Date: **11/14/2022**

RFP No: **2022-084**
Commodity: Cameron Park Zoo Education Center & Vet Hospital
Purchasing Agent: Mr. Kasey Gamblin

Closing Time, Part A Proposal Form, 2:00 P.M. CST, Monday, November 21, 2022
Closing Time, Part B Proposal Form, 2:00 P.M. CST, Tuesday, November 22, 2022
Opening Time: Part A and B, 2:01 P.M. CST, Tuesday, November 22, 2022

RFP Opening Location: Operations Center, Purchasing Services Office, 1415 N. 4th St., Waco, TX 76707

Addendum No: 2

Changing proposal submission to a two day (Part A – Must be turned in by Monday, November 21st at 2:00 P.M. Part B must be turned in by Tuesday, November 22nd at 2:00 P.M. Both will be opened on Tuesday, November 22, 2022 at 2:01 P.M.

Updated Information, Updated Proposal Forms (Part A and Part B)
Questions and Answers

The above-mentioned RFP invitation has been changed in the following manner. **Sign and return addendum to the Purchasing Office by the closing time and date with your RFP response**. Returning this page signed by your authorized agent will serve to acknowledge this change. All other requirements of the invitation remain unchanged. If you have any questions, please call or stop by the Purchasing Office at the above address.

Firm:_____

Address_____

Signature of Person
Authorized to Sign Bid:_____

Signor's Name and Title
(print or type):_____

E-mail Address:_____

Date:_____Telephone:_____Fax:_____

From:_____ (Contractor Print Name Here)

I have received plans, details, and specifications for the project listed above as prepared by Perkins&Will. I have also received Addenda Nos. _____ and have included their provisions in my proposal. I have examined the documents, existing conditions and the site and submit the following proposal. In submitting the proposal, I agree:

1. To hold my proposal open for 90 days after Proposal receiving date.
2. To enter into and execute a contract, if awarded on the basis of this proposal.
3. To execute the contract, if awarded, within ten (10) calendar days after notification of award, and to commence work not later than ten (10) calendar days from date of "Notice to Proceed."
4. To accomplish the work in accord with the Contract Documents.
5. That I have reviewed the AIA A101-2019 and AIA A201-2017, as modified by the Owner and attached to the Request for Proposals.
6. **To complete the work in _____ calendar days**.

I will perform all work of this project for the lump sum price of:

BASE PROPOSAL:_____

_____ Dollars ($_____)

I will include the following alternative items of work as specified for changes to the Base Proposal sum as follows:

ALTERNATE #1: Classroom Skylights. Omit skylights, infill with adjacent roofing system:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #2: Interior Shiplap Siding in Classrooms. Omit shiplap siding, provide painted gypsum board with horizontal reveals:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #3: Interior Shiplap Siding in Corridor / Lobby. Omit shiplap siding, provide painted gypsum board with horizontal reveals:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #4: Acoustical Wall Panels in Classrooms. Reduce square footage of acoustical wall panels in Classrooms by 50%:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #5: Sliding Door System in Classrooms. Omit sliding door system panels and utilize OFOI curtains:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #6.a: Folding Panel Partitions in Classrooms. Reduce height to 10-feet:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

ALTERNATE #6.b: Folding Panel Partitions in Classrooms. Change to wall covering vinyl covering in lieu of fabric:

ADD | DEDUCT _____ Dollars ($_____)
(Circle One)

I will add for any additional work above and beyond the scope of this contract for the cost of all jobsite labor and materials furnished plus_____percent (_____%) for overhead and profit. Overhead and profit includes office personnel and expenses.

I will add for any additional work above and beyond the scope of this contract performed by a subcontractor for the cost of subcontractor plus_____percent (_____%) for overhead and profit.

[Executed on next page]

Executed on _____,2022.

_____
Company Name

[If participant is a corporation]

[complete the following]

ATTEST:

_____

(Corporate Seal)

Signature: _____

Print Name: _____
Sole Owner, or Partner, or President of Corporation
(Delete titles inapplicable to signer)

Whose address is:

_____

_____

Telephone: _____

Fax: _____

Email: _____

From:_____(Proposer company name here)

I will adjust the contract sum in accordance with the following Unit Prices:

ITEM	DESCRIPTION	UNIT	ADD	DEDUCT
1	Moisture Vapor Emission Control System	Square Foot		
2.a	Drilled Piers – 24 inch	Lineal Foot		
2.b	Drilled Piers – 30 inch	Lineal Foot		
2.c	Drilled Piers – 36 inch	Lineal Foot		
2.d	Drilled Piers – 42 inch	Lineal Foot		
3.a	Pier Casing – 24 inch, 20 feet	Per pier		
3.b	Pier Casing – 30 inch, 20 feet	Per pier		
3.c	Pier Casing – 36 inch, 20 feet	Per pier		
3.d	Pier Casing – 42 inch, 20 feet	Per pier		

I will use the following subcontractors on this work:

	Subcontractor's Name	Location	MWBE?
Demolition	_____	_____	_____
Concrete	_____	_____	_____
Masonry	_____	_____	_____
Structural Steel	_____	_____	_____
Glue Laminated Construction	_____	_____	_____
Framing	_____	_____	_____
Exterior Envelope	_____	_____	_____
Millwork	_____	_____	_____
Div 12 – Lab Casework	_____	_____	_____
Roofing	_____	_____	_____
Doors & Hardware	_____	_____	_____

Animal Caging	_____	_____
Storefront & Glazing	_____	_____
Acoustical Ceilings	_____	_____
Drywall	_____	_____
Painting	_____	_____
Floorcovering	_____	_____
Plumbing	_____	_____
HVAC	_____	_____
Electrical	_____	_____
Datacom/Telecommunications	_____	_____
Earthwork	_____	_____
Utilities	_____	_____
Fire Sprinkler/Protection	_____	_____
Fire Alarm	_____	_____

I understand that changes to the above subcontractors are allowable only with Owner's permission. All subcontractors that are not direct employees of the general contractor must be listed in their respective categories. If trade is not applicable, write "NA" or "Not Applicable"; if self-performing, write "SP" or "Self Performed" in the space provided.

[Executed on next page]

Executed on _____, 2022.

_____
Company Name

[If participant is a corporation]

[complete the following]

ATTEST:

_____

(Corporate Seal)

Signature: _____

Print Name: _____
Sole Owner, or Partner, or President of Corporation
(Delete titles inapplicable to signer)

Whose address is:

_____

_____

Telephone: _____

Fax: _____

Email: _____

Addendum #2

To: Bidders	**Date of Issuance:** 11.14.2022
From: Perkins&Will	**Project Name:**Cameron Park Zoo: Education Center & Vet Hospital
Owner: City of Waco	**Project Number:** 185236.000

☒ Architect ☒ Owner ☐ Contractor ☐ Field ☐ Consultant ☒ Other (explain): Bidders

This is an Addendum providing information for Bidder's incorporation into bids. The documents listed below provide additions, deletions, clarifications, or corrections to originally issued documents and are intended to replace or supplement original documents.

Description:

Project Manual: 1 section

32 31 29 – WOOD FENCES AND GATES: Revised section to include delegated design requirements.

23 09 23 - DIRECT DIGITAL CONTROLLERS AND NETWORKS: Revised allowable manufacturers.

Architecture: 10 sheets

A02-01: Clarified extent of sandblast pattern and provided sheet notes for clarity

A02-02: Clarified fencing scope

A13-02: Provided legend for clarity

A17-04: Revised casework and countertop materials

A17-06: Provided sheet notes for clarity

A44-01: Provided sheet note for clarity

A45-11: Revised casework and countertop materials

A52-20: Provided sheet notes for clarity

A52-21: Provided sheet notes for clarity

A52-22: Provided sheet notes for clarity

Structure: 3 sheet

S02-02: Provided section marker for clarity

S10-01SS: Omitted sheet note

S10-02SS: New sheet

Electrical: 4 sheets

E10-01: Powered fixtures 'B2-F' to normal power and provide a 120V circuit.

E10-02: Updated keynote 8 to indicate fixtures will be owner furnished, contractor installed.

E62-01: Added fixture 'B2-F' to light fixture schedule.

E62-04: Updated panel 'EL2' circuit 28.

Technology: 2 sheets

T10-01: Add final wireless access point locations and quantities, per owner provided design.

T10-02: Add final wireless access point locations and quantities, per owner provided design

Attachments:

(19) Drawing sheets, listed above

32 31 29 – WOOD FENCES AND GATES

23 09 23 - DIRECT DIGITAL CONTROLLERS AND NETWORKS

End of Addendum

DOCUMENT 00 01 10

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Reference City of Waco Standard Civil Specifications for Construction: https://www.waco-texas.com/engineering-specifications.asp#gsc.tab=0

END OF TABLE OF CONTENTS

SECTION 23 09 23

DIRECT DIGITAL CONTROLLERS AND NETWORKS

PART 1 - GENERAL

1.1 RELATED WORK

A. Section 23 0901 - Control Systems Integration

B. Section 23 0903 - Control Instrumentation

C. Section 23 0993 - Control Sequences

D. Control Sequences: Refer to Drawings

1.2 REFERENCE

A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.3 DEFINITIONS

A. The following abbreviations, acronyms, and definitions may be used in addition to those found elsewhere in Contract Documents.

1. ASC: Application Specific Controller. A networked device or node that contains a complete, configurable application that is specific to a particular task.
2. Alarms & Events: The exchange of data between devices related to the occurrence of a predefined condition that meets specific criteria (event).
3. BC: Building Controller. Provide supervisory control, scheduling, trend logging & alarm handling.
4. B-OWS: BACnet Operator Workstation
5. B-BC: BACnet Building Controller. Same as SLC.
6. B-AAC: BACnet Advanced Application Controller. Same as PPC.
7. B-ASC: BACnet Application Specific Controller
8. B-SA: BACnet Smart Actuator
9. B-SS: BACnet Smart Sensor
10. BBMD: BACnet Broadcast Management Device
11. BIBBS: BACnet Interoperability Building Blocks. Specific individual function blocks for data exchange between interoperable devices.

12. Broadcasting:	The propagation of data from a device to the control network. Software objects that broadcast data to the network may include the following parameters:
13. Send on Delta:	An adjustable parameter that defines a requirement to broadcast when the data generated by the software object changes by an amount that exceeds this parameter's value. For binary data, this parameter defaults to a change of state. The broadcast of data is initiated when this criteria and the minimum send time requirement have been met. Also referred to as a "Change of Value".
14. Minimum Send Time:	An adjustable parameter that defines a mandatory time period during which no broadcasting of data will occur. Once this time period has been exceeded without a broadcast, the send on delta parameter or the maximum send time parameter shall determine when a broadcast is initiated.
15. Maximum Send Time:	An adjustable parameter that defines the maximum time period between broadcasts of a software object's data to the network. Should the value of a software object remain constant over an extended period of time, the value will be rebroadcast once every maximum time period.
16. BTL:	BACnet Testing Laboratory.
17. Channel:	One or more segments not containing a router.
18. Domain:	A logical collection of devices on one or more channels.
19. FLN:	Floor Level Network. BACnet MS/TP.
20. HMI:	Human-Machine Interface. Graphical operator BAS interface. Same as Graphical User Interface (GUI).
21. LAN:	Local Area Network. Same as Floor Level Network.
22. Maximum Send Time:	Event driven communication parameter specifying the time period for which data must not be sent more than once.
23. Minimum Send Time:	Event driven communication parameter specifying the time period for which data must be sent at least once.
24. PICS:	Protocol Implementation Conformance Statement. Detailed description for a given BACnet device stating its inherent BACnet capabilities.
25. Point:	Group of data, which corresponds to a hardware input, output, or calculated value.
26. PPC:	Programmable Process Controller. Same as Advanced Application Controller (AAC)

27. Repetitious Controls: Controls for critical systems where the control is spread across multiple controllers with separate power sources so there is no single point of failure for the entire system.
28. Scheduling: The exchange of data between devices related to the establishment and maintenance of dates and times at which specified output actions are to be taken.
29. Send on Delta: Event driven communication parameter specifying the amount of variable change before data is to be sent between the Minimum and Maximum send times.
30. SLC: Supervisory Level Controller. Same as Building Controller.
31. Segment: A section of uninterrupted cable where multiple devices may be installed.
32. Subnet: Logical division of a domain.
33. Trending: The accumulation of (time, value) pairs at specified rates for a specified period duration.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Submit shop drawings for each hardware device used and submit complete description of software applications used. Submit manufacturer's printed product data sheets for each device or software program used. Datasheets shall be submitted electronically in pdf format with bookmarks provided for each individual device and table of contents listing each device manufacturer and full model number with links to device pages. Organize sheets in order of model number, alphabetically, then numerically. When a manufacturer's data sheet refers to a series of devices rather than a specific model, the data specifically applicable to the project shall be highlighted or clearly indicated by other means.
   2. Submittals shall include points list of each control input and output, controlled devices, locations of devices, and symbol or label of each control point in software.
   3. Device data sheets shall be submitted with electronic bookmarks as specified in Section 23 0901 - Control Systems Integration. Refer to PART 1 – GENERAL, subsection SUBMITTALS.
   4. Device data sheets shall be submitted simultaneously with Control Systems Integration submittal. Refer to submittals section in 23 0901.

B. Operating and Maintenance Manuals: Refer to Section 23 0901 - Control Systems Integration.

C. Software Manual:
   1. As part of operating and maintenance manuals, submit one software manual per workstation plus one extra copy for archive use. Software manuals shall be divided into separate parts with tabs for each part.

2. Software manual parts shall include:
   a. Complete description of operating system including all commands, configuration programs, printouts, logs, database functions and passwords. Describe general operating procedures, starting with system overview and proceeding to detailed description of each software command feature with sample printed displays and system function description for each option. Include instructions on verifying errors, status, changing passwords and initiating or disabling control programs.
   b. Complete description of programming language including all commands, configuration programs, control loop functions and testing. Describe general programming procedures, starting with system overview and proceeding to detailed description of each software command feature. Include instructions on creating or modifying any control algorithm or parameter, debugging, etc. This shall include all control functions, algorithms, mathematic equations, variables, setpoints, time periods, messages, and other information necessary to load, alter, test and execute custom or pre-written programs.
   c. Software Backup: Upon successful completion of acceptance testing, submit to Owner 2 archive copies of all accepted versions of source code and compiled code for all application programs and data files on CD ROM backup disks. All control software must be readily accessible by Owner using BAS workstation hardware and software.
   d. Web server/data historian SQL database schema (table format) for trend data and event/alarm data.
   e. Control Loop Documentation: Submit indexed summary of each control loop program. Summary shall list in tabular form, name of system, name of control loop, all I/O points used, and reference to sheet number in shop drawings to describe control sequence programmed. For each control loop submit complete printed listing of source code used, all setpoints, high/low alarm points, time event schedules, proportional gains, integrals, derivative values, and other database values.
   f. BAS Points List Summary: Provide detailed summary for each point in the system. Summary shall be cross-index listing of all points in alpha/numerical order with list of control loops which use each point. For each point, include an abbreviated point name, expanded point description, detailed description of each input instrument or output device, and detailed description of exact location of all field hardware. Location descriptions shall include room names, column numbers, elevation (above ceiling, bottom of duct, etc.).

1.5 WARRANTY

A. Provide 1 year warranty on all materials and labor.

B. Warranty requirements shall include furnishing and installing software upgrades issued by the manufacturer during the 1 year warranty period.

1.6 FCC COMPLIANCE

A. Digital equipment furnished under this contract shall be tested and made to comply with limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against interference when operated in commercial environments. Literature shall so note and equipment shall be so labeled to show this compliance.

PART 2 - PRODUCTS

2.1 THE FOLLOWING ARE ACCEPTABLE VENDORS FOR THE CAMERON PARK ZOO EDUCATION CENTER AND VET HOSPITAL:

PRODUCT: BUILDING AUTOMATION CONTROLS

COMPANY: Reliable Controls

ADDRESS: 120 Hallowell Road Victoria, BC V9A 7K2, Canada

CONTACT:

Jim Bonham

Enviromatic

817-269-2873

~~2.1~~2.2 DIRECT DIGITAL CONTROL (DDC) CONTROLLERS

A. General:
1. DDC controllers shall be microprocessor based, field programmable controllers, capable of performing control and energy management functions, and shall be UL listed as Signaling Systems. Each controller shall include its own microprocessor, power supply, input/output modules, and termination modules as required to perform intended function.
2. DDC controller shall receive discrete electrical and/or analog electronic field input signals, convert signals for use by controller, perform control sequences, convert controller information into output signals, and provide control output signals to actuators and field control devices. Inputs and outputs, including communication connections, shall be electrically or optically isolated from controllers.
3. All DDC controllers shall be provided by the same manufacturer.
4. DDC controller with analog input modules shall be capable of accepting any form of linear or non-linear voltage (0-5 VDC or 0-10 VDC), current (4-20 mA) or resistive input (0-1000 ohm).
5. DDC controller with discrete input modules shall be capable of accepting discrete inputs from any device with isolated, dry-type contacts (no grounds or no

voltage) of either normally open (NO) or normally closed (NC) configuration. Provide visible status lights (LEDs) to indicate input point status.

6. Provide input modules capable of interfacing with pulsed output type sensors as required.
7. DDC controller with discrete output modules shall have isolated, dry-type contacts (no grounds or no voltage) of either normally open (NO) or normally closed (NC) configuration. Provide visible status lights (LEDs) to indicate output point status.
8. DDC controller shall have capability to scale, offset, and display proper analog value without field hardware modification. DDC controller shall convert analog input signals to digital values (A/D conversion) and convert digital values to analog outputs (D/A conversion) for modulating control purposes. Some application specific controllers may utilize tri-state or Triac outputs for floating point control of control devices. Floating point control should be limited to non-critical room temperature control and mechanical space heating and cooling.
9. Failsafe hardware shall be provided such that BAS failures result in immediate return to local control. If DDC controller uses database values from other DDC controllers and communication network fails or malfunctions, control loop outputs shall continue to function using last value received from BAS.
10. Failure of network or control devices (i.e. building level controllers, floor level controllers, application specific controllers, routers, repeaters, etc.) shall be alarmed at the Operator Workstation as a Level 3 Critical Alarm.
11. All DDC Hardware shall meet the following requirements:
    a. All DDC controllers shall be connected to an ASHRAE 135 MS/TP, BACnet over ARCNET or BACnet/IP control network and communicate via ASHRAE 135 exclusively.
    b. MS/TP controllers shall operate at a minimum baud rate of 38.4 kbps.
    c. All DDCP shall implement all required functionality of the application network interface via BACnet objects, properties, and services.
    d. All DDC controllers shall conform to the BACnet Testing Lab's Device Implementation Guidelines and be BTL Listed.
    e. Application programs and configuration settings shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration settings.
    f. All settings and parameters used by the application shall be fully configurable to the greatest extent possible, via properties of BACnet objects that can be written to via BACnet services or via properties of BACnet objects that can be written to via BACnet services for the following:
        1). Setpoint
        2). Alarm limit
        3). Schedule modification
        4). Trend modification

g. All other settings and parameters that cannot be written to via BACnet services shall be fully configurable via either properties of BACnet objects that can be written to with a configuration tool, or via hardware settings on the controller itself to support the application.

12. Each DDC panel shall have sufficient I/O capacity to perform specified control sequences and/or include points listed in point schedules. If DDC controller does not have sufficient capacity, provide additional slave I/O panels to achieve required point count.
13. Analog and critical safety discrete control loops shall have inputs and outputs into/from same DDC panel. Analog control loops for major equipment (chilled water, hot water, convertors, air handling units, etc.) shall have PID control.

B. BACnet Building Controller (B-BC):

1. BACnet Building Controllers (B-BCs) shall provide direct connection to high speed, BACnet/IP Local Area Network (LAN) and Campus Ethernet network and serve as communications router for other controllers on slower speed BACnet MS/TP or BACnet over ARCNET Floor Level Network (FLN).
2. Communication between B-BC's shall be through BACnet/IP communication.
3. B-BC's shall have sufficient processor capabilities, hard-drive storage and RAM to implement all types of custom software applications and shall provide supervisory control, scheduling, trend logging & alarm handling functions as follows:
   a. Scheduling:
      1). Each B-BC shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.
   b. Trending:
      1). Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
      2). B-BC shall periodically upload trended data to networked BAS Web Application Server for long term archiving.
      3). Archived data shall be stored in standard database format and shall be made available for use in third-party spreadsheet or database programs.
   c. Alarm Generation:
      1). Alarms may be generated within the system for any object change of value or state either real or calculated. This includes analog object value changes, binary object state changes, and various controller communication failures.
      2). B-BC shall periodically upload alarm logs to networked BAS Web Application Server for long term archiving.
4. B-BC's shall have uninterrupted real time clocks capable of time of day, week, and year information to the system as needed to perform software functions. Clock shall be programmed to reset twice per year to allow for Daylight Savings Time. Clocks in multiple DDC Controllers shall be synchronized to automatically

match designated B-BC's or Web server. Accuracy shall be within 1 second per day.

5. Batteries shall maintain volatile memory and real time clocks for a period of at least 72 hours during power failure. Batteries shall be maintenance free and have minimum life of 2 years. When power has been restored, the following shall occur automatically:
   a. Orderly startup of controlled equipment (user defined)
   b. Continuation of control algorithms
   c. Database revision
   d. Logging of power interruption and restoration times
   e. Battery recharging
6. Provide local visual indication and system annunciation of low battery power for each battery.
7. Each B-BC shall include its own micro-processor, power supply, input/output modules, and termination modules as required to perform intended function.
8. BACnet UDP port number to always be set to 47808 (BAC0).

C. BACnet Advanced Application Controllers (B-AAC):
   1. B-AACs are defined as having sufficient processor capabilities and RAM to implement all types of custom software applications.
   2. B-AACs shall be capable of communicating to BAS network via BACnet MS/TP connected to Building Controller or via BACnet/IP directly.
   3. All B-AACs controlling major mechanical equipment/systems and lab equipment monitoring shall communicate via BACnet/IP as indicated on BAS Network Architecture drawings.
   4. Provide at least one extra communication port at each B-AAC for direct connecting a notebook computer or hand-held terminal.

D. BACnet Application Specific Controllers (B-ASC):
   1. B-ASCs are defined as having standard software burned into EPROM, set points in EEPROM or RAM maintained by battery, and are designed to handle specific types of control sequences.
   2. Application specific DDC Controller shall be capable of communicating to BAS network via low/medium speed network connected to B-BC.
   3. Control outputs may be in the form of floating point control or true analog output control of end devices. Floating point control shall be limited to non-critical room temperature control or mechanical space heating and cooling.
   4. Provide communication ports integral room temperature sensors/thermostats for interface with local terminal equipment controllers or a low range wireless (Bluetooth®) Commissioning tool that provides a temporary wireless connection between the MS/TP network and the laptop computer used to commission.

E. BACnet Router

1. BACnet MS/TP to BACnet/IP and BACnet/ARCNET to BACnet/IP Routers shall perform layer 3 routing of BACnet MS/TP or BACnet/ARCNET packets over an IP network in accordance with ASHRAE 135 Annex J. The router shall provide the appropriate connection to the IP network and connections to the BACnet MS/TP or BACnet/ARCNET network. BACnet Routers shall be capable of configuration via DHCP and Write-Broadcast-Distribution-Table messages but shall not rely on these services for configuration.
2. One router in the IP subnetwork shall be designated as the BBMD (BACnet Broadcast Management Device) and shall be indicated as so on the Network Architecture.
3. BACnet router functionality can also be incorporated into BACnet Building Controllers.

F. BACnet Gateways:
1. Provide gateways to connect BACnet to non-BACnet devices, and non-BACnet DDC controlled equipment.
2. Provide with each gateway an interoperability schedule, showing each point or event on the non-BACnet side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.
3. The following minimum capabilities are required:
   a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.
   b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.
   c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
   d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.
   e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

G. Power Supplies:

1. Power supplies shall operate on nominal 120 V, 60 Hz, single-phase power. DDC Controllers shall be provided with surge and noise protection. Power fluctuation shall not affect control system. Include surge protection on telephone line.
   a. Isolation transformers shall be included when connections are being made between 2 separate buildings.
2. Provide power supplies with UPS

~~2.2~~2.3 DIRECT DIGITAL CONTROL SOFTWARE

A. General:
   1. DDC Controller control strategies shall be Owner definable from engineering workstations.
   2. Software functions and algorithms shall be sufficient to enable implementation of control sequences as specified and shall be able to maintain continuous control as intended.
   3. Control functions shall include both mathematical and logical operators. Control algorithms shall include proportional, integral and derivative control (PID). Adaptive (self-tuning) PID loop parameters, if offered by DDC Controller manufacturer, shall not be used unless adaptive limits are used to adjust limit values based on system status; or written request is submitted and approved by Engineer.
   4. Allow operators to assign unique identifiers of their choice to each connected point. Identifiers shall have at least 8 alpha/numeric characters. References to these points in programs, reports and command messages shall be by these identifiers.
   5. Provide access control (user defined passwords) for system operation. There shall be minimum of 3 access levels. First level shall allow system monitoring only. Second level shall allow monitoring, set point adjustment, and scheduling revision. Third level shall allow modification of control algorithms. System shall return to secured (monitoring only) mode after 5 minutes of inactive operation.
   6. Each DDC Controller shall contain self-diagnostics that continuously monitor proper operation of panel.
   7. If microprocessor malfunctions, control loop outputs shall continue to function using last value received from microprocessor.

B. Building Controller Software:
   1. Provide DDC Controller software application program modules for performing energy management control functions such as time of day change of database values (programmed start/stop, temperature setbacks, etc.), supply air temperature reset based on space load demand, economizer control, optimum start/stop based on current indoor and outdoor psychometrics, duty cycling and client tailored programs required for special applications such as VAV fan matching and supply fan control, enthalpy control, intermediate season or "dead band" control, totalizing, and holiday programming.

2. Provide manufacturer's standard operating system for real time control of system interactions, including database information requests/transfers by system hardware or by operators. Operating system shall also have the following additional capabilities (given that operator has appropriate security access level):
   a. User interface and online system configuration software embedded in Building Controller.
   b. Support for Web services at the automation network level.
   c. Displaying database (point) value including measured values, controlled variables, setpoints, gain factors, and any other adjustable parameters.
   d. Changing or overriding any database value.
   e. Error detection, correction, re-transmission of database values, arithmetic or logical faults.
   f. Alarm reporting including sending alarms to remote workstations, User Interface Web Server or Data Historian on network.
   g. Alarm buffer to retain alarms in order of importance without losing any alarms.
   h. Creating and displaying historical trend logging of any value, limited only by available memory.
   i. Creating new variable database values (soft points) based on arithmetic calculation (including summation or totalizing) on other database values.
   j. Adding new hardware points without overall BAS shutdown.

C. B-ASC Controller Software:
   1. Manufacturer's standard software for B-ASC's may be used only if control sequences can be implemented without modification. If control sequence cannot be accomplished with standard software, provide battery backed RAM or EEPROM DDC Controller (B-AAC) capable of being programmed for specified control sequence.
   2. Provide software for portable PC units to communicate with terminal controllers at the room level network. Software shall allow access to modify, delete or create control strategies at the room sensor location.

~~2.3~~2.4 OPERATOR'S WORKSTATION - HARDWARE

A. Operator Workstations shall communicate with BAS Web Server via standard web interface software. Provide Operator Workstations for operator interface to BAS for monitoring, control, and database management as indicated on BAS Network Architecture Drawings. Proprietary software shall not be required for proper monitoring and control of HVAC systems as specified in section 23 0924 - Graphical User Interface Integration.

B. Laminated plastic nameplates shall be provided for each workstation. Each nameplate shall identify the function, network address and identifier of the workstation. Laminated plastic shall be 0.125 inch thick, white with black center

core. Nameplates shall be a minimum of 1 by 3 inches with minimum 0.25 inch high engraved block lettering. All nameplates shall be attached to the device in conspicuous location.

C. Operator Workstation Hardware (workstation) shall be a standard unmodified digital desktop computer of modular design or a laptop as shown. The modular components of the desktop, or the laptop, shall be products of a single manufacturer which advertises service in all 48 contiguous states. All desktops, laptops, and computer monitors are required to have achieved Bronze registration or higher under the Electronic Products Environmental Assessment Tool (EPEAT).

D. Provide one operator's workstations for operator interface to BAS for monitoring, control, and database management.

~~2.4~~2.5 ENGINEERING WORKSTATION

A. Refer to Operator Workstation section for requirements.

~~2.5~~2.6 WEB APPLICATION SERVER

A. Refer to 25 0924 – Graphical user Interface Integration.

~~2.6~~2.7 DDC ENGINEERING (PROGRAMMING) - SOFTWARE

A. Provide engineering software for one Engineering Workstation.

B. Software shall have the same characteristic and capabilities as DDC Controllers. In addition, operator's workstations shall have the following features.

C. User Programmability:
   1. Engineering workstation software shall include field-engineering tools (software & hardware) for programming all controllers supplied.
   2. All application software shall be interactive, fully prompted, and menu driven and shall provide the following functionality as a minimum:.
      a. Determine control strategies, which have been defined for specific piece of equipment.
      b. Add control loops to system using English language type program language equal to BASIC or other easily learned language or function block programming. (PASCAL, C, or other assembly type languages are not acceptable.)
      c. Add points to system.
      d. Create, modify or delete control strategies.
      e. Create, modify or delete system graphics.
      f. Assign sensors and/or actuators to control strategy.
      g. Tune control loops through adjustment of control loop parameters.
      h. Enable or disable control strategies.

i. Generate hard copy records of control strategies on printer or soft copies to files compatible with Microsoft Office applications.

j. Select points to be alarmable and define alarm state(s).

k. Select points to be trended over a period of time and initiate recording of values.

l. Override Input/Output points for each individual controller.

~~2.7~~2.8 OPERATOR WORKSTATION - SOFTWARE

A. Custom Database Functions:

1. Operator shall be capable of generating long term historical trend logs and displaying information in tabular or graphic formats. Provide all software options for standard and custom report generators.

B. Color Graphics:

1. Provide color graphics software package compatible with manufacturer's standard software. Provide mouse or other special hardware required to operate software. Software shall be capable of user editing of text fields, graphics, alarms, and real-time variables.
2. Software shall be capable of importing files in AutoCAD format, directly or via translators.

~~2.8~~2.9 NETWORK HARDWARE

A. Provide network interface hardware for each device connected to network. Each device shall have sufficient performance as not to degrade specified processing speed.

B. Provide network cabling with sufficient performance as not to degrade specified communication speed. Cabling shall be compatible with proposed system and shall comply with requirements specified in Section 23 0901 - Control Systems Integration.

C. Provide other network support devices that are required for proper operation of network, such as file servers, signal repeaters, network hubs, etc.

D. Provide network diagnostic tool for measuring/confirming bandwidth usage on IP layer.

PART 3 - EXECUTION

3.1 GENERAL

A. Install control equipment in neat, professional manner to satisfaction of Architect and Engineer.

B. Coordinate timely delivery of materials and supervise installation of DDC Controllers and network cabling and devices.

C. Install DDC Controllers and network control devices in accessible locations.

3.2 OVERALL BAS ARCHITECTURE

A. Provide hardware/software to update database in less than 1 second for fast-acting control loops such as pressure control, air or water flow rate control, and air handling unit temperature control, or 10 seconds or less for other control loops.

B. Control software algorithm and inputs and outputs for a single system or piece of equipment shall reside on a single controller and shall not be distributed amongst multiple controllers. If multiple pieces of equipment are to be interlocked, a single "Master" controller shall provide control for all interlocked pieces of equipment, i.e. an AHU and interlocked return fan and exhaust fans.

C. Control loop software algorithm for each analog control loop shall reside on same controller as inputs and outputs required for that specific control loop.

D. Networks that operate via polled response or other types of protocols that rely on central processors, file servers, or other such devices to maintain or manage peer-to-peer communications, shall have redundant components to maintain network in event of failure at central device. Provide automatic changeover (without operator intervention) to redundant device upon failure of any central type processor.

E. Floor Level Network (FLN) network shall be multi-drop digital transmission network utilizing BACnet MS/TP (38.4kbs) communication.

F. Each multi-drop trunk shall be within manufacturer's allowable line lengths without signal degradation. Multi-drop trunks shall be interfaced to system via standard EIA or other industry recognized interfaces so that single failure does not disrupt or halt network.

G. Communications between Building Level DDC Controllers and operator's workstations shall be peer-to-peer, allowing multiple users to access and use system simultaneously with no loss of system performance.

H. Provide levels of connected networks to connect all DDC Controllers, including terminal DDC Controller. Communications to terminal devices shall be similar to capabilities and functions of other DDC Controllers and shall be transparent to operator.

I. Quantity of nodes (devices connected) on any one FLN (MS/TP) shall not exceed 50% of maximum node capacity published by equipment manufacture and Building Controller processor usage shall not be greater than 30% nominal. Provide additional hardware to meet this requirement.

J. Alarm reports from DDC Controllers shall not be impeded by use of either remote or local monitor, or control stations on network either in access mode or programming mode.

K. Provide transient voltage surge suppression devices for controllers and other electronic devices requiring separate line voltage power source.

3.3 DIRECT DIGITAL CONTROLLERS

A. DDC Controller Usage:
1. Select DDC Controller to provide speed of response required for each control loop type. Pressure, flow rate, and air handling unit temperature control must be via Building Level DDC Controller. Application specific DDC Controller may be used for other control loop types.
2. Each DDC Controller shall have sufficient I/O capacity to perform specified control sequences and/or include points listed in any point schedules. If DDC Controller does not have sufficient capacity, provide additional slave panels to achieve required point count.
3. Analog and critical safety discrete control loops shall have inputs and outputs into/from same DDC Controller. Analog control loops for major equipment (chilled water, hot water, convertors, air handling units, etc.) shall have PID control. Air terminal control loops may utilize floating point control from tri-state or Triac outputs from the controller, but require some type of feedback device to prove position.
4. Provide at least one Building Level DDC Controller per mechanical equipment room and, if required, at each PC workstation location.
5. For valves and dampers within 100 ft of associated DDC Controller, mount current to pneumatic (I/P) converter within DDC Controller panel or in adjacent panel. Otherwise mount I/P converters at valve or damper. Provide pressure gauges on main air, and all control output signals.

B. Point Capacity:
1. Provide point capacity required plus spare I/O point capacity in each B-AAC. Spare I/O point capacity is defined as terminal connections, which are ready to accept digital or analog inputs, dry contacts for digital outputs, and variable voltage or current terminals for analog outputs. Universal type points are acceptable for both discrete and analog type points. Spare points do not include any input or output conversion devices.
2. Spare points in each B-AAC shall be as follows:
   a. 4 Digital Inputs
   b. 4 Digital Outputs
   c. 8 Analog Inputs
   d. 4 Analog Outputs

C. Building Controllers:

1. Provide one BBMD in each IP subnet.
2. BACnet UDP port number to always be set to 47808 (BAC0).

D. Application Specific Controllers:
1. ASC controllers serving critical spaces that require maintained space pressurization shall have an acceptable solution to the Auto-Zero/Auto-Calibration sequence if the submitted controller sensors require periodic automatic calibration. Control contractor shall provide one of the following solutions to eliminate loss of room pressurization:
   a. Auto-zero module
   b. Pressure transmitters/flow measuring sensors that require annual calibration in place of standard transmitters that require daily/weekly calibration.
   c. Control contractor shall provide a solution to the mechanical/controls engineer for approval.

E. Gateways:
1. Gateways may be used for communication with non-BACnet control hardware subject to all of the following limitations:
   a. Non-BACnet control hardware shall not be used for controlling built-up units.
   b. Non-BACnet control hardware shall not perform system scheduling functions.

F. Cabinets:
1. Provide local control cabinets for DDC Controllers. DDC Controller cabinets for air terminals may be used directly if enclosures are rated for NEMA 1. All cabinets shall utilize a single master key. Provide 2 spare key sets to Owner.
2. All control cabinets shall be labeled. Labels shall be keyed to the unique identifiers shown on the As-Built drawings

G. Controller Firmware
1. Provide latest version of controller firmware. Include firmware updates for period of one year after system acceptance, coinciding with warranty period. If the upgrade of firmware causes the need to upgrade or reconfigure/reprogram related systems, controllers or software, Contractor shall notify Owner prior to upgrade and provide additional work scope in coordination with other Contractors, as required, at no cost to Owner.

3.4 OPERATOR/ENGINEERING WORKSTATIONS

A. Locate workstations as indicated on plans and Network Architecture.

B. Furniture is provided by others. Provide all necessary connections and extensions to integrate hardware with furniture system.

C. Security access levels for the engineering workstation software shall be setup as follows:

1. Guest (View-only) access level shall have the ability to perform the following tasks:
   a. View Data
   b. View Trends
2. Operator access level shall have the ability to perform the following tasks:
   a. View Data
   b. Acknowledge Alarms
   c. View Reports
   d. Override Points
   e. Change Setpoints
   f. View Trends
   g. Edit Schedules
3. Engineer access level shall have the same access as Operator level with the ability to perform the following additional tasks:
   a. Add Devices
   b. Address Changes
   c. Create Applications
   d. Download Applications
   e. Configure ASCs
   f. Setup Trends
   g. Setup Reports
   h. Modify Alarm Settings

D. Provide security access level setup for 10 users. Coordinate user names, access levels and passwords with Government.

E. System shall provide an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for 5 minutes. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.

3.5 DDC SOFTWARE INSTALLATION

A. Operating system (OS): Contractor shall install the OS on workstations and laptops and configure user names and passwords.

B. Virus Protection software: Contractor shall install the virus protection software on each server, laptop and workstation and shall configure weekly virus scans.

C. Contractor shall install and configure all software packages required to maintain and configure all types of controllers provided as part of this project on each engineering workstation.

D. Software from panels shall be permanently stored on CD ROM and on at least one hard disk at operator's workstation or Web Application Server. Provide auto re-boot feature on power up from system failure. System failures shall not necessitate manual reprogramming to restore normal system function.

E. Provide the latest version of all standard software, including operating system and control software. Include any software updates for period of one year, coinciding with warranty period. Beta released software shall not be used.

3.6 INITIAL PROGRAMMING

A. Control Contractor shall provide initial programming of controllers to accomplish sequences specified.

B. Provide back-up documentation per software manual submittals for all programs, in both written and electronic media formats.

C. Outputs, whether sequenced or not, shall have separate programmable hardware outputs. For air handling units, minimum outside air, maximum (economizer) outside air, return air, relief air, smoke dampers, heating valves, cooling valves, humidifier valves, etc., shall each have separate output.

D. BACnet Naming and Addressing

1. Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For MS/TP, assign from range as indicated by vendor documentation.
2. Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.
3. Every BACnet Building Controller (B-BC) and BACnet Router UDP port number shall be set to 47808 (BAC0).
4. Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.
5. The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

E. Minimum BACnet Object Requirements

1. For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and

all relevant object properties can be modified using BACnet's Write Property Service: all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

2. The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.
3. Support and provide Description and/or Device Type text strings matching signal type and engineering units shown on the points list.
4. Support and provide Inactive Text and Active Text property descriptions matching conditions shown on the points list.
5. For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. Enable the writeable Date List property and support all calendar entry data types.
6. Use Schedule Objects for all building system scheduling.
7. Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint and all constraints associated with Object, such as Proportional Constant, Integral Constant, and Derivative Constant for Loop Object, using BACnet read/write services.

F. Minimum BACnet Service Requirements

1. Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below.

Priority Level	Application
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)

13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

G. Data Sharing:
   1. Data communication from Building Controllers to Engineering Workstation and BAS web server shall be programmed to use Change of Value (COV) data sending and not continuous data polling to limit net work traffic.
   2. Data communication parameters for analog values shall be operator configurable and setup as follows:
      a. Minimum Send Time: 2 seconds
      b. Maximum Send Time: 60 seconds
      c. Send on Delta (COV) :
         1). Space Temperature: ±0.5°F
         2). Process Temperature: ±0.5°F
         3). Air Pressure, AHU: ±0.05" W.C.
         4). Relative Humidity: ±0.5%
         5). Air Flow: ±200 cfm
         6). Water Flow: ±50 gpm
         7). Water Pressure ±0.2 psi
         8). Space Pressure: ±0.01" W.C.
   3. Digital data points shall be sent whenever a state change occurs.

H. Historical Trending:
   1. All inputs and analog outputs shall be trended and shall fully configured and operational. Sample time shall be one minute.
   2. Program historical file for run-times and quantity of start/stops of motor driven equipment
   3. Trend logs are to be stored at the building controllers and uploaded to the BAS web server or data historian when the building controller trend buffer size reaches 90% full or every 30 minutes (FA).
   4. Data points indicated to as "LEED M&V" in the DDC Point Schedules shall be have a sampling time of one minute and averaged over 15 minutes.

I. Alarm/Event Management:
   1. All alarm handling shall be fully configured with consistent alarm messages and priorities or category numbers to identify the system from which the alarm originates.

J. Provide programming of menus to assist new users in accessing screen displays of each point group. Point groups (user definable) shall be initially arranged by DDC

Controller for major equipment and by floor and area for terminal devices. Terminal devices shall also be grouped by air handling system where applicable.

K. When adding to an existing system, groupings, tag names, descriptions, engineering units, etc. shall match the existing system. Transitions from the existing system to the new system shall be seamless in look, functionality, and operation. Controls Contractor shall verify with Owner if any standard naming conventions are being used and continue with those naming conventions when applicable.

L. Program historical file for run-times and quantity of start/stops of motor driven equipment.

M. Program maintenance alarms based on run-times and quantity of start/stops for motor driven equipment.
   1. Provide the following additional alarms:
      a. Controller loss of communications for each controller.
      b. Controller battery alarm for each controller (where available)
      c. Out-of-range, bad, or missing data (fault) for each device.

N. Program alarms using the following levels:
   1. Level 1 - Maintenance Alarm, requiring attention within 1 to 2 days. (Examples: 2-3°F temperature variance from set point; 15-25% relative humidity variance; etc.)
   2. Level 2 - Low Level Alarm, requiring attention within 8 h, preferably during the same shift. (Examples: More than 3°F variance from set point, 30 percent relative humidity or more variance from set points; excess start/stops per day; etc.)
   3. Level 3 - Critical Alarm, requiring immediate attention. (Examples: Non-operation of primary equipment; H-O-A overrides; failure of controllers, routers and repeaters.)
   4. Level 1 and 2 alarms shall not interrupt current user operation, but shall be logged into alarm summary file, indicating status, acknowledgment, and by whom. Level 3 alarms shall interrupt user via audible and/or flashing warning until acknowledged, without losing any work in progress. When alarms are acknowledged, program shall display point group or appropriate graphic display. Level 3 alarms shall also be logged into alarm summary file in similar manner as Level 1 and 2 alarms.

O. Time Schedules:
   1. Provide time schedules for HVAC components/systems as indicated in Control Sequences.
   2. All time schedules shall be fully configured with weekly schedules and all holidays identified by the Owner.
   3. Time schedules are to reside in the Building Controllers.

3.7 POINT LIST

A. Provide points required to implement control sequences specified, whether or not they are listed in schedules. In addition to control points, provide additional points listed in point schedules or defined in Control Sequences.

B. All points shall be programmed with a point name and detailed description. Control contractor shall submit point naming convention to Laboratory/Engineer for approval prior to system programming.

C. Work jointly with Owner to develop point naming convention prior to start of programming.

3.8 AUTO-DIAL ALARM MESSAGES

A. Program up to 30 types of prerecorded voice or fax messages assigned to different alarm types. Assign up to 10 phone numbers for each message. BAS shall automatically call phone numbers without answering machines in predetermined order. If an acceptable phone response is not received after 6 rings (adjustable), system shall automatic retry 3 times (adjustable) before calling next number. Systems shall print level 3 alarm message if no phone numbers were reached.

3.9 GRAPHICS PROGRAMMING

A. Graphics shall be designed to match any existing graphic displays on the existing system when new system is to fully integrate with existing system. Transition from existing graphics to new graphics shall be seamless transition for operator in look, functionality, and operation.

B. On new system, program color graphic displays for each system as described herein. Graphic displays shall consist of pictorial presentations on display monitor/workstation with text description, system schematic, or picture; alarm fields; and database fields for all associated points, including dynamic input values, output values, set points, gains, time schedules, etc. Provide single keystroke access to text file description of control sequence(s) in detail.

C. Make use of color to highlight system components. Components of similar type shall be of same color for all graphics (example: dampers shall be purple, valves yellow, etc.). Alarm fields shall be flashing white letters on red background. Affected component shall also turn red whenever alarm status is indicated. Database fields shall be white letters on black background and shall be dynamically updated and re-displayed on screen by periodically polling database points not less than once every minute.

D. Display time, date, outside temperature and humidity on displays in same location on each graphic. Display command line with English prompt in same location on each graphic. Provide command to direct specific displays without accessing main

menu. Provide means of displaying directory of screens. Arrange displays by group and type.

E. Graphic displays shall be designed to be easily understood. When display screen is too cluttered due to size, limit information to important monitoring data. Provide sub-graphic(s) to display data not displayed on main display.

F. Graphics shall include, but not be limited to:
   1. Site Plans, including each building, building name, and status of all exterior points such as lighting, etc.
   2. Overall building plan of each building. Indicate location of mechanical rooms and areas served by each air handling unit.
   3. Floor plans for each area depicting locations of terminal units, areas served by terminal units, and other remotely located points. Plans shall include full height partitions, column numbers, room numbers, and room names with special functions (not offices, corridors, toilets, storage, etc.).
   4. Schematic type graphics for:
      a. Each air handling system
      b. Supply fan control loop
      c. Relief fan control loop
      d. Cooling coil control loop
      e. Heating coil control loop
      f. Energy wheel control loop
      g. Damper control loops
      h. All air terminal devices shown on floor plans
      i. Medical vacuum system
      j. Each exhaust fan system
      k. Generator status and load
      l. Each VRF system
      m. Room differential pressure monitor
   5. Indicate systems to be graphically represented.
   6. Submit sample graphics (one per type) for review and approval by Owner prior to starting graphics programming.

END OF SECTION

SECTION 32 31 29

WOOD FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence posts and rail framing, slats, and accessories.
2. Excavation for post bases; concrete foundation for posts.
3. Manual gates and related hardware.

B. Related sections include the following:
1. Cast-in-Place Concrete Section 03 30 00.

1.2 SUBMITTALS

A. Product Data: Provide data on wood products, accessories, and hardware.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

C. Samples: Submit two samples of wood posts, slat infill, and rails illustrating color and surface texture.

~~C.~~D. Delegated-Design Submittal: For structural performance of wood fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 QUALITY ASSURANCE

A. Provide wood fences as complete units controlled by single source, including necessary erection accessories, fittings and fastenings.

B. Codes and Standards: Comply with the City of Waco, TX codes and ordinances, latest edition.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wood fence and gate frameworks.

~~2.1~~2.2 FENCE FRAMEWORK.

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:
   1. Fence Height: As indicated on Drawings.
   2. Light-Industrial-Strength Material: Group IC-L, round steel pipe, electric-resistance-welded pipe.
      a. Line Post: Diameter as required by design.~~2.375 inches (60 mm) in diameter~~.
      b. End, Corner, and Pull Posts: ~~2.875 inches (73 mm).~~As required by design.
      c. Gate Posts: ~~Rectangular tubular steel 3.25 by 2.50 inches (83 by 64 mm)~~As required by design.
      d. Gate Frames and Bracing: ~~Rectangular tubular steel Top Rail: 1.25 by 1.63 inches (32 by 41 mm).~~As required by design.
   3. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.

~~2.2~~2.3 SLATS: HORIZONTAL WOOD SLATS.

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

B. Wood boards or slats shall be of cedar,
   1. 6-inch wide #1 Grade Cedar Pickets (high quality cedar, very few knots).
      a. Slats shall be between 3/8 inches and 5/8 inches thick.
   2. Side-by-Side Construction: Slight visibility differences between pickets is acceptable.

C. Wood Rails: Three, 2 x 4 rails, rough sawn Western Red Cedar.

~~2.3~~2.4 Gates:

A. Gate configuration: Swinging, double leaf.

B. Gate Frame Height: As indicated on Drawings.

C. Gate Opening Width: As indicated on Drawings

D. Infill: Comply with requirements for adjacent fence.

E. Hardware for Double Swinging Gates: 180-degree hinges, three (3); drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

~~2.4~~2.5 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A153/A153M.
      a. Color: Black.
   2. Screws: Flat head, hardened steel, corrosion-resistant, length to achieve full penetration into connecting components.

B. Concrete: Provide a mix designed to produce concrete with a minimum 28-day compressive strength of 2,500 psi.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Do not proceed until unsatisfactory conditions have been corrected.

C. Do not begin installation and erection before final grading is completed.

3.2 PREPARATION

A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Bottom of post shall be set not less than 24” in concrete base.

B. Provide forms where required due to unstable soil conditions and for perimeter of fence post base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.

C. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

D. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 INSTALLATION

A. Installation of fence shall be by skilled fence erector and on lines and grades indicated.

B. Install fence posts, rails, and slats plumb, level, and square and in proper planes with other work.

C. Securely attach wood rails and pickets with galvanized nails and bolts and nuts.

3.4 FIELD QUALITY CONTROL

A. Verify that fencing is installed in accordance with provisions of Contract Documents.

B. Tolerances:
   1. Out of level: ± 1/4".
   2. Out of plumb: ± 1/4".

3.5 CLEANING AND PROTECTION

A. After installation, clean soiled fence surfaces. Protect fencing components from damage until acceptance by Owner.

END OF SECTION

RFP #2022-084 Education Center & Vet Hospital
RFP Respondant Question Log
Updated 11/14/2022

#	Respondant	RFQ Respondant Question	A/E Response	Addendum
1	SCI Construction	Is Transformer Pad (Note 1.1 on A01-01 & Note 6 on E01-01) provided and installed by Utility Company?	AEI: No, The transformer pad needs to be built by the contractor as per the utility company's specifications.	n/a
2	SCI Construction	The Fire Water Vault shown by Note 1.6 on A01-01 is not shown on C1.2, please advise.	Walker: It is identified as 6" Double Detector Check Valve on C1.2. Water Meter has been removed with Addendum #1.	n/a
3	SCI Construction	Note 1.14 on A01-01 references equipment schedule on A17 but there are no cages in that schedule. Please advise.	Perkins&Will: Per note 1.14 on A01-01 refer to A17 series (A17-01 through A17-07) for animal caging information.	n/a
4	SCI Construction	Please add V-05 from the equipment schedule on A17-00 to the fixture schedule on E62-01 so electricians know they have to install that.	AEI: The note no 8 is revised to correctly indicate "OFCI".	2
5	SCI Construction	Are black out shade cloths on 10/A32-20 OFOI, OFCI, or CFCI?	Perkins&Will: Roller window shade system (including shadeband material) is CFCI per the requirements of 12 24 13.	n/a
6	SCI Construction	The manufacturers for the cold rooms called out in 13 21 26 do not offer 2 year maintenance warranties required. Please advise.	Perkins&Will: Section 13 21 26-3.6 can be omitted. Cold storage room maintenance contract is not required.	n/a
7	SCI Construction	Light Fixtures Shaded in (B2-F) on E10-01 are not shown on Light Fixture Schedule. Are these OFOI?	AEI: No, these are Contractor Furnished and Contractor Installed. The lighting floor plan and the lighting fixtures schedule are revised to show 120 volt circuit for these fixtures and fixture product data on the schedule.	2
8	SCI Construction	Is sand blasting from 3/A02-01 to be provided by the owner or will that be in the contractors scope of work?	Perkins&Will: All concrete sand blasting is in contractor scope of work. Exact stencil and pattern/layout will be coordinated with Owner prior to install.	2
9	SCI Construction	Is 05/S02-02 the wall around the mechanical yard? If so is the "screen wall" 8/A02-02? Both details say to reference each other's discipline; please provide Support Size and Embedment for that fence/screen wall.	A/E: 05/S02-02 "Typical Section @ Retaining Wall" is to be referenced for the wall around the Mechanical Yard. Refer to revised section 32 31 29 for fencing requirements, including delegated design requirements.	2
10	SCI Construction	Are solar panels referenced by note in 12/S10-00 to be OFOI? If so will the owner provide the information requested?	Perkins&Will: Solar panels are to be OFOI. Owner will coordinate with structural engineer as needed for future installation	n/a
11	SCI Construction	Where is the architectural call out for the "Architectural Fin" noted at the Plan South East Corner.	Perkins&Will: The note on S10-01SS referencing an "Architectural Fin" should be omitted. Architectural fin is not part of project scope and note will be removed from structural drawings.	2
12	SCI Construction	Note H on T10-01 mentions that the final quantity of access points to be provided by owner. Will an allowance be given or will a change order be issued if different that amount shown on plans?	AEI: Final access point quantities and locations have been provided by the owner.	2
13	SCI Construction	Are there any owners allowances?	Owner: No Owner allowances.	n/a
14	SCI Construction	Will Testing be paid for by owner?	City of Waco: Passed testing of reasonable quantity / as required by construction documents will be paid by the Owner. Failed, re-testing, off-hours, or excessive testing is the responsibility of the Contractor.	n/a
15	SCI Construction	Will Builders Risk Insurance be required?	City of Waco: Yes, BR Insurance required	n/a
16	SCI Construction	Is CPVC sprinkler pipe allowed for Fire Sprinkler System?	AEI: No	n/a
17	SCI Construction	Is CPVC or PEX pipe for domestic water allowed?	AEI: No	n/a
18	SCI Construction	Can lab piping be ran in CPVC?	AEI: No	n/a
19	SCI Construction	Will building commissioning be by GC or Owner?	City of Waco: TAB and startup should be provided by GC. Other commissioning will be by Owner.	n/a
20	SCI Construction	Will MC Cable be allowed?	AEI: MC cable is only allowed as short "whips" from above ceiling/ceiling mounted J-boxes to fixtures.	n/a
21	SCI Construction	Can low voltage cable be pulled without conduit or will conduit be required?	AEI: Conduit required in-wall and above inaccessible or open ceiling spaces.	n/a
22	SCI Construction	GeoReport Page 9 paragraph 2 references a recommendation for the top 2 feet of the building pad. We want to confirm this will not be required it is just a recommendation?	EHW: Provide minimum of (2) feet of select non-expansive material below the slab per structural documents: Per General Structural Note 02.01/S00-05, "The Contractor shall perform excavations, footing construction, and preparation of the subgrade under the slab on ground in accordance with the recommendations contained in the geotechnical report and the project specifications." Per General Note 02.02/S00-05, and "per the project geotechnical report, the slab on ground will require a minimum of (2) feet of select non-expansive material below the slab…"	n/a
23	SCI Construction	Will the flooring in the classroom need to be welded seams or just glued down?	Perkins&Will: The resilient sheet rubber flooring should have welded seams per 09 65 18.	n/a
24	SCI Construction	Also what type of adhesive will be required? (Re: Question 23, Flooring)	Perkins&Will: Refer to 09 65 18 - 2.4(B)	n/a
25	John W. Erwin	Drawing "S10-02SS Foundation Plan- Vet Hospital- Structural Slab" does not appear to be in the set of drawings provided. Can you provide?	EHW: S10-02SS has been included in addendum #2	2
26	John W. Erwin	Drawings T11-01 and T11-02 "Audio Visual" General Notes E on both sheets state that AV devices are shown for rough-in purposes only and to refer to AV drawings by True North Consulting Group for detailed information. We are not finding the referenced AV drawings. Can you advise?	City of Waco: Architectural, Electrical and Technology drawings indicate rough-in locations coordinated with AV package. Owner will provide AV drawings by True North Consulting Group during construction phase for reference and coordination.	n/a
27	John W. Erwin	We are not seeing any Division 27 specifications for the Audio Visual, Video Surveillance, Security, Data / IT work, etc. Can you advise?	AEI: Division 27 and 28 specifications have been provided for this project. Audio Visual specifications to be provided by the owner's AV representative.	n/a
28	John W. Erwin	Would the City entertain allowing the respondents to submit their base proposal amount, schedule information regarding duration of the work, required bid security, and the other requested / required documents only at the time proposals are due and then provide respondents one (1) business day to provide the balance of the required information below? a. Alternates, b. Unit Prices, c. Listing of Subcontractors (and their associated references and project references) to be utilized on this work.	City of Waco: Proposer may submit base bid and alternate pricing on the revised part A submission date. Unit pricing and subcontractor information may be submitted on the revised part B submission date. See updated bid form attached.	n/a
29	John W. Erwin	Per drawing A01-01. It states that all landscaping work, except for the areas called to receive new hydroseed grass, is to be performed by the Owner. Please confirm.	Perkins&Will: Hyrdoseed shall be provided by the Contractor at specified areas. All other landscaping and permenant irrigation will be by the Owner.	n/a
30	John W. Erwin	With respect to the areas scheduled to receive new hydroseed grass, how is irrigation to these areas to be handled. Please clarify.	Owner: Temporary surface irrigation to be installed and maintained by the contractor until hydroseed is fully established. The contractor shall be responsible for removal of temporary irrigation no later than one year from project completion.	n/a

31	CSI Creative	I wanted to inquire about the design using Acoufelt Barcode 2 Fracture Tiles & Acoufelt Solid Rectangle Tiles (section 098433) and see if there was an opportunity to save money. Our competing products in the specialty acoustic category typically produce savings of 15% or more. We are a design studio that manufactures all of our products to each customer's program requirements. We are looking to get approved as a manufacturer to the basis of design so that we can work with the General Contractor who is awarded the project. For the Cameron Park Zoo: Education Center & Vet Hospital Project, we will be utilizing our Soundcore® Carved Surfaces AF004 & Soundcore® Profile Surfaces AF009 (www.csicreative.com). We will manufacture the product according to the design and performance specifications based on the selected Acoufelt Barcode 2 Fracture Tiles & Acoufelt Solid Rectangle Tiles.	Perkins&Will: Upon review of substitution request sent via email, CSI Creative is an acceptable alternate manufacturer pending Architect's review and acceptance of a physical sample showing same pattern and color as basis of design product.	**n/a**
32	Encore Fence	Can please get clarification on what West Fence detail to use for the Cameron Park Zoo on page A02-02. Detail 6- West Fence Section states it is 7'6" with no bottom board. Detail 8- West Fence Elevation states it is 9'4" with a 10" Bottom Board.	Perkins&Will: Refer to 1/A02-02 for section detail references. Additional clarification has been provided in addendum 2.	**2**
33	John W. Erwin	Is the combination of painted cabinets/epoxy tops and stainless cabinets/stainless tops intentional, or should Necropsy and Inst. Prep be stainless throughout?	Perkins&Will: Necropsy and Instrument prep should be stainless throughout, refer to addendum 2 drawings.	**2**
34	SCI Construction	Given our lead time, we cannot offer the specified Southern yellow pine (SYP). We are about 14-15 months out. Is it okay to provide Spruce Pine Fir CLT and Douglas-Fir glulam? We will submit a substitution form if required. (We do not offer E-rated Douglas-Fir CLT)	Perkins&Will: Please submit a substitution request with physical samples for formal approval. Alternate wood species are structurally acceptable with members meeting minimum design values as noted in Structural Wood notes on sheet S00-05. Alternative wood species are acceptable Architecturally if specified species do not meet project schedule requirement. Exterior rated CLT and Glulam is required on the project.	**n/a**
35	SCI Construction	Specified FSC Certified lumber - We understand that there is no SFC-certified SYP mass timber supplier yet, including Smartlam and Sterling Structural. It comes with a high premium cost, and often it isn't easy to source. It looks like the design team is pursuing LEED certification. Can Sustainable Forestry Initiative (SFI) certified lumber be acceptable? We have done numerous projects with SFI-certified LEED projects. If required, I can connect the design team with someone from the SFI organization.	Perkins&Will: This is job is not pursuing LEED certification. The SFI certified lumber is accetpable.	**n/a**
36	SCI Construction	Is the EOR requesting the delegated engineering services for a particular scope of mass timber, such as connections and diaphragm? Please confirm so that we can include it in our pricing if necessary. [END OF LOG]	EHW: Connection types have been designed and are indicated in the contract documents. EHW will rely on the manufacturer to produce shop drawings detailing out each condition. If alternate connection types are preferred, alternates will need to be designed by the contractor. If alternate connection types are used, the new connection shall meet or exceed the capacity of the specified connector from the contract documents.	**n/a**