



Appendix A: Breadth Topics



Breadth Topics

The Breadth Topics are intended to demonstrate the breadth skills developed from the Architectural Engineering course work. These breadth topics include the areas of Architectural Engineering outside of construction, e.g., architectural, acoustics, electrical, lighting, and structural. The demonstration of breadth in Architectural Engineering will successfully complete the analyses.

Breadth Topic #1: Electrical/Renewable Energy Breadth

****Contributes to Technical Analysis #1***

The new electrical system will operate on a three-phase 120/208-V system powered by the Duquesne Light Company vault to the main electrical room on the basement floor. Electrical power will be brought into the building's 200-A switchboard at a voltage of 208 V from a ground bus located on the north side of the building.

By utilizing a building-integrated photovoltaic glass window system, the existing energy system will need to be analyzed to determine the required electrical components and connections. The electrical energy consumption of the building and the amount of kWh able to be produced by the photovoltaic system will be calculated. These calculations will help determine the energy savings associated with the photovoltaic glass system. In addition, to allow for the photovoltaic glass window system to be connected to the electrical system designed by Claitman Engineering Associates, Inc., the system will be altered to accommodate the renewable energy source produced by the photovoltaic glass. Research on the different photovoltaic glass window systems connection types, e.g., grid connected, off-grid, and hybrid system, will need to be conducted because the connection type determines the connection requirements to operate on the electrical power system. Also, a constructability review will be conducted to determine if the new electrical system meets with requirements of the photovoltaic glass window system.

Breadth Topic #2: Structural Breadth

****Contributes to Technical Analysis #2***

The existing Level 2 roof is 53 ft. wide on the north end, 79 ft. wide on the south end, and 208-3/4 ft. long. Composed of 2 in. thick gypsum plank with tapered rigid insulation, the existing Level 2 roof's structure includes typical wide-flange beams and steel columns. With ASTM A992 steel specifications, the W shaped beams and columns are designed to have the yield strength of $FY = 50 \text{ kips/in}^2$. In addition, no additional equipment is housed on Level 2's roof structure.

Incorporating a load-bearing green roof system on the Level 2 roof will require a structural analysis of these additional loads on the structural system of the roof. Research on the different types of green roof systems, e.g., extensive and intensive, will be conducted and calculations will be performed to determine the required additional support needed to accommodate the dead load of the green roof



system and the live load of the residential occupants accessing the roof. Also, the additional support, such as the metal roof deck and steel joists, required will be designed to efficiently merge with the existing roof's structural system and evaluated for cost and schedule impacts.