.
 2. Organic Mulch and Mineral Mulch in Planting Areas (per plan): Apply 3-inch (75-mm) average thickness of organic mulch, 2-inch (50mm) mineral mulch, over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 2 inches (50 mm) of trunks or stems.
- 3.7 EDGING INSTALLATION
- A. Install edging where indicated according to manufacturer's written instructions. Anchor with stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
 - B. Shovel-Cut Edging: Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4- to 6-inch- (100- to 150-mm-) deep, shovel-cut edge as indicated on Drawings.
- 3.8 PLANT MAINTENANCE
- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
 - B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
 - C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
 - D. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
 - E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
 - F. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.
- 3.9 MAINTENANCE SERVICE
- A. Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 1. Maintenance Period for Trees and Shrubs: 12 months from date of planting completion.
 2. Maintenance Period for Ground Cover and Other Plants: Six months from date of planting completion.

END OF SECTION

