



February 22, 2013

Lighting & Electrical Systems

AEI Team #: 04-2013



ARCHITECTURAL ENGINEERING INSTITUTE



Our one true aim is to enhance the quality of the communities we work with through innovative ideas and an integrated design approach.

Ingenuity | Quality | Enjoyment | Integrity

1. Executive Summary

As an integrated design team, Architectural Engineering Institute (AEI) Student Competition Team #04-2013 began our building design by creating a list of team, construction and design goals. We focused on creating an integrated building design that would increase community involvement, improve student and teacher environments, and be a leader in safety and security. Some of the goals that applied to the Lighting and Electrical discipline were things like creating an energy efficient design, making building control systems user friendly, and producing an ideal learning environment. We also referenced codes, achieved required design criteria, and integrated design recommendations throughout the building.

During the design process of the Reading Elementary School, we made a conscious effort to meet all goals and create a functional school design. By using things like low wattage, energy efficient fluorescent lamps, energy saving controls, and ideal daylighting systems, we were able to create a school that was 42% below the ASHRAE 2010 Standard 90.1 Space-by-Space lighting requirements. It is confirmed, through thorough documentation, that the total watts used by the lighting system is approximately 50,083 W, well below the allowed 85,871 W.

The total elementary school building load is 714kVA. This load includes all lighting, receptacle, and kitchen loads, as well as building heating and cooling systems such as heat pumps, chiller, and electric hot water heater. This load also includes a 25% growth factor in case of future changes to the school. The pool and clinic renovation in Phase 2 adds approximately 100kVA to the load. There will be a 350 kW diesel generator to supply electricity to the main elementary school, the renovated Clinic space, and adjacent Natatorium for 27 hours.

Overall, the design presented in the project write-up and following appendices validates the proposed building design obtaining or exceeding design criteria. Please visit the project write-ups from the other disciplines for further knowledge of their system designs.

2. Introduction

In the Reading Elementary School pictured in Figure 1, we focused on creating a collection of building systems that enhances the quality of the community through innovative ideas and design. We aimed to design a “high performance” elementary school that functions as a multipurpose space for the community through a collaborative and multi-disciplinary design.



Figure 1 : Rendering of Elementary School and Phase 2

While designing the lighting and electrical systems, the goals were to provide a functional and energy saving solution that provides an enjoyable and secure environment for the students, faculty, and staff.

We started the process by arranging the site and incorporating daylight and shading systems that are most beneficial to the interior of the building. We worked with mechanical students, structural students, and construction management students, in order to integrate the separate disciplines early in the design process. This enabled the creation of the best building façades and site layout solutions. A good façade solution is one that allows a pleasing amount of daylight into the space to create a healthy and productive work environment, while keeping excessive amounts of direct sunlight from affecting the students. It is desirable to obtain this performance while maintaining an aesthetically pleasing design.

After completing the façade design, we moved into the interior lighting and electrical systems while continuing to work with the other disciplines. We strived to provide an integrated and energy efficient solution for the school while encouraging a modern, user friendly design. Throughout this write-up, the design process, research, assumptions, and design conclusions for the lighting and electrical systems will be presented.