REQUIREMENTS FOR PROJECT DESIGN CALCULATIONS

Energy and Operation:

Facilities & Services receives funds from the State of Illinois each year to pay for the utilities and the operation and maintenance of campus buildings. The AE shall design all new and remodeled buildings on campus to minimize the life cycle cost of operation, maintenance and utilities.

Life Cycle Cost (LCC) Analysis:

The AE firm(s) shall design a least life cycle cost facility. LCC Analyses shall be utilized to select energy related options on all Projects 25,000 GSF or larger.

> *Comment: Campus building energy and maintenance costs must be evaluated in the context of the total building. Life Cycle cost comparisons should consider the effects of only one measure at a time.*

The AE is encouraged to discuss options with the U of I prior to calculating LCC. Life expectancies used in the LCC Analyses shall be consistent with the system life expectancies stated in these *Standards*. Note that LCC Analysis results are required to be submitted with a variance request that has the potential to affect the life cycle cost of the facility. The Life Cycle Cost (LCC) Analysis method may be chosen by the AE but the analysis should be accepted as a recognized method by the industry. Note that regardless of the method used, all inputs and outputs of the LCC should be submitted for review along with the results of the analysis. These include, but are not limited to: initial costs, replacement costs, annually recurring maintenance costs, non-annually recurring maintenance costs, energy costs, water costs, system life expectancies, etc.

Energy Values for the LCC will vary. Contact the U of I for the most current values.

Proof of Compliance with Energy Standards:

The AE firm shall design the building envelope and building systems to maximize energy performance within the U of I Design Guidelines. The AE shall use a computer simulation model to assess the energy performance and identify the most cost effective energy efficiency measures. Quantify energy performance as compared to a baseline building. Provide documentation to demonstrate the design meets the current revision of *ASHRAE 90.1,2007* and approved addenda. Design shall be in compliance with the International Building Code, and the National Fire Protection Association 101, Life Safety Code. See the *Energy Conservation* general guideline within these *Standards* for energy reduction requirements.

Harmonic Analysis Report for Variable Frequency Drives (VFD's):

The AE firm shall demonstrate compliance to IEEE 519-1992 (Guide for Harmonic Control and Reactive Compensation for Static Power Converters). Based on the Design Engineering Firm's harmonic analysis report for each particular Project, additional steps may have to be taken to assure compliance to IEEE 519-1992.

1. The AE report shall contain Total Harmonic voltage and current Distortion (THD) caused by the VFD's as well as other known non-linear loads. The results shall be based on a computer-aided circuit simulating the actual system.

2. The total harmonic voltage distortion shall be less than 5%. If the voltage THD exceeds 5%, additional equipment shall be required to reduce the voltage THD to an acceptable level.

Controlled Storm Water Discharge Policy:

The AE shall prepare and submit calculations which compare the peak storm water characteristics of the construction site before the construction begins to the peak storm water runoff characteristics of the site after the construction is complete. The AE must also prepare and submit plans detailing the retention/detention method chosen to reduce the peak storm water runoff to that which existed on the site prior to construction. See the *Storm Water Drainage Systems* section within these *Standards* for more information.

Emergency Generator Load Calculations:

Emergency generator load calculations shall be submitted to verify that the appropriate loads described as follows will be powered upon transfer. The engine generator set shall be three-phase and shall power all code-required loads including egress lighting. In addition, systems critical to building operation and department research shall be provided with emergency power. Typical building critical loads include: sump pumps; ejector pumps; perimeter heating system pumps where applicable, Communications Equipment Rooms (CERs) and other appropriate loads. The elevator starting current requirements shall be included in the design of the emergency power system to allow the emergency generator adequate starting capacity to operate the elevator upon transfer. The generator shall be designed with a minimum of 20% additional capacity for future loads. See *Section 26 32 00 – Generator Assemblies* within these *Standards*.

Extensions of Primary Electrical Distribution:

Extensions of the primary distribution system shall be part of the building design. The U of I shall review conceptual designs before allowing the project to proceed. Special instructions will be supplied to govern this type of design.

(Transformer) Review Load Calculations:

Review the load calculations data and transformer KVA capacities with the U of I before proceeding with final design layouts.

Telecommunications:

The commissioned Project AE shall provide floor plans that meet the requirements of *Section 27 00 00 – Communications*. New construction and major remodeling or renovation projects will require the services of a BICSI Registered Communications Distribution Designer (RCDD) Telecommunications Engineer. At the Urbana campus, the Campus Information Technologies and Educational Services (CITES) will assist the commissioned Project AE in this regard by providing this service for a fee consistent with U of I policy. Minimum qualifications for the Telecommunications Engineer are as listed in *Section 27 00 00*.

Design Parameters:

The design parameters shall be noted on the Drawings and shall comply with the applicable requirements of the International Building Code for construction document submittals. Include at a minimum the following:

1. The use and occupancy classification for each building/area.

2. Gross square footage for each floor and for the entire building.

3. The designated construction type as derived from the International Building Code.

***Structural Loads**:*

Indicate Floor Loads (Live Load PSF, Dead Load PSF, deflection limits), Wind Loads, Roof Loads, and Seismic Design criteria, including earthquake loads when applicable.

Seismic Load Design:

In compliance with an executive order issued by the Governor of Illinois in 1990, the design and construction of all new state facilities shall be in accordance with seismic load design and construction standards provided in the current edition of the International Building Code.

***HVAC**:*

Summer and winter outdoor climatic design conditions for heating and cooling in terms of dry bulb temperature, mean coincident wet bulb temperature and directional wind velocity.

1. Summer and winter outdoor climatic design conditions for evaporation in terms of wet bulb temperature and mean coincident dry bulb temperature.

2. Summer and winter indoor environmental design conditions for various space types and modes of operation in terms of dry bulb temperature and relative humidity.

Fire Protection & Plumbing Systems:

1. Identification of sprinkler zones and corresponding hazard classifications.

2. Domestic water flow test data indicating individual hydrant identification numbers with corresponding elevations, flow and pressure readings.

3. Indicate the number of male and female occupants per floor/area for determining the appropriate number of restroom fixtures.

4. Indicate rainfall data for roof drain and storm water retention system design.

5. Summary of storm water retention analysis for the building site. (Entire analysis should be made available upon request.)

Electrical Systems:

1. The total connected and running electrical load as well as the anticipated diversified load for each branch panel, motor control center, distribution panel, transformer/unit substation as well as for the building as a whole.

2. Submit a short-circuit (fault) analysis for the building electrical system during the design phase at the 50% submittal. Analysis should be based on the electrical system design and equipment selection up to the 50% design level; assumption can be introduced for the equipment not yet shown in the design. Final short-circuit (fault) analysis should be submitted after all equipment is approved. Analysis shall be based on actual equipment rating.

3. Summary of breaker/fuse coordination analysis for the building electrical system(s). (Entire analysis should be made available upon request.)

4. Summary of harmonic analysis for any building electrical system that incorporates non-linear loads in excess of 15% of the total load. (Entire analysis should be made available upon request.)

Lighting Systems:

1. Exterior Lighting Calculations: AE shall submit one copy of point-by-point calculations indicating designed lighting levels in compliance with IESNA recommendations. Areas where these calculations are required include walkways, plazas, parking lots and athletic facilities.

2. Interior Lighting Calculations: AE shall submit one copy of point-by-point calculations indicating designed lighting levels for each typical space use (office, classroom, corridor, etc). Point-by-point calculations may not be required for every room in the project.

3. Interior Lighting / Energy Usage Calculations: AE shall submit one copy of installed lighting power density calculations (output from COMcheck software or similar format) indicating that total installed lighting power is in conformance with applicable energy codes.

Exhibit:

See *Exhibit 00 01 00-1, AE Minimum List of Deliverables* for a complete list of deliverables required for each project phase.