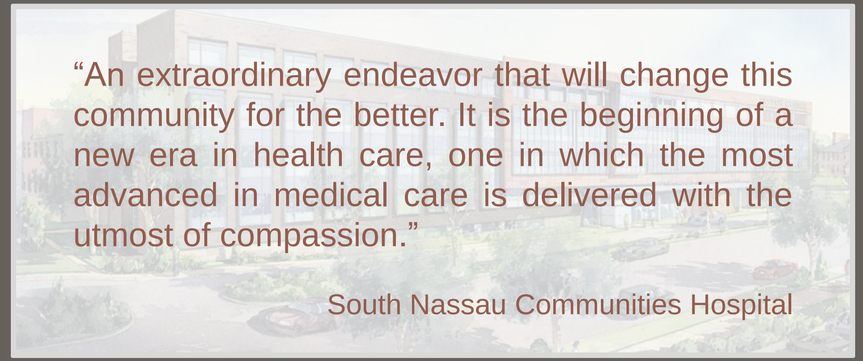
South Nassau Communities Hospital North Addition

The Pennsylvania State University AE Senior Thesis

Carl Speroff | Lighting Electrical | April 13, 2011
Advisors: Dr. Kevin Houser & Ted Dannerth



"An extraordinary endeavor that will change this community for the better. It is the beginning of a new era in health care, one in which the most advanced in medical care is delivered with the utmost of compassion."

South Nassau Communities Hospital

Building Overview

Presentation Outline:

Building Statistics

Location:	Oceanside, New York
Size:	160,000 SF
Cost:	$64,100,000
Construction:	December 2003 – May 2005

Project Team

Owner:	South Nassau Communities Hospital
Architect:	Cannon Design
Engineer:	Cannon Design
Construction Manager:	Bovis Lend Lease
General Contractor:	KLMK Group

CREDIT: GOOGLE MAPS

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- ***Building Overview***
- *Electrical Depth*
  - *Feeder Redesign*
- *Design Concepts*
- *Main Lobby*
  - *Mechanical Breadth*
  - *Lighting Design*
- *Nurses Station*
  - *M.A.E. Study*
  - *Lighting Design*
- *Courtyard*
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  - *Lighting Design*
- *Conclusion*

Lighting Design

Circulation Space:	Main Lobby
Special Purpose Space:	Auditorium
Outdoor Space:	Courtyard
Large Work Space:	Nurses' Station

Thesis Scope of Work

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Electrical Design

Branch Circuit Redesign:	Four Lighting Spaces
Depth Study 1:	Feeder Upsizing Analysis
Depth Study 2:	Motor Control Center Design

Breadth Work

M.A.E. Study:	Biological Effects of Light
Architectural Study:	Courtyard Redesign
Mechanical Study:	Diffuser Relocation

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Feeder Sizing / Voltage Drop Analysis

Overview

- Smaller wire sizes have larger impedance
  - More wasted energy

- Cost comparison
  - Cost of wasted energy
  - Initial cost of upsizing

- Feeder located on emergency only branch were excluded

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Feeder Sizing / Voltage Drop Analysis

Method

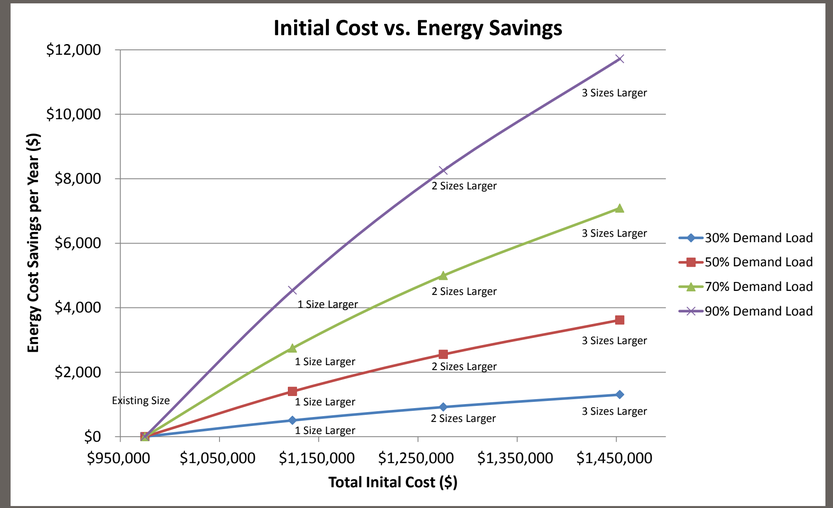
- Voltage drop calculations for each feeder
  - Eaton 2006 Consulting Application Guide

- Calculate total cost of energy loss, conductors, and conduit
  - Hospital utility rates
  - RS Means 2011

- Increase feeders by 1, 2, and 3 sizes

- Analyze different demand loads

Presentation Outline:



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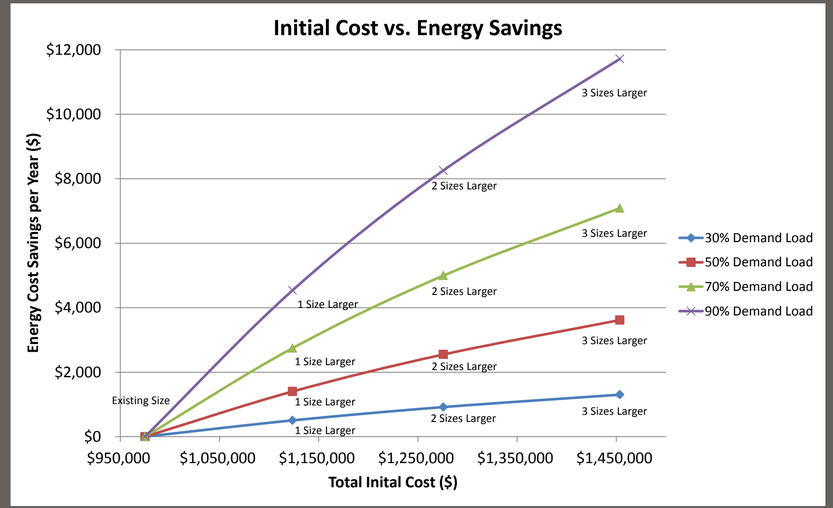

SIMPLE PAYBACK PERIOD (YEARS)			
	1 Wire Size Larger	**2 Wire Sizes Larger**	**3 Wire Sizes Larger**
30% DEMAND LOAD	294.99	327.86	367.68
50% DEMAND LOAD	106.20	118.03	132.37
70% DEMAND LOAD	54.18	60.22	67.53
90% DEMAND LOAD	32.78	36.43	40.85

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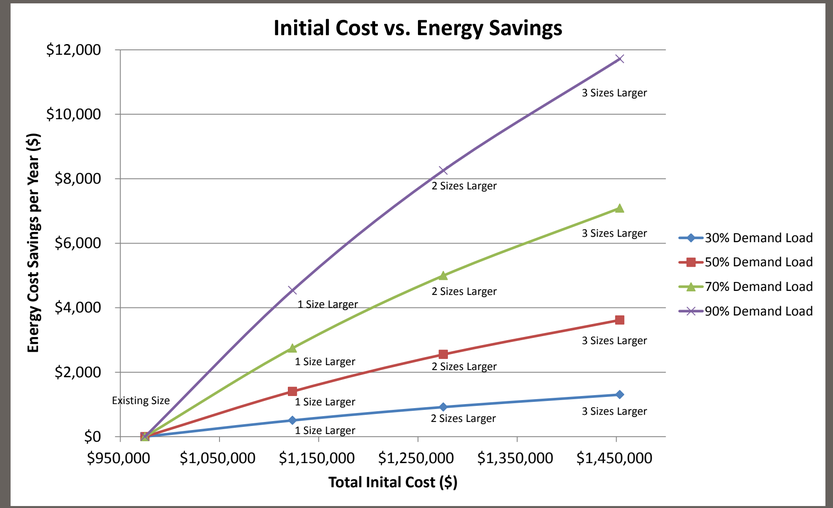

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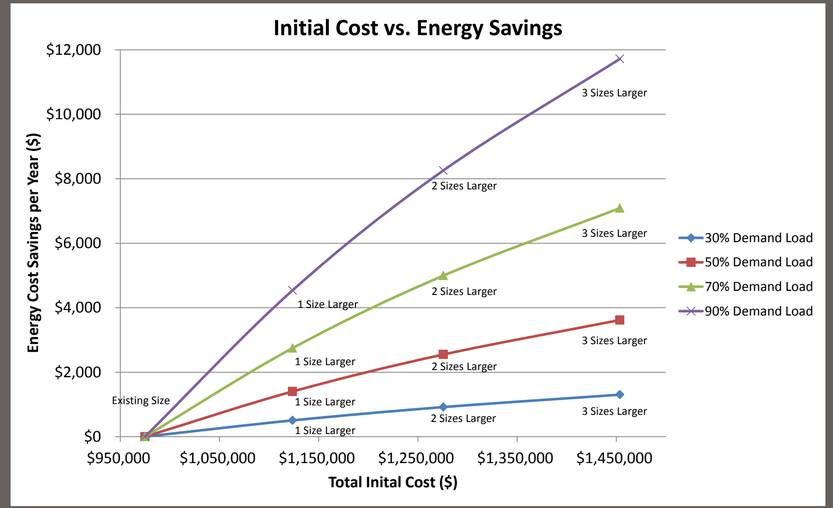

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SIMPLE PAYBACK PERIOD (YEARS) - 90% LOAD			
	1 Wire Size Larger	2 Wire Sizes Larger	3 Wire Sizes Larger
ALL FEEDERS	32.78	36.43	40.85
LARGE FEEDERS	20.79	23.21	29.07

Design Concepts

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Owner's Vision

- Extraordinary endeavor that will change the community
- Begin a new era in health care
- Provide advanced medical care with the utmost compassion

Project Goals

- Provide a dignified, comfortable space for patient healing
- Provide a fresh and updated image while preserving legacy
- Create a modern look to reflect the cutting edge clinical and programmatic changes
- Create a welcoming beacon with hospitable interior spaces

Presentation Outline:

Lighting Design Goals

- Create relaxing and welcoming environments
- Create a crisp, modern appearance
- Accentuate architecture
- Meet or exceed recommendations and requirements

Main Lobby

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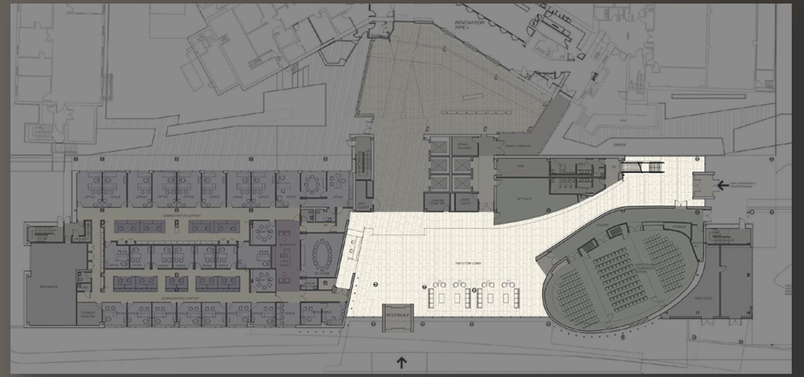


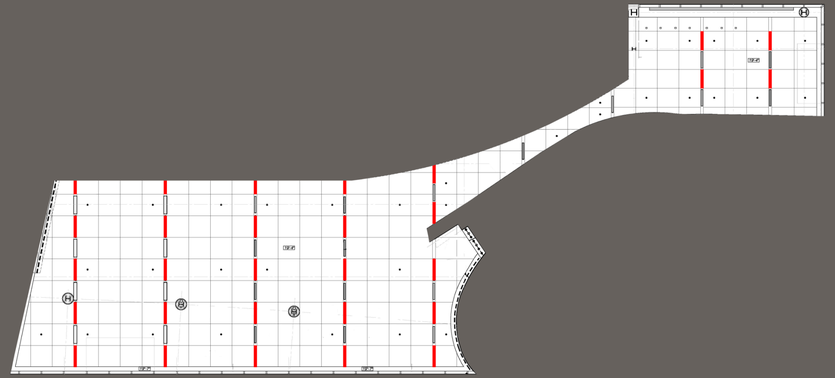
Presentation Outline:

Design Considerations

Appearance:	Create a lasting first impression
Architecture:	Build on initial concept
Impression:	Create a relaxing, spacious environment
Orientation:	Highlight points of interest
Circulation:	Encourage movement

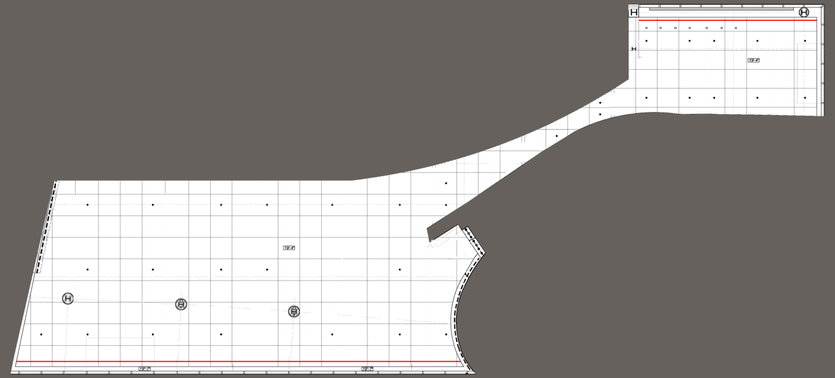
Presentation Outline:

Original Design



Presentation Outline:

New Design



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Luminaire Layout

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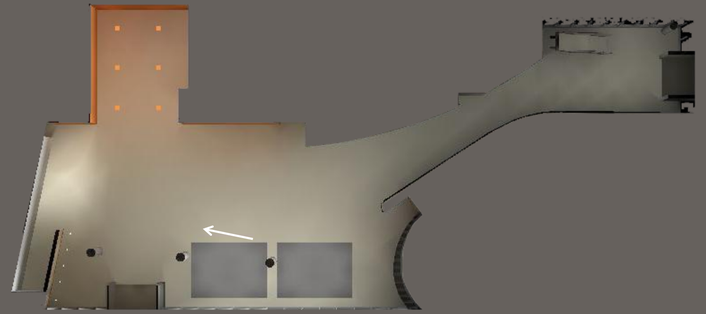

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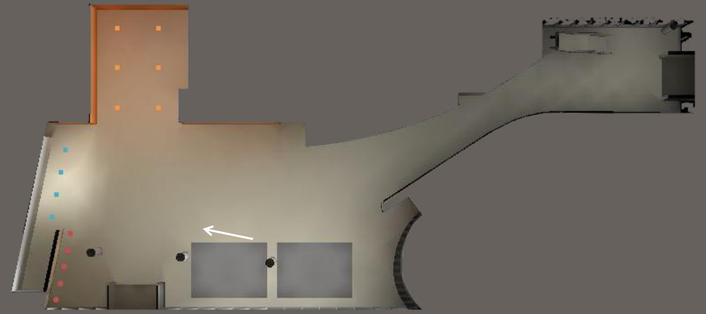

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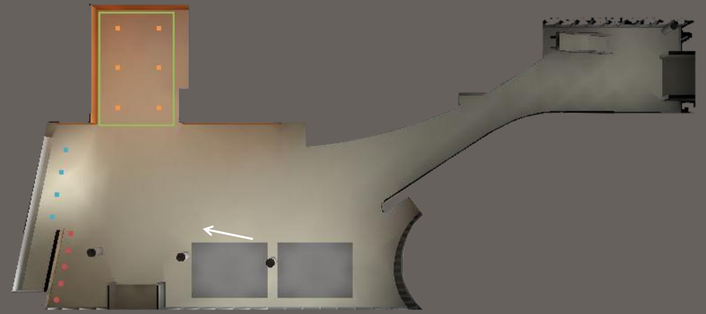

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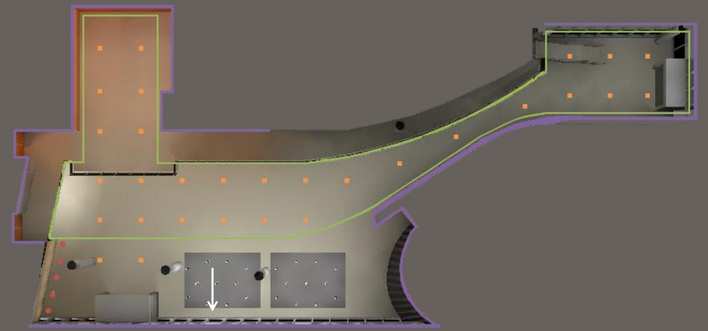

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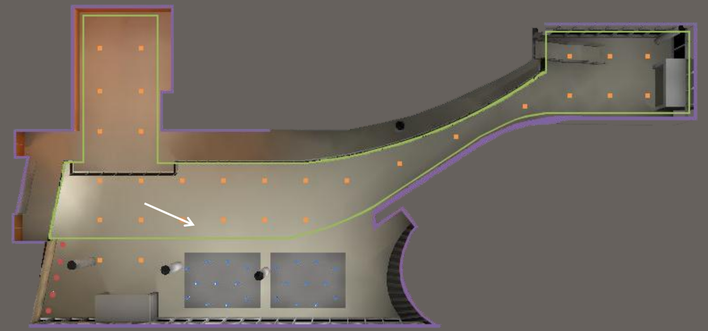

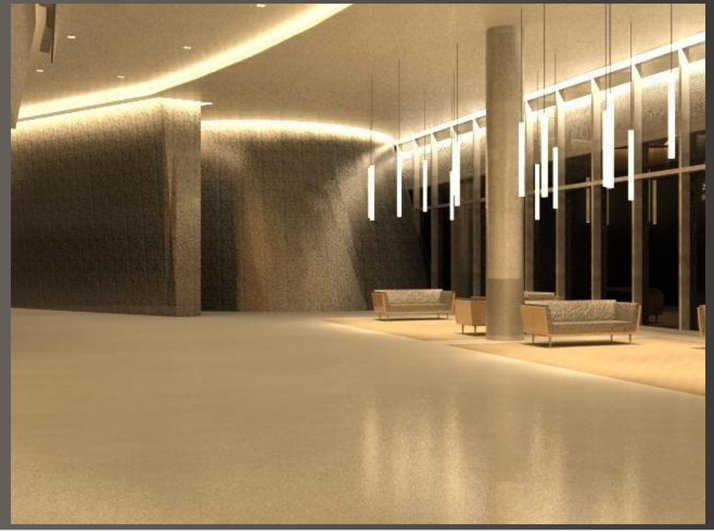

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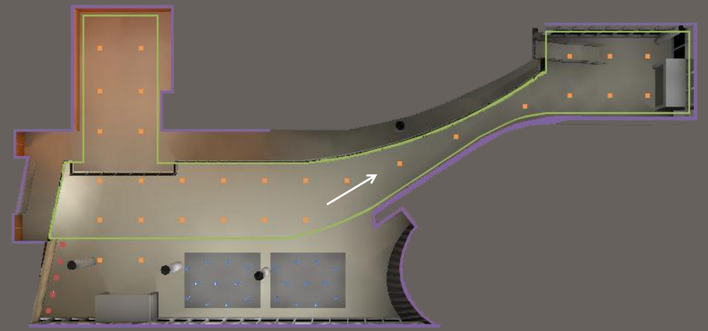

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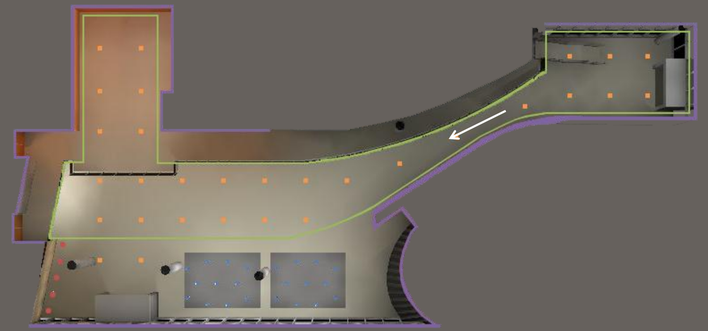

Presentation Outline:

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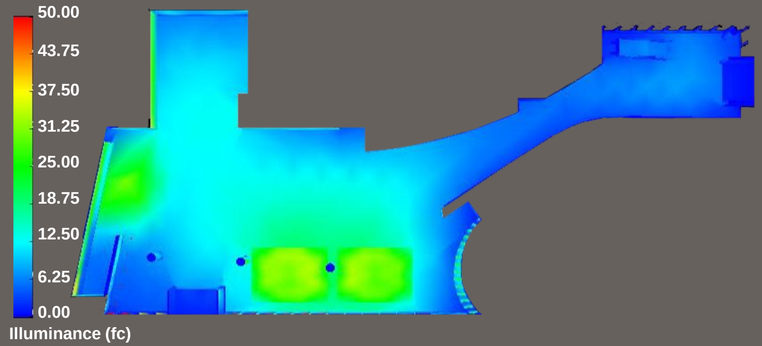

IESNA Illumination Recommendations for Main Lobby		
Area	Avg. Horizontal Illuminance	
	Target	Design
Lobby	5 fc	10 fc
General Waiting Area	10 fc	12.81 fc
Reading in Waiting Area	30 fc	33 fc
Corridors / Stairs	5 fc	10 fc
Reception	50 fc	49.56 fc

ASHRAE Power Density Requirements		
Area	Allowable	Design
Main Lobby	1.3 W / SF	0.86 W / SF

Presentation Outline:

Design Considerations

Function:	Design to adequate illuminance levels
Impression:	Create spacious, clear environment
Appearance:	Uniform layout, eliminate haziness
Flexibility:	Design for day and night
Health:	Maximize occupant health and productivity

Presentation Outline:

Goal

- Investigate impact of artificial lighting on circadian rhythms
  - How can this be used beneficially?

- Apply to lighting design of the nurses' station

Circadian Rhythms

- Circadian rhythms are daily rhythms which repeat every 24 hours
- Nearly all behavioral and physiological parameters exhibit circadian rhythms
- Light is the primary stimulus for these systems

Presentation Outline:

Problem

- Disruption of light-dark cycle can lead to phase shifts
- Night shift workers prone to lapses in performance and alertness
- Lighting products and systems are designed and measured based on our visual system

Quantity | Spectrum | Distribution | Duration | Timing

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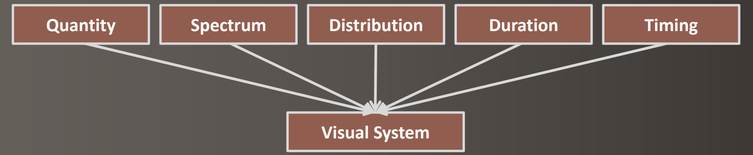

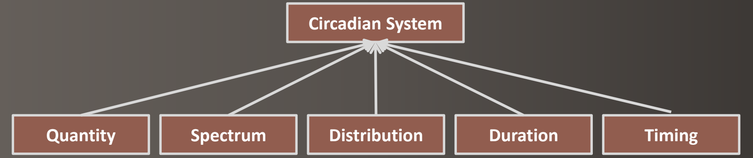

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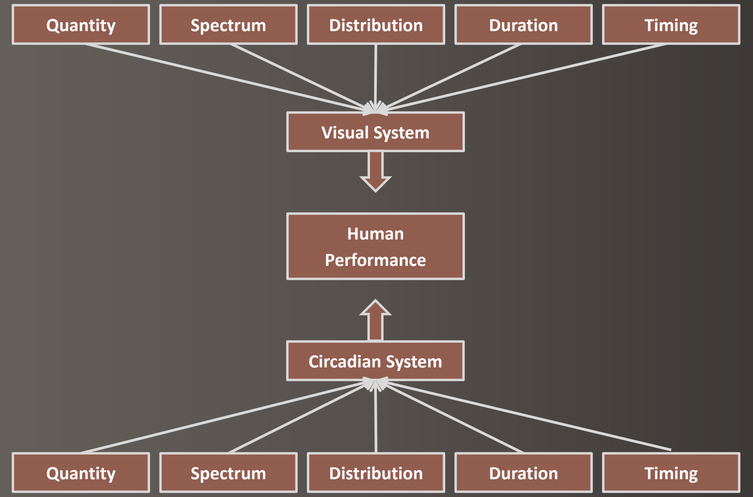

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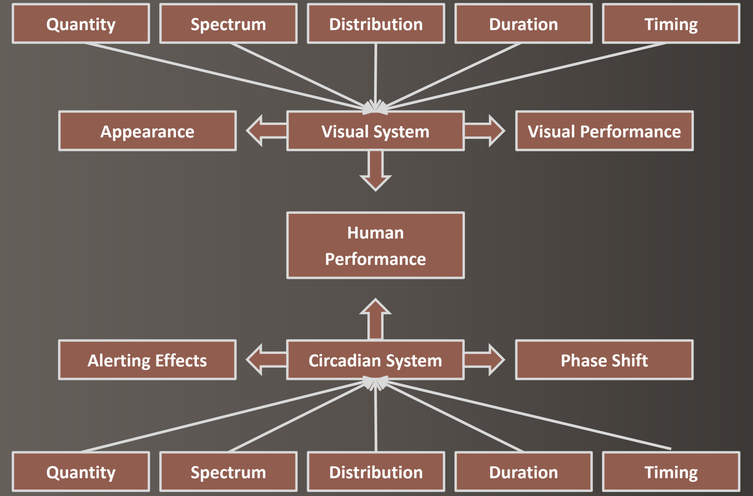

Presentation Outline:

Solution

Quantity:	20 – 50 fc on the retina
Spectrum:	465 – 480 nm
Distribution:	Upper visual field
Duration:	10 – 15 minutes
Timing:	Night time exposure

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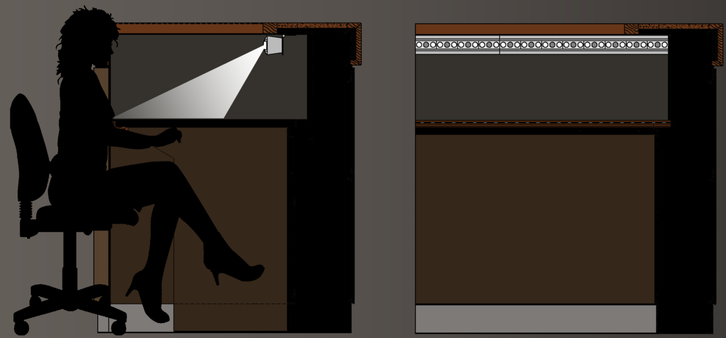

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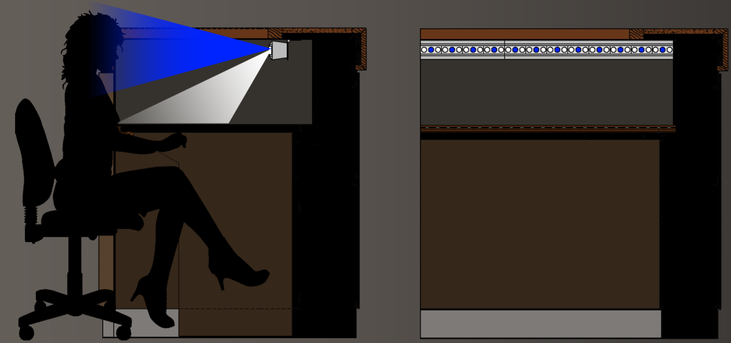

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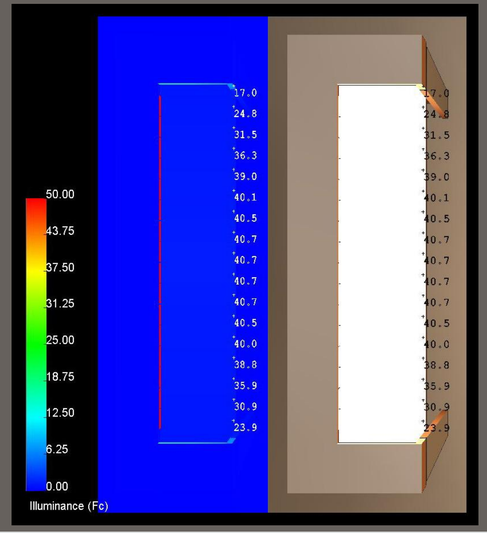

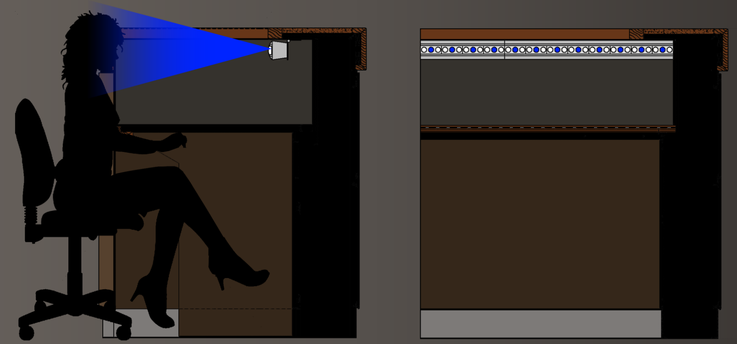

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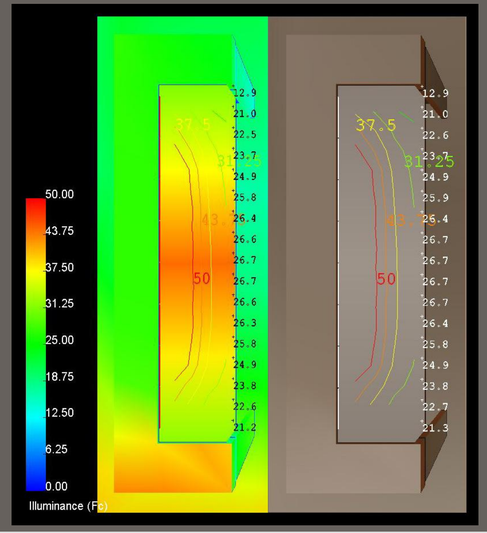

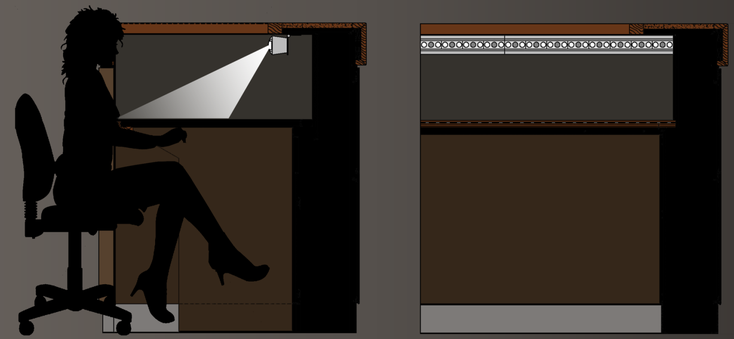

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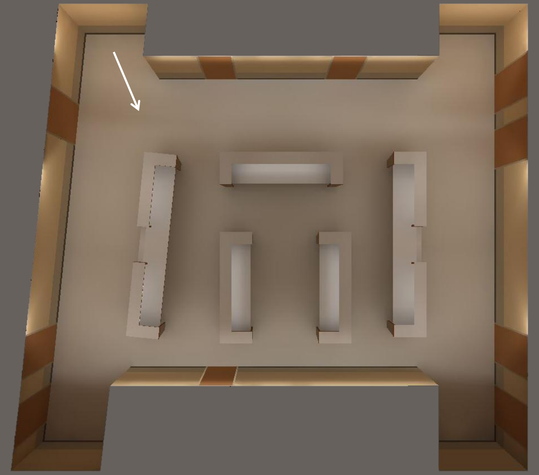

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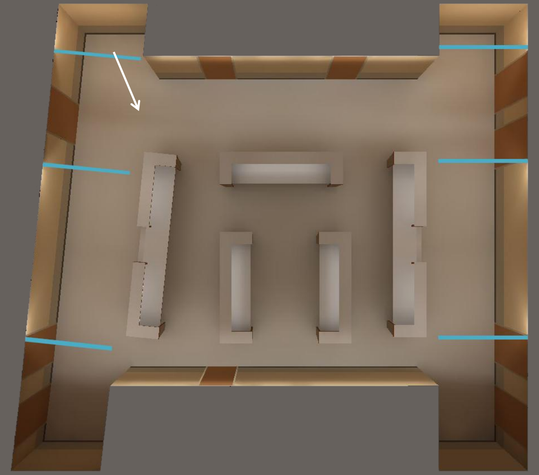

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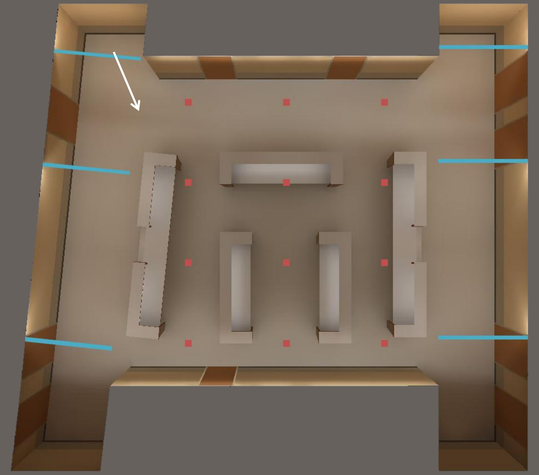

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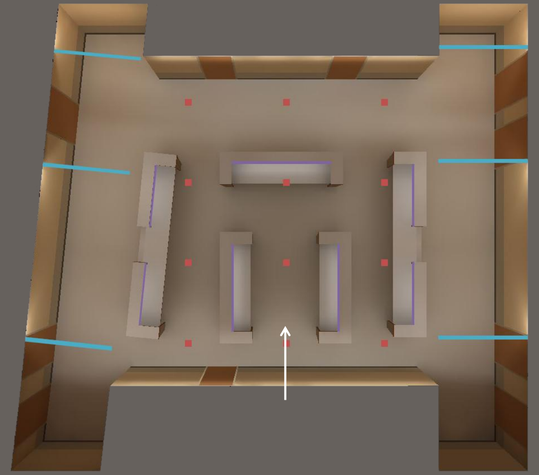

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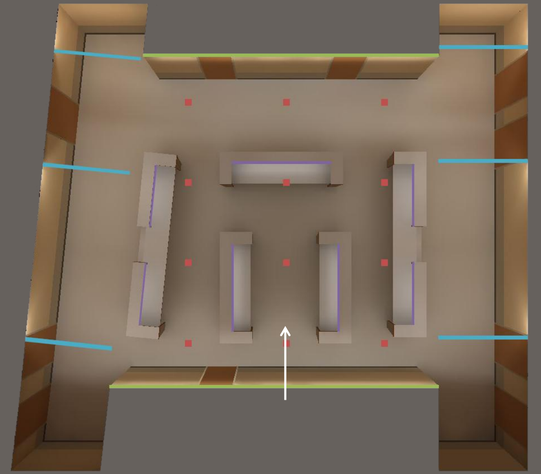

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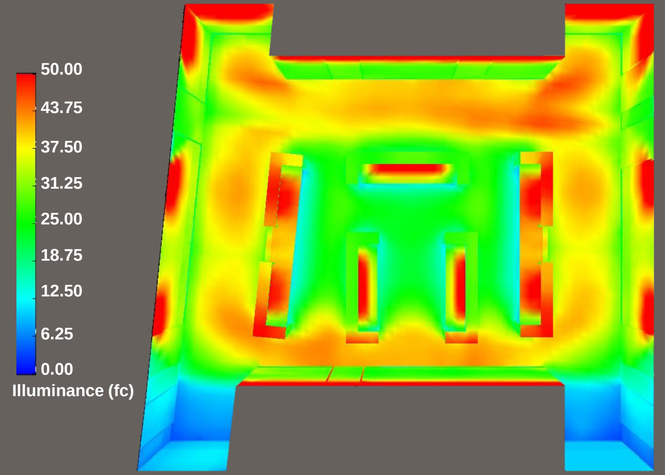


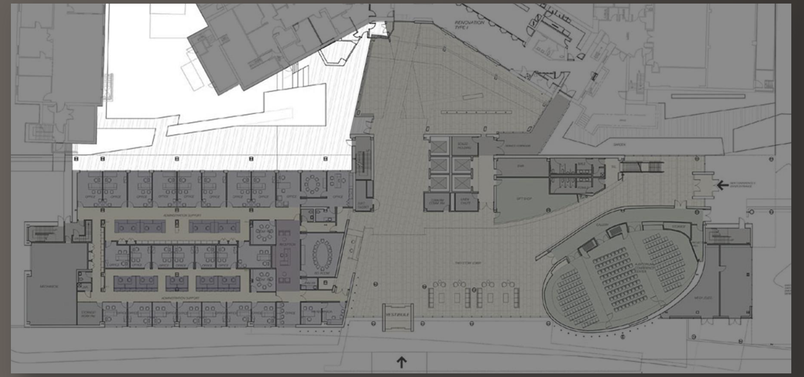
IESNA Illumination Recommendations for Nurses' Station		
Area	Avg. Illuminance	
	Target	Design
General Horizontal @ 2.5'	30 fc	31 fc
General Vertical	5 fc	10 fc
Desk Horizontal	50 fc	48 fc
Desk Vertical	10 fc	10 - 45 fc
Circadian Vertical	20 - 50 fc	25 - 45 fc

ASHRAE Power Density Requirements		
Area	Allowable	Design
Nurses' Station	1.0 W / SF	1.55 W / SF

Presentation Outline:

Design Considerations

Security:	Create boundaries
Movement:	Define pathways
Control:	Limit glare and spill
Hierarchies:	Highlight landscaping
Impression:	Create a pleasant outdoor environment



Presentation Outline:

- Building Overview
- Electrical Depth
  - Feeder Redesign
- Design Concepts
- Main Lobby
  - Mechanical Breadth
  - Lighting Design
- Nurses Station
  - M.A.E. Study
  - Lighting Design
- **Courtyard**
  - **Architectural Breadth**
  - Lighting Design
- Conclusion

Original Design

Presentation Outline:

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New Design

Presentation Outline:

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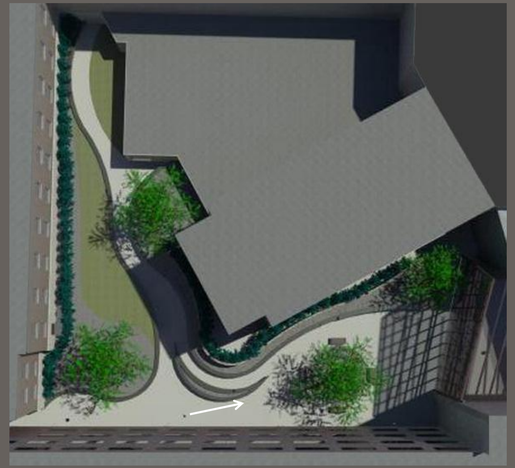
New Design



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Luminaire Layout

Presentation Outline:

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  - ***Lighting Design***
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Luminaire Layout

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Luminaire Layout

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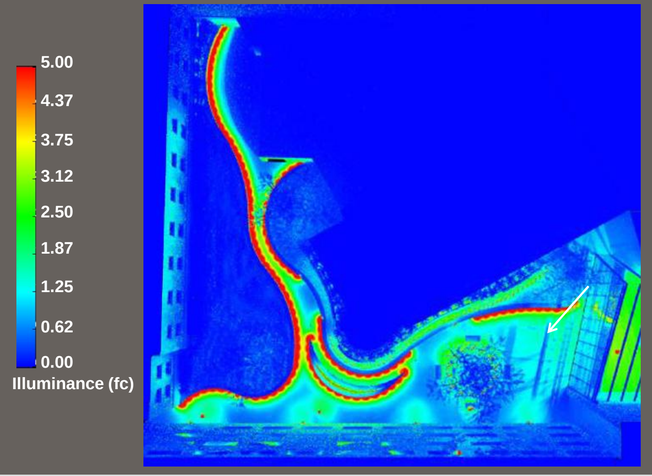
Luminaire Layout

Presentation Outline:

Luminaire Layout

Presentation Outline:

Performance



IESNA Illumination Recommendations for Courtyard		
Area	Avg. Illuminance	
	Target	Design
General Lighting	0.5 fc	2 fc
Paths	1 fc	5 fc

ASHRAE Power Density Requirements		
Area	Allowable	Design
Courtyard	1.0 W / SF	0.10 W / SF

Conclusion

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Electrical Design

- Feeder upsizing only feasible for long runs with high loads

Mechanical Breadth

- New diffuser layout allows for original design

Architectural Breadth

- Creates an attractive and relaxing extension of the conservatory

Lighting Design

- Relaxing and welcoming environments
- Modern design which enhances architecture
- Meets or exceeds recommendations and requirements

Acknowledgements

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- **Conclusion**

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Dr. Kevin Houser
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Family and Friends

Question and Answer Session

The Pennsylvania State University AE Senior Thesis

Carl Speroff | Lighting Electrical | April 13, 2011
Advisors: Dr. Kevin Houser & Ted Dannerth