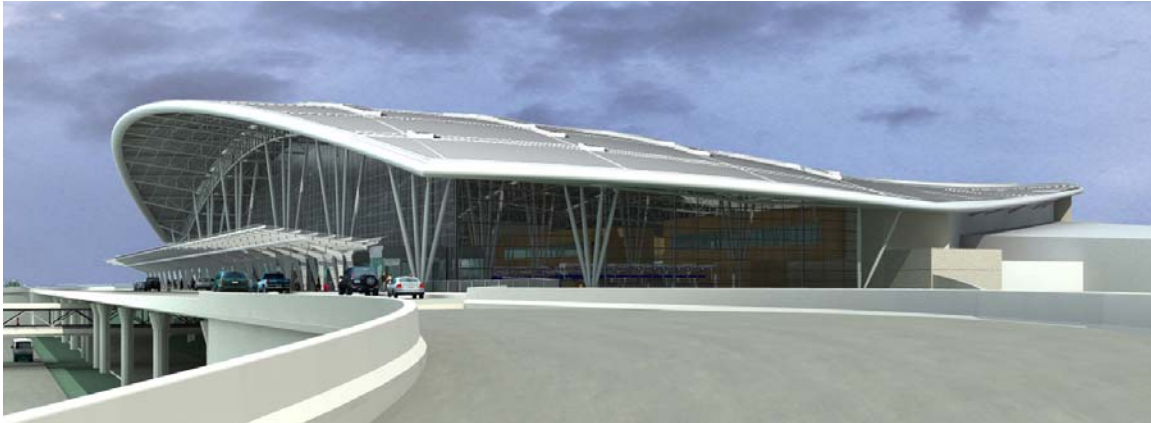


Ming Norman Tsui
Lighting/Electrical Option
Faculty Advisor: Dr. Moeck
December 12, 2005

Indianapolis International Airport – New Midfield Terminal

Executive Summary – Depth Work



The following thesis proposal will consist of an in-depth analysis focusing on the lighting design, complemented by an electrical systems analysis and two breadth topic studies that are closely relevant issues that my thesis building must address to.

My proposal will cover the five areas that I have conducted my schematic design on, starting from the beginning of the arrival path sequence: the Exterior Arrival/Departure Canopy area, Ticket/Check-in Hall, Civic Plaza, and the two nearly identical Passenger Concourses.

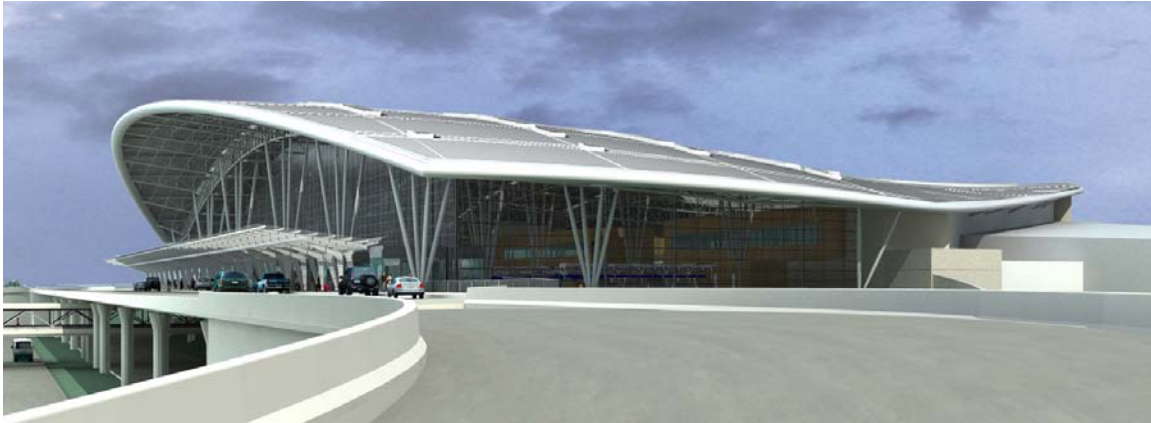
As part of my schematic lighting design process, rigorous architectural integration will revitalize and create an invigorating lighting experience for the end-users.

Electrical system will be reevaluated and redesigned if necessary, to accommodate the additions of architectural/lighting features to the airport.

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Executive Summary – Breadth Work



In addition to the depth work, two breadth work topic that is closely related and significant to my thesis building will be discussed.

Breadth topic 1 will focus on the LEED certification status, in which, more modification to the already designed airport can earn more LEED points to achieve LEED Gold rating.

Breadth topic 2 will provide an re-assessment on the construction management aspect of this project. New cost analysis will be performed on the new lighting scheme, as well as benefit/value analysis on the new architectural features, electrical system, and the differentials cost for cost per extra LEED points. Payback period will be recalculated.

Background

The Indianapolis Airport Authority's goals for the New Indianapolis Airport demanded that the air-travel gateway for "The Crossroads of America" be modern, efficient and uniquely representative of the history and future of Indiana. The result is a structure that is shaped to work with the wind and the sun, with full natural illumination. The terminal is meant to foster economic growth and make Indianapolis a clearly distinct travel destination. It reflects the economic and cultural history of the Indianapolis area and symbolizes its bright future, while applying newly advanced security considerations.

Depth Proposal: Lighting

Problem

The overall appearances of all the spaces are without a doubt looking modern to our contemporary time. However, to really elaborate fully on the theme of being “the airport for the future” or “the prototype for all future airport design”, the current lighting design scheme seems slightly under-stated. With all the spaces that are enclosed in high performance curtain walls, potential glare problems can occur hence, must be corrected. Giant circular skylight over the Civic Plaza symbolizes and brings reminiscent to the Monuments Circle in downtown Indianapolis; however, glare, visual discomfort as well as increased cooling load demand during summer time will occur.

Solution

To really accentuate the curvilinear body of the airport exterior, I have proposed to extract the futuristic, aerodynamically crafted organic contour of the exterior, directly juxtapose it into all of the interior spaces to form a unified design solution. This is a language I have developed specifically to this airport and I will speak it consistently throughout the path for the spaces sequence. A series of architectural elements will be integrated poetically and meticulously into each space.

A heavy plantation scheme is to be installed to replace more than 50% of the marble floor tiles. I propose to bring “Green” directly into this great interior space. The vegetation shall provide shielding from the afternoon sun, as well as natural cooling for the passengers down below. It’s proposed to be a very cost effective, environmentally friendly and aesthetically pleasing solution to the Civic Plaza without adding additional cost, damaging the environment and ruining the organic theme of my design.

Please see my [Tech 3 Presentation](#) for proposal details on all other spaces other than Civic Plaza.

Solution Method

A series of different rendering, photomontage and illustration method will be used to mock up the desired result. Softwares includes 3D Studio Max/Viz, Archvision RPCs, Photoshop, Illustrator, AGI32 and Radiance will be utilized. Layout alternative will be explored and decided after multiple computer visualization comparison with 3D Studio Max/Viz. AGI32 lighting calculation will be used at the end to ensure light level reaches the IESNA standard. Daylighting alteration will be considered and compared based on the daylight analysis that was performed in Technical Assignment 1. The power density of the space will then be calculated and reviewed based on ASHRAE 90.1.

Tasks & Tools

- I. Finalization of Schematic Design Phase
 - a. Further research alternative of architectural integration for lighting installation
 - b. Ensure new scheme will satisfy IESNA design guidelines
 - c. Maintain LEED daylight standard
 - d. New luminaire layout for each spaces
- II. Fixture Selection
 - a. Finalize fixture selection based on availability info provided by manufacturer
 - b. Specify lamp types with wattages that will keep the design within the prescribed power density guidelines described in ASHRAE 90.1
 - c. Select ballasts capable of providing the necessary control
- III. Software Modeling
 - a. Create 3D models of spaces in Viz/Max
 - b. Radiance will be utilized for the daylighting calculations
 - c. 3D Studio Max or Viz will be utilized for all other aesthetical rendering/illustration

d. Lightscape has been integrated into 3D Studio Max/Viz which allowed pseudo color renderings. I will be the first student to conduct false color rendering with Viz/Max if my experiment attempt is successful. AGI32 will only be considered as my backup software.

Lutron Comments

I have received some very positive feedback on my enthusiasm on my presentation as well as my approach of design. The comments are mixed with opposite view points of whether the architectural integration is “too much”, or a fantastic creation. Regardless, implementation seems to be one thing I must take into careful consideration before I move forward with my ideas.

Depth Proposal: Electrical Design

Problem

The current electrical power distribution system for the Indianapolis International Airport is almost perfectly designed to handle the existing condition. However, with the redesign of the lighting system, it could potentially either increase or decrease power consumption, therefore, distribution system along with their corresponding protective devices would need to be resized. Since the airport has such a tremendous network of electrical system, I will focus on just one particular area of the airport, possibly just the Civic Plaza due to the significant changes that's made architecturally.

Solution

I will compute the change in design loads and resize the distribution equipment and protective devices for the Civic Plaza only. Since I am expecting the cooling load during summer would be significantly reduced, electricity consumption would be reduced in proportion as well. I will reassure this power saved can be used and supplement elsewhere within the airport, hence without further alternating the existing electrical system. I will then reconstruct a new wiring plan for the different feeding resulted from the changes to the Civic Plaza.

Solution Method

I will recalculate the electrical loads based on the 2002 National Electrical Code guidelines, including all demand factors. Modifications of the existing system may be required to accommodate new lighting loads, panel board locations, and transformers. Wire, conduit, and over current protection will then be resized using tables provided by the NEC.

Tasks & Tools

- I. Calculate Loads - Determine new lighting loads for Civic Plaza using NEC 2002 guidelines
- II. Analyze Panel boards
 - a. Size lighting panel boards according to calculated (if inadequate)
 - b. Size over current protection for panel boards using tables in the NEC
 - c. Distribute loads onto the panel boards, balanced by each phase
- III. Specify Circuits (if inadequate)
 - a. Size conductors using article 310 of the NEC 2002
 - b. Size conduit using annex C of the NEC 2002
- IV. Protective Device Coordination (if inadequate)
 - a. Determine appropriate sized over current protection devices
 - b. Check over current device protection coordination

Breadth – LEED

The Indianapolis International Airport has just began its construction 6 months ago in June. Although the design is finalized by the architects, I propose here that several adjustments made in my schematic lighting design and architectural integration can potentially help yielding more points in LEED certification. The building currently holds an expected LEED silver rating. With the modification I put forth, the airport will gain from the following LEED credits, hopefully will push it through a LEED Gold rating status:

Lighting Pollution Reduction.

Resources Reuse

Ventilation Effectiveness

Innovation in Design

Breadth – Construction Management

At the end of all research, a detailed cost analysis of the new lighting and architectural system will be performed to reassure my design assumption in the beginning is correct. The cost analysis will include cost associated with fixtures, electrical equipment, architectural elements, plantation, labor, and installation. A benefit/value analysis will then be performed to check if redesigning is beneficial to the client, furthermore, would the LEED point be cost effective as well as their marginal expense will be presented for each point.

Schedule

January 9 - 22	Finalize design choices
January 23 – February 5	Finalize fixture selection, IES files, and ballast information
February 6 - 19	Intensive production session for illustration
February 20 - 28	Refine Renderings
March 1 - 3	Perform cost analysis for breadth work
March 4 - 12	Spring Break
March 13 - 19	Perform LEED analysis
March 20 - 26	Create Floor plans, electrical plans, control diagrams
March 27 – April 5	Finalize Thesis report
April 1 - 9	Prepare PowerPoint presentation
April 10 - 12	Thesis presentations