spertus

יהלי אור

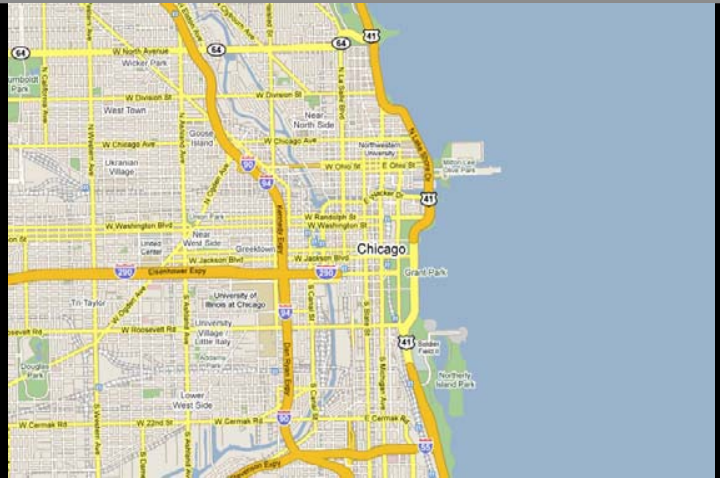
Kanis Glaewketgarn

Lighting / Electrical l AE Senior Thesis l April 14, 2009

WELCOME

Kanis Glaewketgarn's AE Senior Thesis

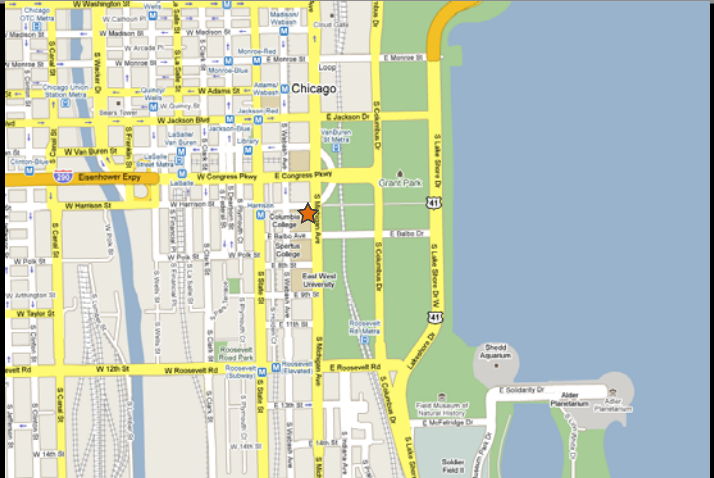
PROJECT OVERVIEW



spertus


W Ontario St
E Ontario St
W Ohio St
E Ohio St
E Grand Ave
River East Plaza
The Shops at the Mart
W Wacker Dr
E Wacker Dr
W Randolph St
E Randolph Dr
W Washington St
Near West Side
W Adams St
W Jackson Blvd
E Jackson Dr
Chicago
Eisenhower Expy
Roosevelt University
W Harrison St
Grant Park
N Lake Shore Dr
University of Illinois at Chicago
University Village Little Italy
W Roosevelt Rd
E Roosevelt Rd
Shedd Aquarium
Adler Planetarium
Northerly Island Park
Near South Side
W 18th St
Dan Ryan Expy

PROJECT OVERVIEW



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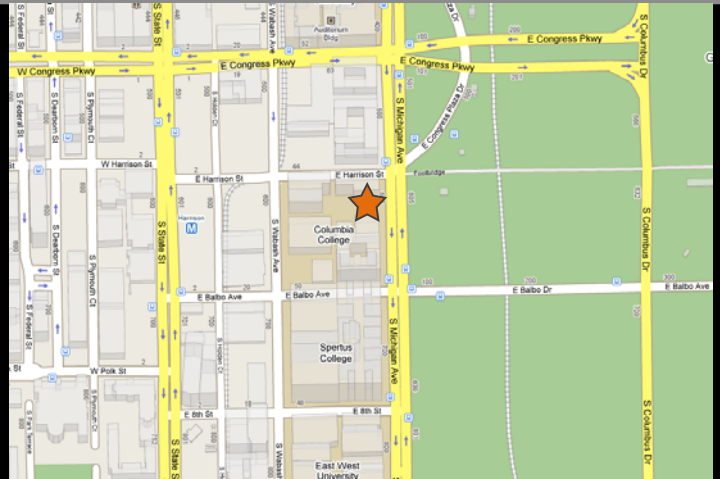
PROJECT OVERVIEW



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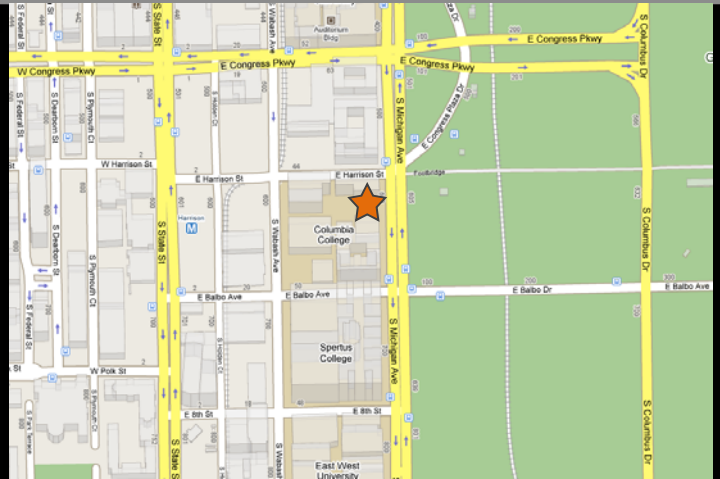

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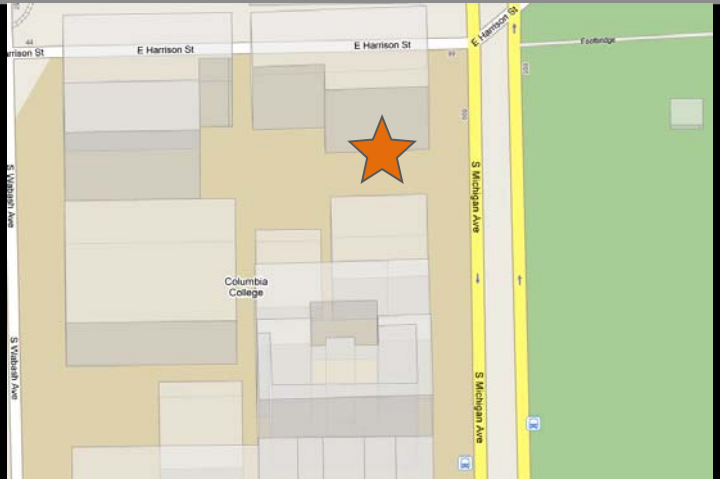

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PROJECT OVERVIEW

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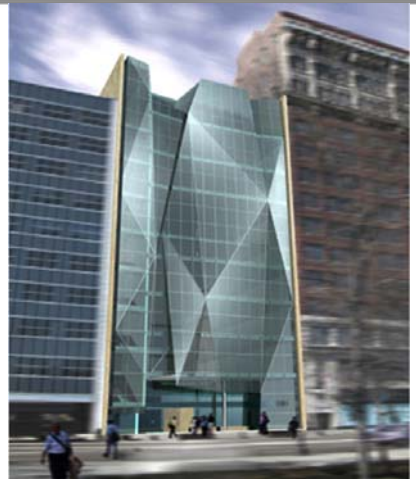


Building name: **Spertus Institute of Jewish Studies**

Key project team: **Architect – Krueck+Sexton**
Lighting Design – Schuler Shook
MEP – Environmental System Design
Structural Engineer –Tylk Gustafson Reckers Wilson Andrews
General Contractor – W.E. O'Neil Construction Co.

Location and site: **610 S. Michigan Ave Chicago IL 60605**

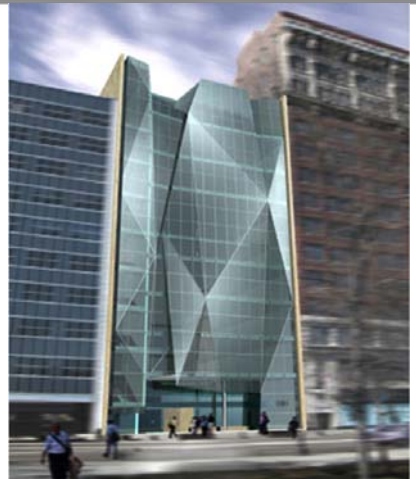
Space types: **Museum**
College
Library

Size: **155,000 Sq.ft.**

Number of stories: **11**

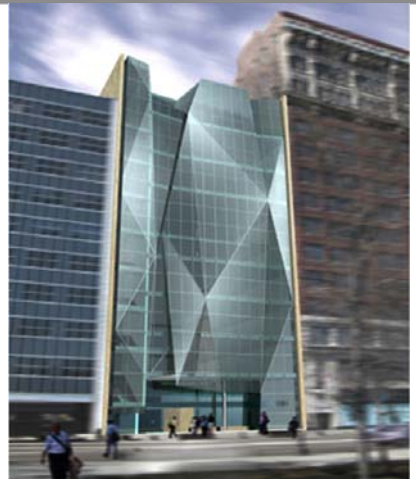
spertus

SCOPE OF WORK



Lighting Redesign	• **Building Façade** • **Lobby Atrium** • **Feinberg Theater** • **Open Office**
Electrical Redesign	• **Four Spaces**
Electrical Depth	• **Energy Efficient Loads** • **Energy Efficient Transformers**
Breadth Study	• **Acoustics** • **Design Integration**

SCOPE OF WORK



Lighting Redesign	• Building Façade • **Lobby Atrium** • **Feinburg Theater** • Open Office
Electrical Redesign	• Four Spaces
Electrical Depth	• **Energy Efficient Loads** • Energy Efficient Transformers
Breadth Study	• **Acoustics** • Design Integration

ARCHITECTURAL CONCEPT

To INTEGRATE and UNIFY what is generally seperated:

Library
Theater
Museum
Classrooms
Offices

To create a VERTICAL campus

OUTLINE

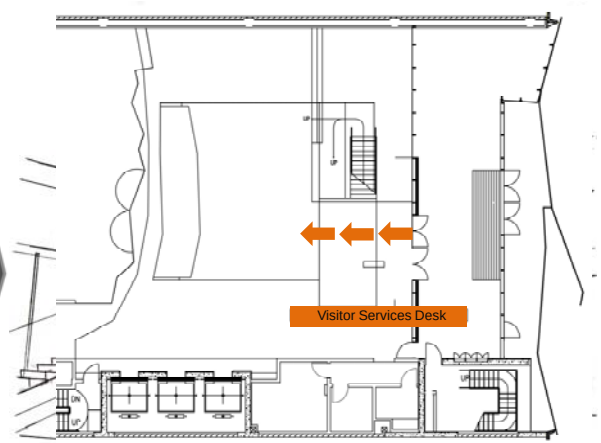
LIGHTING DESIGN OBJECTIVES

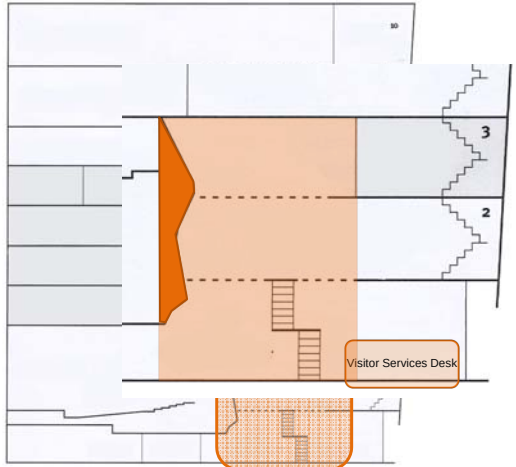
Integrated lighting design solutions

Energy efficient equipment

Flexible lighting/control system

OUTLINE





OUTLINE

Architectural Concept

Lighting Redesign
- **Lobby Atrium**
- Feinberg Theater

Daylighting Study

Electrical Depth
- Energy Efficient Loads

Breadth Study
- Acoustics

LIGHTING REDESIGN **LOBBY ATRIUM**

Visual Environment
- Appearance of the space
- Color appearance
- Highlights and focal point
- Way-finding / Direction / Orientation

Visual Performance
- 10 FC on the ground
- System Control and Flexibility

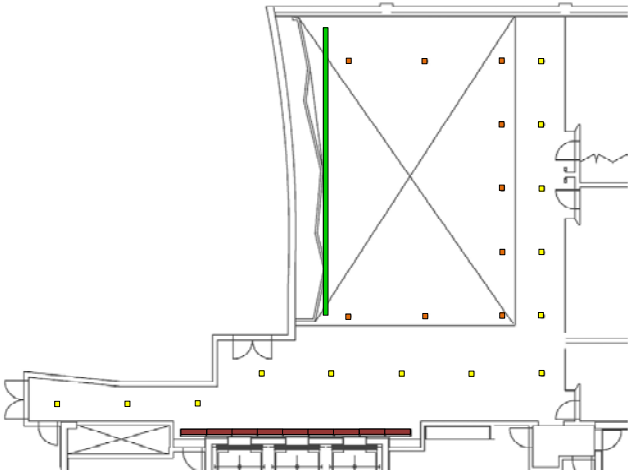
OUTLINE

70W T6 Ceramic Metal Halide Downlight

20W T4 Ceramic Metal Halide Downlight

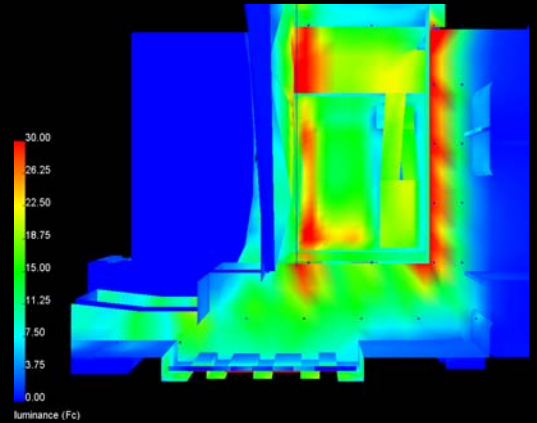
Linear LED

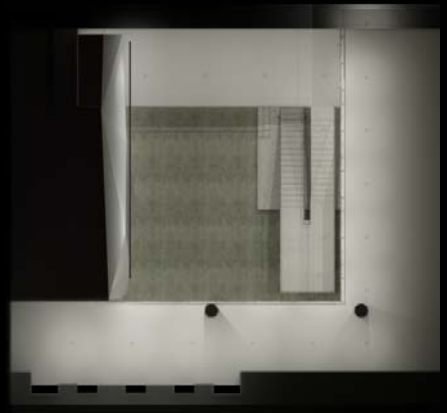
T5 Linear Fluorescent Cove



OUTLINE

Average Illuminance: 12 FC





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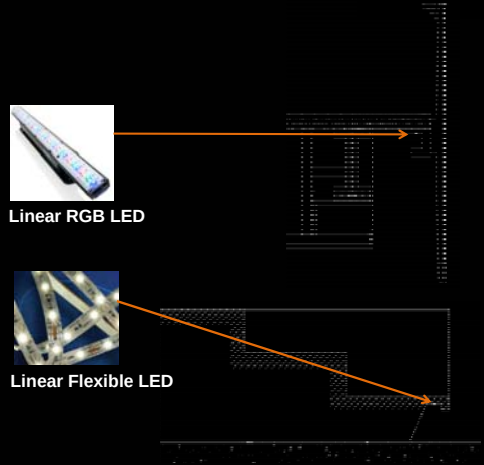

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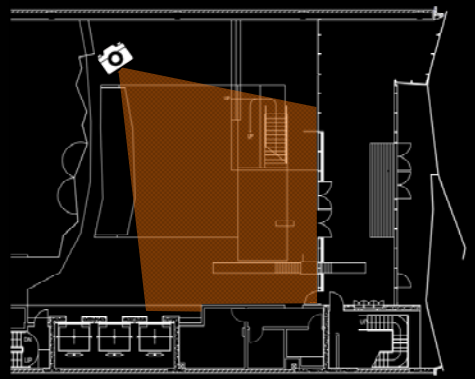

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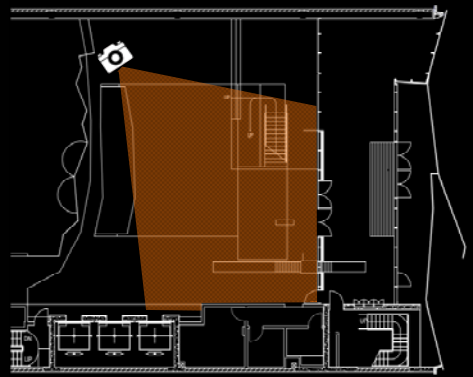

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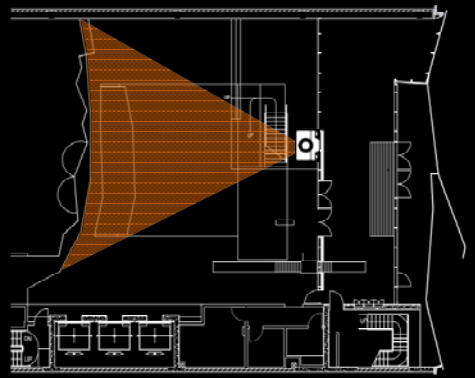

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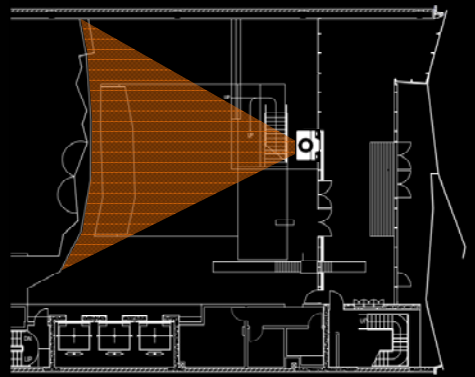

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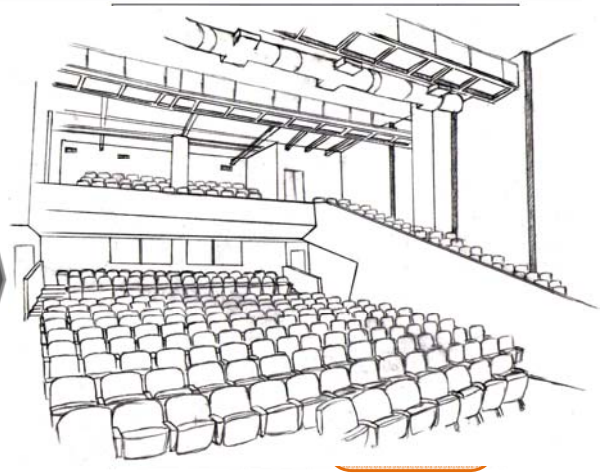
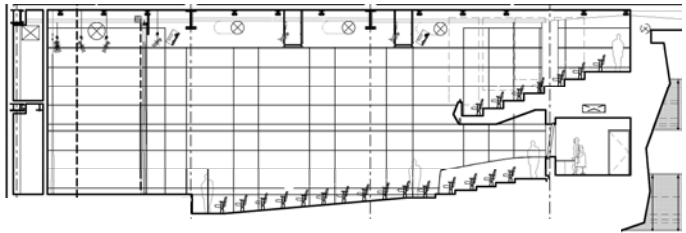




Activities/Tasks

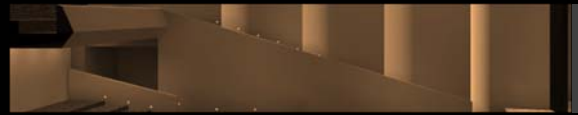
- Lectures
- Live Performances
- Films

Capacity: 400 seats

OUTLINE

Visual Environment

- Defined Architectural Form
- Color Appearance
- Way-finding / Direction
- Direct and reflected Glare



Visual Performance

System Control and Flexibility

- Lecture Mode – 30 FC
- Pre-show Mode – 10-20 FC
- Show-time Mode

OUTLINE

(2) 42W CFL Recessed Downlight

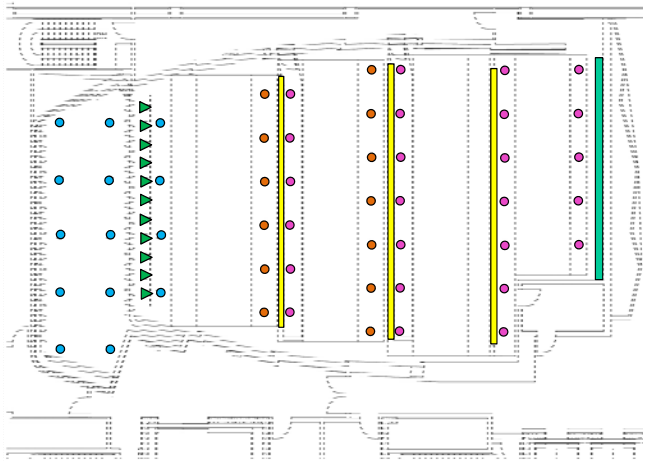
100W PAR38 Halogen Recessed Downlight

T5HO Linear Fluorescent Cove

T5 Linear Fluorescent Indirect/Direct Wall Mounted

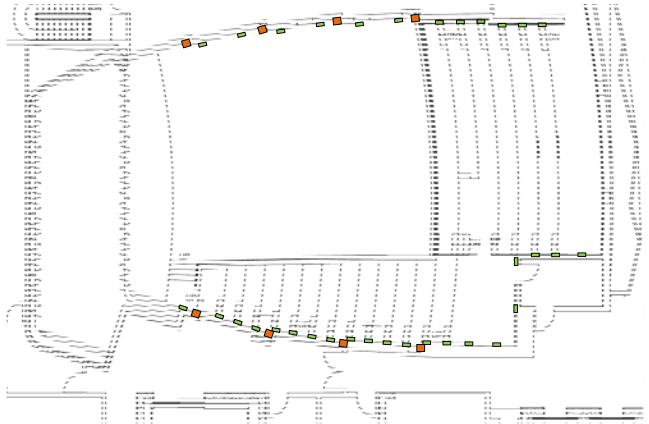
100W PAR38 Halogen Track System

(2) 42W CFL Cylinder Downlight



Linear RGB LED

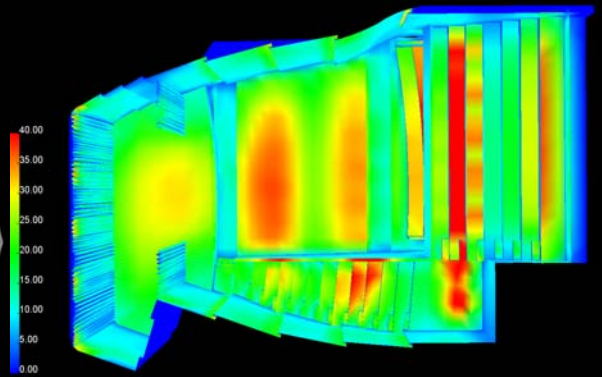
LED Steplight



OUTLINE

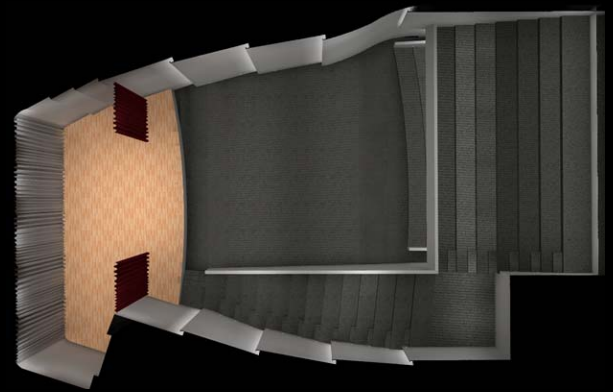
FEINBERG THEATER

Average Illuminance: 29 FC



Type	F8	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20
Light Level	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Scene: **Lecture** I Pre-show I Show time



OUTLINE

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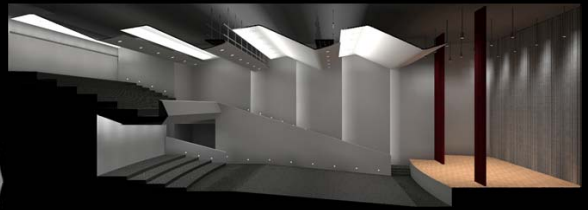
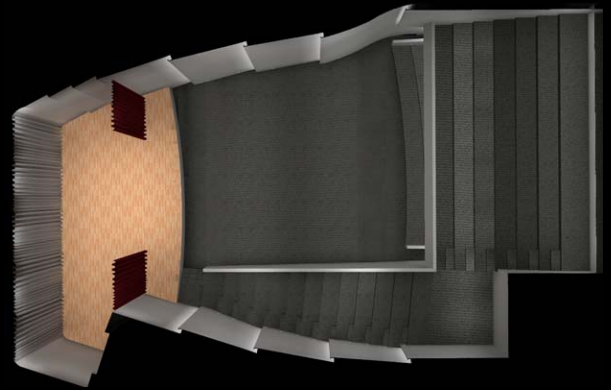
Average Illuminance: 29 FC



Type	F8	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20
Light Level	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

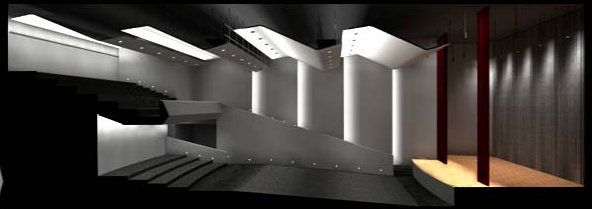
Scene: **Lecture** I Pre-show I Show time



OUTLINE

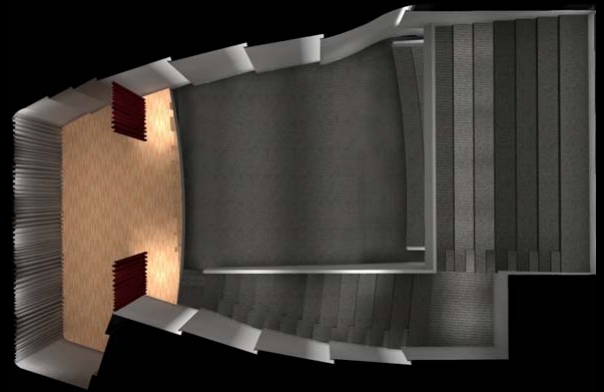
FEINBERG THEATER

Average Illuminance: 14 FC



Type	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20
Light Level	off	100%	50%	50%	50%	50%	50%	100%	75%	60%

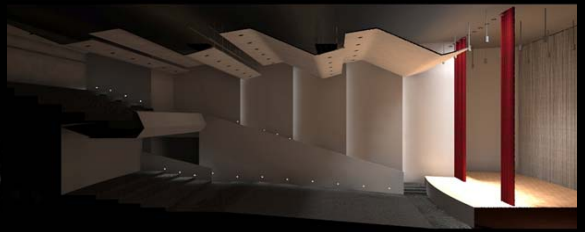
Scene: Lecture I **Pre-show** I Show time

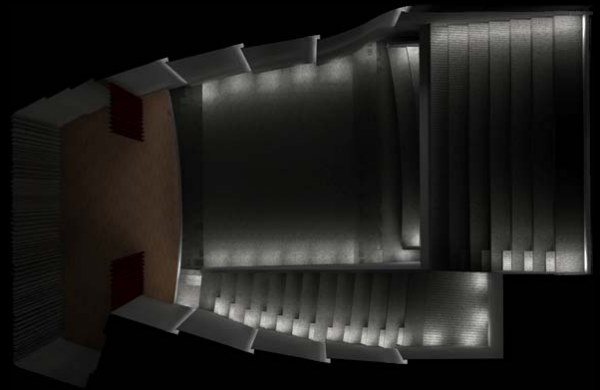


OUTLINE

FEINBERG THEATER

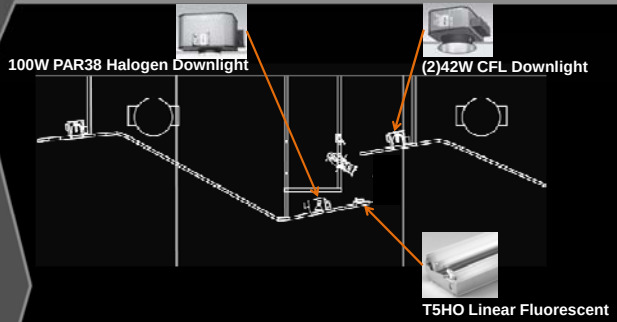
Scene: Lecture I Pre-show I **Show time**

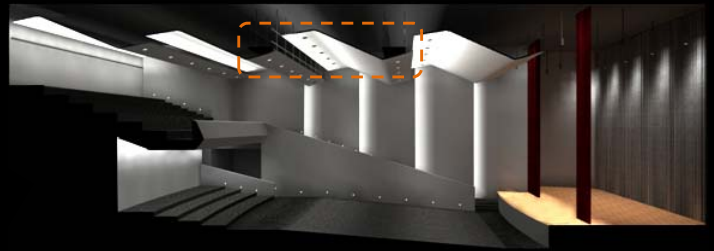




Type	F8	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20
Light Level	10%	off	off	off	off	off	off	off	100%	off	vary

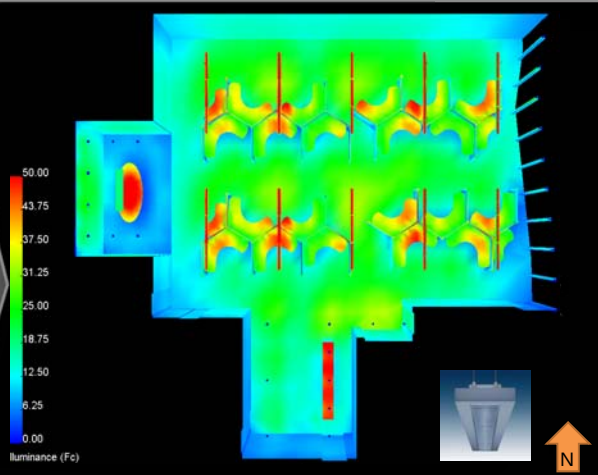
OUTLINE





OUTLINE

OPEN OFFICE



Objective: To identify the most effective dimming configuration for daylight harvesting, while maintain quality of light in the space

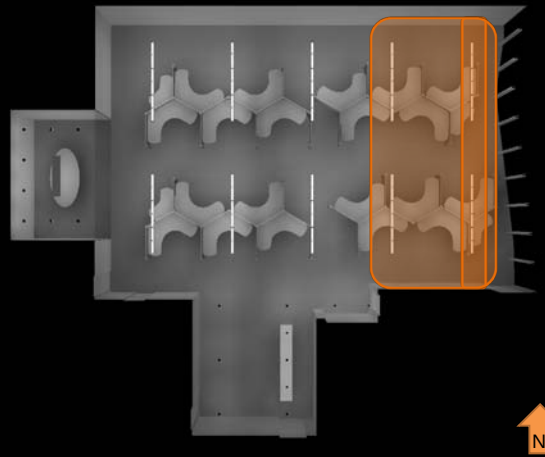
Constrains >> Location >> Chicago
Latitude – 41°59'N
Longitude – 87°54'W

Materials >> Façade Curtain Wall – Fritted Glass (τ = .5)
Solar Shades – Fabric (τ = .2)

Electric Lighting >>
Indirect/Direct Suspended Pendant
T5HO – 4400 lumens

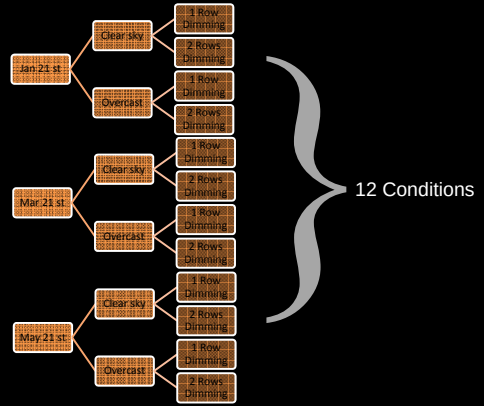
Target Illuminance >> 30 FC on the workplace

OPEN OFFICE



Options: 1 Row Dimming (6 Fixtures)
2 Rows Dimming (12 Fixtures)

Conditions:



DAYLIGHTING STUDY OPEN OFFICE

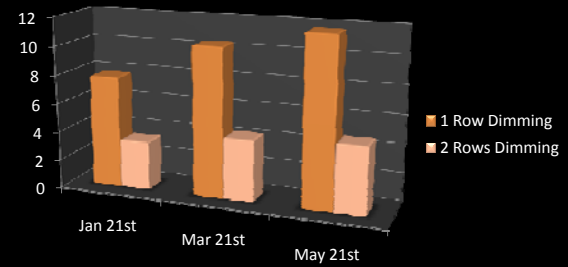
Jan 21st	1-row dimming (6 fixtures)		2-rows dimming (12 fixtures)	
	Clear	Overcast	Clear	Overcast
Dimming Level	0.63	0.479	0.90	0.906
Watts Saving	119	171	65	62
% Saving	6	9	3	3
Avg % Saving	7.8		3.4	
Preferred Option	✓		×	

Mar 21st	1-row dimming (6 fixtures)		2-rows dimming (12 fixtures)	
	Clear	Overcast	Clear	Overcast
Dimming Level	0.62	0.186	0.90	0.856
Watts Saving	122	266	65	94
% Saving	7	14	3	5
Avg % Saving	10.4		4.3	
Preferred Option	✓		×	

May 21st	1-row dimming (6 fixtures)		2-rows dimming (12 fixtures)	
	Clear	Overcast	Clear	Overcast
Dimming Level	0.66	0	0.91	0.819
Watts Saving	109	327	57	118
% Saving	6	18	3	6
Avg % Saving	11.7		4.7	
Preferred Option	✓		×	

Conclusion: 1 Row Dimming can save more energy for all conditions

- Peak energy saving is 18% on May 21st during the overcast condition
- Average energy saving is 10%



OUTLINE

Architectural Concept

Lighting Redesign
- Lobby Atrium
- Feinberg Theater

Daylighting Study

Electrical Depth
- Energy Efficient Loads

Breadth Study
- Acoustics

ENERGY EFFICIENT LOADS

Objective: Utilizing energy efficient light sources to downsize electrical equipment and reduce operating costs, while maintain quality of light and the integrity of the design

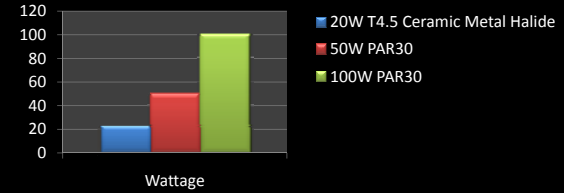
OUTLINE

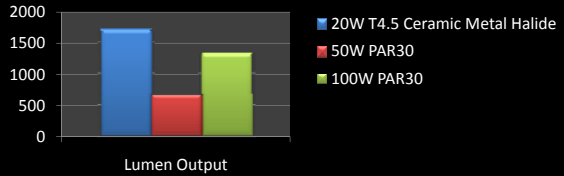
ENERGY EFFICIENT LOADS

Gift Shop

20W T4.5 Ceramic Metal Halide

50&100W PAR30 Halogen
Quantity: 105 Fixtures





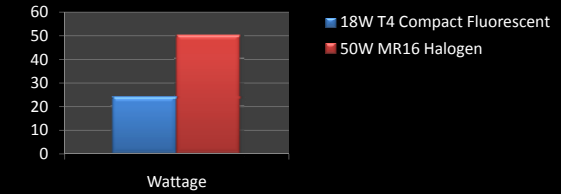
OUTLINE

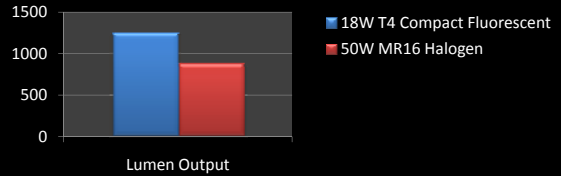
ENERGY EFFICIENT LOADS

General illumination throughout the building

18W T4 Compact Fluorescent

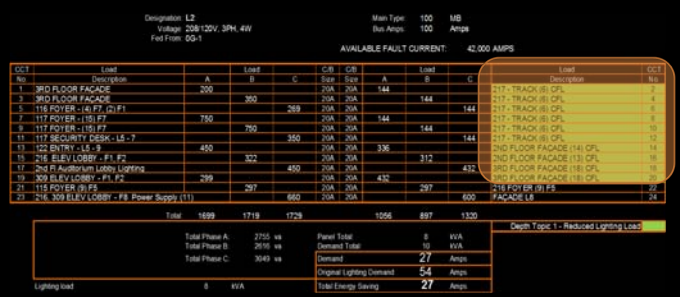
50W MR16 Halogen





ENERGY EFFICIENT LOADS

Resizing Panelboards >> 7 Panelboards are affected



Designation: L2
Voltage: 208/120V, 3PH, 4W
Fed From: 00-1

Main Type: 100 MB
Bus Amps: 100 Amps

AVAILABLE FAULT CURRENT: 42,000 AMPS

CCT No	Load Description	Load A	Load B	Load C	C/B Size	C/B Size	Load A	Load B	Load C	Load Description	CCT No
1	3RD FLOOR FACADE	200			20A	20A	144			217 - TRACK (6) CFL	2
3	3RD FLOOR FACADE		360		20A	20A		144		217 - TRACK (6) CFL	4
5	116 FOYER - (4) F7, (2) F1			269	20A	20A			144	217 - TRACK (6) CFL	6
7	117 FOYER - (15) F7	750			20A	20A	144			217 - TRACK (6) CFL	8
9	117 FOYER - (15) F7		750		20A	20A		144		217 - TRACK (6) CFL	10
11	117 SECURITY DESK - L5 - 7			350	20A	20A			144	217 - TRACK (6) CFL	12
13	122 ENTRY - L5 - 9	450			20A	20A	336			2ND FLOOR FACADE (14) CFL	14
15	216 ELEV LOBBY - F1, F2		322		20A	20A		312		2ND FLOOR FACADE (13) CFL	16
17	2nd Fl Auditorium Lobby Lighting			450	20A	20A			432	2ND FLOOR FACADE (18) CFL	18
19	309 ELEV LOBBY - F1, F2	299			20A	20A	432			3RD FLOOR FACADE (18) CFL	20
21	115 FOYER (9) F5		297		20A	20A		297		216 FOYER (9) F5	22
23	216, 309 ELEV LOBBY - F8 Power Supply (11)			660	20A	20A			600	FACADE L6	24
	Total	1699	1719	1729			1056	897	1330		

Depth Topic 1 - Reduced Lighting Load

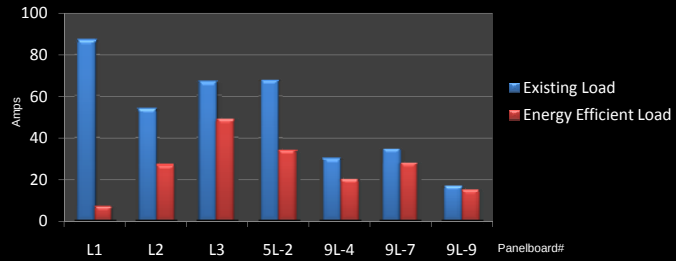
Total Phase A:	2755 va	Panel Total	8	KVA
Total Phase B:	2616 va	Demand Total	10	KVA
Total Phase C:	3049 va	Demand	27	Amps
		Original Lighting Demand	54	Amps
Lighting load	8 KVA	Total Energy Saving	27	Amps

OUTLINE

ENERGY EFFICIENT LOADS

PANELBOARD	REDUCED AMPS
L1	40
L2	27
L3	18
5L-2	34
9L-4	10
9L-7	7
9L-9	2
TOTAL AMPS SAVING	138
TOTAL VA SAVING	16560
14 hrs/day, 365 days/year @ $0.095 /KW hr	
TOTAL ANNUAL ENERGY (KW hr) SAVING	84621.6
TOTAL ANNUAL ENERGY COST SAVING ($)	8039.05

Resizing Panelboards >> 7 Panelboards are affected

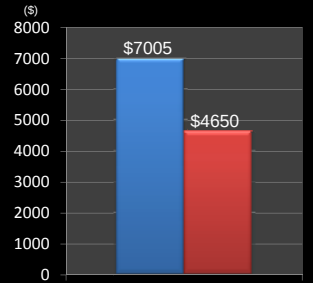


Total Annual Energy Saving **85,000 KW hr** or **$ 8,040**

OUTLINE

ENERGY EFFICIENT LOADS

Resizing Feeders >> from General Panelboards to Lighting Panelboards



Total Initial Cost Saving: **$ 2,355**

ACOUSTICS

Objective: Analyze and Redesign of Feinberg Theater Acoustics

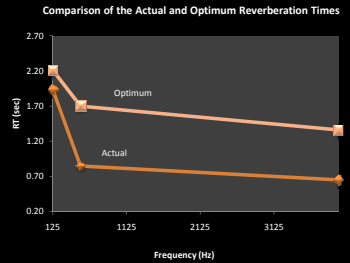
Design Criterions:

- Multipurpose Auditorium
- Compromise reverberation time for speech and instrumental music and chorus
- Mid-frequency reverberation of 1.7 at 500 Hz
- 1.3 and 0.8 multiplier for 125 and 4000 Hz
- Sound reinforcement

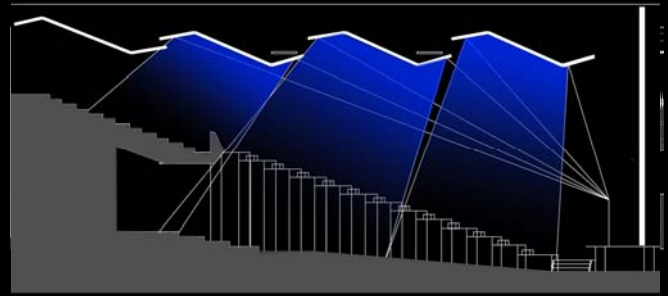
	Frequency (Hz)		
	125	500	4000
Target	**2.21**	**1.7**	**1.36**

OUTLINE

Existing Condition



Proposed Design



OUTLINE

Results Summary

Lighting : Lighting redesign successfully provides quality lighting and reinforces the architecture of the space through the use of energy efficient equipments and flexible control systems.

Electrical: Both the initial and operating costs are reduced through the use of energy efficient light sources and equipments.

Acoustics: Acoustical performance including reverberation times and sound projection are improved through the proposed ceiling panels.

spertus

SPECIAL THANKS:

Primary project team:

Owner: **Spertus Institute of Jewish Studies**
Architects: **Krueck+Sexton Architects**
MEP/FP & Tel/Data: **Environmental Systems Design**
Lighting Design: **ISP Design Inc. / Schuler Shook**
Structural Engineer: **Tylk Gustafson Reckers Wilson Andrews**
General Contractor: **W.E. O'Neil Construction Co.**

Advisors: **Professor Houser**
Professor Mistrick
Professor Dannerth
Professor Holland
Professor Parfitt

& Family + Fellow AEs

QUESTIONS I COMMENTS