Request for Designer Qualification Submittals

NCSU Electrical Distribution Upgrade Project

North Carolina State University

State Construction ID 19-21163
Code: 41924
Item: 303
NCSU Project No. 201920030
Facility ID 199Z
Project Description:
This project will install a new underground 15 kV medium voltage distribution system. Six new feeder loops, twelve circuits, will replace the existing electrical distribution system serving NC State’s main campus in its entirety. New construction will include metal clad switchgear feeder breaker up fit, distribution feeder ductbank & manhole, cable, pad mounted switchgear and SCADA control scope. Project involves significant underground utilities, civil/sitework and transportation (vehicle and pedestrian) coordination, requiring experienced subconsultants as part of the design team.

Project Scope
The total project budget of $58,800,000 includes design, construction and associated construction costs.

Project Site
The project is located on North & Central Campus Precincts.

Pre-Submittal Meeting
A Pre-submittal Meeting will be held on 2/10/20 at 2:00 p.m. in NC State University Administrative Services III Building Room 124A/B 2701 Sullivan Drive. Attendance is not mandatory but highly encouraged.

Project Schedule
Designer Selection – April 2020
Design Start – June 2020
Construction Start – October 2021
Construction Completion – October 2024

Design Process
The selected firm will work through the North Carolina State University Office of the University Architect with a building committee that includes user representatives. The process will include normal involvement of the State Construction Office.

Critical Selection Factors
Interested firms can participate in the process by submitting a current SF 330 form and addressing the following in a written proposal. Please note that one hard copy and one electronic copy (CD/DVD/USB Flash Drive) of the proposal is requested. Most of the criteria listed below can be accommodated in sections A-G of the 330 form. Section H can be used for any additional information. The total submittal, including letter of interest, is limited to 26 sheets of paper. Both sides of the sheet may be used for a total of 52 pages. Firms are requested to assure receipt of proposals at address listed below by 3:00 p.m. on Friday, February 28th, 2020.

1. Experience and expertise with similar projects.
2. Past performance on similar projects.
3. Experience in design projects to be part of an existing campus or urban context.
4. Adequate staff and proposed consultant team – qualifications and examples of previous collaborations.
5. Historically Underutilized Business representation in proposed consultant team
7. Proposed design approach or methodology.
8. Recent experience with project cost estimates and schedule adherence.
9. Construction administration capabilities.
10. Record of successfully completed projects without major legal or technical problems.
11. A minimum of three references with current contact information.
12. Other (if there is other)

Designer Selection Process
Following the receipt of proposals, a University Interview Committee, appointed by the Secretary to the University Board of Trustees' Building and Property Committee, will shortlist, interview and make a recommendation of selection to the University Board of Trustees' Buildings and Property Committee.

Questions/Proposal Submittal
In order that the selection process be as objective as possible, do not contact members of the Board of Trustees, or any university officials other than the project manager. All questions and project submittals are to be directed to:

Damian Lallathin
NC State University
Capital Project Management
Box 7216 (2701 Sullivan Drive)
Raleigh, North Carolina 27695-7216
Phone 919-513-0373
dlallat@NCSU.edu
Background:

In 2015 NC State worked with an Electrical Engineering consultant to complete a study of the medium voltage electrical distribution system on North, Central & West campus precincts. The purpose of the study was to complete an existing condition assessment to determine remaining useful life, identify operational deficiencies and to develop recommendations for upgrade of the existing system planning for future load growth. Early indication of the study during the existing condition assessment phase revealed that the distribution system as a whole had extended beyond its useful life and recommendations for a complete system renovation were developed with the following goals:

- Organize the system to reduce operational risk
- Enhance reliability
- Improve safety
- Position the University for future growth.

The study results:

- Developed current and future building load profiles and system loading
- Developed overall system configuration, substation transformation and underground distribution.
- Develop Feeder Maps for recommended future system configuration
- Developed a model of the proposed medium-voltage electrical distribution.
- Prepared Basis of Design for key design elements:
  a. Feeder Sizing and Configuration
  b. Distribution Switchgear
  c. SCADA Requirements

The University has completed the recommended substation improvements to support a complete replacement of the electrical distribution system outside of the substation down to each building transformer. This project will design & construct a new underground medium voltage distribution system utilizing the basis of design developed in the study as the owner’s project requirements.

Experience:

The University is seeking professional underground engineering services, design & construction management, specialized in the distribution of 15kV utility. Experience necessary:

- Experience working on Higher Education Projects in a congested urban campus with proven success at communicating and coordinating work plans to avoid disruptions to on-going Campus activities and operations.
- A multidisciplinary design team capable of managing underground unknowns, capable of reacting to developing unforeseen utility conflicts and support design of utilities other than the primary 15kV distribution system.
- Experience working with in a multi consultant team contracted with the University. Additional 3rd party consultants expected to support design & construction: Construction Manager, Commissioning Agent, Construction material testing agent, Geotechnical/CMT & SUE consultant.
- Personnel should have a minimum of 15 to 20 years of expertise in design and construction of 15kV medium voltage distribution under applicable codes and standards.
System Overview:

Existing Substation Defined

NC State’s North & Central campus precincts receive electrical power from Duke Energy Progress (DEP) at the 115kV – 12.47kV Sullivan Substation located on Central campus and is owned and operated by the University. Two overhead transmission service taps enter the substation from the existing DEP 115kV transmission line between Method and Raleigh substations. Sectionalizing of the DEP transmission system is configured such that service can be maintained to the University from either DEP substation point of delivery in the event of a failure and or scheduled maintenance outage.

Within the substation two delta-wye ground transformer banks are installed and connected to the Duke Energy Progress 115kV transmission system via separate circuit switchers. Transformer bank 1 was installed when the Sullivan Substation was originally constructed and consists of three 10/13/16MVA 115 – 7.2kV single phase units connected with delta primary and wye ground secondary. Transformer bank 2 consists of a single three phase unit rated 30/40/50MVA 115 – 12.47Y/7.2kV with delta primary and wye ground secondary. Transformer bank 2 is equipped with an auto load tap changer (LTC) to maintain auto voltage control while transformer bank 2 is managed with a manual LTC. Each transformer bank is interconnected to two 15 kV arc resistant metal clad switchgear with a main tie main bus arrangement. To maximize reliability and facilitate maintenance activities without impact or outages to Campus a double circuit breaker scheme is used to serve the distribution system. The double breaker-double bus configuration in this application consists of two main buses per switchgear, each normally energized. Two circuit breakers exist for each circuit. Each circuit is configured as a primary loop with an open point at the midpoint. Each ½ of the loop is served from both SWGR maximizing flexibility and reliability.

The current operating configuration is set up that transformer bank 2 is primary and transformer bank 1 is on standby. The substation SCADA system provides remote operation and monitoring of the metal clad switchgear main, tie and feeder breakers as well as automated bus transfer and overcurrent
lockout to automatically restore loop power in the event of loss of one substation source. In the future it is planned to replace transformer bank 1 with a matching 30/40/50MVA 115 – 12.47Y/7.2kV transformer with auto LTC and operate the two transformations sources in parallel, thus the matching metal clad SWGR. Until replacement each SWGR tie operates closed forming bus A/B & C/D.

The main advantages of this scheme include:

• Flexible operation,

• Very high reliability,

• Isolation of either main bus for maintenance without disrupting service,

• Isolation of any circuit breaker for maintenance without disrupting service,

• Double feed to each circuit,

• No interruption of service to any circuits from bus fault,

• Loss of only one circuit for breaker failure, and

• All switching with circuit breakers.
Existing Distribution System Defined

The North & Central Campus distribution is a 12,470Y/7200V 3-phase 4-wire multipoint grounded wye system. Seventeen distribution feeders currently provide power through underground concrete encased duct banks to serve building loads and 4 express feeders serve two steam & chilled water central utility plants. The existing NCSU system configuration serving the building load is a nested loop system. Distribution switches are fed downstream radially from other distribution switches and form loops that are downstream from other loops. Due to existing conditions sectionalizing for maintenance and or failure isolation is difficult to attain without disruption to many buildings. Some distribution switches in the existing nested loop configuration do not have ties to other power sources, which makes sectionalizing loads not an option. This is not an effective or reliable solution. Many feeder cables are installed in common ductbanks such that failure of one feeder cable could result in the failure of other cables serving unrelated equipment resulting in extended outages to major portions of the Campus. The age and condition of many switches, both in manholes and above grade, indicate the switches have exceeded their useful life and should be replaced. Many ductbanks were installed over 40 years ago and are not deemed reliable for reuse. These ductbanks feature fiber type conduit that tends to collapse with age rendering it unusable to remove old cable or install new cable.
**New Distribution System Basis of Design:**
A mainline loop configuration includes distribution switches that form one loop via loop feeders and tie back to the substation. Radial load feeders from each of these switches serve the loads. This mainline loop configuration is crucial to effectively sectionalize loads and resume power in case of a feeder failure.

![Typical Loop Diagram](image)

**New Distribution System Scope of Work:**
The new substation feeder configuration will maintain the two express feeders to both the Cates and Yarbrough Central Utility Plants. The existing Bragaw Switchgear will be eliminated. Campus building distribution configuration will feature loop with normal open point with load normally, evenly split between loop sections. Nested sub-loops will be eliminated. The new North and Central Campus feeder loops will originate from feeder breakers at the Sullivan Substation and route to their respective campus loads in concrete encased ductbanks. The North Campus will feature three feeder loops originating from six feeder breakers at the substation. The Central Campus will feature three feeder loops originating from six feeder breakers at the substation.
Distribution System SCADA

Distribution automation will consist of remote supervisory switch motor operators for mainline switch operation and switch position indication. Tap ways will be equipped with fault indicators with remote contact monitoring. Mainline ways will utilize PT’s and CT’s installed on each phase of each way to facilitate remote fault location and aid in sectionalizing for faulted circuits. An SEL 451 Protection, Automation and Control System relay will be provided in each pad mounted switchgear with inputs and outputs wired to support remote monitoring and control. All 451’s will communicate with the campus RTAC to coordinate self-healing in the event of a fault.

Mainline feeder faults will be cleared by the feeder breaker at the substation switchgear. This will result in an outage to all customers connected to the faulted half of the feeder loop. The 451’s at each switch will communicate to the RTAC if they experienced the fault passing through their switch. The RTAC will then instruct the switches to operate, isolating the fault and enabling the restoration in a matter of seconds.

Sequence of Events:

- Main line fault occurs
- Substation breaker clears fault
- Switches report status to the RTAC so that fault location can be identified.
- RTAC IDs fault and open both switch ways on faulted circuit.
- N.O. switch from opposite feeder closes to re-energize all circuits except faulted circuit.
- Open feeder breaker closes back-in.
- Personnel clear fault. System is placed back in normal operating scenario.
Design Discipline Services Required:

Civil/Site Engineering
- Electrical ductbank and electrical manhole design
- Permitting – RR ROW Crossing
- Jack & bore – RR ROW Crossing
- Environmental Impact Analysis and Remediation (E&C)
- Phasing, traffic/pedestrian control coordination support for construction manager
- Site demolition and landscape restoration

Structural Engineering
- Electrical ductbank & electrical manhole detailing
- Equipment pads

Electrical Utility Distribution Engineering
- SWGR breaker cubical fit up
- Primary & secondary power distribution
- Protective Relaying (settings & programming)
- Load and Short Circuit Analysis, Coordination Study
- Phasing, building cutovers/temporary generation

SCADA Automation & Smart Grid Design Engineering
- Provide controls configuration, and system setup for the required controllers and network devices. Provide logic associated with protective relaying to provide for a self-healing distribution loop.

Environmental Engineering
- Environmental impact assessment
- Hazardous material handling
  - Asbestos
  - PCB’s

Cost Estimating
- Calculate opinions of probable cost for each submission as indicated in the deliverables schedule below.
Design & Construction Phases:

Advanced Planning

- Examine briefly the updated 2019 Student Housing Master Plan to evaluate if changes are necessary in planned circuit loading assumed in the basis of design 2015 electrical master plan.
- The University’s Physical Master Plan, last updated in 2014, will be updated in 2020. Coordinate with any new developments.
- Stakeholder involvement was solicited from the following University stakeholder organizations at a stakeholder charrette during the previous study. Advanced planning will Review MP Charrette comments and re-visit with current stakeholders.
  - Campus Architect
  - Operations
  - Environmental Health and Public Safety
  - Landscape Architect
  - Communications Technologies
  - Facilities
  - Capitol Project Management
  - Housing
  - Dining
  - Athletics
  - Transportation
- Evaluate considerations for distribution equipment replacement locations.
- Examine easement documentation
- Significant traffic flow issues that could affect the construction cost.
- Determine Equipment Pre-purchase requirements
- Determine early site package requirements
- Determine early SCADA design build package requirements
- Submit required documentation to obtain easement encroachment approval from Duke Energy Progress in accordance with DEP’s transmission right-of-way guidelines/restrictions for all underground ductbank installation entries.
- Submit application & supporting documents to obtain a facility encroachment and permit for right of entry with in railroad track property shared by the NC Railroad Company (NCRR), Norfolk-Southern Railroad (NS RR), and CSX Railroad (CSX RR).
- Determine ductbank routing and SUE level requirements. Develop site survey scope and SUE test pit locations. Develop traffic control plans for procurement of work by the owner.

Design Phase


CMR Collaboration

- Reconcile Cost Estimates at each design submittal
- Incorporate CMR constructability comments
- Coordinate alignment of project scope and budget
- Meetings with the Owner, CMR and consultants as required to sufficiently coordinate and address items 2 and 3
Commissioning Agent Collaboration

- The commissioning agent shall act as the overall quality assurance manager, coordinating not only start up and testing during construction but quality control requirements of all aspects of project development of design & construction
- The Designer shall integrate specifications provided by the Commissioning agent into the bid package.
- The Designer will respond to the Commissioning agent’s design phase comments and coordinate with their consultants to resolve issues.

Bid Phase

- Assist CM in structuring bid packages to facilitate greatest HUB participation.
- Assist with the contractor prequalification process by providing qualifications requirements such as recommended work experience and bonding capacity.
- Attend pre-bid meeting and bid openings

Construction Phase

The designer’s responsibilities during the construction phase shall be as described in the State Construction Manual, and as set forth in the State of North Carolina Standard Form Of Agreement Between Owner And Designer.

Cx Agent Collaboration

- The Designer shall assist in the coordination of, and attend the pre-function and functional tests/start-up tests as required by the project.
- The designer shall perform all inspections and provide documentation as required by the quality assurance program defined during the design phase and integrated into the specifications.