

Date                                   October 2008

Project                               Tennessee State University Campus Master Plan

Subject                              4. Future Campus Requirements  
                                          4.5 Utility Infrastructure Requirements  
                                          4.5.2 Electrical Distribution

From                                 I.C. Thomasson Associates, Inc.

To                                     Tennessee State University

---

The objective of this work is to discuss capacity of the electrical distribution system and suggestions for improvement.

**1. ELECTRICAL SYSTEM CAPACITY & GROWTH**

The existing TSU electrical power distribution system is at approximately 70 percent redundancy between its two (2) substations. Each substation has a 5000 kVA capacity. An additional 3,000-4,000 kW demand can be added to the distribution system without exceeding the two (2) substations' capacity, but the redundancy will obviously decrease. A change in the distribution system operating procedures may also be required if certain sections of the Campus become more heavily loaded than others, i.e., distribution switching may be required during heavy loading periods.

New buildings can be fed from the following methods of distribution:

- Use existing padmount switches that have spares switch compartments or that become available due to buildings that are demolished.
- Install new padmount switches into the existing underground loop system by splicing into existing manholes and extending the underground loop. Use the new padmount switches to feed the new buildings.

**2. NEW BUILDING DEMAND**

Total new building area is projected to be 1,054,000 square feet, and the area of existing buildings to be demolished is 273,864 square feet. The overall difference between new and demolished buildings is 780,136 square feet.

There are many factors that determine a building's power demand, such as building purpose, type of heating, LEED certification, etc. However, a conservative watts per square foot to use for a Master Plan is 8 Watts/Sq. Ft. Using this demand factor, the estimated demand for the overall new building area is (8 W/Sq. Ft. x 780,136 = 6,241,088 Watts), or 6,241 kW.

**3. ELECTRICAL SYSTEM CAPACITY & GROWTH**

The existing TSU electrical power distribution system is at approximately 70 percent redundancy between its two (2) substations. Each substation has a 5000 kVA capacity. An additional 3,000-4,000 kW demand can be added to the distribution system without exceeding the two (2) substations' capacity, but the redundancy will obviously decrease. A change in the distribution system operating procedures may also be required if certain sections of the Campus become more heavily loaded than others, i.e., distribution switching may be required during heavy loading periods.

New buildings can be fed from the following methods of distribution:

1. Use existing padmount switches that have spares switch compartments or that become available due to buildings that are demolished.
2. Install new padmount switches into the existing underground loop system by splicing into existing manholes and extending the underground loop. Use the new padmount switches to feed the new buildings.

### **3. ELECTRICAL SYSTEM CAPACITY RECOMMENDATIONS**

The two (2) limiting factors in the TSU electrical distribution system are the substation transformers (2 at 5000kVA each) and the distribution loop cable, which is rated for almost 3000 kVA. However, the loop is switched in quadrants although the quadrants are not equal in demand (kW). As mentioned above, the substation capacity is 10,000 kVA, and will be exceeded with an additional ~4000 kW load. Therefore, the existing distribution system cannot accommodate the total projected new building demand. There are no improvements that can be made to the existing system once this demand is exceeded without replacing both substations with larger transformers and replacing all the underground 5kV cable with larger 5kV cable. This would be a major project and could cost as much as \$20,000,000 to complete.

The projected Northeast Housing & Support expansions are located very far from the underground distribution system. Therefore, it is recommend to have a separate service from the Utility for this area and not feed these buildings from the existing underground distribution system

### **4. ELECTRICAL SYSTEM IMPROVEMENT RECOMMENDATIONS**

Barge Waggoner Sumner & Cannon recently evaluated the TSU electrical distribution system and wrote a 3-Year Plan for the Tennessee Board of Regents. This report is titled "4 KV Electrical Distribution System – 3 Year Plan", dated April 18, 2008, SBC No. 166/001-03-2005. ICT concurs with all six (6) of the recommendations listed in this report for upgrades and for increased system flexibility and reliability. These projects and their estimated costs are listed as follows:

Project #1: Complete underground ductbank tie between East and West Substations, estimated cost \$1,733,000.

Project #2: Replace switchgear in East and West substations with motor operated switches and add motor operators to eight (8) existing S&C loop switches, estimated cost \$865,000.

Project #3: Add additional RTU's and motor operators at thirteen (13) existing S&C loop switches and connect into existing SCADA system, estimated cost \$1,471,000.

Project #4: Add a 2.2 MW standby generator at the East substation, estimated cost \$968,000.

Project #5: Install miscellaneous loop switches for more flexibility and reliability, estimated cost \$512,000.

Project #6: Replace structures and transformers in West substation, estimated cost \$492,000.