Schematic Design Narrative
For
Missouri State University
Telecommunications Center Generator Replacement

IMEG #24007158.00
February 10, 2025

A. Introduction

1. The primary purpose of this report is to describe the scope associated with the generator replacement and backup power system upgrades at the Missouri State University Telecommunications Center in Springfield, Missouri.

2. Project scope includes replacement of the existing generator and revisions to the backup power distribution system in order to achieve full building backup. The data center portion of the Telecommunications Center will also receive an upgraded fire alarm system. The data center's existing uninterruptible power supply (UPS) will be replaced with another UPS currently located in Cheek Hall.

3. Due to equipment lead times and MSU's preference to have equipment procured by a contractor, the expected construction completion date is summer 2026.

B. General Building Design Criteria and Assumptions

1. Building Code - 2012 International Building Code

2. Existing Building Code - 2012 International Existing Building Code

3. NFPA 70 National Electrical Code (NEC) - 2011

4. NFPA 110 Standard for Emergency and Standby Power Systems - 2010

C. Existing Conditions and Demolition

1. An existing 100 kW, 208/120V Olympian generator is located in the outdoor equipment yard. It is nearing the end of its expected useful life and does not have the capacity to back up the entire facility as desired. It will be removed to allow for the installation of a new generator in its place. The current generator provides optional standby power for the data center, according to NEC article 702. Power for the overall Telecommunications Center is served at 480/277V from a 4160V:480/277V MSU-owned transformer in the equipment yard.

2. The existing generator annunciator panel in the data center will be removed.

3. An existing ASCO automatic transfer switch fed by the existing generator is located in the data center and will be removed as it will not be required for the new distribution.

4. The existing emergency system (NEC article 700) loads in the building requiring backup power include emergency egress lighting, fire alarm, and public safety communications systems. Battery systems are believed to provide backup power for these loads. Confirmation via additional field investigation or confirmation from MSU is required.

5. The existing data center UPS will be removed to allow for its replacement to be installed.

6. The existing Gemini brand fire alarm and detection system in the data center will be removed.

7. Per the power meter on the facility's main distribution panel, the existing peak load experiences was 136 kW.

D. New Work

1. Additional loads to be added to the facility include approximately 45 kW of data center equipment, plus associated cooling equipment. Assuming new loads will total approximately a peak of 75 kW, the peak expected load for the facility is 210 kW.

2. A new 250/300 kW/kVA, 480/277V, diesel generator will be provided in the outdoor equipment yard. It will be provided with 24-hour sub-base fuel tank and weatherproof, sound-attenuating enclosure. MSU's preferred manufacturer is MTU. Lead time is currently approximately 20 weeks.

    a. MSU electrical standards state "Natural gas is the preferred fuel for emergency generators." However, during the project kickoff meeting, it was discussed that the MSU staff on the call either preferred diesel or had no preference, and that there is natural gas at the back side of the loading dock. It is currently outside the scope of this project to study and design a natural gas supply for the new generator.

    b. In addition to the MSU standard, natural gas may be considered a recommended fuel source should there be a need for the generator to have an extended continuous runtime. During the project kickoff meeting, it was discussed that 24-hours of diesel fuel is expected to suffice, and it is possible to add fuel to the tank while the generator is running in an emergency should an extended runtime be required without increasing fuel storage capacity. Compared to a diesel fuel tank, natural gas also has less routing maintenance required. A risk with natural gas is an outage should the natural gas utility have an outage.

c. It is important to note that a 250 kW natural gas generator costs approximately twice as much as a diesel unit, with an estimated price of nearly $200,000.

d. Explicit approval from the Authority Having Jurisdiction will be required if a natural gas generator is to provide backup power for emergency system loads such as emergency egress lighting and public communication systems per NEC article 700.12(B)(3). An exception may not need to be granted if the emergency loads in the facility have adequate battery backup power, allowing the additional generator backup to fall under the NEC article 702 Optional Standby category.

3. A generator connection cabinet will be provided in the outdoor yard.

   a. The generator feed to the building will pass through this cabinet.

   b. The cabinet will allow for the temporary connections of a portable generator should the permanent generator experience an extended downtime as a best practice.

   c. The cabinet will also allow for temporary connection to a portable load bank to allow for testing the generator under full load as a best practice.

4. A generator annunciator panel will be provided in the building, and the generator will be monitored by the campus building automation system, which is a Johnson Controls system.

5. A new 600 amp, 480/277V, NEMA 3R automatic transfer switch with bypass isolation will be provided in the outdoor equipment yard. MSU's preferred manufacturer is ASCO. The lead time is currently approximately 25 weeks.

   a. Bypass isolation will be provided so that the switch can be safely maintained while passing through power to the loads.

   b. The main normal power 600A, 480/277V feed from the exterior transformer's secondary windings will be re-routed through the transfer switch in order to provide the facility with full backup power.

   c. From a NEC-compliance perspective, providing generator backup for the entire facility through one transfer switch presents similar concerns to that of using a natural gas generator. NEC requires separate transfer switches for Emergency loads such as emergency egress lighting or public communication systems, and Optional Standby loads such as most building loads.

      1) If only one transfer switch is to be used to provide full facility backup via the generator, the transfer switch would need to be considered for the

Optional Standby branch with all emergency loads in the building redundantly backed up by another source such as batteries. Backup via battery sources is believed to be the existing condition for Emergency System loads in the facility but requires further verification. Alternatively, the Authority Having Jurisdiction (AHJ) may grant an exception to having both Emergency Systems and Optional Standby loads served through the same transfer switch.

2) Providing separate transfer switches for Emergency Systems and Optional Standby in this existing facility is highly difficult and expensive due to space constraints and amount of revision that would be required to the existing distribution. The existing distribution would be both difficult to tie into, and various circuits in the existing distribution would require relocation into a dedicated Emergency Systems panelboard(s). This panelboard(s) does not have an obvious location and would require a step down 480:208/120V transformer be added to the distribution which there also is not an obvious location for.

3) Providing separate transfer switches for Emergency Systems and Optional Standby in this facility projects to add significant construction costs in the realm of $50,000 -100,000 and adding several pieces of distribution equipment to the facility requiring space and maintenance.

4) IMEG's recommendation is that battery backup of existing Emergency Systems loads be verified, or added if not present, to allow for code compliance with a single transfer switch for the building. If it is MSU's desire to allow backup of existing or future Emergency System loads by the generator in this facility, it is IMEG's recommendation that an exception by the AHJ be pursued to allow for a single transfer switch to serve both the Emergency System and Optional Standby loads.

6. All equipment bussings will be aluminum or copper, and all wire will be copper except for feeders 150 amps or greater.

7. An electrical load study, including short circuit analysis, voltage drop, arc flash, and selective coordination, will be carried out on the entire power system for the Telecommunications Center. The final study will be conducted by the electrical contractor.

8. Existing MSU-owned Schneider Electric Galaxy VS UPS located in Cheek Hall will be relocated to the Telecommunications Center and connected to the data center electrical distribution.

9. The data center will be provided with a new Simplex brand fire alarm and detection system which will integrate with the existing building's main fire alarm and detection system.

10. Refer to the attached Appendix A for additional information.

E. Project schedule

1. Schematic Design review meeting (virtual) – February 20, 2025

2. Design Development issuance to MSU – March 14, 2025

3. Design Development review meeting (in-person at MSU) – March 27, 2025

4. Construction Documents issuance to MSU – April 11, 2025

5. Construction Documents review meeting (virtual) – April 22, 2025

6. Bid Documents issuance to MSU – April 28, 2025

7. Issue for Bid – April 29, 2025

8. Pre-Bid Meeting (in-person at MSU) – May 6, 2025

9. Bid Opening – May 20, 2025

10. MSU submits to A&F – May 28, 2025

11. Board of Governor's Approval – June13, 2025

12. Notice to Proceed to Contractor – June 13, 2025

13. Construction Completion – Summer 2026

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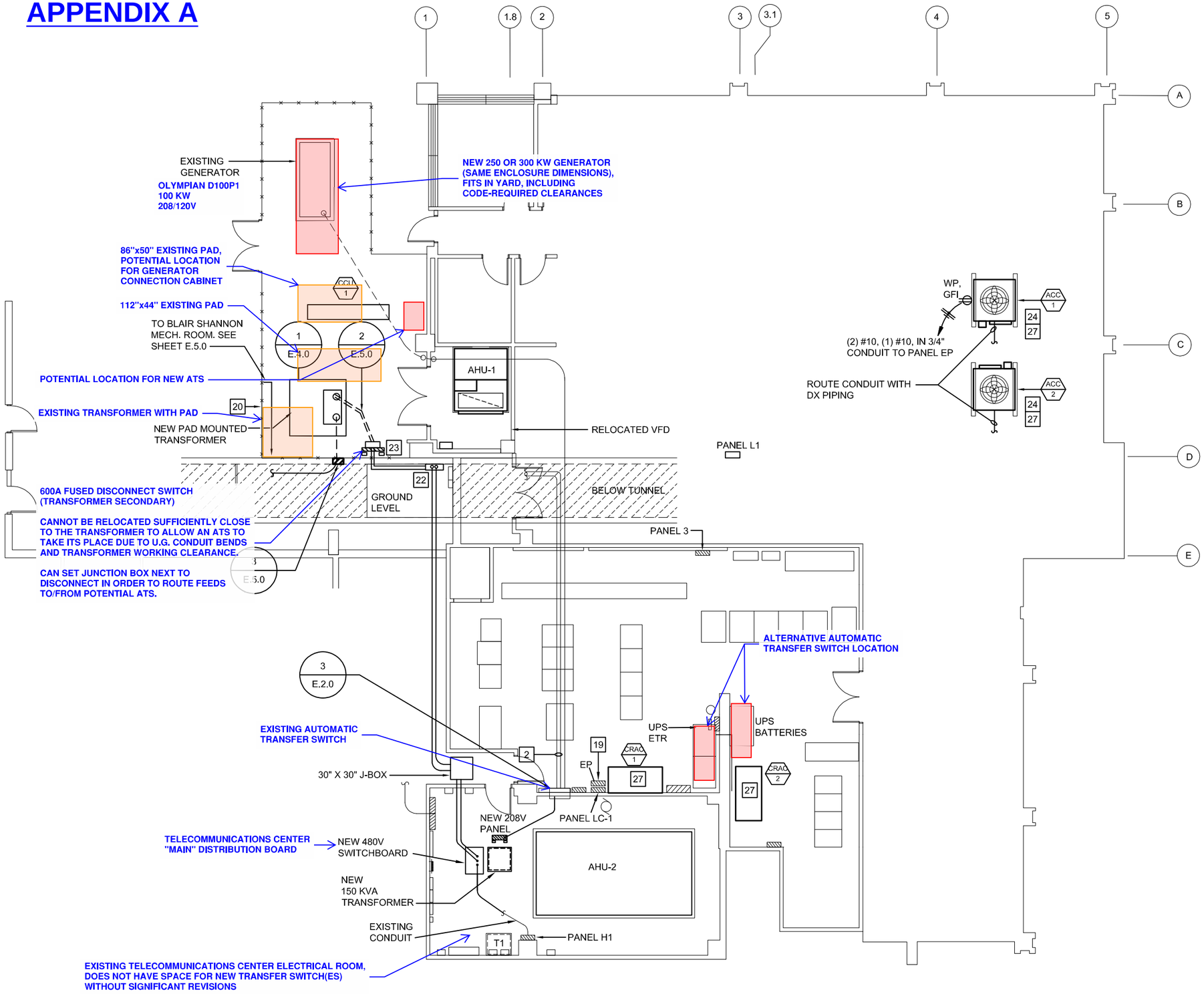
Enclosures

APPENDIX A



REVISED 1ST FLOOR PLAN

2 / E.2.0

1/8" = 1'-0"