

**Bid Documents**

for

**CSWD Hinesburg Drop-Off Center**

**Located at the Town of Hinesburg Highway Dept.  
907 Beecher Hill Road  
Hinesburg, Vermont**

August 30, 2019



*Chittenden Solid Waste District*

**Chittenden Solid Waste District  
Brian Wright – Director of Engineering  
1021 Redmond Road  
Williston, Vermont  
(802) 872-8100 x215**

**ADVERTISEMENT FOR BIDS**

Chittenden Solid Waste District

1021 Redmond Road, Williston, VT 05495

Separate sealed BIDS for the construction of (briefly describe nature, scope and major elements of the WORK)

CSWD – Hinesburg Drop-Off Center. will be received by Chittenden Solid Waste District

at the office of CHITTENDEN SOLID WASTE DISTRICT, 1021 Redmond Road, Williston, VT 05495

until 2:00 PM, September 18, 2019.

The CONTRACT DOCUMENTS may be examined at the following locations:

Chittenden Solid Waste District, 1021 Redmond Road, Williston, VT 05495  
Lamoureux & Dickinson, 14 Morse Drive, Essex Junction, VT 05452

Copies of the CONTRACT DOCUMENTS may be obtained at: Chittenden Solid Waste District  
located at 1021 Redmond Road, Williston, VT, at a cost of \$25.00 per set.

A Performance BOND will be required for this project. No Bid BOND or Payment BOND are required for this project.

A Pre-Bid meeting will be held at 10:00 am on September 9, 2019, at the site of construction located at 907 Beecher Hill Road in Hinesburg, VT.

Bidders may call Josh Tyler, the CSWD Director of Operations, at 802-872-8100 x210, with any questions about getting plan sets or information regarding the Pre-Bid Meeting.

## INFORMATION FOR BIDDERS

BIDS will be received by Chittenden Solid Waste District (herein called the "OWNER"), at the CHITTENDEN SOLID WASTE DISTRICT, 1021 Redmond Road, Williston, VT 05495 until September 18, 2019, at 2:00 PM.

Each BID must be submitted in a sealed envelope, addressed to Chittenden Solid Waste District at 1021 Redmond Road, Williston, VT 05495. Each sealed envelope containing a BID must be plainly marked on the outside as BID for CSWD Hinesburg Drop-off Center and the envelope should bear on the outside the name of the BIDDER, BIDDER'S address, license number if applicable, and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the OWNER at:

Chittenden Solid Waste District  
Attn: Josh Tyler  
1021 Redmond Road  
Williston, VT 05495

**A Pre-Bid meeting will be held at 907 Beecher Hill Road, Hinesburg, VT, at 10:00 am on September 9, 2019.**

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required. In addition to the BID form, a SCHEDULE is required as part of the BID (See page 3 for Schedule details).

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified, shall not be considered. No BIDDER may withdraw a BID within 45 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID form by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

All questions by prospective BIDDERS as to the interpretations of the INFORMATION FOR BIDDERS, Forms of PROPOSAL, Form of CONTRACT, Plans, Specifications or BONDS, must be submitted in writing to the Consulting Engineer, by September 11, 2019. An interpretation will be mailed by email to all known prospective BIDDERS at the email addresses given by September 13, 2019. Failure of any BIDDER to receive any such ADDENDUM or interpretation shall not relieve such BIDDER from any obligation under its BID as submitted. All ADDENDA so issued shall become part of the CONTRACT DOCUMENTS.

In the event there is any discrepancy in the PROPOSAL between any price in words, figures, or the extended totals, the price in words shall govern and the extended totals in each case shall be corrected accordingly at the discretion of the OWNER. No BID will be accepted which does not contain a price for each item in this PROPOSAL.

Prospective BIDDERS and their agents will be permitted to make, at their own responsibility and expense, such borings, soundings, or other investigations over the site of the proposed work as they deem necessary. They must satisfy themselves by personal examination of the location of the proposed work, and by such other means as they deem necessary, as to the actual conditions and requirements of the WORK and as to the actual quantities required for the construction. Prices bid shall include every and all costs for the construction complete between the limits indicated on the plans and/or as set out in the specifications.

At the time of the opening of BIDS, each BIDDER will be presumed to have inspected the site and to have read

and to be thoroughly familiar with the Drawings and CONTRACT DOCUMENTS (including all ADDENDA).

The failure or omission of any BIDDER to receive or examine any form, instrument, or documents shall in no way relieve any BIDDER from the obligation in respect to its BID.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

The OWNER shall issue a NOTICE OF AWARD and the AGREEMENT within 10 days of the BID opening. The BIDDER shall execute the AGREEMENT and furnish the required insurance certification within three (3) calendar days.

The OWNER, within ten (10) days of receipt of acceptable Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the OWNER not execute the Agreement within such period, the BIDDER may by WRITTEN NOTICE, withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.

The OWNER shall issue the NOTICE TO PROCEED within ten (10) days of the execution of the Agreement. The "Date of Issuance" of the NOTICE TO PROCEED shall start the CONTRACT time. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended only by mutual written agreement between the OWNER and CONTRACTOR.

If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

The OWNER may make such investigations as it deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER, all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the BIDDER fails to submit the requested information and data or the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

**A conditional or qualified BID will not be accepted.**

The project will be awarded to the responsive, responsible BIDDER, based upon consideration for the base BID price and the Schedule. CSWD retains the right to determine responsiveness and responsibility of the BIDDERS, and to accept other than the lowest bid based upon our evaluation of the BIDS and SCHEDULES.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT, shall apply to the contract throughout.

This PROJECT is subject to all of the Safety and Health Regulations (CFR 29, Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. CONTRACTORS are urged to become familiar with the requirements of these regulations.

Successful BIDDERS must, if requested, submit a list of all SUB-CONTRACTORS who will perform WORK on the PROJECT, and written signed statements from authorized agents of labor pools with which they will or may deal for employees on the WORK together with supporting information to the effect that such labor pools' practices and policies are in conformity with Executive Order No. 11246; that they will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing WORK under the CONTRACT or, a certification as to what efforts have been made to secure such statements when such agents or labor pools have failed or refused to furnish them prior to award of the CONTRACT.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall, in no way, relieve any BIDDER from any obligation in respect to his BID.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUB-CONTRACTORS when requested to do so by the OWNER.

BID to include the name of the Building Manufacturer and the general building specifications and details of the proposed building for the pole barn structure. BIDDER shall, as part of the BID, certify that their proposed building system meets the requirements of Section 13121 of the Detailed Specifications.

Bid shall also include the name of the Compactor Manufacturer and the model number of the proposed compactor units.

**SCHEDULE:** Each Bidder shall submit, as part of the BID, a SCHEDULE for completion of the project. It is CSWD's intent to accept the bids and issue a Notice-to-Proceed by October 1, 2019, and to open and operate this facility before the end of calendar year 2019. CSWD recognizes that winter conditions could affect "finishing activities" such as painting handrails, or pavement line stripping, and that there may be long lead items that will affect the schedule.

In the contract documents contained herein, CSWD is using a 90 calendar day construction time limit. This will be adjusted as necessary to conform to the winning bidders proposed schedule. Please Note: the winning bid determination will include SCHEDULE considerations and the winning bid may not be the lowest BID price.

If the Contractor can guarantee a finished project within 90 calendar days, then that schedule time limit will be used in the contract.

However, if there are long lead items or anticipated weather issues with "finishing items" that cannot be delivered for use by CSWD before the 90 calendar day time frame, then the Contractor shall submit a two phase schedule. PHASE 1 will be what can be completed and delivered for use by CSWD within the 90 calendar day timeframe, and PHASE 2 will be for those items that will be completed after the 90 calendar day timeframe. Base the PHASE 2 schedule on working during weekday hours, as CSWD will be operating the facility on Saturdays.

For the Phase 1 scope of work, CSWD must have a functioning facility to include: booth, tip wall, tip wall railing, all electrical work for booth and compactors, compactors, concrete slabs, bituminous pavement base course, pavement line stripping, and fencing with gates.

**BID**

Proposal of \_\_\_\_\_ (hereinafter call "BIDDER"), organized and existing under the laws of the State of \_\_\_\_\_ doing business as: \_\_\_\_\_ (a corporation, a partnership or an individual)

To the: Chittenden Solid Waste District (hereinafter called "OWNER".)

In compliance with your Advertisement for BIDS, BIDDER hereby proposes to perform all WORK for the construction of:

the CSWD Hinesburg Drop-Off Center.

In strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID, each party thereto certifies as to his own organization, that his BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on the date of issuance of the NOTICE TO PROCEED and to fully complete the PROJECT within 90 consecutive calendar days thereafter, or as negotiated with the BIDDER during the Award Process. BIDDER further agrees to pay as liquidated damages, the sum of \$ 1000 for each consecutive calendar day thereafter as provided in Section 15 of the General Conditions.

BIDDER acknowledges receipt of the following ADDENDUM:

\_\_\_\_\_  
\_\_\_\_\_

**BID FORM**

BIDDER agrees to perform all the WORK described in the CONTRACT DOCUMENTS for the following prices:

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>UNIT QUANTITY</u>	<u>UNIT PRICE</u>	<u>EXTENDED AMOUNT</u>
1.	Mobilization	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
2.	Site Prep and Erosion Control	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
3.	Earthwork and Gravel Base	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
4.	Abandon Water Well	1 Each	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
5.	Concrete Pads	31 CY	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
6.	Bituminous Pavement	509 Tons	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
7.	Block Tipping Wall and Bunker	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
8.	Handrail on Block Wall	76 LF	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
9.	Electrical Work	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
10.	Compactors (Furn & Install)	2 each	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
11.	Pre-Engineered Pole Barn Building	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	
12.	Operators Booth	1 LS	\$ _____	\$ _____
	UNIT PRICE (written)		_____	

- 13. Chain Link Fencing 644 LF \$ \_\_\_\_\_ \$ \_\_\_\_\_  
UNIT PRICE (written) \_\_\_\_\_
- 14. Chain link Fence Gates 4 Each \$ \_\_\_\_\_ \$ \_\_\_\_\_  
UNIT PRICE (written) \_\_\_\_\_
- 15. Post Mounted Sign 1 Each \$ \_\_\_\_\_ \$ \_\_\_\_\_  
UNIT PRICE (written) \_\_\_\_\_
- 16. Topsoil, Seeding and Mulch 1 LS \$ \_\_\_\_\_ \$ \_\_\_\_\_  
UNIT PRICE (written) \_\_\_\_\_

**Total Project Amount** \$ \_\_\_\_\_

**Total Project Amount (Written)** \_\_\_\_\_

ALTERNATE BID ITEM

- 17. 3000 Watt Solar Array 1 LS \$ \_\_\_\_\_ \$ \_\_\_\_\_  
UNIT PRICE (written) \_\_\_\_\_

**NOTICE OF AWARD**

TO:

PROJECT Description:

CSWD Hinesburg Drop-Off Center .

The OWNER has considered the BID submitted by you for the above described WORK in response to its ADVERTISEMENT FOR BIDS dated August 30, 2019, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$ \_\_\_\_\_, This BID includes/does not include the Alternate Bid Option.

You are required by the Information for Bidders to execute the Agreement and furnish the required certificates of insurance within three (3) calendar days from the date of this NOTICE to you.

If you fail to execute said Agreement and to furnish said certificates within three (3) 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. 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 TO AWARD to the OWNER.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2019.

\_\_\_\_\_  
Owner

By \_\_\_\_\_  
Title \_\_\_\_\_

**ACCEPTANCE OF NOTICE**

Receipt of the above NOTICE OF AWARD is hereby acknowledged

by \_\_\_\_\_

this \_\_\_\_\_ day of \_\_\_\_\_, 2019.

By \_\_\_\_\_

Title \_\_\_\_\_

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## AGREEMENT

THIS AGREEMENT, made this \_\_\_\_\_ day of \_\_\_\_\_, 2019, by and

Between the Chittenden Solid Waste District, hereinafter called "OWNER" and

\_\_\_\_\_ doing business as a corporation hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR will commence and complete the construction of  
CSWD Hinesburg Drop-Off Center.
2. The CONTRACTOR will furnish all the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT described herein.
3. The CONTRACTOR will commence the WORK required by the CONTRACT DOCUMENTS on the date of issuance of the NOTICE TO PROCEED and will complete the same within 90\* calendar days unless the period for completion is extended otherwise by the CONTRACT DOCUMENTS. The CONTRACTOR acknowledges that the date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the CONTRACTOR further agrees to pay as liquidated damages, the sum of \$1000.00 for each consecutive calendar day that the CONTRACTOR shall be in default after the time specified in the Agreement and as provided in Section 15 of the General Conditions.
4. The CONTRACTOR agrees to perform all the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of \$\_\_\_\_\_ as shown in the BID schedule. This WORK includes/does not include the Alternate Bid Item.
5. The term "CONTRACT DOCUMENTS" means and includes the following:
  - (A) Advertisement for BIDS
  - (B) Information for BIDDERS
  - (C) BID
  - (D) Agreement
  - (E) General Conditions
  - (F) General Specifications
  - (G) NOTICE OF AWARD
  - (H) NOTICE TO PROCEED
  - (I) CHANGE ORDER
  - (J) DRAWINGS prepared by Lamoureux & Dickinson, Michael Dugan Architect, LN Consulting, and Hardy Structural Engineering, numbered C1 through C6, A-1, A-2, F1, & F2, E1 through E4, and S1-1.0 dated August 30, 2019 on the Title sheet.
  - (K) ADDENDA: None
  - (L) Fair Employment Practices and Americans with Disabilities Act.

\* NOTE: This form is to show the BIDDER the Format of the Agreement, but the final agreement will have schedule and time limit text that describes the accepted schedule from the BIDDER.

6. The OWNER will pay to the CONTRACTOR in the manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in 2 copies, each of which shall be deemed an original on the date first above written.

OWNER: \_\_\_\_\_

ATTEST: \_\_\_\_\_  
(Signature)

BY: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_  
(Please print)

Name: \_\_\_\_\_  
(Please print)

Title: \_\_\_\_\_

Title: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

BY: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_  
(Please print)

(Contractor Seal)

Address: \_\_\_\_\_

\_\_\_\_\_  
Phone #

ATTEST: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_  
(Please print)

Title: \_\_\_\_\_

**NOTICE TO PROCEED**

To: \_\_\_\_\_  
(Contractor)

Date of Issuance: September 30, 2019

Project: CSWD Hinesburg Drop-Off Center

\_\_\_\_\_  
You are hereby notified to commence all WORK on this date in accordance with the Agreement dated \_\_\_\_\_, 2019. The date of completion of all WORK is \_\_\_\_\_ 2019.

\_\_\_\_\_  
(Owner)

By: \_\_\_\_\_

Title: \_\_\_\_\_

**ACCEPTANCE OF NOTICE**

Receipt of the above NOTICE TO PROCEED

is hereby acknowledged by \_\_\_\_\_,  
(Name of Contractor)

this the \_\_\_\_ day of \_\_\_\_\_, 2019\_

By: \_\_\_\_\_  
(Printed or Typed Name)

By: \_\_\_\_\_  
(Signature)

Title: \_\_\_\_\_

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**CHANGE ORDER # 1**

Project No.  
Contract No.  
CONTRACT TITLE: CSWD Hinesburg Drop-Off Center

Date: \_\_\_\_\_  
Agreement Date: \_\_\_\_\_

OWNER: Chittenden Solid Waste District  
CONTRACTOR:

ORIGINAL PRICE: \_\_\_\_\_  
Original Completion Date: \_\_\_\_\_

The following changes are hereby made to the CONTRACT DOCUMENTS:

DESCRIPTION:

JUSTIFICATION:

PRICE: This C.O.<sup>(1)</sup> will not change the Contract Price  
Current Contract Price per most recent C.O.:  
The new Contract Price including this C.O. is:

\$

TIME: Current Contract Calendar Days as per most recent C.O.:

This C.O. will not change the Contract Calendar Days  
The new Contract Calendar Days including this C.O. is:

The new Contract Completion Date is:

The attached Contractor's Revised Project Schedule reflects increases or decreases in Contract Time as authorized by this C.O.

Stipulated price and time adjustment includes all costs and time associated with the above described change. Contractor waives all rights for additional compensation or time extension for said change. Contractor and Owner agree that the price(s) and time adjustment(s) stated above are equitable and acceptable to both parties.

REQUESTED BY:

SIGNATURES/APPROVALS:

Recommended By: \_\_\_\_\_ (Engineer)

Accepted By: \_\_\_\_\_ (Contractor)

Ordered By: \_\_\_\_\_ (Owner)

(1) C.O. means Change Order

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## GENERAL CONDITIONS

- |  |   |
|--|---|
| 1. Definitions                               | 16. Correction of Work                      |
| 2. Additional Instructions & Detail Drawings | 17. Subsurface Conditions                   |
| 3. Schedules, Reports and Records            | 18. Suspension of Work, Termination & Delay |
| 4. Drawings and Specifications               | 19. Payments to Contractor                  |
| 5. Shop Drawings                             | 20. Acceptance of Final Payment as Release  |
| 6. Materials, Services and Facilities        | 21. Insurance                               |
| 7. Inspection and Testing                    | 22. Contract Security                       |
| 8. Substitutions                             | 23. Assignments                             |
| 9. Patents                                   | 24. Indemnification                         |
| 10. Surveys, Permits, Regulations            | 25. Separate Contracts                      |
| 11. Protection of Work, Property, Persons    | 26. Subcontracting                          |
| 12. Supervision by Contractor                | 27. Engineer's Authority                    |
| 13. Changes in the Work                      | 28. Land and Rights-of-Way                  |
| 14. Changes in Contract Price                | 29. Guaranty                                |
| 15. Time for Completion & Liquidated Damages | 30. Taxes                                   |

### 1. DEFINITIONS

1.1 Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.2 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications or corrections.

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

1.4 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

1.5 BONDS - Bid, Performance, and Payment Bonds and other instruments of security, furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.7 CONTRACT DOCUMENTS - The contract, including Advertisement For Bids, Information For Bidders, BID, Bid Bond, Agreement, Payment Bond, Performance Bond, NOTICE OF AWARD, NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, and ADDENDA.

1.8 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.9 CONTRACT TIME - The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

1.10 CONTRACTOR - The person, firm or corporation with whom the OWNER has executed the Agreement.

1.11 DRAWINGS - The part of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.12 ENGINEER - The person, firm or corporation named as such in the CONTRACT DOCUMENTS.

1.13 *FIELD ORDER* - A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

1.14 *NOTICE OF AWARD* - The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.

1.15 *NOTICE TO PROCEED* - Written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with the WORK and establishing the date of commencement of the WORK.

1.16 *OWNER* - A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.

1.17 *PROJECT* - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.18 *RESIDENT PROJECT REPRESENTATIVE* - The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

1.19 *SHOP DRAWINGS* - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.

1.20 *SPECIFICATIONS* - A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.21 *SUBCONTRACTOR* - An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

1.22 *SUBSTANTIAL COMPLETION* - That date as certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.23 *SUPPLEMENTAL GENERAL CONDITIONS* - Modifications to General Conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing prior to inclusion in the CONTRACT DOCUMENTS, or such requirements that may be imposed by applicable state laws.

1.24 *SUPPLIER* - Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

1.25 *WORK* - All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.26 *WRITTEN NOTICE* - Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the WORK.

## 2. *ADDITIONAL INSTRUCTION AND DETAIL DRAWINGS*

2.1 The CONTRACTOR may be furnished additional instructions and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

2.2 The additional drawings and instruction thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

### 3. SCHEDULES, REPORTS AND RECORDS

3.1 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the WORK to be performed.

3.2 Prior to the first partial payment estimate the CONTRACTOR shall submit construction progress schedules showing the order in which he proposes to carry on the WORK, including dates at which he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

3.2.1 The dates at which special detail drawings will be required; and

3.2.2 Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The CONTRACTOR shall also submit a schedule of payments that he anticipates he will earn during the course of the WORK.

### 4. DRAWINGS AND SPECIFICATIONS

4.1 The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental work necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.

4.2 In case of conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over scale dimensions, and detailed DRAWINGS shall govern over general DRAWINGS.

4.3 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or and inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR's risk.

### 5. SHOP DRAWINGS

5.1 The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER'S approval of any SHOP DRAWING shall not release the CONTRACTOR from responsibility for deviations from the CONTRACT DOCUMENTS. The approval of any SHOP DRAWING, which substantially deviates from the requirement of the CONTRACT DOCUMENTS, shall be evidenced by a CHANGE ORDER.

5.2 When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.

5.3 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been approved by the ENGINEER. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER.

## 6. MATERIALS, SERVICES AND FACILITIES

6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.

6.2 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

6.3 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

6.4 Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

6.5 Materials, supplies or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

## 7. INSPECTION AND TESTING

7.1 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

7.2 The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS.

7.3 The CONTRACTOR shall provide at his expense the testing and inspection services required by the CONTRACT DOCUMENTS.

7.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

7.5 Inspections, tests or approvals by the engineer or others shall not relieve the CONTRACTOR from his obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

7.6 The ENGINEER and his representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and also for any inspection, or testing thereof.

7.7 If any WORK is covered contrary to the written instructions of the ENGINEER it must, if requested by the ENGINEER, be uncovered for his observation and replaced at the CONTRACTOR'S expense.

7.8 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in questions, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an 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 an appropriate CHANGE ORDER shall be issued.

## 8. SUBSTITUTIONS

8.1 Whenever a material, article or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalog number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalog number, and if, in the opinion of the ENGINEER, such material, article, or piece of equipment is of equal substance and function to that specified, the ENGINEER may approve its substitution and use by the CONTRACTOR. Any cost differential shall be deductible from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

## 9. PATENTS

9.1 The CONTRACTOR shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, however, if the CONTRACTOR has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the ENGINEER.

## 10. SURVEYS, PERMITS, REGULATIONS

10.1 The OWNER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK together with a suitable number of bench marks adjacent to the WORK as shown in the CONTRACT DOCUMENTS. From the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

10.2 The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTAL GENERAL CONDITIONS. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, he shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted as provided in Section 13, CHANGES IN THE WORK.

## 11. PROTECTION OF WORK, PROPERTY AND PERSONS

11.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

11.2 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the

OWNER or the 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 the CONTRACTOR.

11.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. He will give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.

## 12. SUPERVISION BY CONTRACTOR

12.1 The CONTRACTOR will supervise and direct the WORK. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

## 13. CHANGES IN THE WORK

13.1 The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, an equitable adjustment shall be authorized by CHANGE ORDER.

13.2 The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FIELD ORDER entitles him to a change in CONTRACT PRICE or TIME, or both, in which event he shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or TIME within thirty (30) days. The CONTRACTOR shall not execute such changes pending the receipt of an executed CHANGE ORDER or further instruction from the OWNER.

## 14. CHANGES IN CONTRACT PRICE

14.1 The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

- (a) Unit prices previously approved.
- (b) An agreed lump sum.
- (c) The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the WORK. In addition, there shall be added an amount to be agreed upon but not to exceed fifteen (15) percent of the actual cost of the WORK to cover the cost of general overhead and profit (OHP) if the prime CONTRACTOR performs the work, and not to exceed five (5) percent additional markup by the prime CONTRACTOR if the work is done by a SUB-CONTRACTOR, who is allowed an amount to be agreed upon but not to exceed fifteen (15) percent OHP for the work.

## 15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the NOTICE TO PROCEED.

15.2 The CONTRACTOR will proceed with the WORK at such rate of progress to insure final completion within the CONTRACT TIME. IT is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

15.3 If the CONTRACTOR shall fail to complete the WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the contractor will pay to the OWNER the amount for liquidated damages as specified in the BID for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS.

15.4 The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the WORK is due to the following, and the CONTRACTOR has promptly given WRITTEN NOTICE of such delay to the OWNER or ENGINEER.

15.4.1 To any preference, priority or allocation order duly issued by the OWNER;

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a CONTRACT with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 15.4.1. and 15.4.2 of this article.

## 16. CORRECTION OF WORK

16.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

16.2 All removal and replacement WORK shall be done at the CONTRACTOR's expense. If the CONTRACTOR does not take action to remove such rejected work within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

## 17. SUBSURFACE CONDITIONS

17.1 The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

17.2 The OWNER shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless he has given the required WRITTEN NOTICE; provided that the OWNER may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

## 18. SUSPENSION OF WORK, TERMINATION AND DELAY

18.1 The OWNER may suspend the WORK or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER which notice shall fix the date on which WORK shall be resumed. The CONTRACTOR will resume the WORK on the date so fixed. The CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any suspension.

18.2 If the CONTRACTOR is adjudged as bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK or if he disregards the authority of the ENGINEER, or if he otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his surety a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method he may deem expedient. In such case the 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 and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

18.3 Where the CONTRACTOR's services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

18.4 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the CONTRACT. In such case, the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit.

18.5 If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the ENGINEER fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the CONTRACTOR substantially the sum approved by the ENGINEER or awarded by arbitrators within thirty (30) days of this approval and presentation, then the CONTRACTOR may, after ten (10) days from delivery of a WRITTEN NOTICE to the OWNER and the ENGINEER, terminate the CONTRACT and recover from the OWNER payment for all WORK executed and all expenses sustained. In addition and in lieu of terminating the CONTRACT, if the ENGINEER has failed to act on a request for payment or if the OWNER has failed to make any payment as aforesaid, the CONTRACTOR may upon ten (10) days WRITTEN NOTICE to the OWNER and the ENGINEER stop the WORK until he has been paid all amounts then due, in which event and upon resumption of the WORK, CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT TIME or both to compensate for the costs and delays attributable to the stoppage of the WORK.

18.6 If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER or ENGINEER to act within the time specified in the CONTRACT DOCUMENTS, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, shall be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays necessarily caused by the failure of the OWNER or ENGINEER.

## 19. PAYMENTS TO CONTRACTOR

19.1 At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER's title to the material and equipment and protect his interest therein, including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within ten (10) days of the presentation to him of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate. The OWNER shall retain ten (10) percent of the amount of each payment until final completion and

acceptance of all WORK covered by the CONTRACT DOCUMENTS. The OWNER at any time, however, after fifty (50) percent of the WORK has been completed, if he finds that satisfactory progress is being made, shall reduce Retainage to five (5) percent on the current and remaining estimates. When the WORK is substantially complete (operational or beneficial occupancy), the retained amount may be further reduce below five (5) percent to only that amount necessary to assure completion. On completion and acceptance of a part of the WORK on which the price is stated separately in the CONTRACT DOCUMENTS, payment may be made in full, including retained percentages, less authorized deductions.

19.2 The request for payment may also include an allowance for the cost of such major materials and equipment, which are suitably stored either at or near the site.

19.3 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

19.4 The OWNER shall have the right to enter the premises for the purpose of doing WORK not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

19.5 Upon completion and acceptance of the WORK, the ENGINEER shall issue a certificate attached to the final payment request that the WORK has been accepted by him under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK.

19.6 The CONTRACTOR will indemnify and save the OWNER or the OWNER'S agents harmless from all claims growing out of the lawful demands of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER'S request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR shall be resumed, in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the CONTRACTOR, his Surety or any third party. In paying any unpaid bills of the CONTRACTOR, any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for any such payments made in good faith.

19.7 If the OWNER fails to make payment thirty (30) days after approval by the ENGINEER, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

## 20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and others relating to or arising out of this WORK. Any payment, however, final or otherwise, shall not release the CONTRACTOR or his sureties from any obligations under the CONTRACT DOCUMENTS or the Performance BOND or Payment BONDS.

## 21. INSURANCE

21.1 The CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR'S execution of the WORK, whether such execution be by himself or by any SUBCONTRACTOR or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 Claims under workmen's compensation, disability benefit and other similar employee benefit acts;

21.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death or his employees;

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the

CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

21.2 Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER prior to commencement of the WORK. These Certificates shall contain a provision that coverage afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the OWNER

21.3 INSURANCE REQUIREMENTS. Insurance obtained by the CONTRACTOR to cover the below-listed requirements shall be procured from an insurance company registered and licensed to do business in the State of Vermont. All insurance coverage for property damage shall provide coverage for "Replacement" cost. Before the CONTRACT is signed and becomes effective, the CONTRACTOR shall file with the OWNER a certificate of insurance, in duplicate, executed by an insurance company or its licensed agent(s), on a form satisfactory to the OWNER, stating that with respect to the CONTRACT awarded, the CONTRACTOR carries insurance in accordance with the following requirements. Renewal certificates for keeping the required insurance in force for the duration of the CONTRACT shall also be filed as specified above. No warranty is made that the coverages and limits listed herein are adequate to cover and protect the interests of the CONTRACTOR and any SUBCONTRACTOR for the CONTRACTOR'S and any SUBCONTRACTOR'S operations. These are solely minimums that have been established to protect the interests of the OWNER. The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, insurances as hereinafter specified:

21.3.1 Workers Compensation Insurance. With respect to all operations performed the CONTRACTOR shall carry Workers Compensation Insurance in accordance with the laws of the State of Vermont, 21 V.S.A. Chapter 9. The CONTRACTOR shall also ensure that all SUBCONTRACTORS carry Workers Compensation Insurance in accordance with 21 V.S.A. Chapter 9 for all work performed by them.

21.3.2 Commercial General Liability Insurance. With respect to all operations performed by the CONTRACTOR and SUBCONTRACTORS, the CONTRACTOR shall carry Commercial General Liability Insurance on an occurrence form providing all major divisions of coverage, including but not limited to:

Premises - Operations  
Independent Contractor's Protective  
Products and Completed Operations  
Personal Injury Liability

Contractor's General Liability and Property Damage Insurance will be obtained by the CONTRACTOR protecting him from all claims for personal injury, including death, and all claims for destruction of or damage to property arising out of or in connection with any operations under the CONTRACT DOCUMENTS, whether such operations be by himself or by any SUBCONTRACTOR under him, or anyone directly or indirectly employed by the CONTRACTOR or by a SUBCONTRACTOR under him. Contractual Liability applying to the CONTRACTOR'S obligations, unless this requirement is waived in writing by the OWNER, shall have Limits of Coverage not less than:

\$1,500,000 Each Occurrence  
\$2,000,000 General Aggregate applying, in total, to this project only  
\$2,000,000 Products/Completed Operations Aggregate  
\$ 250,000 Fire Damage Legal Liability

*21.3.3 Automobile Liability Insurance. The CONTRACTOR shall carry Automobile Liability Insurance covering all motor vehicles, including owned, hired, borrowed, and non-owned vehicles, used in connection with the project. Limits of Coverage shall be not less than:*

*Bodily Injury: \$1,000,000 Each Person, \$1,000,000 Each Occurrence  
Property Damage: \$ 500,000 Each Occurrence, OR  
Combined Single Limit: \$1,500,000 Each Occurrence*

*21.3.4 Railroad Protective Liability Insurance. When the CONTRACT involves work on, over or under the right-of-way of any railroad, the CONTRACTOR shall carry, with respect to operations performed by the CONTRACTOR and/or by the CONTRACTOR'S SUBCONTRACTORS, Railroad Protective Liability Insurance in a form and amount as required by the railroad company and as specified in the Special Conditions and/or*

*Supplemental Specifications for the project. If not available from insurance companies registered and licensed to do business in the State of Vermont, this insurance may be procured from Eligible Surplus Lines Companies approved by the Vermont Department of Banking, Insurance, Securities, & Health Care Administration (BISHCA). The CONTRACTOR shall file the original Railroad Protective Policy and one duplicate policy with the OWNER. The OWNER will transmit the original Railroad Protective Policy to the railroad concerned. The CONTRACTOR shall cooperate with and allow the railroad company or its agents free and full access to the project during construction along with all materials and equipment necessary in order that their duly authorized employees or agents may do any and all railroad construction, inspection, flagging and watching. The CONTRACTOR shall defend, indemnify, and save harmless the railroad and all of its officers, employees, and agents against any claim or liability arising from or based on any delay to the CONTRACTOR as a result of railroad construction or maintenance, whether by the railroad company, its employees, or agents.*

*21.3.5 General Insurance Conditions. The insurance specified under paragraphs 21.3.1, 21.3.2, and 21.3.3 above shall be maintained in force until acceptance of the project by the OWNER. Under paragraph 21.3.2 above, Products and Completed Operations Coverage shall be maintained in force for at least one year from the date of acceptance of the project. Under paragraph 21.3.4 above, the Railroad Protective Policy shall remain in force until all work required to be performed on railroad property is completed to the satisfaction of the Railroad and the OWNER. The contractual liability insurance requirements detailed in the Contract Documents are to indemnify, defend, and hold harmless the OWNER, and railroad(s), as applicable, and their officers, agents, representatives, and employees, with respect to any and all claims, causes of actions, losses, expenses, or damages that arise out of, relate to, or are in any manner connected with the CONTRACTOR'S work or the supervision of the CONTRACTOR'S work on this project. Each policy, except the Workers Compensation Policy, shall name the OWNER, and railroad(s), as additional insureds for actions, losses, expenses or damages that arise out of, relate to, or are in any manner connected with the CONTRACTOR'S work or the supervision of the CONTRACTOR'S work on this project. Umbrella Excess Liability Policies may be used in conjunction with primary policies to comply with any of the limit requirements specified above. "Claims-made" coverage forms are not acceptable without the prior written consent of the OWNER. The CONTRACTOR shall investigate and the CONTRACTOR and/or insurance company shall either adjust or defend all claims against the insured for damages covered, even if groundless. Each policy furnished shall contain a rider or non-cancellation clause reading in substance as follows:*

*Anything herein to the contrary notwithstanding, no cancellation, termination, or alteration of this policy by the company or the assured shall become effective unless and until notice of cancellation, termination, or alteration has been given by registered mail to the OWNER, at least 30 calendar days before the effective cancellation, termination, or alteration date unless all work required to be performed under the terms of the CONTRACT is satisfactorily completed as evidenced by the formal, final acceptance of the project by the OWNER. There shall be no directed compensation allowed the CONTRACTOR on account of any premium or other charge necessary to take out and keep in effect such insurance or bond; the cost thereof shall be considered included in the general cost of the work.*

21.3.6 The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

21.4 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, in accordance with the provision of the laws of the state in which the WORK is performed, Workmen's Compensation Insurance, including occupational disease provisions, for all of his employees at the site of the PROJECT and in case any WORK is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous WORK under this CONTRACT at the site of the PROJECT is not protected under Workmen's Compensation statute, the CONTRACTOR shall provide, and shall cause, each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.

21.5 The CONTRACTOR shall secure "All Risk" type Builder's Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the BID. The policy shall cover not less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, wind, collapse, riot, aircraft, water and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR, the ENGINEER, and the OWNER.

## 22. CONTRACT SECURITY

22.1 A Performance BOND will be required for this project. A Bid BOND or Payment BOND are **not** required for this project.

## 23. ASSIGNMENTS

23.1 Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign or otherwise dispose of the CONTRACT or any portion thereof, or of his right, title or interest therein, or his obligations hereunder, without written consent of the other party.

## 24. INDEMNIFICATION

24.1 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting there from; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

24.2 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of the may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.

24.3 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, design or SPECIFICATIONS.

## 25. SEPARATE CONTRACTS

25.1 The OWNER reserves the right to let other CONTRACTS in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS 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. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

25.2 The OWNER may perform additional WORK related to the PROJECT by himself or he may let other CONTRACTS containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTORS who are parties to such CONTRACTS (for the OWNER, if he is performing the additional WORK himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate his WORK with theirs.

25.3 If the performance of additional WORK by other CONTRACTORS or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, WRITTEN NOTICE thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves him in additional expense or entitles him to an extension of the CONTRACT TIME, he may make a claim therefore as provided in Section 14 and 15.

## 26. SUBCONTRACTING

26.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those parts of the WORK which under normal contracting practices, are performed by specialty SUBCONTRACTORS.

26.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(S), in excess of fifty (50) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

26.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of his SUBCONTRACTORS, and of persons wither directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

26.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of SUBCONTRACTORS and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.

26.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

## 27. ENGINEER'S AUTHORITY

27.1 The ENGINEER shall act as the OWNER'S representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed. He shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

27.2 The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

27.3 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The ENGINEER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

28. LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The CONTRACTOR shall provide at his own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

29. GUARANTY

29.1 The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one, (1) year from the date of SUBSTANTIAL COMPLETION or FINAL COMPLETION OF THE PROJECT or specified part, as appropriate. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION or FINAL COMPLETION OF THE PROJECT or specified part, as appropriate, that the completed project is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the project resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full force and effect through the guarantee period.

30. TAXES

30.1 The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

Form RD 1924-18 (Rev. 6-97)		UNITED STATES DEPARTMENT OF AGRICULTURE RURAL DEVELOPMENT FARM SERVICE AGENCY  <b>PARTIAL PAYMENT ESTIMATE</b>		CONTRACT NO. _____ PARTIAL PAYMENT ESTIMATE NO. _____ PAGE _____	
OWNER: _____		CONTRACTOR: _____		PERIOD OF ESTIMATE FROM _____ TO _____	
CONTRACT CHANGE ORDER SUMMARY				ESTIMATE	
No.	Agency Approval Date	Amount		1. Original Contract ..... 2. Change Orders ..... \$0.00 3. Revised Contract (1 + 2) ..... \$0.00  4. Work Completed* ..... 5. Stored Materials* ..... 6. Subtotal (4 + 5) ..... \$0.00 7. Retainage* ..... 8. Previous Payments ..... 9. Amount Due (6-7-8) ..... \$0.00 * Detailed breakdown attached	
		Additions	Deductions		
TOTALS		\$0.00	\$0.00		
NET CHANGE		\$0.00	\$0.00		
CONTRACT TIME					
Original (days) _____		On Schedule <input type="checkbox"/> Yes <input type="checkbox"/> No		Starting Date _____	
Revised _____				Projected Completion _____	
Remaining _____					
<b>CONTRACTOR'S CERTIFICATION:</b> The undersigned Contractor certifies that to the best of their knowledge, information and belief the work covered by this payment estimate has been completed in accordance with the contract documents, that all amounts have been paid by the contractor for work for which previous payment estimates was issued and payments received from the owner, and that current payment shown herein is now due.			<b>ARCHITECT OR ENGINEER'S CERTIFICATION:</b> The undersigned certifies that the work has been carefully inspected and to the best of their knowledge and belief, the quantities shown in this estimate are correct and the work has been performed in accordance with the contract documents.		
Contractor _____			Architect or Engineer _____		
By _____			By _____		
Date _____			Date _____		
<b>APPROVED BY OWNER:</b>  Owner _____  By _____  Date _____			<b>ACCEPTED BY AGENCY:</b> The review and acceptance of this estimate does not attest to the correctness of the quantities shown or that the work has been performed in accordance with the contract documents.  By _____ Title _____ Date _____		

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0575-0042. The time required to complete this information collection is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information.



**INSTRUCTIONS FOR CONTRACTORS OR SUBCONTRACTORS**  
**RELEASE AND WAIVER OF LIEN FORM**

1. At the preconstruction meeting, the OWNER will receive from the CONTRACTOR a list of all major items (s)he intends to subcontract.
2. Prior to the first requisition for payment, the OWNER will inform the CONTRACTOR as to which of these subcontractors or vendors may be required to complete a CS1-107.
3. The CONTRACTOR shall include in the payment package a CS1-107 form for the over-all CONTRACT and those of any subcontractors or vendors so identified by the OWNER.
4. For all interim payments prior to 90% completion of the CONTRACT, the CONTRACTOR may delete, "...the undersigned does hereby waive, release and relinquish any and all claims, demands and rights of lien for all work, labor, materials, machinery or other goods, equipment or services done, performed or furnished from the first statement.
5. Final payment requires complete wording in the first statement and a fully executed form.

**GENERAL CONTRACTOR'S OR SUBCONTRACTOR'S**  
**RELEASE AND WAIVER OF LIEN**

For and in consideration of the receipt of \$ \_\_\_\_\_, in payment for labor and/or materials furnished, the undersigned does hereby waive, release and relinquish any and all claims, demands and rights of lien for all work, labor, materials, machinery or other goods, equipment or services done, performed or furnished for the construction located at the site hereinafter described, to wit:

\_\_\_\_\_  
(Project Name and Owner)

\_\_\_\_\_, Vermont as of \_\_\_\_\_  
(Date)

The undersigned further warrants and represents that any and all valid labor and/or materials and equipment bills, now due and payable on the property herein above described in behalf of the undersigned, have been paid in full to date of this waiver, or will be paid from these funds.

\$ \_\_\_\_\_  
Total Paid to Date This Contract

\$ \_\_\_\_\_  
Current Payment Due

\$ \_\_\_\_\_  
Total Billed to Date This Contract

\_\_\_\_\_  
Contractor/Sub-Contractor

\_\_\_\_\_  
Witness Signature

By: \_\_\_\_\_

\_\_\_\_\_  
Witness Printed Name

Title: \_\_\_\_\_

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**Supply (with an original signature) the Consent of Surety to Reduction in Retainage, using AIA Document G707A or a similarly formed document, along with the original of the Contractor's request for the reduction of retainage attached. A sample of the Contractor's request form for reduction in retainage is below. This document will be submitted to the Engineer for review and recommended approval to the Owner prior to the payment requisition which shows a reduction in retainage at successful completion of at least 50% of the work (not including materials stored on site) or at Substantial Completion for further reduction below 5% (but not less than the remaining value of work to be completed). Retainage will not be reduced until the Surety provides a document in the form (as noted above) to the Contractor for submission by the Contractor to the Owner which indicates that the Surety agrees with the reduction.**

Note: if additional copies are needed, a copy of the Consent of Surety form and a copy of the Contractor's Request for Reduction of Retainage is acceptable.

~~CONTRACTOR'S REQUEST for Reduction of Retainage~~

**FOR OWNER USE ONLY**

Project Name  
Project #  
Date

Name:  
Funding #  
Contract #  
Contractor:

FROM: Contractor Name, Address

PROJECT:

**CONTRACT NO.:**

**CONTRACT WORK:**

Adjusted Total Contract (Including Change Orders)		\$	_____
Work Completed (Not Including Material Stored)	%	\$	_____
Current Retainage	%	\$	_____
Requested Retainage	%		_____

Consent of Surety Letter attached

Contractor Signature: \_\_\_\_\_

Contractor's Typed Name: \_\_\_\_\_

Title \_\_\_\_\_ Date \_\_\_\_\_

**ENGINEER'S RECOMENDATION For Reduction of Retention**

Pursuant to the conditions of the Construction Documents and my evaluation of the satisfactory performance by the Contractor in the execution of the work, I do  do not  recommend release of retention and future percentage as set forth below.

Typed Name	Recommend Release/Sign	Do Not Recommend Release/Sign	Date
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____

**OWNER'S AUTHORIZATION For Reduction of Retention**

Authorization is hereby granted for retention on the subject contract to be maintained at \_\_\_\_\_% until further notice.

Owner's Authorized Representative Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Owner's Authorized Representative Typed Name: \_\_\_\_\_

**E-MAIL THIS FORM:** This form may be submitted to OWNER/ENGINEER electronically for review by e-mail addressed to the OWNER'S Authorized Representative at: \_\_\_\_\_ and the ENGINEER at: \_\_\_\_\_

**NOTE:** Form may be submitted electronically only for review purposes. To meet contractual requirements, form submitted to OWNER must have original signatures and be accompanied by Consent of Surety. Reduction of Retainage does not release the Contractor or Surety of the requirements to satisfactorily complete the Contract.





**CERTIFICATE OF FINAL COMPLETION AND ACCEPTANCE OF WORK**

CONTRACT NO. \_\_\_\_\_ AGREEMENT DATE: \_\_\_\_\_

CONTRACT DESCRIPTION: \_\_\_\_\_  
\_\_\_\_\_

Notice to Proceed Date of Issuance: \_\_\_\_\_

Completion Date per Agreement and Change Orders # \_\_\_\_\_ thru # \_\_\_\_\_: \_\_\_\_\_

**FINAL CERTIFICATION OF CONTRACTOR**

I hereby certify that the WORK as identified in the Final Estimate of Payment for construction CONTRACT WORK dated \_\_\_\_\_, represents full compensation for the actual value of WORK completed. All WORK completed conforms to the terms of the AGREEMENT and authorized changes.

\_\_\_\_\_  
DATE

CONTRACTOR \_\_\_\_\_  
Signature \_\_\_\_\_  
Title \_\_\_\_\_

**FINAL CERTIFICATION OF ENGINEER**

I have reviewed the CONTRACTOR'S Final Payment Request dated \_\_\_\_\_ and hereby certify that to the best of my knowledge, the cost of the WORK identified on the Final Estimate represents full compensation for the actual value of WORK completed and that the WORK has been completed in accordance with the terms of the AGREEMENT and authorized changes. This certification is provided in accord with the terms of GENERAL CONDITION number 19.5.

\_\_\_\_\_  
DATE

ENGINEER \_\_\_\_\_  
Signature \_\_\_\_\_  
Title \_\_\_\_\_

**FINAL ACCEPTANCE OF OWNER**

I, as representative of the OWNER, accept the above Final Certifications and authorize Final Payment in the amount of \$ \_\_\_\_\_ and direct the CONTRACTOR'S attention to the GENERAL CONDITION #20. The guaranty for all WORK completed subsequent to the date of SUBSTANTIAL COMPLETION, expires one (1) year from the date of this Final Acceptance.

\_\_\_\_\_  
OWNER

\_\_\_\_\_  
Authorized Representative

\_\_\_\_\_

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SECTION 01010  
SUMMARY OF WORK

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Contract Description.
- B. Project Description.
- C. Contractor use of site and premises.
- D. Work Sequence.

## 1.2 CONTRACT DESCRIPTION

- A. Contract Type: Unit Prices as described in the Agreement.
- B. Name of Contract: CSWD Hinesburg Drop-Off Center

## 1.3 PROJECT DESCRIPTION

- A. The project consists of construction of earthwork, drainage improvements, new asphalt, tip wall, compactors, attendant booth, yard waste bunker, the installation of a Pole Barn and associated concrete pad, and miscellaneous related site improvements.
- B. The OWNER has the option to add to the WORK the Alternate Bid Item for the 3000 Watt Solar Array.

## 1.4 CONTRACTOR USE OF SITE AND PREMISES

- A. Contractor shall :
  - 1. Assume full responsibility for protection and safekeeping of products stored on and off premises.
  - 2. Move stored products that interfere with the operations of OWNER or another contractor.
  - 3. Obtain and pay for all additional storage or work areas required for his operations.
- B. Contractor staging area shall be limited to the footprint of the site. There may be a possibility for the Contractor to use property adjacent to the site along the south edge of the site within 50 feet of the fence line as shown, for use as a staging area, if approved by the Town of Hinesburg.
- C. Construction Operations: Limited to project pavement area, and other pre-approved property.
- D. Time Restrictions for Performing Work: Work will be performed between the hours of 7:00 A.M. and 6:00 P.M. Monday through Friday. There will be no work done on legal holidays. Work proposed outside of these times may be allowed if pre-approved by the OWNER .
- E. Utility Outages and Shutdown: Contractor shall notify the Owner and the Town of Hinesburg at least 48 hours in advance of any planned shutdown of any services.

## 1.5 WORK SEQUENCE

- A. During the construction period, coordinate construction schedule and operations with Engineer. Complete installation of all improvements within time allowed.

## PART 2 - PRODUCTS

(Not Used.)

## PART 3 - EXECUTION

The new improvements shall be installed in accordance with the plans, and tested where applicable, before being placed in service. All disturbed construction areas shall be restored to their original condition.

END OF SECTION

SECTION 01025  
MEASUREMENT AND PAYMENT

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Measurement and payment criteria applicable to the Work performed under a unit price payment method.
- B. Defect assessment and non-payment for rejected work.

## 1.2 PAYMENT

- A. Payment Includes: Full compensation for all required labor, products, materials, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- B. Total compensation for required Unit Price WORK shall be included in the Unit Price BID. Claims for payment unit price work not covered in the list of Unit Price pay items shall not be considered.
- C. Progress payments will be made on the basis of actual measurements and quantities determined by the CSWD Construction Engineer.
- D. Final Payment for the work will be made on the basis of actual measurements and quantities determined by the CSWD Construction Engineer.

## 1.3 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. Any work rejected by the Engineer for failure to comply with the Contract Documents shall be promptly removed by the CONTRACTOR and replaced or re-executed in accordance with the Contract Documents and at no expense to the OWNER. The CONTRACTOR shall also make good all work of other CONTRACTORS destroyed or damaged as a result of the removal or re-execution of the rejected work.
- C. All removal and replacement work shall be at the CONTRACTOR'S expense. If the CONTRACTOR fails to remove rejected work within ten (10) days of receipt of WRITTEN NOTICE to do so, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR. The authority of the Engineer to assess the defect and identify payment adjustment is final.

## 1.4 NON-PAYMENT FOR REJECTED PRODUCTS

Payment will not be made for any of the following:

- A. Products wasted or disposed of in a manner that is not acceptable.
- B. Products determined as unacceptable before or after placement.
- C. Products remaining on hand after completion of the Work.

## 1.5 SCHEDULE OF UNIT PRICES

- A. Bid Item 1: Mobilization – The total lump sum shall not exceed 10% of the total base bid amount. 100% of the item will be allowable on the first requisition, subject to retainage.

Bid Item 2: Site Preparation and Erosion Control – Payment shall be by lump sum. Work shall include removal of all trees, stumps, debris, and vegetation necessary to commence earthwork. Work shall also include, but not be limited to installation and maintenance of erosion control measures shown on the plan sheets. Payment shall be full compensation for the work shown on the plans and details in the specifications at the price indicated on the Bid Form.

Bid Item 3: Earthwork and Gravel Base – Payment shall be by Lump Sum. The work includes, but is not limited to: stripping and stockpiling any existing topsoil, cutting, filling, and compacting the subbase soils to the elevations appropriate to achieve the final grades shown of the plans, placing roadway fabric, and purchasing, placing, and compacting the gravel base materials specified. This work includes all material required to bring

the subbase grades up to plan elevations, and the disposal of any excess material at an offsite location.

Bid Item 4: Abandon Water Well – Payment shall be by Each. The work includes, but is not limited to all labor, equipment, and materials required to abandon the existing drilled well on the project site in accordance with the detail on the plans and the requirements of the State of Vermont Groundwater Protection Division.

Bid Item 5: Concrete Pads – Payment shall be by Cubic Yard of concrete placed. Payment shall be full compensation for all the labor, equipment, and materials needed to provide and place the 12" crushed stone base, and install the two concrete pads, one for the pole barn and one for the compactor area. Work shall include, but is not limited to installation of forms, reinforcing mesh or rebar as shown on the plans, and placement and finishing of the concrete and finish surfaces. The contractor, at his or her own expense, shall be responsible for coordinating and providing two concrete tests for each pad, to include strength analysis of the concrete.

Bid Item 6: Bituminous Pavement - Payment shall be by unit price for tons. This item includes all labor, equipment, and materials required for the contractor to place the wearing course and top course of bituminous pavement to the compacted thicknesses shown on the plans. All labor, materials and equipment required to construct the line striping as shown on the plans shall be included as incidental to this item.

Bid Item 7: Block Tipping Wall and Bunker – Payment shall be Lump Sum. Payment shall be full compensation for all labor, equipment, and materials for the contractor to prepare the base for the unit blocks, and installation of the unit blocks to the lines and grades shown on the plans for both the tip wall and the yard waste bunker. Blocks shall have staggered joints as noted on the plans. This item includes backfilling of the wall where applicable, with the backfill meeting the requirements of the plans.

Bid Item 8: Handrail on Block Wall – Payment shall be by linear feet for the length of horizontal handrail placed along the top of the wall. Measurement for this item shall be the horizontal distance along the top rail of the handrail assembly, and this measurement includes all posts, rails, base plates, toe plates, and anchor bolts that make up the Handrail assembly. Payment shall be full compensation for all labor, equipment, and materials for the contractor to install the handrail to the specifications shown on the plans.

Bid Item 9: Electrical Work - Payment shall be by Lump Sum. The work includes all labor, equipment, and materials associated with the installation of all electrical and communications work on this project including, but not limited to: installation of a new meter socket on existing panel board; all underground conduits as shown on the plans including conduits from the operators booth to the potential solar array location; all conductors from the existing electrical service location to the site, including to the pole barn, attendant booth, and to the disconnect switches for the compactor units, and all wiring within the operators booth; includes the compactor disconnect switches and mounting posts; includes Variable Frequency Drives as described on the plans; Voice, Data and Security systems as shown on the plans; and all lighting fixtures and switches for the operators booth and the pole barn; and to complete the electrical work needed to provide a fully functional system. This work includes the conductors and junction boxes for the security system, but the actual security cameras, motion detector fixtures and keypad will be installed by others. It is the responsibility of the general contractor to coordinate all the subcontractors so that the cost of all electrical related work and materials is either covered under this item, or another bid item. The conductors for the Alternate Bid for the Solar Array are **not** included with this pay item, but are included in Alternate Bid Item 17 – 3000 Watt Solar Array. **Any electrical or telecommunications items not specifically listed in a bid item shall be considered subsidiary to one or more related bid items. The failure of the bidder or their subcontractor to cover the cost of an item necessary for a fully operational and functional facility will not be justification for a change order.**

Bid Item 10: Compactors (Furnish & Install) - Payment shall be by Each. The work includes, but is not limited to all labor, equipment, and materials required to provide a fully functional compactor system as shown on the plans and specifications. This work shall include: the installation of the compactors to the alignment as shown on the plans and anchoring the units to the concrete pads; to mount the power unit on the top of the compactor; wire the power unit to the disconnect switch; mounting the operators controls to the railing near the compactor; and troubleshooting the units for full operations.

Bid Item 11: Pre-Engineered Pole Barn Building - Payment shall be by Lump Sum and shall be for full

compensation for the mobilization and de-mobilization to the site, as well as full compensation for materials, equipment and labor associated with the complete design, delivery, and construction of the three-sided building with metal siding and metal roofed pole barn. This work shall include the labor, materials and equipment for the foundation units for each column as shown on the plan or as designed by the building manufacturer and approved by CSWD. Work and materials shall be in accordance with Section 13121 of the General Specifications section of the Bid Documents.

Bid Item 12: Operators Booth - Payment shall be by Lump Sum. The work includes, but is not limited to all labor, equipment, and materials required for a fully functioning building to include: excavation; backfill; foundation concrete footings, walls and floor slab; wood framing; insulation; drywall; drop ceiling; sheathing; roofing; doors; windows; trim carpentry; countertops; paint; flooring and base trim; AC/Heating heat pump system; lighting fixtures and internal wiring; and all other work as shown on the architectural plans. The building shall be wired to accommodate all specified electrical and communications systems. Electrical work or materials needed for the booth, which are not included in Bid item 9 or other bid items shall be provided under this item. **Any electrical or telecommunications items not specifically listed in a bid item shall be considered subsidiary to one or more related bid items. The failure of the bidder or their subcontractor to cover the cost of an item necessary for a fully operational and functional facility will not be justification for a change order.**

Bid Item 13: Chain Link Fencing - Payment shall be by Linear Feet based on the horizontal length of 6 ft. high perimeter chain link fencing placed. Payment shall be full compensation for all labor, equipment, and materials for the contractor to install the fencing, to include concrete bases, pipe supports, wire supports, and all other hardware as shown on the plans and specifications.

Bid Item 14: Chain Link Fence Gates - Payment shall by Each for each gate installed. For clarification, each entrance and exit drive serving the facility shall have two swinging gates, for a total of four gates. Gates shall be 6 ft. high to match the perimeter chain link fencing placed. Payment shall be full compensation for all labor, equipment, and materials for the contractor to install the gates, to include concrete bases, pipe supports, wire supports, latches, receiving posts, and all other hardware as shown on the plans and specifications.

Bid Item 15: Post Mounted Sign - Payment shall be by Each. Payment shall be full compensation for all labor, equipment, and materials for the contractor to install the facility sign (to be provided by CSWD), and all other hardware as shown on the plans and specifications to include pressure treated posts to mount the sign to.

Bid Item 16: Topsoil, Seed, and Mulch - Payment shall be Lump Sum. Payment shall be full compensation for all labor, equipment, and materials needed for the establishment of a healthy catch of grass in all disturbed areas of the site not covered by concrete or bituminous. The work shall include, but not be limited to; spreading and fine grading topsoil to a minimum depth of 4", seeding and mulching, and maintaining erosion control measures until vigorous grass is established. Given the time of year for commencement of construction, if grass is not established in the fall of 2019, the contractor will be responsible for returning in the spring of 2020, to re-seed, as needed to establish a healthy catch of grass.

Alternate Bid Item 17: 3000 Watt Solar Array - Payment shall be Lump Sum. Payment shall be full compensation for all labor, equipment, and materials needed for the complete installation of a fully functioning solar array as described in the General Specifications Section 26 3100. This work includes: the electrical conductors from the Operators Booth to the Solar Array, and full electrical installation. The electrical conduits needed for the proposed solar array site shall be included in Bid Item 9 – Electrical Work.

## PART 2 - PRODUCTS

(No products are required in this Section)

## PART 3 - EXECUTION

(No work is required in this Section)

END OF SECTION

SECTION 01330  
SUBMITTALSPART 1 – GENERAL

## 1.1 DESCRIPTION

- A. This section includes general requirements for project submittals by the Contractor.

## 1.2 SHOP DRAWINGS, SAMPLES, PROJECT DATA

- A. The Contractor shall submit for review by the Engineer three copies of all shop drawings, setting schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or the Engineer's instructions. Deviations from the Drawings and Specifications shall be called to the attention Engineer at the time of the first submission of shop drawings and other drawings for consideration. The Engineer's review of any drawings shall not release the Contractor from responsibility for such deviations. Shop drawings shall be submitted with such promptness as to cause no delay in his work or the work of any other Contractor.
- B. When submitted for the Engineer's review, all shop drawings shall bear the Contractor's certification that he has reviewed, checked and approved the shop drawings, that they are in harmony with the requirements of the Project and with the provisions of the Contract Documents, and that he has verified all field measurements and construction criteria, materials, catalog numbers and similar data. The Contractor shall also certify that the work represented by the shop drawings is recommended by the Contractor and the Contractor's Guaranty will fully apply.
- C. All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for his review. Samples shall be furnished so as not to delay fabrication, and to allow the Engineer reasonable time for the consideration of the samples submitted.
- D. Checking of submittals is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.
- E. The Contractor may only proceed with fabrication and construction of items with returned submittals marked "No Exception Taken" or "Make Corrections as Noted." Resubmit submittals if marked "Rejected", "Revise and Resubmit" or "Submit Specified Item."
- F. The Contractor shall furnish such samples of material as may be required for examination and test. All samples of materials for tests shall be taken according to ASTM Specifications or as provided in the Contract Documents.
- G. All samples shall be submitted by the Contractor with a covering letter indicating that such samples are recommended by the Contractor for the service intended and that the Contractor's Guaranty will full apply.

- H. All materials, equipment and workmanship shall be in accordance with samples guaranteed by the Contractor and reviewed by the Engineer.

END OF SECTION

SECTION 01700  
PROJECT CLOSEOUT

PART 1 GENERAL

1.1 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.2 FINAL CLEANING

- A. Contractor will provide final cleaning after final acceptance.
- B. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.3 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.4 WARRANTIES

- A. Provide notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- C. Submit prior to final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

PART 2 PRODUCTS

(Not Used.)

PART 3 EXECUTION

(Not Used.)

END OF SECTION

SECTION 02741  
 BITUMINOUS CONCRETE PAVEMENT

02741.01 DESCRIPTION. This work shall consist of constructing one or more courses of bituminous mixture on a prepared foundation in accordance with these specifications and the specific requirements of the type of surface being placed, and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the Plans or established by the Engineer.

02741.02 MATERIALS. Materials shall meet the requirements of the following Subsections:

Performance-Graded Asphalt Binder.....VTRANS 702.02

Emulsified Asphalt, RS-1..... VTRANS 702.04

Aggregate for Marshall Bituminous Concrete Pavement..... VTRANS 704.10(a)

The grade of Performance-Graded (PG) asphalt binder used to produce bituminous concrete pavement shall be as shown on the Plans.

02741.03 COMPOSITION OF MIXTURE.

(a) Gradation. For each pavement type, the materials shall be combined and graded to meet the limits specified in the following table:

- 1) Air Voids (Va). The percent of air voids of the mixture shall be calculated by the following formula:

TABLE 02741.03A - PERCENTAGE BY MASS PASSING SQUARE MESH SIEVE

Sieve	Type I	Type II	Type III	Type IV	Type V
31.5 mm (1 1/4 inch)	100				
25.0mm (1 inch)	95-100	100			
19.0mm (3/4 inch)	74-86	95-100	100		
12.5 mm (1/2 inch)	60-80	64-88	95-100	100	
9.5 mm (3/8)		50-82	70-90	95-100	100
4.75 mm (No. 4)	35-60	32-62	42-75	48-78	85-100
2.36 mm (No. 8)	25-45	22-45	28-56	28-56	66-88
1.18 mm (No. 16)		13-35	14-41	14-41	45-67
600 µm (No. 30)	10-25	8-27	7-31	7-31	27-53

300 µm (No. 50)		3 - 20	3 - 22	3 - 22	13 - 40
75 µm (No. 200)	2 - 6	2 - 6	2 - 6	2 - 6	2 - 7
Total Aggr.	94 - 97	93 - 97	92 - 97	92 - 95	91 - 93
Bitumen (% of Total Mix)	3 - 6	3 - 7	3 - 8	5 - 8	7 - 9

- (b) Design Criteria. The materials shall be combined and graded to meet the following criteria:

TABLE 0274I.03B -DESIGN CRITERIA

Marshall Test Properties	Medium Duty Bituminous Concrete Pavement - 50 blows/side	Bituminous Concrete Pavement - 75 blows/side
Air Voids	3.0 - 5.0	3.0 - 5.0
Voids in the Mineral Aggregate (VMA) % Type I	13.0 min.	13.0 min.
VMA %Type II	14.0 min.	14.0 min.
VMA % Type III	15.0 min.	15.0 min.
VMA %Type IV	16.0 min.	16.0 min.
Stability, Newtons	5340 min.	8010 min.
Flow, millimeters	2.0 - 4.5	2.0 - 4.0
% Stone Screenings (Fine Aggregate Portion) Passing 2.36 mm (No. 8) sieve	60.0 min.	75.0 min.

$$V_a = 100 \times ((G_{mm} - G_{mb}) / G_{mm})$$

where:

$G_{mm}$  = Maximum specific gravity of uncompacted mixture (AASHTO T 209)  
 $G_{mb}$  = Bulk specific gravity of compacted mixture (AASHTO T 166, Method A)

Unless otherwise noted on the Plans, all bituminous concrete pavement shall be designed in conformance with the design criteria for Bituminous Concrete Pavement.

Unless otherwise specified for highways, Type I shall be used for base course, Types I or II shall be used for binder course, and Types II, III, or IV shall be used for wearing course. Unless otherwise specified for bridges, Type IV shall be used for binder course.

- (b) Mix Design. The Marshall Method of Mix Design will be used to develop a mix that will meet the specified Design Criteria. A copy of all test data used in developing the mix design, including graphs, may be required with the submittal of the mix design.

The job-mix formula for each mixture shall establish a single percentage of aggregate passing each sieve and a single percentage of bituminous material to be added to the aggregate. No change in the job-mix formula may be made without the written approval of the Engineer. The job-mix formula must fall within the master range of the specification as shown in Subsection 02741.03(a).

No work shall be started until the Contractor has submitted and the Engineer has approved a mix design including cold feed and hot bin gradations, mixing times, the percentage of each ingredient including bitumen, the job-mix formula from such a combination, and the optimum mixing and compaction temperatures as required in the Marshall Method of Mix Design.

The Engineer may approve changes in the design's job-mix formula or discontinue use of the design if placement, finishing, or compaction characteristics are determined by the Engineer to be unsatisfactory.

At the time the above mix design is submitted, the Contractor shall indicate and make available for sampling and testing the PG asphalt binder and stockpiles of all aggregates proposed for use.

02741.04 WEATHER AND SEASONAL LIMITATIONS. The bituminous material shall not be placed when the ambient air temperature and temperature at the paving site in the shade and away from artificial heat is below 5C (40F) for courses 35 mm (1 1/4 inches) or greater in compacted thickness or below 10 C (50F) for courses less than 35 mm (1 1/4 inches) in compacted thickness.

Bituminous material shall not be placed on a wet or frozen surface or when weather or other conditions would prevent the proper handling, finishing, or compacting of the material, unless otherwise approved by the Engineer.

Bituminous material shall not be applied between November 1st and May 1st. Bituminous wearing course materials shall not be applied before May 15<sup>th</sup> or after October 15<sup>th</sup>.

When it is in the public interest, the Construction Engineer may adjust the ambient air temperature requirements, pavement temperature requirements, or extend the dates of the paving season.

02741.06 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be uniformly heated to the specified temperature. A continuous supply of the bituminous material shall be provided to the mixer at a uniform temperature at all times.

02741.07 PREPARATION OF AGGREGATES. The aggregate for the mixture shall be dried and heated at the mixing plant before being placed in the mixer. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate and to avoid depositing soot or unburned fuel on the aggregate. Immediately after heating, the aggregates shall be screened and conveyed into separate bins ready for batching and mixing with bituminous material.

If required to meet the gradation requirements, mineral filler shall be added in a manner approved by the Engineer after the aggregates have passed through the dryer.

The above preparation of aggregates does not apply for drum-mix plants.

02741.08 MIXING. The dried aggregates shall be combined with the bituminous material in a manner that will produce a mixture which, when discharged from the mixing unit, shall be at the temperature specified on the approved mix design unless otherwise directed by the Engineer.

The dried aggregates shall be combined in the mixer in the appropriate proportions required to meet the job mix formula and be thoroughly mixed prior to adding the bituminous material. Dry mix times shall be

increased as deemed necessary by the Engineer in such cases that RAP material is introduced into the mixer. The bituminous material shall be measured and introduced into the mixer in the amount determined by the Engineer for the material being used and at a temperature in accordance with Subsection 702.06, unless otherwise directed by the Engineer.

After the required amounts of aggregate and bituminous material have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is obtained. The mixing time shall be regulated by the Engineer and a suitable locking mechanism shall be provided for such regulation.

All plants shall have a means of eliminating oversized and foreign material from being incorporated into the mixer.

02741.09 HAULING EQUIPMENT. To prevent the mixture from adhering to the beds, trucks used for hauling bituminous mixture shall have tight, clean, and smooth metal beds which have been thinly coated with a bond release agent. Petroleum based products will not be permitted.

The trucks used for hauling bituminous mixture shall be compatible with the equipment used for placing the bituminous mixture. Trucks are not to be cleaned and/or emptied on surfaces to be paved.

Each truck shall have a cover of canvas or other suitable material of sufficient size to extend over all sides of the haul vehicle to afford protecting the mix from the weather. When necessary to assure placement of material at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

02741.10 PLACING EQUIPMENT. The bituminous concrete paver shall be a self-propelled unit with an activated screed or strike-off assembly capable of being heated if necessary and capable of spreading the mixture without segregation for the widths and thicknesses required. The screed shall be adjustable to provide the desired cross sectional shape.

Pavers shall be in good mechanical condition, equipped with all necessary attachments, and designed to operate electronically for controlling the grade of the finished surface. Bituminous pavers shall distribute the mixture over the entire width or over such partial width as may be practical. Additionally, pavers shall be equipped such that, upon extension of the screed a distance of 450 mm (18 inches) or more, auger extensions shall be used as directed by the Engineer.

The adjustments and attachments of the paver shall be checked and approved by the Engineer before placement of bituminous material.

Bituminous concrete pavers shall be equipped with a sloped plate to produce a tapered or notched tapered edge at longitudinal joints. The sloped plate shall produce a tapered or notched tapered edge having a minimum face slope of 1 vertical: 3 horizontal. The plate shall be able to accommodate compacted mat thicknesses from 35 mm to 100 mm (1 1/4 inches to 4 inches). The bottom of the sloped plate shall be mounted 10 mm to 15 mm (3/8 inch to 1/2 inch) above the existing pavement.

Bituminous pavers shall be equipped with a joint heater of at least 6250 BTU/min (110,000 W) capacity to heat the longitudinal edge of the previously placed mat to a surface temperature of 95°C (200°F), or higher if necessary, to achieve bonding of the newly placed mat with the previously placed mat without undue breaking or fracturing of aggregate at the interface. The surface temperature shall be measured immediately ahead of the screed. The joint heater shall be equipped with automated controls which shut off the burners when the paving machine stops and reignites them with the forward movement of the paver. The joint heater shall heat the entire area of the previously placed wedge to the required temperature. Heating to the point of 95°C (200°F) or higher shall immediately precede placement of the bituminous material.

02741.11 ROLLERS. Rollers shall be in good mechanical condition, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the bituminous mixture. The mass (weight) of

the rollers shall be sufficient to compact the mixture to the required density without crushing the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls or tires.

Pneumatic-tired rollers shall be equipped with appropriate skirts at all times and be preheated prior to use in order to avoid picking. The Contractor shall remove all picked material from the surface.

Vibratory rollers shall have separate controls for energy and propulsion. They shall be equipped with automatic cutoffs that stop the vibration prior to the roller stopping and/or reversing its direction of travel.

02741.12 CONDITIONING OF EXISTING SURFACE. All surfaces shall be cleaned and sprayed with an emulsion meeting the requirements of Emulsified Asphalt, RS-1 before placing of any bituminous mixture, unless otherwise ordered by the Engineer. The emulsion shall be applied under pressure at a rate of 0.05 to 0.14 L/m<sup>2</sup> (0.01 to 0.03 gallons/yd)

02741.13 PLACING AND FINISHING. The finished surface shall be of uniform texture and evenness and shall not show tearing, shoving, or pulling of the mixture.

At the time of discharge from the haul vehicle, the bituminous mixture shall be within 6°C (10°F) of the compaction temperature for the approved mix design.

The Contractor shall, during all phases of the paving operation, protect from damage all exposed surfaces that are not to be treated.

The bituminous mixture shall be placed and finished with the specified equipment, shall be struck off in a uniform layer to the full width required and of such depth that each course, when compacted, shall have the required thickness, and shall conform to the grade and elevation specified.

When operating in tandem on multi-lane paving, the pavers shall be of the same type and have the same characteristics. Material for leveling may be spread by the use of a grader, if approved by the Engineer.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, luted, and compacted by hand methods.

All material shall be produced early enough in the day in order that the completion of spreading and compaction of the mixture will occur during daylight hours, unless night paving has been approved for the project. No traffic will be permitted on placed material until the material has been thoroughly compacted and has cooled to 60°C (140°F) unless otherwise authorized by the Engineer.

The use of water to cool the pavement will not be permitted.

The Agency may require that all work adjacent to the pavement, such as guardrail, cleanup, and turf establishment, be completed prior to placing the wearing course when such work could cause damage to the pavement. When bituminous concrete pavement is to be placed on a bridge deck having a waterproofing membrane, a rubber-tired or rubber tracked paver shall be used to place the binder course of pavement.

On projects where traffic will be maintained, the Contractor may be required to schedule daily paving operations such that at the end of each work day all travel lanes of the roadway on which work is being performed will be paved to the same limits or as directed by the Engineer.

Suitable permanent aprons or temporary fillets shall be constructed at side road intersections and driveways as directed by the Engineer within 24 hours of adjacent mainline paving. Permanent aprons shall be constructed within 5 working days of adjacent mainline paving. Reasonable access to and from the mainline mat shall be maintained at all times.

02741.14 COMPACTION. Immediately after the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, tearing, or shoving. Should the mix exhibit these characteristics, and the Contractor is unable to remedy these conditions to the satisfaction of the Engineer, both placement and approval of the mix design will be terminated.

The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Generally, one breakdown roller will be needed for each paver used in the spreading operation.

Leveling courses shall be compacted using a self-propelled pneumatic-tired roller unless otherwise directed in writing by the Engineer. On base, binder, and wearing courses, the initial or breakdown rolling shall be done by using a two-axle tandem roller; intermediate rolling shall be done by using a two-axle tandem roller or self-propelled pneumatic-tired roller; and final rolling shall be done by using an additional two or three axle tandem roller. The equipment used for shoulder construction shall be sufficient to obtain the required compaction while the mixture is in a workable condition.

To prevent adhesion of the mixture to the rollers, the rollers shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. Excess liquid and petroleum products will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hand tampers.

Unless otherwise directed, the longitudinal joint shall be rolled first and then rolling shall begin at the low side of the pavement and proceed towards the center or high side with lapped rollings parallel to the centerline. The speed of the roller shall be slow and uniform to avoid displacement of the mixture, and the roller shall be kept in as continuous an operation as practicable. Rolling shall continue until all roller marks and ridges have been eliminated.

Rollers shall not be stopped or parked on new, freshly placed bituminous material.

Any mixture that becomes loose and broken, mixed with dirt or is in any way defective shall be removed and replaced with fresh hot mixture which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of bitumen shall be removed and replaced. These replacements shall be at the Contractor's expense.

Should the Contractor choose to use vibratory rollers, the following additional criteria shall govern their operation:

Vibratory rollers may be used when operated at an amplitude, frequency, and speed that produces a mat conforming to specifications and which prevent the creation of transverse ridges in the mat. Vibratory rollers may be used as a breakdown roller, an intermediate roller, or a finish roller. They shall not be used as a substitute for a pneumatic-tired roller on leveling courses, nor shall they be used for compacting lifts of pavement under 25 mm (1 inch) in depth. A single vibratory roller shall not be used alone as the breakdown, intermediate and finish roller, but may be used as any one of the rollers in the roller train.

If the Engineer determines that unsatisfactory compaction is being obtained, unacceptable surface distortion is occurring, or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed in accordance with the fourth paragraph of this Subsection. All requirements of this Subsection shall apply regardless of compaction equipment used.

The Contractor assumes full responsibility for, and shall repair at the Contractor's expense, all damages which may occur to highway components and adjacent property if vibratory compaction equipment is used.

**02741.15 JOINTS.** Joints between old and new pavements, or between successive day's work, shall have a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a transverse joint constructed.

Transverse butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at a location approved by the Engineer, where the pavement has a true surface as determined by the use of a straightedge at least 4.9 m (16 feet) long. The transverse joint shall be thoroughly coated with Emulsified Asphalt, RS-1 just prior to depositing new paving mixture.

Transverse tapered joints shall be formed by ramping down the last 450 to 600 mm (18 to 24 inches) of the course being placed to match the lower surface. Care shall be taken in raking out and discarding the coarser aggregate at the low end of the taper, and in rolling the taper. The taper area shall be thoroughly coated with Emulsified Asphalt, RS-1 just prior to resuming paving. As the paver places new mixture on the taper area, placement shall proceed such that an evenly graduated deposit of mixture will complement the previously made taper. Shovels may be used to add additional mixture if necessary. The joint shall be smoothed with a rake and properly rolled, with coarse material discarded.

Longitudinal joints that have become cold shall be coated with Emulsified Asphalt, RS-1 before the adjacent mat is placed. If directed by the Engineer, such joints shall be cut back to a clean vertical edge prior to coating with the emulsion.

Unless otherwise directed by the Engineer, longitudinal joints shall be offset at least 150 mm (6 inches) from any joint in the lower courses of pavement. Transverse joints shall not be constructed nearer than 300 mm (12 inches) from the transverse joints constructed in lower courses.

02741.16 SURFACE TOLERANCE. The surface will be tested by the Engineer using a straightedge at least 4.9 m (16 feet) in length at selected locations parallel with the centerline. Any variations exceeding 3 mm (1/8 inch) between any two contact points shall be satisfactorily eliminated. A straightedge at least 3 m (10 feet) in length may be used on a vertical curve.

02741.17 TRAFFIC CONTROL. Whenever traffic must be maintained during a paving operation, uniformed traffic officers and/or flaggers shall be stationed at each end of the section being paved and at such other locations as may be required by the Engineer.

Whenever one-way traffic is maintained by the Contractor, the traveling public shall not be delayed more than 10 minutes unless otherwise directed by the Engineer. Two-way traffic shall be maintained during non-working hours.

02741.18 METHOD OF MEASUREMENT. The quantity of Bituminous Concrete Pavement to be measured for payment will be the number of tons for a lot of mixture (each type) complete in place in the accepted work as determined from the weigh tickets.

02741.19 BASIS OF PAYMENT. The accepted quantity of Bituminous Concrete Pavement will be paid for at the Contract unit price per ton. Payment shall be full compensation for furnishing, mixing, hauling, and placing the material specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work. When not specified as items in the Contract, the costs of cleaning and filling joints and cracks, sweeping and cleaning existing paved surfaces, the emulsified asphalt applied to tack these surfaces, and tacking of manholes, curbing, gutters, and other contact surfaces will not be paid for directly, but will be incidental to the item of Bituminous Concrete Pavement.

End of Section

## SECTION 03300 CAST-IN-PLACE CONCRETE

## 1. GENERAL

1.1. Scope. Work to be performed under this section shall include all labor, equipment, materials, tools, accessories, plant and incidentals necessary to furnish and install all cast-in-place concrete, together with all miscellaneous and appurtenant items, as shown on the Drawings and as specified herein.

1.2. Related Work Specified Elsewhere

1.2.1. Section 02201 - Excavation and Backfill For Structures

1.3. Reference Standards. Except as modified or supplemented herein, all Work shall conform to the following standards, latest edition. Refer to standards for detailed requirements.

1.3.1. ACI 318 - Building Code Requirement for Reinforced Concrete

1.3.2. ACI 301 - Specifications for Structural Concrete for Buildings

1.3.3. ACI 347 - Recommended Practice for Concrete Formwork

1.3.4. ACI 305 - Recommended Practice for Hot Weather Concreting

1.3.5. ACI 306 - Recommended Practice for Cold Weather Concreting

1.3.6. Publication SP-2, ACI Manual for Concrete Inspection

1.3.7. ASTM A 615 -Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

1.3.8. ASTM A 185 -Specifications for Welded Steel Fabric for Concrete Reinforcement.

1.3.9. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

1.4. Submittals. The following shall be submitted to and approved by the Engineer 15 calendar days prior to concrete placement.

1.4.1. Lab Design Mix. Prior to the start of Work, Contractor to submit a statement of the proportions for the concrete mixture. Statement to include:

1.4.1.1. Location & identification of aggregate source.

1.4.1.2. Batch quantities for one (1) cubic yard of concrete, including:

1.4.1.2.1. Weight of fine aggregate in a saturated surface dry condition.

1.4.1.2.2. Weight of coarse aggregate in a saturated surface dry condition.

1.4.1.2.3. Weight or number of 94-pound bags of cement.

1.4.1.2.4. Weight or gallons of water.

1.4.1.2.5. Amount and description (including manufacturer, specific product name, and number) of all admixtures.

1.4.1.3. Test results on trial batch concrete made from the proposed mix design, including:

1.4.1.3.1. Cement factor in bags per cubic yard based on yield tests.

1.4.1.3.2. Water-cement ratio.

1.4.1.3.3. Percent of entrained air.

1.4.1.3.4. Consistency in inches of slump.

1.4.1.3.5. At least three 28-day compressive strength tests.

1.4.1.4. Brand, type and place of manufacture of cement.

1.4.1.5. Aggregate test results for grading, deleterious substances and physical properties using test procedures developed by ACI.

1.5. Reinforcing Steel. Product data sheet and statement of manufacturer's compliance with applicable standards.

1.6. Construction Joint. Location of all wall and slab construction joints.

1.7. Record of the Work. Contractor to keep a record of time, date and location of each concrete placement and submit these records to the Engineer.

1.8. Notice of Placement Activities. Contractor shall notify the Engineer at least 48 hours before an intended cast-in-place concrete placement. No structural cast-in-place concrete shall be placed until all reinforcing, forms and foundation soils have been inspected by the Engineer.

1.9. Protection of the Work. Contractor to be responsible for protection of all Work prior to acceptance. In place, concrete shall not be subjected to loadings or stress prematurely..

1.10. Storage of Materials. Cement and aggregate shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete.

1.10.1. All reinforcing steel shall be stored in a dry location and protected from excessive accumulation of rust or scale.

## 2. MATERIALS

2.1. Cement. All cement shall be Portland Cement Type II conforming to "Specifications for Portland Cement" (ASTM C 150-62). The same brand cement for all exposed cast-in-place concrete shall be used.

2.2. Stone Aggregate. Fine and coarse aggregate shall conform to "Specifications for Concrete Aggregates" (ASTM C33-61 T). Fine aggregates shall be clean, hard, natural and free from all foreign matter. Coarse aggregate shall be sound, crushed rock or gravel, free from adherent coating, organic water or injurious amounts of flat or friable pieces.

2.3. Water. Water used in mixing shall be potable, cleaned and free from deleterious amounts of oil, acids, alkalis and organic material.

2.4. Admixtures. "Protex" as manufactured by Protex Industries, Inc. and conforming to Specifications of Air-Entraining Admixtures for Concrete (ASTM C260) is an approved air entraining admixture. Other admixtures for retarding or accelerating concrete may be used in strict accordance with manufacturer's recommendations and ASTM Specifications upon approval of Engineer.

2.5. Form Material. For unexposed concrete surfaces, forms may be undressed lumber free from excessive knots. For exposed surfaces, use wood or metal forms as required to give finish as specified

2.6. Reinforcing Steel. Reinforcing steel shall be deformed bars conforming to "Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement" (ASTM A615) and shall be Grade 60.

2.7. Welded Wire Fabric. Welded wire fabric shall conform to "Specifications for Welded Steel Fabric for Concrete Reinforcement" (ASTM A185) and shall have minimum wire yield strength of 60,000 psi.

## 3. METHODS AND PROCEDURES

### 3.1. Concrete Mix

3.1.1. Proportions. Concrete is to be proportioned according to laboratory designed mixes using the type of aggregate specified and producing the minimum of twenty-eight (28) day ultimate compressive strength as noted on the Construction Documents. All concrete shall be made with stone aggregate unless specifically noted, and no concrete shall have a 28-day compressive strength of less than 4,000 psi.

3.1.2. Cement and Water Content. The minimum quantity of cement used per cubic yard of concrete shall be 580 pounds. Water content shall not exceed 0.48 pounds water/ pounds cement.

3.1.3. Air Entrainment. An air-entraining agent shall be added to all stone concrete to entrain 5%-8% by volume. Air-entraining agents shall be in strict accordance with the recommendations of the manufacturer and the testing laboratory for the design mix to assure strength requirements are being fully met or exceeded.

3.1.4. Mixing of Materials. The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer.

3.1.4.1. For stone concrete, mixing shall continue for at least one minute after all materials is in the mixer. Ready mixed concrete shall be mixed and delivered in accordance with "Standard Specifications for Ready Mixed Concrete" (ASTM C94-69).

3.1.4.2. Sufficient time shall be allowed for proper mixing on the concrete to provide uniformity throughout the batch. Long delays in concrete placement shall be avoided and any concrete, which has not been placed within ninety (90) minutes after water has been added to the mix, shall be rejected. Over wet mixes shall be rejected and shall not be corrected by the addition of either aggregate or cement to the mixer. Mix not less than ten minutes in transit mix trucks after addition of the mixing water.

3.1.5. Consistency Slumps shall be minimum, consistent with placing requirements. Slump test shall be made in accordance with "Slump Test for Consistency of Portland Cement Concrete" (ASTM C143-58). Unless written approval is obtained from the Engineer, the maximum slump shall be three (3"  $\pm$  1 ") inches and the maximum size aggregate shall be one and one-half (1 ½ ) inches.

### 3.2. Concrete Forms

3.2.1. Forms shall conform to the shape, lines, grades and dimensions of the concrete as detailed on the Construction Drawings. All forms for exposed finished surfaces shall be built with the material needed to produce the form, texture and design specified in Concrete Finishes of this section.

3.2.2. Design of Forms. Forms shall be sufficiently tight to prevent leakage of mortar and shall be properly braced or tied together to maintain the desired position. The formwork shall be designed for the loads outlined in Part 3, Section 102 of "Recommended Practice for Concrete Form Work" (ACI 347-78). The forms shall be oiled for ease of removal of forms after setting of concrete.

3.2.3. Form Ties and Incidentals. Form ties shall be bolts and rods (adjustable for tightening) arranged so that no metal is within 3 to 4 inches of surface after removal of forms. Ordinary wire ties will be allowed with the specific approval of the Engineer. No ties through exposed concrete will be allowed. Set forms for all required anchors, bolt inserts, slots, sleeves, supports, etc., furnished under portions of this Specification and installed under this section.

3.2.4. Removal of Forms. Forms shall not be disturbed until concrete has hardened sufficiently to permit their removal with safety. The removal of the forms shall be carried out in such a manner as to insure the safety of the structure. Unless otherwise permitted by the Engineer, forms shall not be removed until 24 hours after placement.

3.3. Control and Expansion Joints. Expansion and control joints shall be constructed in accordance with Construction Drawings. Unless otherwise indicated on the Construction Drawings, install one inch (1") thick asphalt impregnated fiberboard expansion joint filler (ASTM D 1752) wherever concrete slabs abut buildings or footings or as shown on the plan details. All expansion joint filler shall extend the full depth of the slab.

3.3.1. Provide control joints at maximum of 15 feet each way, unless otherwise noted, in interior slabs of grade. Where saw cut joints are permitted, start cutting as soon as concrete has

hardened sufficiently to prevent dislodgement of aggregates. Saw a continuous slot to a depth of one-fourth the thickness of the slab but not less than 1 ¼ inch. Complete saw cutting within 12 hours after placement.

### 3.4. Concrete Placement

3.4.1. Preparation for Placing Before placing concrete, all equipment for mixing and transporting concrete shall be cleaned and all debris and ice shall be removed from places to be occupied by concrete. Forms shall be properly treated and all reinforcement cleaned of ice and other coatings. Water shall be removed from place of deposit before concrete is placed.

3.4.2. Conveying Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials. Equipment for chute, pumping, or pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery and without separation of the materials.

3.4.3. Other Trades Install by way of example, anchor bolts, reinforcing steel, pipe and conduit openings and sleeves, bearing plates, and knockouts as provided by other trades and as required by other trades. Provide minimum 7 days notice to Engineer, Owner, or other trades prior to requiring materials or detailing information. Installation to meet location, dimension and alignment requirements of other trades.

3.4.4. Depositing Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to re-handling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the space between the bars. No concrete that has been partially hardened or been contaminated by foreign matter shall be deposited on the Work, nor shall re-tempered concrete be used. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. Place concrete in approximately horizontal layers avoiding displacement of reinforcement above fresh concrete and formation of seams and planes of weakness in sections. When construction joints are necessary, they shall be located as specified in this section under Construction Joints. For bonding fresh concrete, roughen and clean exposed surface and brush with neat cement grout. Place new concrete before grout takes initial set.

3.4.5. Compaction Place concrete in layers not over 24" deep; compact each layer by mechanical internal vibrating equipment supplemented by hand spading, rodding, tamping, as directed. Vibrators shall not be used to transport concrete inside forms. Limit vibration duration to the time necessary to produce satisfactory consolidation without causing objectionable segregation. Do not insert vibrator into lower courses that have begun to set.

3.4.6. Weather Conditions Unless adequate protection is provided and the Engineer's approval is obtained, concrete shall not be placed during rain, sleet, or snow. When the mean temperature falls below 40°F for three successive days, concreting shall conform to "Recommended Practice for Cold Weather Conditions: (ACI 306 R-78). Concrete placed in hot weather shall meet the standards of "Recommended Practice for Hot Weather Concreting (ACI 305R- 77). Concrete is not to be placed under water. A suitable means shall be provided for lowering the water level below surfaces upon which concrete is to be placed. This may require excavating approximately 12 inches below the bottom of the concrete surface and refilling with gravel and compacting. The groundwater shall not be allowed to rise to the bottom of the concrete until 24 hours after the concrete has been completed. Water shall not be allowed to fall upon or run across the concrete during this period.

3.4.7. Protection and Curing. Concrete protection and curing shall be in conformance with ACI 308- 71. Immediately after placing or finishing, concrete surfaces not covered by forms shall be protected from loss of surface moisture. All concrete shall be kept in a moist condition for at least five (5) days after placement. Curing compounds may be used upon approval of the Engineer.

3.5. Slabs on Grade. All slabs on grade shall be placed directly on the prepared gravel subgrade where shown on the Construction Drawings. Construction joints shall be placed such that no section of slab is greater than 25 feet on a side. Finishes, Expansion & Control joints & protection shall be as specified under other sections of this section.

3.5.1. Gravel base course shall comply with the requirements depicted on the project plans.

### 3.6. Concrete Finishes

#### 3.6.1. Floor slabs.

3.6.1.1. Floated Finish. After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and the surface has stiffened sufficiently to permit the operation. During or after the first floating, planes of surface shall be checked with a 10-foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface plane within tolerance not exceeding ¼ inch in 10 feet throughout. The slab shall then be refloated immediately to a uniform sandy texture.

3.6.1.2. Troweled Finish. Apply trowel finish to monolithic slab surfaces that are exposed to view unless otherwise shown in schedule. The surface shall be first float finish, next power-troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture and appearance and shall be planed to a tolerance not exceeding 1/8 inch in 10 feet. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

#### 3.6.2. Formed Surfaces.

3.6.2.1. Rough Form Finish. Includes formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding W' in height rubbed down or chipped off.

3.6.2.2. Smooth Form Finish. Includes formed concrete surfaces exposed to view or to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete, such as waterproofing, damp-proofing, painting or

other similar system. Produce smooth form finish by selecting form materials to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smooth.

3.6.2.3. Smooth Rubbed Finish. Provide smooth rubbed finish, when specified, for all exposed concrete surfaces, which have received smooth form finish treatment not later than the day after form removal. Moisten concrete surfaces and rub with carundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

3.6.2.4. Related Unformed Surfaces. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless other shown.

3.6.3. Chamfer. All exterior comers shall receive 3/4" chamfer.

3. 7. Repair of Surface Defects. After forms are removed, remove all flaws or damaged areas resulting from improper or poor concrete operations, rebuild or patch when approved by the Engineer. All exposed surfaces shall have fins and other projections carefully removed, offsets leveled, and voids saturated with water and patched to a true and even surface with a wood float. Patch all holes left by the removal of the form ties or bolts. Patching material shall be a stiff mixture of sand and cement, the color of which matches the concrete being patched. Any major area of faulty or honeycombed concrete shall be completely removed and patched at the direction of the Engineer

### 3.8. Reinforcement

3.8.1. Placing Reinforcement Reinforcing steel, at the time concrete is placed, shall be free from scale, rust or other coatings that will destroy or reduce bond. Reinforcement shall be accurately placed as shown on the Construction Drawings and shall be adequately secured in position by concrete or plastic chairs and spacers.

3.8.1.1. Reinforcing shall be furnished in the full lengths indicated on the Construction Drawings unless otherwise authorized by the Engineer. Splicing of bars, except where shown on the Construction Drawings or specified, shall not be permitted without written approval by the Engineer. Reinforcement placed in any member shall be inspected before any concrete is placed and the Engineer shall be notified 24 hours in advance before any concrete placement.

3.8.1.2. The placing, fastening, splicing and supporting of reinforcing steel and welded wire fabric shall be in accordance with the Construction Drawings and the latest edition of the CRSI "Recommended Practice for Placing Reinforcing Bars" and in accordance with ACI 318- 77. Bars shall be placed around all comers to splice steel in adjacent walls, footers and slabs (such detailing may not be shown on Construction Drawings).

3.8.2. Concrete Protection & Reinforcement: Where not otherwise indicated on the Construction Drawings, the minimum thickness of concrete over the reinforcement shall be as follows:

- 3.8.2.1. Concrete deposited against earth: 3"
- 3.8.2.2. Slabs and walls not exposed to weather or earth: 1"
- 3.8.2.3. All other concrete placed in forms:
  - 3.8.2.3.1. For bars larger than #5: 2"
  - 3.8.2.3.2. For bars #5 or smaller: 1 1/2"

3.8.3. Bearing Plates, anchor bolts, etc. Place all bearing plates, anchor bolts, reinforcing rods and other structural items furnished by other trades. Contractor to provide 7-day notice to all such trades prior to affected pour. Installation to be within tolerances required by other trades.

#### 4. FIELD QUALITY CONTROL

4.1. Concrete Tests. 6" x 12" cylinders shall be taken at the point of placing in the forms, shall be job cured and tested in accordance with ASTM Standards by the Engineer. For each strength of concrete used, one set of four (4) cylinders for each day's placement, but not less than one (1) set of cylinders for each 100 cubic yards placed shall be taken. Two (2) cylinders at seven (7) days and two (2) cylinders at twenty-eight (28) days shall be tested. In addition, when in the opinion of the Engineer, there is a possibility of the surrounding air temperature falling below 40° F; additional specimens to be cured under job conditions may be required.

4.2. Enforcement of Strength Requirements When the strengths shown by the test specimens fall below the specified values, the Engineer shall have the right to require changes in proportions to apply on the remainder of the Work.

4.2.1. If concrete fails to meet the strength requirements of this specification, the Engineer may order the Contractor to have a testing laboratory, acceptable to the Engineer, take and test core samples of questionable concrete. The Engineer may order all low-strength concrete removed and replaced if core strengths are below specified strengths. All costs connected with concrete coring and removal and replacement of low-strength concrete shall be borne by the Contractor.

4.2.2. Contractor shall repair all core holes at his expense.

4.3. Slump Tests Engineer to conduct slump tests on each day's placement and on individual trucks whenever concrete consistency varies. Test failure shall be grounds for rejection of individual or batch loads.

4.4. Air Content Engineer to conduct air tests on each day's placement and on individual trucks as determined by the Engineer. Test failure shall be grounds for rejection of entire batch until satisfactory tests are obtained.

End of Section

## SECTION 13121

## PRE-ENGINEERED POLE BARN BUILDING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Provide pre-engineered building systems, including, but not limited to, primary and secondary structural framing systems, roofing, siding, and accessories. The basis of these specifications is from Lester Building Systems, however, other manufactures will be considered:
1. Building shall be supported by wood columns on concrete pad footings, framing to be clear span truss and columns, siding and roofing to be steel.
  2. Bidder Shall submit, **as part of the bid**, the Pre-Engineered Pole Barn Building Manufactures name, and the general building specifications and details of the proposed building system.
  3. The building is 40 feet wide with two 20' spans, by 20 feet deep. This item includes the beams required for the 20' opening on the front side of the building and all structural requirements for this span configuration.

## 1.2 REFERENCES

- A. ASTM International:
1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  3. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
  4. ASTM C523 - Method of Test for Light Reflectance of Acoustical Materials by the Integrating Sphere Reflectometer.
  5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  6. ASTM C991 - Standard Specification for Flexible Glass Fiber Insulation for Metal Buildings.
  7. ASTM C1036 - Standard Specification for Flat Glass.
  8. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
  9. ASTM D523 - Standard Test Method for Specular Gloss.
  10. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test.
  11. ASTM D3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
  12. ASTM D3841 - Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels.
  13. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet.
  14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  15. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

### 1.3 SYSTEM DESCRIPTION

- A. Structural Frame Design:
  - 1. Design shall be based on the following building framing and enclosure criteria:
    - a. Type: Clear span roof truss.
    - b. Minimum Clear Height: 12 feet (min. at eave).
    - c. Columns: Sitting on concrete piers independent of slab.
    - d. Purlins: Recessed between trusses in galvanized steel joist hangers.
- B. Overall Structure (Barn) Dimensions:
  - 1. Depth: 20 feet 0 inches, outside to outside of primary or secondary wall framing.
  - 2. Length: 40 feet 0 inches, outside to outside of primary or secondary wall framing.
  - 3. Height: 12 feet 0 inches, minimum clearance from top of floor to underside of truss or rafter.
  - 4. Roof Slope: 3:12 (units of rise per 12 units of run).
- C. Structural Requirements:
  - 1. Building Code: International building Code (IBC) and ASCE-7, current edition.
  - 2. Design Loads: To be determined by Structural PE for VT typical loading conditions. Design criteria includes:
    - a. Ground Snow Load
    - b. Ground Exposure Factor
    - c. Roof Load, Live load
    - d. Roof Dead Load
    - e. Ceiling Dead Load
    - f. Wind Load
    - g. Wind Exposure: per building code
    - h. Maximum Considered Earthquake per building code.
    - i. Collateral Loads: Additional loads imposed by contract documents other than weight of building systems specified in this section.
    - j. Combination Loads: Comply with Building Code.
  - 3. Structural Design:
    - a. Perform calculations using diaphragm and/or frame analysis. Incorporate bracing as required.
    - b. Comply with AF&PA "National Design Specification for Wood Construction (NDS)."
    - c. Trusses:
      - 1) Limit deflection for live or snow loads to L/240 for trusses supporting ceilings and to L/180 for overhangs and trusses not supporting ceilings.
      - 2) Comply with appropriate NDS and Truss Plate Institute (TPI) standards.
    - d. Metal Wall and Roof Panels:
      - 1) Design in accordance with AISI "Specifications for the Design of Light-Gauge, Cold-Formed Steel Structural Members" and in accordance with sound engineering methods and practices.
    - e. Plywood or Oriented Strand Board Sheathing: Comply with APA "Plywood Design Specification."
    - f. Expansion/Contraction Provisions: Design roof attachment system to allow for expansion and contraction of metal roofing, due to seasonal temperature variations, without detrimental effect to the roof panels.

### 1.4 SUBMITTALS

- A. Manufacturer's Data: Provide Manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's specifications and installation instructions for building components and accessories.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.

- B. Shop Drawings: Showing roof framing, cross sections, roof and wall covering and trim details and accessory and component details clearly indicating proper assembly.
- C. Structural Engineer Certification: Letter signed by a Professional/Structural Engineer, registered to practice in Vermont, verifying compliance with Snow Design Requirements. Letter shall reference specific dead loads, live loads, wind loads, tributary area load reductions (if applicable) collateral loads, seismic loads, end use categories, and governing building code including edition and load applications.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum ten years experience in producing pre-engineered wood buildings of the type specified.
- B. Installer Qualifications: Minimum three years experience in erection of pre-engineered wood buildings of the type specified.
- C. Structural Engineer's Qualifications: Minimum of three years designing post frame structures; registered in the jurisdiction of the project.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation. Follow manufacturer's recommended storage procedures. Do not allow steel siding and roofing to contact the ground.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

#### 1.7 PROJECT CONDITIONS

- A. Anticipate environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### 1.8 WARRANTY

- A. Structural Design - Lifetime: Manufacturer warrants that the building designed will not experience an occurrence of structural failure or an occurrence of structural damage due to improper structural design on account of weather conditions, such as wind, ice, and snow. The foregoing warranty is limited to 50 years with respect to any Owner which is not an individual.
- B. Preservative Treated Materials: 50 years. Preservative treated lumber, including structural columns, are warranted by the original materials manufacturer against failures due to fungal decay and termite infestation.
- C. Roofing and Siding Finish: Warranted by the original materials manufacturer for 40 years from the date of shipment. Refer to Warranty document for complete details.
- D. Individual Building Products: Manufacturer's standard warranty.
- E. Installation Warranty: One year general installation warranty, five years against roof leaks.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Acceptable Building Manufacturers: Lester Building Systems, Morton Buildings, Conestoga Buildings, or Ag Structures LLC, or others, only if they meet the other requirements of this Section.

## 2.2 STRUCTURAL FRAMING

- A. Footings:
1. Concrete piers to support Columns:
    - a. Cast-in-place 4000 psi concrete sized to meet required loading
- B. Primary Framing:
1. Columns:
    - a. Treated Lumber Section:
      - 1) Lumber: No. 1 or Better Southern Yellow Pine, pressure treated with Chromated Copper Arsenate, Type III, to a retention of 0.6 pcf (9.6 kg/m<sup>3</sup>) and kiln dried after treating to 19 percent maximum moisture content.
      - 2) Fabrication: Laminate individual pieces using ring shank or wire feed nails per manufacturer's engineered nailing pattern. Fasteners shall have ASTM A153 galvanizing.
    - b. Untreated Lumber Section:
      - 1) Lumber: Lumber: No. 1 or Better Southern Yellow Pine or Douglas Fir-Larch or other equivalent NDS approved species/grade kiln dried to 19 percent maximum moisture content.
      - 2) Fabrication: Laminate individual pieces using ring shank or wire feed nails per manufacturer's engineered nailing pattern.
      - 3) Grade and size shall be selected to support imposed loads within deflection limits.
    - c. End Joint Connection of Treated and Untreated Sections: Factory fabricated finger joint.
    - d. Configuration:
      - 1) Sidewall and Endwall Columns: 3 ply or 4 ply combining 2x4, 2x6, 2x8, or 2x10 (50x150, 50x200, 50x250 mm) dimension lumber as required by "Structural Design" requirements specified herein.
      - 2) Corner Columns: 2 ply or 3 ply 2x4, 2x6 or 2x8 (50x150, 50x200 mm) dimension lumber as required by "Structural Design" requirements specified herein.
    - e. Column Anchorage:
      - 1) Anchor blocks factory adhered to column base.
      - 2) Concrete collar pinned to column base with steel reinforcing rods.
  2. Trusses: Comply with "Structural Design" and "Quality Assurance" requirements as specified herein.
    - a. Comply with TPI "Design Specification for Metal Plate Connected Wood Trusses" and "Quality Standard for Metal Plate Connected Wood Trusses."
    - b. Manufacturer shall have a third party inspection program to verify compliance with requirements of TPI.
    - c. Stamp trusses with inspection agency identification.
- C. Secondary Framing:
1. Purlins and Girts:
    - a. Lumber: No. 2 or Better dimension lumber kiln dried to 19 percent maximum moisture content.
    - b. Configuration: 2x4 or 2x6 (50x100, 50x150 mm) as required by "Structural Design" requirements specified herein.
      - 1) Girts: Size, grade and spacing to meet wind and deflection criterion.

- a) Face mounted to exterior side of column.
  - 2) Purlins: Precision cut to fit between trusses flush with top of top chord. Provide 20 gauge galvanized purlin saddle hangers.
  - c. Spacing: As required by "Structural Design" requirements specified herein.
- 2. Splashplank:
  - a. Lumber: No. 2 or Better Southern Yellow Pine, preservative treated, to a retention of 0.6 pcf (9.6 kg/m<sup>3</sup>) of copper naphthenate.
  - b. Configuration: 2x6 or 2x8 (50x 150 or 50x200 mm) dimension lumber. Milled S4S for single row and milled T&G for multiple rows.
- 3. Bracing, Wall and Lateral Truss Type (where required by "Structural Design"):
  - a. Lumber: No. 2 or Better dimension lumber.
  - b. Configuration:
  - c. 2x4 or 2x6 (50x100, 50x150 mm) as required by "Structural Design" requirements specified herein.

### 2.3 METAL ROOFING

- A. Metal Roofing:
  - 1. Material and Finish: 26 Gauge, ASTM A 653 (A 653 M), Structural Quality, Grade 80 (550) (formerly Grade E), galvanized steel with G60 (Z180) zinc coating both sides, Triple Spot Test.
- B. Fasteners: Color coated No. 10 piercing screws with 1/4 inch (6 mm) hex head pre-assembled to 1/2 inch (13 mm) O.D. dome seal or bond seal galvanized steel and EPDM washers.

### 2.4 ROOFING ACCESSORIES

- A. Ridge Cap:
  - 1. Translucent ridge light.
- B. Translucent Ridge Light: Clear Polylit, standard ridge profile, acrylic and polyester resins with gel coat UV protective layer.; ASTM D3841, minimum 8 ounces per square foot, 65 percent visible light transmission. Translucent roof panels (pre-approved by the owner) may be an acceptable alternate to a ridge light.
- C. Eave Overhang Fascia Flashing:
  - 1. Size: 12 inches nominal.
  - 2. Fascia Flashing Color: TBD
  - 3. Vented Soffit Color: TBD.
- D. End Overhang Fascia Flashing:
  - 1. Size: 12 inches nominal.
  - 2. Fascia Flashing Color: TBD
  - 3. Vented Soffit Color: TBD.
- E. Ridge Vent: Provide continuous ridge vent along length of building.

### 2.5 SIDING

- A. Siding:
  - 1. Material and Finish: 29Gauge, ASTM A 653 (A 653 M), Structural Quality, Grade 80 (550) (formerly Grade E), galvanized steel with G60 (Z180) zinc coating both sides, Triple Spot Test.
    - a. Exterior Surface Finish:
      - 1) Bonderize and provide baked on primer and Valspar Weather-X, or equal (silicone polyester, or equal) finish coat, 0.9 mil (0.023 mm) minimum dry film thickness. Color shall be approved by CSWD Engineer.

- 2) Gloss (60 Degrees): ASTM D523, 20 to 80.
- 3) Pencil Hardness: ASTM D3363, F to 2H.
- 4) T-Bend: ASTM D4145: 2T to 4T.

B. Siding Accessories:

1. Wall Trim and Flashings: Provide manufacturer's standard pre-engineered wall trim and flashings.
2. Material and Finish: As shown on Erection Drawings, except as specified herein.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that site conditions are acceptable for erection/installation of pre-engineered wood building system.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory conditions.
- C. Commencement of work by erector/installer is acceptance of site conditions.

#### 3.2 ERECTION- STRUCTURAL FRAMING

- A. Erect in accordance with manufacturer's instructions and approved shop drawings.
- B. Provide temporary erection and wind load bracing to maintain structure plumb and in alignment until installation of permanent bracing and/or roofing and wall coverings are completed.
- C. Do not field cut or alter structural members without approval of Architect and manufacturer.

#### 3.3 INSTALLATION

- A. Erect building per manufacturer's instructions and sequencing.
- B. Metal Roofing:
  1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners as shown on Erection Drawings.
  2. Sidelap: Minimum one full corrugation.
  3. Endlap: 8 inches (200 mm) for slopes 4 in 12 to 5 in 12. Secure together over and to structural members.
  4. Special detailing is required for slopes less than 2 in 12. Refer to construction documents.
  5. Accessories: Install as shown on Erection Drawings.

END OF SECTION

SECTION 26 3100  
PHOTOVOLTAIC COLLECTORS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Photovoltaic system requirements.
- B. Photovoltaic modules.
- C. Photovoltaic module mounting system.
- D. Photovoltaic combiner boxes.
- E. Photovoltaic inverters.
- F. Monitoring system.

## 1.2 REFERENCE STANDARDS

- A. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2016.
- B. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2016.
- C. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2016.
- D. IEC 61215 - Crystalline Silicon Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval; 2005.
- E. IEC 61646 - Thin-Film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval; 2008.
- F. IEEE 1547 - Standard for Interconnecting Distributed Resources with Electric Power Systems; 2003, with Amendment 1, 2014.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- H. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.
- I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 489B - Outline of Investigation for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures for Use with Photovoltaic (PV) Systems; Current Edition, Including All Revisions.
- L. UL 489B - Outline of Investigation for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures for Use with Photovoltaic (PV) Systems; Current Edition, Including All Revisions.
- M. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.
- N. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- O. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.
- P. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.
- Q. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.
- R. UL 2579 - Low-Voltage Fuses - Fuses for Photovoltaic Systems; Current Edition, Including All Revisions.

- S. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.
- C. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.
  - 1. Include copies of documentation with submittals.
- D. Utility Interconnection:
  - 1. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.
    - a. Include copies of documentation with submittals.
  - 2. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
  - 3. Coordinate with Utility Company to provide utility metering suitable for system requirements.
  - 4. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

### 1.4 SUBMITTALS

- A. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, details, and description of operation.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.
  - 1. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Design Data:
  - 1. Include structural calculations, certified by structural engineer, for equipment and mounting system.
  - 2. Include electrical calculations for array and associated equipment other than the basis of design products and configuration.
- E. Certify that products of this section meet or exceed specified requirements.
- F. Certify that work of this section does not void roof warranty.

- G. Installer's Qualifications: Include evidence of compliance with specified requirements.
- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- I. Manufacturer's detailed field testing procedures.
- J. Manufacturer's detailed startup procedures.
- K. Rebate and incentive documentation.
- L. Utility interconnection documentation.
- M. Source quality control test reports.
- N. Field quality control test reports.
  - 1. Include manufacturer's field reports.
- O. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
  - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- P. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- Q. Maintenance contracts.
- R. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- S. Software: One copy of software provided under this section.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with Utility Company requirements for interconnection.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.
  - 1. Licensed in the State in which the Project is located to install photovoltaic systems.
  - 2. Manufacturer's authorized installer.
  - 3. Supervisor: North American Board of Certified Energy Practitioners (NABCEP) certified PV Installer or three years experience supervising the installation of photovoltaic systems.
- F. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

## 1.7 WARRANTY

- A. Specified warranties indicate minimum requirements. Provide additional warranties or extended warranty periods where required to qualify for rebate and incentive programs.
- B. Photovoltaic Modules:
  - 1. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
  - 2. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.
- C. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- D. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- E. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESIGN

- A. Construction documents are schematic. Final design of system shall be by contractor.

### 2.2 MANUFACTURERS

- A. Photovoltaic Modules - Basis of Design: As indicated under product article below.
- B. Photovoltaic Modules, Crystalline Silicon:
  - 1. Kyocera Solar, Inc; \_\_\_\_\_: [www.kyocerasolar.com/#sle](http://www.kyocerasolar.com/#sle).
  - 2. BP Solar: [www.bpsolar.us](http://www.bpsolar.us).
  - 3. Sharp Electronics Corporation; \_\_\_\_\_: [www.sharppusa.com](http://www.sharppusa.com).
  - 4. SolarWorld Americas; \_\_\_\_\_: [www.solarworld-usa.com/#sle](http://www.solarworld-usa.com/#sle).
  - 5. Kyocera Solar, Inc; \_\_\_\_\_: [www.kyocerasolar.com](http://www.kyocerasolar.com).
  - 6. Substitutes: Equivalent Equals.
- C. Photovoltaic Module Mounting System:
  - 1. Cooper B-Line, a division of Cooper Industries; \_\_\_\_\_: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - 2. Direct Power and Water Corporation; \_\_\_\_\_: [www.dpwsolar.com/#sle](http://www.dpwsolar.com/#sle).
  - 3. Unirac, Inc: [www.unirac.com](http://www.unirac.com).
  - 4. PHP Systems/Design; \_\_\_\_\_: [www.phpsd.com](http://www.phpsd.com).
  - 5. TRA Snow and Sun; \_\_\_\_\_: [www.trasnowandsun.com/#sle](http://www.trasnowandsun.com/#sle).
  - 6. Substitutions: Equivalent Equals.
- D. Photovoltaic Combiner Boxes:
  - 1. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  - 2. SolarBOS, Inc; \_\_\_\_\_: [www.solarbos.com/#sle](http://www.solarbos.com/#sle).
  - 3. Solectria Renewables, LLC; \_\_\_\_\_: [solectria.com/#sle](http://solectria.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- E. Photovoltaic Inverters:
  - 1. Schneider Electric; \_\_\_\_\_: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
  - 2. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  - 3. Solectria Renewables, LLC; \_\_\_\_\_: [www.solectria.com/#sle](http://www.solectria.com/#sle).
  - 4. Xantrex Technology Inc; a subsidiary of Schneider Electric: [www.schneider-electric.us](http://www.schneider-electric.us).
  - 5. Substitutes: Equivalent Equals.
- F. Monitoring System:
  - 1. Schneider Electric; \_\_\_\_\_: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
  - 2. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  - 3. Solectria Renewables, LLC; \_\_\_\_\_: [www.solren.com/#sle](http://www.solren.com/#sle).

4. Xantrex Technology Inc; a subsidiary of Schneider Electric:  
www.schneider-electric.us.
  5. Substitutes: Equivalent Equals.
- G. Source Limitations: For each type of component, furnish products produced by a single manufacturer and obtained from a single supplier.

### 2.3 PHOTOVOLTAIC SYSTEM REQUIREMENTS

- A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.
- B. System Description:
1. Photovoltaic array is ground-mounted in location indicated on the drawings.
  2. Orientation of array is as indicated on the drawings.
  3. System includes interconnection with utility grid (grid-tied system).
    - a. Utility metering configuration: Net metering.
  4. System does not include battery storage system.
  5. System does not include engine generator.
  6. System includes DC system surge protection.
  7. System includes monitoring system.
- C. Capacity:
1. Total Nominal Rated Power Output of Array: 3 kW, rated under Standard Test Conditions (STC).
    - a. The intent is to produce enough power to offset monthly kWh use of approximately 300. Actual kW output may need to vary from 3 kW depending on study to be performed by PV supplier.
- D. Size:
1. Array: Designed to fit within the area designated on the drawings.
- E. Appearance:
1. Arrange array such that modules are aligned with uniform spacing.
  2. Make no alterations affecting appearance of building exterior or interior without approval of Architect.
  3. Final determination of acceptable appearance is by Architect.
- F. Fire Resistance Rating: Provide photovoltaic module and mounting system combination that together with the roof covering form a system listed in accordance with UL 1703 to provide a fire rating equal to or better than the required fire rating of the roof.
- G. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.
1. Comply with ASCE 7.
  2. Include structural calculations demonstrating compliance with submittals.
- H. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.
- I. Provide products listed, classified, and labeled as suitable for the purpose intended.
- J. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.
- K. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.
- L. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- M. Arrange array to minimize shading during peak production periods.

## 2.4 PHOTOVOLTAIC MODULES

- A. Acceptable Module Types: Either crystalline silicon or thin film modules complying with specified requirements will be considered for this project.
- B. General Requirements:
  - 1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; listed as complying with UL 1703.
  - 2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1, IEC 61215-1-1, and IEC 61215-2.
  - 3. Thin Film Photovoltaic Modules: Comply with IEC 61646.
  - 4. Frame: Anodized aluminum.
  - 5. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
  - 6. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
  - 7. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).
  - 8. Power Rating Tolerance: Plus 10 or minus 5 percent.

## 2.5 BALANCE OF SYSTEM COMPONENTS

- A. Photovoltaic Module Mounting System:
  - 1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
  - 2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.
  - 3. Ground-Mounted Arrays:
    - a. Module Tilt Angle: As required to provide maximum energy production for installed location.
    - b. Foundation Type: As required for soil conditions at installed location.
- B. Photovoltaic Combiner Boxes:
  - 1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.
  - 2. Combiner Boxes: Rated for 600 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.
  - 3. Fuseholders: Touch-safe; suitable to accept fuses indicated.
  - 4. Number of Input Circuits: As indicated or as required for termination of strings, with minimum of 25 percent spare capacity for future expansion.
  - 5. Enclosure: NEMA 250, Type 3R, unless otherwise indicated.
- C. Photovoltaic Inverters:
  - 1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
  - 2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
    - a. Maximum power point tracking (MPPT).
    - b. LCD display.
    - c. Integral DC disconnect.
    - d. Integral DC ground fault detection and interruption (GFDI).
    - e. Integral DC arc fault circuit interrupter (AFCI).
  - 3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.

4. Total Harmonic Distortion: Less than five percent.
5. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  - a. Indoor Clean, Dry Locations: Type 1.
  - b. Outdoor Locations: Type 3R.
- D. Enclosed Switches, in Addition to Requirements of Section 26 2818:
  1. Switches for DC System: Rated for 600 V DC.
  2. Switches Connected to Supply Side of Service Disconnecting Means: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Surge Protective Devices, in Addition to Requirements of Section 26 4300:
  1. Surge Protective Devices for DC System:
    - a. Rated for 600 V DC.
    - b. Listed and labeled as complying with UL 1449, Type 1.
    - c. Surge Current Rating: Not less than 50 kA per mode.
    - d. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- F. Molded-Case Circuit Breakers and Switches for DC System: Rated for 600 V DC; listed as complying with UL 489B.
- G. Fuses, in Addition to Requirements of Section 26 2813:
  1. Fuses for DC System: Rated for 600 V DC.
  2. Fuses for Protection of Photovoltaic Strings and Arrays: Photovoltaic fuses listed as complying with UL 2579.
- H. Monitoring System:
  1. Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.
  2. System communications interfaces to be wired or wireless, with compatible interconnected components.
    - a. Provide suitable raceway, minimum 3/4 inch trade size, for all required wired connections.
  3. System to monitor and record, in 15 minute intervals:
    - a. Inverter status.
    - b. Instantaneous power (kW).
    - c. Cumulative energy production (kWh).
    - d. Irradiation.
    - e. Ambient temperature.
    - f. Wind speed and direction.
  4. Energy Production Meter: Revenue grade, with accuracy of plus or minus two percent.
  5. System real-time and historical data to be accessible from the following locations:
    - a. Personal computer(s), via internet connection.
    - b. Remote personal display(s), quantity and location as indicated on the drawings.
    - c. Remote public display(s), quantity and location as indicated on the drawings.
  6. System to provide alarm notification via e-mail or instant message.
  7. System to be compatible with third party monitoring service to be selected by Owner.

## 2.6 SOURCE QUALITY CONTROL

- A. Factory test the following products to verify operation and performance characteristics. Include test reports with submittals.
  1. Photovoltaic modules.
  2. Photovoltaic inverters.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

**3.2 PREPARATION**

- A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.

**3.3 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.
- D. Circuiting Requirements, in Addition to Requirements of Section 26 0519:
  - 1. Wiring Methods:
    - a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.
    - b. Unless otherwise indicated, use type THHN/THWN-2 single-conductor building wire in suitable raceway for wiring between combiner box(es) and point of interconnection.
    - c. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.
    - d. Install cables in suitable raceway where readily accessible or where required by authority having jurisdiction.
    - e. Use suitable twist-on insulated spring connectors, mechanical connectors, or compression connectors for photovoltaic circuit splices and taps.
  - 2. Photovoltaic DC System Conductor Color Code:
    - a. Negative Grounded System:
      - 1) Positive: Red.
      - 2) Negative/Grounded: White.
    - b. Positive Grounded System:
      - 1) Positive/Grounded: White.
      - 2) Negative: Black.
  - 3. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.
- E. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 0526:
  - 1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.
  - 2. Grounded DC Systems: Ensure that there is only one point of system grounding connection to the grounded conductor, including external connections and connections internal to equipment.
- F. Identification Requirements, in Addition to Those Specified in Section 26 0553:
- G. Identification Requirements:
  - 1. Color for Photovoltaic System Identification Nameplates and Labels: White text on red background, unless otherwise required by NFPA 70 or authorities having jurisdiction.

2. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.
3. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".
4. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
5. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
  - a. Rated maximum power-point current (operating current).
  - b. Rated maximum power-point voltage (operating voltage).
  - c. Maximum system voltage.
  - d. Short-circuit current.
6. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
7. Where the inverter output connection is located in a panelboard on the opposite (load) end from the input feeder location or main circuit location in order to meet requirements of NFPA 70, use identification nameplate or identification label to identify the overcurrent device with the word message "Warning; Inverter output connection; Do not relocate this overcurrent device".
8. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
9. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for photovoltaic systems equipped with DC ground-fault protection in accordance with NFPA 70. Include the word message "Warning - Electric Shock Hazard; If a ground fault is indicated, normally grounded conductors may be ungrounded and energized".
10. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.
11. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

#### 3.4 FIELD QUALITY CONTROL

- A. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Inspection and testing to include, at a minimum:
  1. Inspect each system component for damage and defects.
  2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.

3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.
  4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
  5. Measure and record ambient conditions, including date and time, ambient temperature, cell temperature, solar irradiance in the module plane, and wind speed.
  6. Measure and record open circuit voltage of each string.
  7. Measure and record voltages at the inverter AC and DC inputs.
  8. Measure and record operating current for each string, sub-array, and array.
  9. Measure and record AC output power.
  10. Perform inverter functional test.
    - a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.
  11. Verify proper operation of monitoring system.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- E. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  1. Record all system operations and malfunctions.
  2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.
- 3.5 SYSTEM STARTUP
- A. Provide services of a manufacturer's authorized representative to assist in performing system startup. Include manufacturer's detailed startup procedures with submittals.
  - B. Obtain Owner's approval prior to performing system startup.
  - C. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.
  - D. Prepare and start system in accordance with manufacturer's instructions.
- 3.6 CLEANING
- A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.
- 3.7 CLOSEOUT ACTIVITIES
- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
  - B. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
    2. Instructor: Manufacturer's authorized representative.
    3. Location: At project site.
- 3.8 PROTECTION
- A. Protect installed products from subsequent construction operations.
- 3.9 MAINTENANCE
- A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of photovoltaic system for two years from date of Substantial Completion, to include the work described below; Include a complete

description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

- B. Provide trouble call-back service upon notification by Owner:
1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION