DIVISION 33 - UTILITIES

Contents

33 05 00 Common Work Results for Utilities

Design Standards

1. The design must include all necessary specifications and drawings to adequately detail the work to be installed. The designer shall account for any portion of the exterior utility work that may be accomplished by subcontractors doing work specified in other divisions.

2. A single, comprehensive drawing showing all sitework and utilities shall be provided. Depending on the complexity of the project, individual drawings may also be required.

3. New construction and major renovations must include sub-metering of lighting, plug loads, equipment loads, and HVAC loads at the building level. It is expected that this will be accomplished with 10 or fewer submeters. All meters shall be connected through Ethernet to Clemson University's Powerlogics server. Consult with University Utility Services for approval of submetering layout and design prior to installation.

4. All submetering shall be compatible with and be integrated into the Schnider Electric PowerLogic server present on Clemson's campus.

5. See Section 01 51 00 concerning the requirements and charges for temporary utilities that may be specified in the contract.

6. Clearly specify soil compaction requirements for the backfill in the trenches used for the installation of all utilities in this Division. This needs to agree with any compaction requirements specified in Division 31.

7. Clearly specify that all trenching activities shall comply with Clemson's Urban Forest and Landscape Management Policy.

8. The designer shall give special attention to assuring that all required permits for both the construction of these utilities and the operation of them are obtained from the regulating authority.

9. Consult the OSE Manual for information concerning requirements, codes, and standards that are applicable to this design. The design shall comply with all local codes having jurisdiction, OSHA regulations, ADA compliance, and any applicable seismic codes.

10. Clearly specify the appropriate level of testing and inspections that are required of the individual utility systems and the specific phases of the inspections to be done at intervals of the installation, i.e., prior to backfill of the trench over any piping.

11. Designs shall provide for manholes or catch basins at each point where either the grade or direction of storm sewers change. Manholes or catch basins in excess of 4 feet in depth must be provided with ladder type steps on a vertical wall of the structure.

12. All manholes and catch basins must be provided with frames and/or covers to allow access for maintenance.

13. Clearly specify that the products to be provided for installation under this Division are in strict accordance with the Product and Material listing for this Division.

Trenchless Utility Installation

1. The University incorporates trenchless utility installation (directional boring) in instances that are either economically feasible or are a better choice in dealing with possible disruption of other services on campus.

Utility Line Signs, Markers, and Flags

1. The University maintains a thorough mapping of the utility systems on campus. Although special attention is given to obtaining field locations of these utility systems as they are installed, various methods of marking these utilities for future reference is also desired. The designer shall utilize current industry standards in providing on-site marking methods that will assist in utility location at later dates.

33 05 97 Utility Identification

1. All new construction and any renovation that establishes labeling conventions for non-electric utilities shall follow the standards set forth in the most recent version of ANSI/ASME 13.1.

2. Labels shall indicate the type of utility and direction of flow on all labels. Labels shall also be no more than 20 feet apart. For dual temperature hydronic piping, the standard convention of green with white writing shall be used with labeling as Dual Temp. Supply (DTS) and Dual Temp. Return. (DTR).

3. When an existing convention other than the one listed above is present, the existing color-coding system shall be followed for all new work on the system while maintaining the label spacing and direction of flow indication above.

33 10 00 Water Utilities

Existing System and Design Information

1. Clemson University operates its own potable water distribution system, receiving water from Anderson Regional Joint Water System's (ARJWS) Hartwell Lake Filter Plant. The water purchased from ARJWS is piped into Clemson University through two (2) master meters in parallel 8-inch turbine located at the Kite Hill standpipe. There is also an emergency service connection provided by the City of Seneca (Seneca Light & Water), a surface water system. Storage for Clemson University's drinking water includes the 300,000 gallon Ravenel storage and the 1,000,000 gallon standpipe on Kite Hill.

2. Details of the water distribution system can be found on the University Atlas and the University Water Network GIS maps. To gain access to these documents, contact your appropriate University project manager. Distribution pressure varies around the campus, therefore, for any proposed facility, request that a flow test for both static and residual pressure be made. University Utilities can usually conduct these tests

as needed.

33 11 13 Public Water Utility Distribution Piping

1. Specify that no domestic water piping is installed as to enter a building from under the finished concrete slab.

2. Design must allow for and specify that piping shall be buried below recorded frost penetration, but no less than 36" below finished grade.

3. Specify the installation of appropriate thrust blocks that are needed to properly anchor piping at changes in direction and other required locations. The design must clearly indicate the details required for these thrust blocks.

4. Clearly specify the coordination of any permitting requirements for the installation of these water lines – both the permit to construct and the permit to operate the system. See Division 01 for permitting responsibilities.

5. Specify the level and the method of disinfection of these water lines in accordance with permit requirements or other code requirements.

6. Regulations contained in the Safe Drinking Water Act concerning lead and copper concentrations shall be complied with, including the specification and the selection of piping materials to ensure this compliance.

7. Specify that all new and repaired water distribution system piping shall be inspected my Utilities Services and recorded by the University Facilities Surveyor prior to any backfilling.

33 11 19 Fire Suppression Utility Water Distribution Piping

1. Most water distribution lines on campus serve multiple building systems such as domestic water supply and fire suppression. In these cases, the construction of these lines will be done to the most restrictive of the applicable codes, laws and regulations.

2. The color scheme of fire hydrants installed on the fire suppression water system shall be in accordance with instructions contained in the most current version of AWWA C502.

33 12 13 Water Supply Backflow Preventer Assemblies

1. Reduced pressure type backflow preventers shall be used for domestic water service. Building backflow protection devices shall be designed and installed in parallel to facilitate annual maintenance. See University Fire Suppression and Domestic Water Riser Schematic for installation details.

2. The type of backflow preventer will be based upon the degree of hazard:

    - All cafeteria buildings, food service buildings, buildings with wet laboratories, nursing buildings, and medical facilities will be provided with reduced pressure principal devices.

- Buildings with wet fire sprinklers will be provided with devices that are rated for such service.
- All irrigation systems will be provided with at least double check valve assemblies.
- Carbonated beverage dispensers will be provided with the manufacturer's backflow preventers.

3. Reduced pressure principal devices will be installed in a manner that prevents immersion when the device discharges water.

4. Any installation that results in a direct cross connection between a public water supply and a source of contamination is prohibited.

5. Provide a complete rubber parts repair kit attached to the valve for future maintenance.

33 12 16 Water Utility Distribution Valves

1. Specify that all underground valves shall be provided with a valve box and cover to allow access.

2. Valves installed in unpaved areas shall have concrete "donut" rings around the valve cover at the ground surface for protection.

3. Installations requiring special operating tools shall have the applicable tool furnished with the installation.

4. Specify that contractors are not to operate existing water valves in Clemson's water distribution system. The contractor is to contact Clemson's Utilities Services to have University personnel perform any valve operations.

33 12 19 Water Utility Distribution Fire Hydrants

1. Adequately detail the orientation of fire hydrants to accommodate access by firefighting equipment and vehicles. Consult with the Project Manager and the University Fire Code Official concerning coordination of the location and orientation of all hydrants.

33 12 33 Water Utility Metering

1. Clemson University prefers that water meters for a particular facility be located in a mechanical room or other appropriate location within the facility. This meter assembly must include all applicable backflow preventers and isolation valves. See Division 22 for additional information on metering.

2. Provide combination meters for potable water and standard meters for irrigation.

33 13 00 Disinfecting of Water Utility Distribution

1. The disinfection of new water distribution systems and piping must be specified in accordance with South Carolina DHEC requirements.

33 30 00 Sanitary Sewerage Utilities

Existing System and Design Information

1. Clemson University operates its own sanitary sewerage collection system and sewerage treatment plant. The locations of piping connected to the system are available from University Utilities Services.

2. Clearly specify the coordination of any permitting requirements for the installation of any sanitary sewer lines. This includes both the construction and operating permits.

33 31 00 Sanitary Utility Sewerage Piping

1. Clearly specify any allowable installation tolerances from specified line and grade.

2. Reinforced concrete piping is not allowed for sanitary sewer piping.

3. The maximum between manholes shall not exceed 250 linear feet.

4. All new sanitary sewer systems shall be inspected via a recording CCTV system. Contact University Utilities for submittal requirements.

5. Specify that all new and repaired sanitary sewerage piping shall be inspected my Utilities Services and recorded by the University Facilities Surveyor prior to any backfilling.

33 31 00 Sanitary Utility Sewerage Structures

1. Manholes must be located at all changes in plan direction and abrupt changes in elevations. Drop manholes must be specified in accordance with accepted design standards.

2. Specify that all inverts in sanitary manholes shall be constructed in place. Pre-cast inverts are not allowed.

3. Pre-cast sanitary sewer manholes shall be specified to with an eccentric top section with cast in place ladder rungs.

4. Manhole rings and lids shall be specified to meet the requirements of the application. Lids shall have cast in letters stating, "Sanitary Sewer".

5. Specify that all new and repaired sanitary sewerage structures shall be inspected by Utilities Services and recorded by the University Facilities Surveyor prior to any backfilling.

33 39 23 Sanitary Utility Sewerage Cleanouts

1. At a minimum, locate cleanouts in accordance with International Plumbing Code as adopted by Chapter 5 of OSE Manual.

2. The designer shall be responsible for identifying any need for additional cleanouts beyond those needed for a code compliant installation and shall include these in the completed design. Consult with the Project Manager and other applicable University personnel as early in the design process as possible for requirements regarding specialized equipment or any unique conditions or needs that may exist.

33 40 00 Storm Drainage Utilities

Existing System and Design Information

1. Clemson University's storm sewerage system is generally laid out in three major distribution trunks, each draining approximately one-third of the campus. Proper storm drainage shall be addressed on any new structure or facility tied into the existing system.

2. The designer shall be aware of the requirements of EPA/DHEC permitting requirements for NPDES Permits for Storm Water Discharges and assure that any applicable aspects of these requirements are complied with. The Project Manager can provide current information concerning any existing NPDES Permit issued to Clemson University.

3. Design calculations for large drainage projects shall be submitted as part of closeout documentation.

4. The University's storm sewer system is not designed to handle storms of greater intensity than the theoretical ten-year frequency.

33 41 00 Storm Utility Drainage Piping

1. The minimum acceptable size for storm drainage piping receiving surface water from ground or paved areas is 15 inches in diameter.

2. Curbs and gutters shall be planned to facilitate the disposal of storm water.

3. Planter boxes and planted areas surrounded by walks shall be piped to the storm sewer system rather than discharging onto walkways.

4. All drop inlets and catch basins shall be designed to allow adequate drainage assuming 50 percent blockage of all water accepting openings.

5. Drop inlets are not allowed in walking surfaces.

6. Catch basins and drop inlets along roadways and in parking lots shall be placed outside of vehicular and pedestrian pathways.

7. Drainage systems serving foundations, areaways, and roofs shall connect to the University's storm sewer system at a catch basin with a top elevation lower than the ground floor elevation of the building.

8. Specify that all new and repaired storm drainage systems shall be inspected by Utilities

Services and recorded by the University Facilities Surveyor prior to any backfilling.

9. All new storm sewer systems shall be inspected via a recording CCTV System. Contact University Utilities Services for submittal requirements.

33 47 26 Storm Drainage Water Retention Structures

1. Storm Drainage Water Retention Structures shall follow design standards defined in the SCDES BMP Handbook or the elected permit authority's design manual as required by the Clemson University Storm Water Management Program.

2. Clemson University recognizes the following BMPs as LID storm drainage structures when designed in accordance with specifications in the SCDES BMP Handbook:

   - Vegetated Conveyance Swales
   - Bioretention Areas
   - Vegetated Filter Strips
   - Infiltration Trenches
   - Porous Surfacing

3. As stated in the University Stormwater Management Program, use of LID BMPs is the preferred method of stormwater management and should be implemented whenever practical as part of the policy objective.

4. The requirement of the construction of storm water retention structures will be dictated by to the DHEC/NPDES permit that may be required for the project.

33 60 00 Hydronic and Steam Energy Utilities

Existing System and Design Information

1. Chilled water is distributed throughout the campus via a campus loop chilled water supply and reverse return systems. Detailed information relating to the chilled water system is available upon request from University Utility Services.

2. Steam and condensate systems are distributed throughout the campus via an underground conduit system or through the main utility tunnel system. This piping system consists of a steam line at 115 psig saturated, a pumped condensate return line, and a high-pressure condensate drip line if required.

33 61 00 Hydronic (Chilled Water) Distribution Piping

1. Specify that the minimum depth of uninsulated chilled water lines be 6 feet below finished grade.
2. Specify insulation of chilled water lines in accordance with the Products and Material Listing for this Division.

3. Include a chilled water bridge installed per Clemson's Chilled Water Supply Bridge Detail in all new building construction.

33 61 33 Metering

1. Chilled water to all facilities must be metered.

2. The designer shall pay particular attention to clear piping requirements for the appropriate meter installation.

33 63 13 Underground Steam and Condensate Distribution Piping

1. Steam manholes must be designed for proper drainage. Pipe the drainage to existing storm drainage system if possible.

2. Main distribution steam line piping must be designed utilizing an underground conduit system. Design and layout of the distribution piping must be such to allow for expansion in the underground conduit system through the use of expansion loops. The design must adequately detail type and location of all required anchors, guides, and supports.

3. Service connections to individual facilities are to be installed utilizing direct burial, pre- insulated piping as indicated in the Products and Materials Listing at the end of this Division.

4. Specify insulation of steam lines in accordance with the Products and Material Listing for this Division.

33 63 33 Metering

1. Steam distribution to the facility must be metered.

2. The designer shall pay particular attention to clear piping requirements for the appropriate meter installation.

33 70 00 Electrical Utilities

Existing System and Design Information

1. Clemson University operates its own power distribution system through both concrete encased duct bank systems and the main utility tunnel system. Power is transmitted at 4160 or 12,470 volt wye, 3 phase, 4 wire, 60 cycle AC. Consult Utilities Services for the primary voltage to be provided for a project and standards on the specific circuit and connection equipment required as well as the number of conduits to be installed in a particular duct bank system.

2. Electrical utilities systems shall conform to the following documents as applicable:
   - Clemson University Medium Voltage Guidebook
   - Clemson University Pad Mount Transformer Specs
   - Clemson University Medium Voltage Cable Specs

33 71 19 Electrical Underground Ducts and Manholes

1. Conduit encased in concrete shall have spacers and supports installed in accordance

with manufacturers specifications prior to concrete placement. The concrete encasement surrounding the duct bank shall be rectangular in cross-section and provide at least 3 inches of concrete cover for the ducts. Conduit shall be separated by a minimum of 3 inches of concrete. Coordinate the requirements of the concrete encasement with the requirements for other concrete specified in Division 3.

2. The first 10’ of conduit entering and exiting a manhole or structure must be RMC or NEMA rated Sch. 40 – PVC, in concrete-encased duct bank.

3. Conduit joints shall be staggered by rows and layers to provide a duct line of maximum strength.

4. Specify that during construction, contractor shall protect partially completed line from the entrance of debris and dirt with suitable conduit plugs. At the completion of each section of duct line, specify that each conduit shall have a stiff bristle brush having the same diameter as the conduit pulled through it until clear, then plugged with temporary end plugs.

5. A pull string shall be installed in all empty conduit not used in the present project.

6. Duct lines shall have a continuous slope away from buildings of not less than 3%.

7. Changes in direction of the conduits shall be accompanied with long sweep bends having a minimum radius of curvature of 25 feet.

8. Changes in direction of duct banks shall be minimized between manholes to facilitate pulling of cable. There shall be no more than 180 degrees of bend between manholes.

9. A 12” sump with cover shall be provided in the bottom of each vault.

10. Take special care in determining the finish elevations of manhole tops and covers to accommodate the installation and minimize surface water infiltration. The highest point of the vault shall be 18” below final grade.

    - Conduits shall be cleaned and tested for continuity prior to installation of cables or pull strings as follows:

    - The conduit shall then be swabbed out by pulling through a brush and/or rags which remove any additional debris from the conduit. The process shall be repeated until the conduit is free of debris.

    - A steel mandrel not less that 2 inches long and having a diameter no less than 70 percent of the inside diameter of the conduit or an equivalent approved by the CU Utilities Electrical Engineer shall be passed through the entire run of conduit from one end to the other between vaults, transformers, and/or poles without binding. The mandrel’s length shall be that it will only pass through conduit/innerduct with a bending radius of 24 inches. Conduits which do not allow the mandrel to be pulled or passed through freely will be repaired or replaced and re-tested.

- Should the mandrel become stuck in the conduit then the length of conduit where the mandrel was stuck shall be condemned and replaced to the satisfaction of the University Utilities Electrical Engineer.

33 71 49 Medium Voltage Wiring

1. All medium voltage systems shall comply with the Medium Voltage Guidebook.

2. The designer shall be especially thorough in coordinating the requirements for wiring under this Division with those requirements specified in Division 26 of this document.

1. Specify adequate experience level and documentation of all personnel engaged in the installation of medium voltage wiring and the making of cable splices for this wiring. It is preferable that this task be done by a single individual throughout the project.

4. Adequately specify any special tests, precautions, notifications, etc. that are needed prior to energizing any medium voltage cable and associated equipment. Medium voltage cables shall be VLF withstand tested following IEEE 400.2 guidelines before being placed into service.

5. Specify the proper protection of medium voltage cable both prior to installation and during the actual installation within a conduit system.

6. For any additional information on Medium Voltage installations, please contact University Utility Services.

33 72 00 Utility Substations and Associated Equipment

1. The installation and construction of new substations or additions to existing substations require design based on the requirements of the individual substation. University Utility Services can supply the appropriate information on this type of facility and its specific requirements.

2. Specify adequate experience level and documentation of all personnel engaged in the installation of medium voltage wiring and the making of cable splices for this wiring.

3. Adequately specify any special tests, precautions, notifications, etc. that are needed prior to energizing any medium voltage cable and associated equipment. Medium voltage cables shall be VLF withstand tested following the most recent IEEE 400.2 guidelines before being placed into service.

33 80 00 Communications Utilities

Existing System and Design Information

1. Clemson University operates and maintains its own outside plant communications distribution system for voice, data and video system. This infrastructure includes underground ductbanks, manholes and fiber optic cabling.

2. Clemson uses Voice-over-IP (VOIP) for campus telephone services and therefore does not install any Clemson-owned outside plant copper cabling. Instead, for the limited amount of analog telephone services needed, Clemson obtains telephone utility services from AT&T.

3. Inquire with the Facilities project manager to determine who from the Clemson Network Services and Telecommunication (NST) department has been assigned to serve as the NST Technical Lead (NSTTL). It is imperative that the NSTTL and the telecommunications designer on the A&E team be involved from the beginning of the project (typically the pre-design phase).

4. Refer to Clemson's Telecommunications Distribution Design Guide (TDDG) (https://ccit.clemson.edu/services/network-phones-cable/infrastructure-standards) for instructions about designing outside plant telecommunications infrastructure on campus. Adherence to these requirements is mandatory, and many of the requirements involve interaction with the CCITPM to inquire about project-specific nuances.

5. In addition to the design guidelines in the TDDG, a set of specification sections have been prepared for specific projects on campus. For any projects involving outside plant telecommunications infrastructure, please send an email to ITHELP@clemson.edu and request that the current version Word documents for the following sections be sent to you. Designers shall directly edit these specification documents for applicability to each Clemson project, rather than using their own specification documents.

PRODUCTS AND MATERIALS – DIVISION 33 – UTILITIES

Water Utilities

Fire Suppression Water Distribution Piping

- Ductile Iron – Schedule 40, with resilient joints. Use mechanical joints for fittings and appurtenances.

Fire Hydrants

- Mueller Super Centurion 250 without Aquagrip or approved equal having a 3-way valve, with two 2-1/2" and one 4" hose connections.

Potable Water Distribution Piping

- Ductile Iron – Schedule 40, with resilient joints. Use mechanical joints for fittings and appurtenances.
- Polyvinylchloride (PVC) – Schedule 40, may be acceptable for use in some locations. Consult the University Utilities prior to specifying the use of PVC.

Valves

- Eddy #F-2405, AWWA or approved equal with iron body, bronze trim, non-rising stem, mechanical joint connection, 200 psi, open to the left, with 2" operating nut.
- Underground installations shall require valve box and cover for access.

Sanitary Sewer Utilities

Manholes

- Concrete pre-cast manholes with eccentric top section, and cast in place ladder rungs.

Manhole Rings and Lids

- Cast iron, selected for proper strength for particular application.
- Lids shall have cast in letters stating, "Sanitary Sewer."

Sanitary Sewerage Piping

- In areas subjected to heavy traffic loading or in difficult maintenance locations – Ductile Iron – Schedule 40.
- In areas not subjected to heavy traffic loading –Contech A-2000 PVC or approved equal.

Storm Drainage Utilities

Catch Basins and Junction Boxes

- Pre-cast concrete, or built-in-place masonry, with cast in place steps if deeper than 4 feet.

Manhole Lids and Grates

- Cast iron selected for proper strength for particular application.
- Lids must have cast in letters stating, "Storm Sewer."

Storm Drainage Piping

- Reinforced concrete (RCP), Contech A-2000, ADS (Advanced Drainage System slip-joint), or approved equal.
- The use of corrugated metal pipe is not allowed.

Storm Drainage Water Retention Structures

All storm drainage water retention structures shall use materials specified in the SCDES BMP Handbook or the elected permit authority's design manual.

Mechanical Utilities

Hydronic (Chilled Water) Distribution Piping

- 6" and Smaller: Schedule 40 Ductile Iron
- 6" Through 12": Schedule 30 Ductile Iron
- 12" and Larger: Schedule 20 Ductile Iron

Steam Distribution Piping

- Steel pipe meeting ASTM A120 Grade A or ASTM A53 Grade B

Valves

- Steam Piping: Class 150 cast steel, bolted bonnet, seal welded seat rings, butt weld ends.
- Chilled Water Piping: Wafer type butterfly valves, as manufactured by Nibco, Demco, or approved equal with 2" square operating nut, with valve box and cover.
- Chilled Water Bridge Valve: Sentinel Segmented V-Ball and Pratt Electric Operator or approved equal.

Insulation

- High Pressure Steam Piping: 2" O.C. Kaylo or approved equal
- Low Pressure Steam Piping and Condensate: 1-1/2" O.C. Kaylo or approved equal
- Pumped Concentrate: No insulation

Electrical Utilities

Electrical Underground Ducts

- Concrete Encased Ductbanks: Rigid PVC, Type DB 60 by Carlon, Queen City Plastics or approved equal. Spacers, supports, and end bells shall be PVC or high impact polystyrene.
- Direct Burial Ducts: Rigid steel conduit, galvanized with bitumastic coating.

Manholes

- Pre-cast concrete, with 36" or 42" opening in top for frame and cover, based on AASHTO HS 20 loading, complete with cast iron frame and cover, pulling irons, cable racks, bottom sump, with provisions for attaching entering duct or conduit, and provisions for electrical grounding.
- Power manholes to be octagonal 8' x 8' x 6.5' inside dimension.
- Telephone and Communication manholes to be 6' x 6' x 6' inside dimensions.

Manhole Frames and Covers

- Sumter Machinery Company – EJIW 1825 or approved equal that is cast iron, Neenah rated for AASHTO HS 20 loading vehicular traffic. Ring and cover shall provide a minimum 32" clear opening when collar is 3' or less and 36" clear opening when collar is taller than 3'.
- Covers to have cast in letters stating either "Electric" or "Communications" as appropriate.