

ATTACHMENT A4.3: SHADE CANOPY SPECIFICATIONS

RFP for Design Build Contract: Solar Power Generation System at
Ocean Discovery Institute



SECTION 05 90 02: STRUCTURAL PHOTOVOLTAIC SHADE CANOPY SPECIFICATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The RFP and all Attachments.
- B. Division 1 of the Specifications
- C. Section 26 00 00: General Electrical Specifications
- D. Section 26 60 00: Photovoltaic System Specifications

1.02 GENERAL

- A. This project includes the design and construction of Structural Photovoltaic Shade Canopies (PV Canopies). The design and installation shall conform to all requirements as defined by the applicable codes, laws, rules, and standards as specified in the RFP.
- B. Drawings must be signed Engineer of Record (EOR) or as required per DSA requirements.
- C. The Contractor shall include all items and all work reasonable inferred by these specifications and the RFP for compliance with all applicable structural codes. If the Contractor is in doubt as to the intent of any portion of these specifications and the RFP, or necessary information is omitted, the Contractor shall notify the Site Owner/Host in writing for clarifications or corrections to be provided by addendum.
- D. All design documents, cut sheets, and technical specifications shall be submitted, reviewed and accepted by the Site Owner/Host per the guidelines specified in the RFP.
- E. General Specifications as described in Section 26 00 00: General Electrical Specifications, are referred to herein and shall apply to this specification. Section 26 00 00 shall be deemed to supersede this specification in the case of conflicts.

1.03 WORK INCLUDED

- A. The work shall include the design and construction of the structural systems, in conformity with applicable codes and professionally recognized standards.
- B. The structural design shall be fully developed, including descriptions and calculations for all structural components. The site, plans, elevations, schedules and detail drawings must be sufficiently developed to reflect the overall design per the RFP and as described in Section 26 00 00, Photovoltaic System Specifications.
- C. Contractor shall provide all materials, labor, equipment, services, and incidentals necessary to install the structures at each Site as shown on the design drawings and as specified hereinafter.
- D. Contractor shall provide temporary power and lighting as required for construction. Additionally, contractor must provide sufficient temporary facility lighting in place of removed existing lighting during construction phase until under canopy lighting is fully operational.
- E. Contractor responsible for location of all underground utilities and infrastructure with the use

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of Ground Penetrating Radar (GPR) or equivalent technology.

- F. Contractor shall be responsible for prompt removal and disposal of spoils from all related construction activities.

1.04 COATINGS AND CORROSION CONTROL

- A. Each canopy system and associated components must be designed and selected to withstand the environmental conditions of the site (e.g., temperatures, winds, rain, flooding, etc.) to which they will be exposed. The design life shall be a minimum of 25-years.
- B. All structural members and racking installed outdoors shall be hot dipped galvanized steel.
 - 1. All galvanized materials cut during construction shall be field coated with a long-lasting rust inhibiting coating, color matched and intended for coating hot-dipped galvanized metal in outdoor settings.
 - 2. All galvanized materials shall be in compliance with ASTM 123/A-02 Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
 - 3. All purlin framing members shall be G90 galvanized steel. If structure is in close proximity to coastal conditions (within 1 mile), G120 galvanized steel or higher shall be installed per Engineer of Record's specification.
- C. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.

1.05 GEOTECHNICAL STUDY AND ANALYSIS

- A. A geotechnical analysis shall be provided by Contractor and performed by a qualified geotechnical engineering contractor. The results of the analysis shall be used when designing the foundations for the structures on the Site.
- B. At a minimum, the following should be included in the analysis:
 - 1. Review publicly available geotechnical information. This may include soils and geologic maps and literature, photographs, hydroelectric reports, groundwater reports, and water well data.
 - 2. Coordination and mobilization of the geotechnical services team for subsurface exploration of the Site. This should include working with the local utilities to mark any existing underground utilities (such as cables, gas lines, piping, etc.).
 - 3. Study the Site to determine the presence of faults, ground fissures, and other potential geologic hazards that could affect the structural design and construction of the Facility.
 - 4. Drilling or digging of exploratory borings and pits. The amount and depth shall be determined by the Contractor.
 - 5. Performance of cone penetration tests. The amount and depth shall be determined by the Contractor.
 - 6. Laboratory testing of collected soil samples from the borings and test pits. An evaluation of the in-place moisture content and dry density, gradation, plasticity, consolidation characteristics, collapse potential, expansivity, shear strength, resistivity, chloride content, sodium sulfate content, and solubility potential (total salts) should be conducted.

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7. Analyze the corrosivity of the soil upon determination of a professional engineer. Include a recommendation for the type of cement to be used in concrete foundations. Also include recommendations for corrosion protection for underground steel, including rigid metal conduit (such as the need for polyvinyl chloride [PVC] coating).
- C. A detailed report shall be provided outlining the tasks performed and the results of the testing. Included in the report should be any recommendations for the foundation designs, structural support designs, corrosion protection, pile drive frequency, minimum pile size, and any geologic conditions that may prevent the development of the project. For ground mount systems, an opinion on the viability of driven piles as the PV racking supports should be provided.

PART 2 – PRODUCTS

2.01 SOLAR CANOPY STRUCTURES

- A. Canopies shall have a minimum clear height of 12 foot at the lowest point of any structure to parking and driving aisle. Minimum clear height of 2 feet at lowest point of any structure to any other adjacent building or structure. Clear heights shall be verified by the Contractor with the Site Owner/Host and increased as needed. Canopy shall adhere to all fire separation requirements between canopy structure and adjacent building.
- B. All structural system components shall be designed and constructed to withstand the environmental conditions of the site to which they will be exposed. The mounting systems shall be designed and installed to resist dead load, live load, corrosion UV degradation, wind loads, and seismic loads appropriate to the geographic area over the expected life of the PV system, a minimum 25-years.
- C. The PV Canopies shall consist of single column and interconnected **truss** chords/beams with solar modules installed in either portrait or landscape orientation connected to the purlins. Columns shall be located between parking stall spaces with **truss** chords cantilevered to either side of the column for both dual entry (aisle) and single entry (perimeter) parking structures.
- D. All materials shall conform to the requirements, tolerances, etc. of the latest editions of the AISC Manual of Steel Construction, AISI Specifications for the Design of Cold Formed Steel Members, ASTM Standard Specifications for General Requirements for rolled steel plates, shapes, sheets and bars for structural use.
- E. All canopy bolts, nuts and washers, unless otherwise noted, shall be hot dip galvanized or stainless steel.
- F. Purlins shall be mounted between the **truss** top **truss** chords/beams unless otherwise noted. Top of purlins shall be flush with the top of the upper chord to provide a flat plane for uniform mounting of solar panel and integrated racking system.
- G. Purlins shall be bolted to clips on **truss** top chords/beams with zinc plated Grade 5 bolts, unless otherwise specified by the Structural Engineer of Record. Number of purlins and purlin spacing shall be determined by solar module and integrated rack layout. Mounting holes for the racking system and solar module installation shall be pre-located and pre-drilled prior to finishing and coating operations.
- H. Canopies placed in parking lots shall be clearly labeled with max clearance for vehicles at the low points. Labels shall be rated for long-term UV exposure with lifetime to match warranties specified for PV panels in Section 26 60 00. Minimum labeling of one every 50 feet of carport on the long axis and one at every exterior corner of each array within a parking lot. Label should be easily

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visible from a vehicle.

- I. Structural caissons/foundations for canopies in parking lots shall extend a minimum height of 30 inches above grade and be located a minimum of caisson depth (as required for the canopy loading) away from the adjacent building foundations or the caisson design shall neglect upper 6' of soil support as per geotechnical recommendations.
- J. Electrical conduits extending from the canopy to grade are to be encased in the foundations, not mounted on the outside of finished piers. All electrical connections between separate structures shall be underground. Overhead "jumpers" between structures shall not be permitted.
- K. For canopies located in parking lots, a minimum of two three-inch (3") spare conduits shall be installed from the main electrical service to one array that covers ADA parking stalls. Conduits shall originate at the main service cabinet and follow the PV AC homerun conduits to the point designated on the Site Detail Sheets. In the absence of a designated termination point at the canopies, conduit shall terminate at the first column of a designated carport or centered between the closest ADA and standard parking stalls closest to the AC panel board. The spare conduit shall terminate in a Christy box (hand hole). Spare conduit shall include a minimum of two sufficiently rated pull strings or wires inside conduit for future wire pull. Additional spare conduits may be required as specified in the Site Detail sheets.
- L. All framing material shall be drained or have provisions to prevent water pooling on or within the framing member (weep holes).
- M. All canopies to be co-planer and in alignment horizontally and vertically with adjacent arrays. Top of column heights shall be shown in design drawings.
- N. All anchor bolts shall be double nutted or 'staked' (threading irreversibly altered) to protect from structural compromise and vandalism.
- O. All structural connections at the flanged base of columns shall be outfitted with metal pole skirts coated to match columns. Pole skirts shall have rounded corners.
- P. Canopies shall have a minimum tilt of five degrees (5°) and maximum tilt of ten degrees (10°).

2.02 LIGHTING SYSTEMS

- A. Canopy lighting systems shall be designed to meet the Illuminating Engineering Society of North America (IESNA) requirements for parking lot areas, to meet or exceed minimum values and maximum uniformity ratios as listed in the IESNA criteria.
- B. Canopy Lighting shall meet all Title 24 requirements for installations in California.
- C. All lighting sources shall be LED type.
- D. Lighting control system shall be connected to the existing lighting controls in each area. If tie-in with existing circuits is not feasible, Contractor shall establish new circuit and controls.
- E. Install custom shielding or other mitigation measures to avoid light pollution and glare to neighbors.
- F. The routing of all exposed conduit shall be proposed by the contractor and approved by the architect prior to rough-in.
- G. Lighting design on canopies shall insure cut-off light control to limit spill light or glare to adjoining areas as-needed. Design and install custom shielding or other mitigation measures to avoid light pollution and glare to neighbors.

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- H. Existing pole mounted lighting in areas of new carport canopies shall be removed. Modify other existing lighting to coordinate with the new work and design, including reconnection of any existing downstream circuiting and controls to remain. Foundations of existing pole mount lighting are to be completely removed a minimum of 6-inches below grade, with grade restored to surrounding condition.
- I. New design shall cover all areas of the parking lots (in the area of the work) to leave no dark spots and meet IESNA and requirements for all areas previously covered by light standards removed under this contract. Contractor shall install new pole mounted luminaires if canopy lighting does not provide sufficient lighting in all areas previously covered by removed or altered light standards. Existing fixtures may remain, if not in direct conflict with canopies or causing shading of new canopies.
- J. Canopies shall include all required provisions for a fully functioning egress lighting installation at the parking lot as designed in the DSA approved drawings for the Living Lab site (Attachment D1.1) for the building. And include provisions for all required labor and hardware to connect complete lightings installed on the underside of the solar canopies to the premises lighting system and lighting inverter.
- K. Lightings used for egress path lighting shall be those specified in the Living Lab DSA drawings and approved by the electrical engineer. Lightings have already been purchased by the district, and shall be owner furnished, contractor installed.
- L. Lighting to be mounted to Solar canopy per original contract documents. If this detail is not possible, contractor to provide detail modified as required for the specific structural components of the proposed solar structure.
- M. A lighting plan shall be included showing proposed mounting locations and heights of lightings in relation to the parking lot and surrounding building structure. Lightings shall be mounted to the bottom of the solar structure at heights and locations matching those shown on the original construction documents. Lighting plan shall indicate orientation of glare control accessories and aiming instructions as called out in contract documents. Lighting plan shall include proposed routing of conduit and conductors for lightings mounted on the solar canopy from the building interior, through main structural column and along underside of solar canopy to lightings. Lighting control panel relay zone designation shall be indicated beside each lighting on the proposed lighting plans, and any lighting connected to the premises emergency lighting inverter shall be indicated on the lighting plan. Relay zone designation and lightings connected to the emergency lighting inverter shall match as shown in the DSA drawings for Living Lab.

PART 3 - EXECUTION

3.01 SITE PREPARATION AND INSPECTION

- A. Contractor shall direct, oversee and inspect all site work related to structural installation. Site preparation shall be in accordance with final drawings and specifications provided by manufacturer.

3.02 INSTALLATION

- A. Erect/Stand structural steel with proper equipment and qualified installers.
- B. Actively cooperate with other trades and provide incidental welding, connections, etc. for securement of work of others to structural steel framing.

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- C. Erect/Stand temporary flooring, planking, and scaffolding necessary in connection with erection of structural steel or support of erection machinery. Use of temporary floors shall be as required by municipal or state laws and governing safety regulations. Hoist metal deck onto structural frame.
- D. After erection, clean connections and abrasions to shop coat and spot paint with same primer used in shop.
- E. Installation of the structural system and all components shall be in strict accordance with manufacturer's recommendations.
- F. Post installation, Contractor shall provide the materials and labor to grout the base of the column to produce a finished joint.

3.03 ERECTION TOLERANCES

- A. Erection tolerances for structural steel work shall be in accordance with latest AISC "Code of Standard Practice for Steel Buildings and Bridges".

3.04 BOLTING

- A. High strength steel bolts shall be used where indicated. Fabrication and erection shall be in strict accordance with the latest edition of "Specifications for Assembly of Structural Joints Using High-Strength Steel Bolts", as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Load indicator washer shall be used. Use beveled washers on sloping surfaces.

3.05 WELDING

- A. Welding and welded joints shall be in accordance with AWS standards. Work shall be performed by operators who have been qualified by test in accordance with AWS D1.1, "Structural Welding Code – Steel", to perform type of work required for this project.
- B. All methods, sequence, qualifications and procedures, including preheating, postheating, etc. shall be detailed in writing and submitted to Architect for review by the testing laboratory. Provisions shall be made in detailing of lengths of members for dimensional changes as a result of shrinkage stresses so as to provide specified finished dimensions.
- C. Remove all runoff tabs, and bottom backing bars. Top backup bars to be removed or have continuous fillet weld to column.

3.06 ANCHOR BOLTS

- A. Provide at site, for others to install, all anchor bolts, bearing plates, and templates to be embedded in concrete.
- B. Provide necessary steel or wood templates and diagrams for setting and securing of such anchor bolts in concrete forms.
- C. Be jointly responsible with others for proper locating and installing, and make good any deficiencies and errors.
- D. Setting of anchor bolts in hardened concrete necessitates drilled holes solidly grouted in place with epoxy grout. Submit materials and methods for review and approval.

END OF SECTION