

Chandler City Hall

Chandler, Arizona

Thesis Proposal

AE481W: Architectural Engineering Senior Thesis

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Executive Summary

Chandler City Hall is structure comprised of a combination of elements. Exhibiting a theme of respecting the past and acknowledging the future, both the architecture and implemented lighting design complement the space will represent a sense of timelessness.

Spring proposal work consists of two depth and two breadth topics that provide alternative design solutions for Chandler City Hall.

The lighting depth proposes a new lighting design for each of the following four spaces:

- Main Lobby – A Circulation Space
- Open Office – A Large Work Space
- Council Chamber – A Special Purpose Space
- Exterior Façade – An Outdoor Space

The IESNA 9th edition Lighting Handbook and ASHRAE/IESNA 90.1 – 2007 will guide the design process. However, with the desired effect that Chandler City Hall is to implement on the City of Chandler, the lighting design considerations also involve several details pertaining to aesthetics, perception and experience of the space.

The lighting of the open office space will be complement with a daylighting integration system using photosensors to control the environment in the space as an M.A.E. focus.

The electrical depth consists of a new design of the branch circuit distribution to accommodate the new lighting design, a protective device coordination study which include short circuit calculations, and two depth topics. An addition of a photovoltaic array will be analyzed and evaluated to determine potential sustainable energy savings. This system has potential due to the location of Chandler City Hall in Chandler, Arizona. A cost benefit analysis will also be conducted in terms of initial versus energy costs or saving of increasing feeder sizes.

An acoustical/architectural breadth analysis will be conducted to improve the acoustical quality of the Council Chamber auditorium space. For the lobby space, a façade/solar loading analysis will be conducted, evaluating the east and south facing two-story glass curtain wall.

Table of Contents

Executive Summary.....	2
Building Overview.....	4
Lighting Depth.....	6
Lutron Comments.....	7
Electrical Depth.....	9
M.A.E. Focus: Daylighting.....	11
Breadth 1.....	12
Breadth 2.....	13
Schedule.....	14

Building Overview

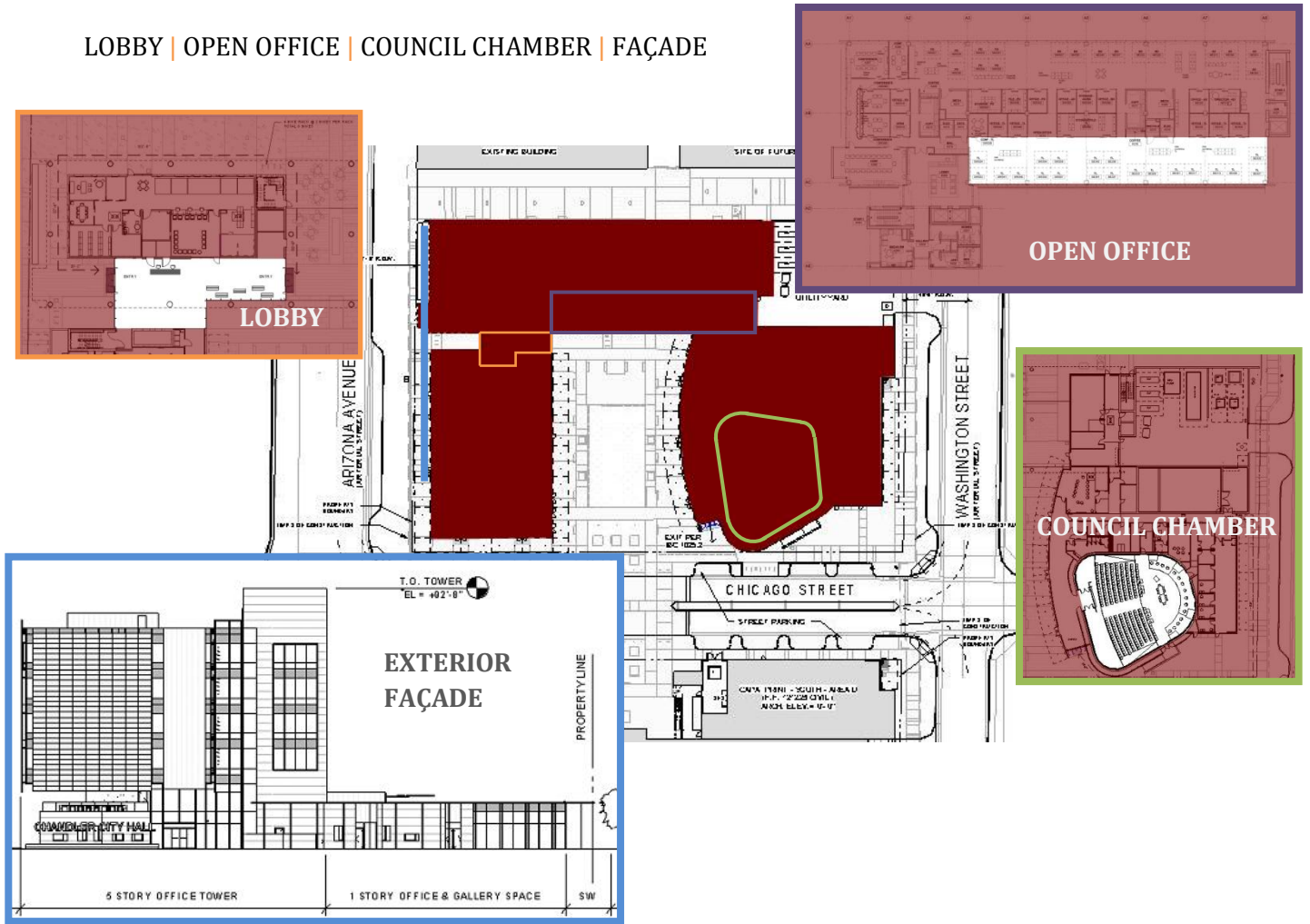
In efforts aimed to provide a new “urban edge” to the city of Chandler, Arizona; Chandler City Hall reflects the idea of respecting the past and acknowledging the future. The five story, 137,000 sq. ft. building located in Chandler, Arizona is comprised of the city clerk, communications and public affairs, a Vision gallery and the Council Chamber. Costing approximately \$52 million the Chandler City Hall complex is designed to host business-like city clerk and council affairs as well as be available for community events. Construction ran from April 2009 until November 2010 and with its completion it connects the civic, commercial, historic centers of the town of Chandler. Timelessness is the essence created within Chandler City hall by reinstating the past and expressing the technology of the future.

Stone veneer lines the lower single story portions of Chandler City Hall, creating a character and natural scale for the building. The tower portion however stands tall and transparent, encompassed by a glass curtain wall. Linearly the height of the building is expressed by stainless steel panels running down the building, then turning inward serving as a canopy ceiling before extending into the lobby as a ceiling element. Displaying the Vision Gallery and transitional spaces, glass curtain walls line the public spaces within the building. Unlike the other glass portions of the façade, the Council Chamber’s exterior provides a translucent aesthetic.

Practical, yet artistic, the west façade of the tower boasts a Ned Kahn art scrim. An array of perforated pieces of stainless steel set out from the façade overlay the glass curtain wall serving as both shading and artistic purposes. With the wind, these panels sway in creating a wavelike movement across the scrim.

Chandler City Hall | Areas of Interest

LOBBY | OPEN OFFICE | COUNCIL CHAMBER | FAÇADE



Depth Proposal | Lighting

Overview

The lighting design for Chandler City Hall will reinforce the client's vision for the building through use of a sleek, modern design while also demonstrating energy efficiency to help achieve the LEED rating the building is striving for. Within the multi-use facility the lighting design will create a comfortable work environment for city officials and also serve as an attractive destination for community events and gatherings. In the design of the lighting systems, luminaires and control systems will be selected to create the desired lighting design with a focus on four distinct spaces:

Main Lobby – A Circulation Space
Open Office – A Large Work Space
Council Chamber – A Special Purpose Space
Exterior Façade – An Outdoor Space

The lighting design for each space in Chandler City Hall should reflect a sense of timelessness and create a connection linking historic Chandler, AZ to the present and modern technologies. Based on feedback received from the board of professionals at the Lutron presentations, the proposed schematic lighting design concepts presented from technical report three will be further developed. An analysis of the design criteria and design considerations will be coupled with the concepts to continue in the design process. Luminaires will be selected, control systems will be developed and scenes created for the designated spaces. The designs will be input into computer software to generate and analyze the desired lighting design for each of the spaces to verify functionality.

Lobby

Drawing those into the space, the stainless steel ceiling over the entryway extends inside as the ceiling of the main lobby. The main lobby is the first experience as one enters Chandler City Hall. Its architecture emphasizes a variety of materials including stone, wood, glass, and steel. The appearance of the space should be welcoming with the lighting design emphasizing both this experience and the unique variety of materials within the space.

The proposed lighting design will create focal points out of the destination spots within the lobby. This includes the highlighting of the reception desk and the benches in the gathering space. A guiding element integrated in the ceiling in a linear can aid in circulation by drawing people through the space. Additionally, to emphasize the materiality of the space, the stone and wood are lit through use of a washing technique and linear grazing lighting technique. Overall, the lighting scheme developed in the lobby, should accent the prominence of both the materials and the space.

Open Office

The open office is enclosed by a south facing glass façade that makes use of external shading louvers to control direct sunlight that would otherwise inhibit the space. Employees will spend long hours in this space. The proposed lighting design will implement an indirect lighting system in order to create a comfortable environment with minimal glare from fixtures and reflections. Task lighting at the cubicles will complement the ambient lighting system employing a flexible lighting component adjustable at each workstation. The design shall employ an energy efficient solution coupled with daylighting system with photosensor control.

Council Chamber

The Council Chamber is a multi-use auditorium space that will host a variety of events. The materials in this space exhibit a sense of warmth through widespread use of wood veneer within the space. Due to the variety of events that could potentially occur in the Council Chamber auditorium, at least two lighting scenes should be developed if not more. The main two lighting scenes will include a public and a private setting, with public for council meetings where the audience and council will interact and the private setting for presentations and demonstrations.

The public setting should implement a lighting design that would be functional for the council events. This may include an interactive audience as well. More of a uniform lighting scheme will be developed with a focus on the front council. An upward grazing technique on the high peripheral walls plus adding highlight wood ceiling undulations create an appealing aesthetic as well as make the windowless space feel more spacious.

The private setting will utilize the many of the same fixtures from the public setting however some of the layers of light will be peeled away to create a non uniform setting, with dimmer lighting the local of the audience and a more direct focus on a single presenter or demonstration.

Exterior Façade

Standing tall amongst a low lying town, Chandler has an opportunity to create a prominent stance with the lighting design and its presence. This space desires a lighting design that will enhance the architecture materials of the building while implementing an energy efficient solution and adhere to the dark skies concern common to Arizona cities and towns.

Lutron Presentation | Designer Comments

Mike Barber

- Overall concept well articulated
- Consider sheen of stone material
- Further develop daylighting and interaction in the open office space

- Reinforce and develop how light can reinforce the movement of the facades
- For art scrim, point sources may work better than uniform linearity

Lee Brandt

- Overall good graphics
- A little fast
- Define all materials
- Entrance façade, pick a surface
- Minimalistic could be good on art scrim to pick up a slight shimmer

Luke Tighe

- Be careful not to let layering/additions of light reduce overall “wow” factor
- Back wall wants to be defined in both settings in auditorium
- Express physical motion from winder with lighting
- Open office, standard and safe
- Column in lobby, minimize instead of glow
- Broad strokes and minimalistic will enhance the space
- Addressed the right things on the façade, stray away from dynamic components

Tasks and Tools

Schematic Lighting Design:

Further develop and finalize the lighting design based on comments from the design professionals.

Model Spaces:

Use AutoCAD to accurately model the selected spaces three dimensionally.

Equipment Selection:

Select appropriate equipment to comply with schematic design goals and criteria.

Analyze Daylighting:

Use Daysim to evaluate the daylight that enters the affected spaces.

Analyze Electric Lighting:

Use AGI32 and/or 3D Studio Max to ensure the designed lighting system provides adequate illuminance levels as specified in the IESNA Handbook. Additionally, analysis of power densities will be conducted to meet the requirements set forth in ASHRAE 90.1.

Final Renderings:

Use manufacturer .ies files in the modeled spaces to create final renderings using AGI32 and/or 3D Studio Max.

Documentation:

Properly document all designs. Assemble cut sheets, create a fixture schedule, reflected ceiling plans, lighting plans, and summarize final designs.

Depth Proposal | Electrical

Overview

The electrical depth of the spring semester thesis consists of a redesign of the branch circuits, a short circuit analysis, and two depth topics.

The existing electrical distribution system for Chandler City hall receives its power supply from Arizona Public Service, located in Phoenix, Arizona. Arizona Public Service owns all equipment and feeders through the service entrance up until the main switchboard. At this point the building voltage system is 480Y/277V, 3PH, 4W. A 3000A three-pole main switchboard with an AIC rating of 65K serves the branch circuits of the electrical system. The majority of the building systems is serviced by the 480Y/277V system, with mechanical loads and dimming panels stepped down to a 208Y/120V system.

Branch Circuit Distribution

The branch circuit distribution systems will be redesigned for each of the spaces to be re-lighting. This includes the main lobby, an open office space, the Council Chamber auditorium, and the exterior façade. Feeders and panel boards will be resized where deemed necessary for the newly proposed lighting design.

Short Circuit Analysis

An analysis of the protective device coordination system will be studied. The concentration of this study extends from the utility to the main switchboard SES#1. Protective devices will be coordinated for the new system components due to the redesigned systems and short circuit calculations will be included to complement the new coordination system.

Depth Topic: Photovoltaic Addition

The addition of a photovoltaic array to Chandler City Hall has the potential to generate sustainable energy. Cost estimates of materials and wiring will be evaluated and compared to the potential energy savings that could be generated after to be determined payback period. Chandler City Hall stands five stories tall amongst many single and double story height building eliminates the concern of shadows from surrounding buildings and the Arizona climate provides for ideal weather conditions for a photovoltaic solution. A design and layout will be developed to create the most efficient solutions and then tied into the building's electrical distribution system.

Depth Topic: Cost-Benefit Analysis of Increasing Feeder Sizes

An analysis of both initial and energy costs for increasing feeder sizes will be conducted. While a lesser initial cost exists in installing smaller wire sizes, there exists a potential energy saving through use of larger wires. Larger wires exhibit less resistance, and in turn less energy loss than smaller wires. Data will be gathered from the existing circuitry and compared to a system using the larger wires in the same configuration and layout. The data will then be compared to evaluate which system is most cost effective in terms of smaller versus larger wire sizes.

M.A.E. Focus | Daylighting

The 3rd floor open office space is partially encompassed by a south-facing glass curtain wall façade. This façade makes use of external shading devices to help minimize unwanted direct sunlight while still allowing plenty of usable sunlight into the space. With this there an opportunity to generate savings by implementing a photosensor system to control the electric lighting through either dimming or switching. An exploratory analysis will be conducted to determine the best system to maximize energy savings in the open office space.

Breadth Proposal | Acoustical and Architectural

The Council Chamber auditorium is a multi-use space that could be used for a variety of different functions or events. Of these include council meetings, town meeting, lectures, presentations and a variety of other community events. The ceiling system within the auditorium could potentially be redesigned to accommodate the new lighting design system for the auditorium space. In the system redesign, an improved reverberation time suitable to any potential event will be sought. In addition to the ceiling system, this could include the addition of sound absorber acoustical materials on other surfaces within the space.

Breadth Proposal | Façade System and Solar Loading

Several spaces within Chandler City Hall are encompassed by a glass curtain wall façade. Of these spaces, all but one makes use either of exterior shading devices or interior roller shades. Nearly half of the main lobby is encompassed by a two story curtain wall facing both to the east and south. This leaves the potential for large amounts of direct sunlight in the morning and early afternoon hours. In addition to the sunlight penetration, an evaluation of the solar heat gains within the lobby will be conducted. The system will be redesigned to reduce solar heat gains with an improvement of the quality of the natural light within the space. This will be done by evaluating potential replacement of the glass to fritted glass and/or the addition of shading devices integrated into the architecture of the façade.

AE 482 Schedule - Spring Proposal Work		
<i>Week</i>	<i>Focus</i>	<i>Activity</i>
1/10/2011	<i>Lighting</i>	Develop and finalize schematic design
		Model spaces in 3D
1/17/2011	<i>Lighting</i>	Continue and finish modeling in 3D
		Import into lighting software apply appropriate materials
1/24/2011	<i>Lighting</i>	Begin fixture selection
		Start daylight analyses for open office and lobby
		1/28/2011 Milestone#1- Daylighting analyzed
1/31/2011	<i>Façade/Solar</i>	Use daylighting analysis to begin breadth topic study
	<i>Lighting</i>	Lobby lighting and calculations
2/7/2011	<i>Acoustics</i>	Auditorium acoustical design
	<i>Lighting</i>	Auditorium lighting and calculations
2/14/2011	<i>Electrical</i>	Increased feeder size analysis
	<i>Lighting</i>	Office lighting and daylight integration
	<i>Lighting</i>	2/18/2011 Milestone#2- Interior lighting designed
2/21/2011	<i>Façade/Solar</i>	Analyze daylight heat gain of redesigned system
	<i>Electrical</i>	Photovoltaic array addition
2/28/2011	<i>Lighting</i>	Exterior façade renderings
		3/4/2011 Milestone#3- Breadth analyses completed
3/7/2011	<i>Spring Break</i>	
3/14/2011	<i>Electrical</i>	Branch circuit redesign
	<i>Electrical</i>	Protective device coordination
3/21/2011	<i>Lighting</i>	Continue/finish renderings and documentation
	<i>All</i>	3/25/2011 Milestone #4 - Organize and format final report
3/28/2011	<i>All</i>	Finalize final report
	<i>All</i>	Arrange Final Presentation
4/7/2011	<i>All</i>	Final Reports due
4/18/2011	<i>All</i>	Final Presentations
4/30/2011	<i>All</i>	Senior Banquet