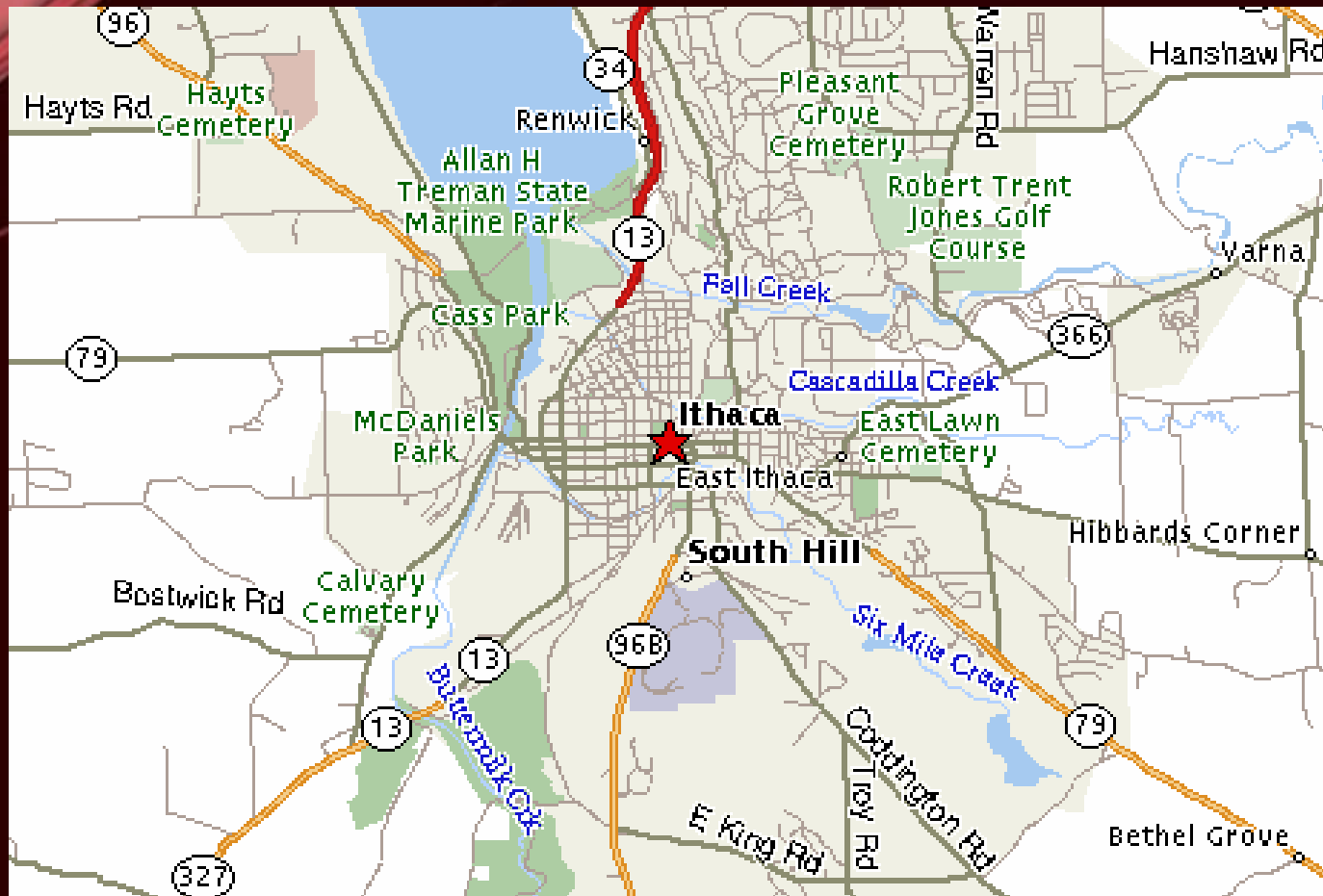




James J. Whalen Center for Music
Ithaca College, Ithaca, NY

Benjamin M Hagan
Lighting/Electrical
Senior Thesis Presentation
Tuesday April 13, 2004

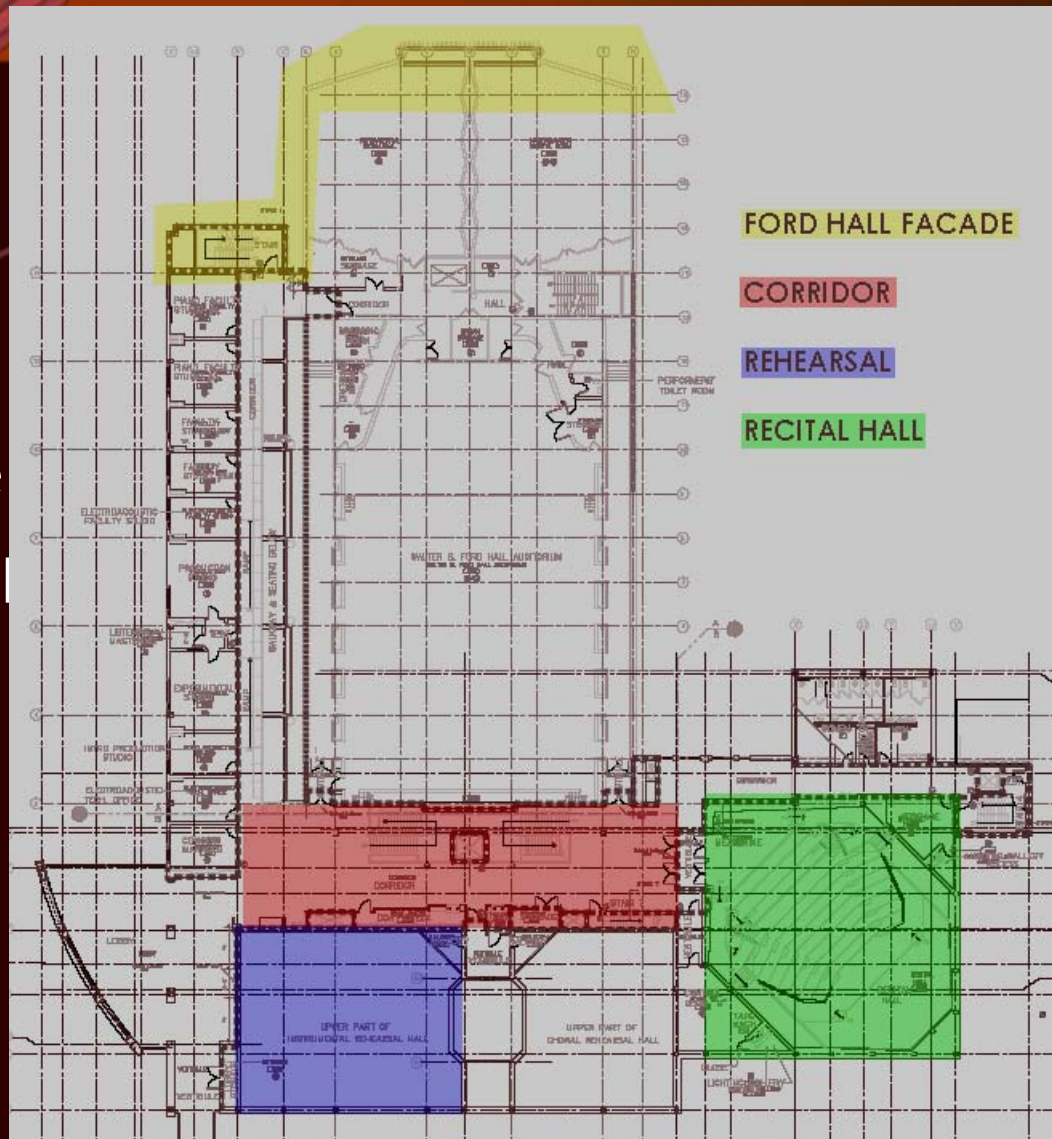
facility introduction



Ithaca, NY

facility introduction

Whale
Center



facility introduction



presentation outline

- **ford hall façade**
 - lighting design
- **rehearsal room**
 - system comparison
 - lighting design
 - acoustic analysis
- **corridor**
 - lighting design

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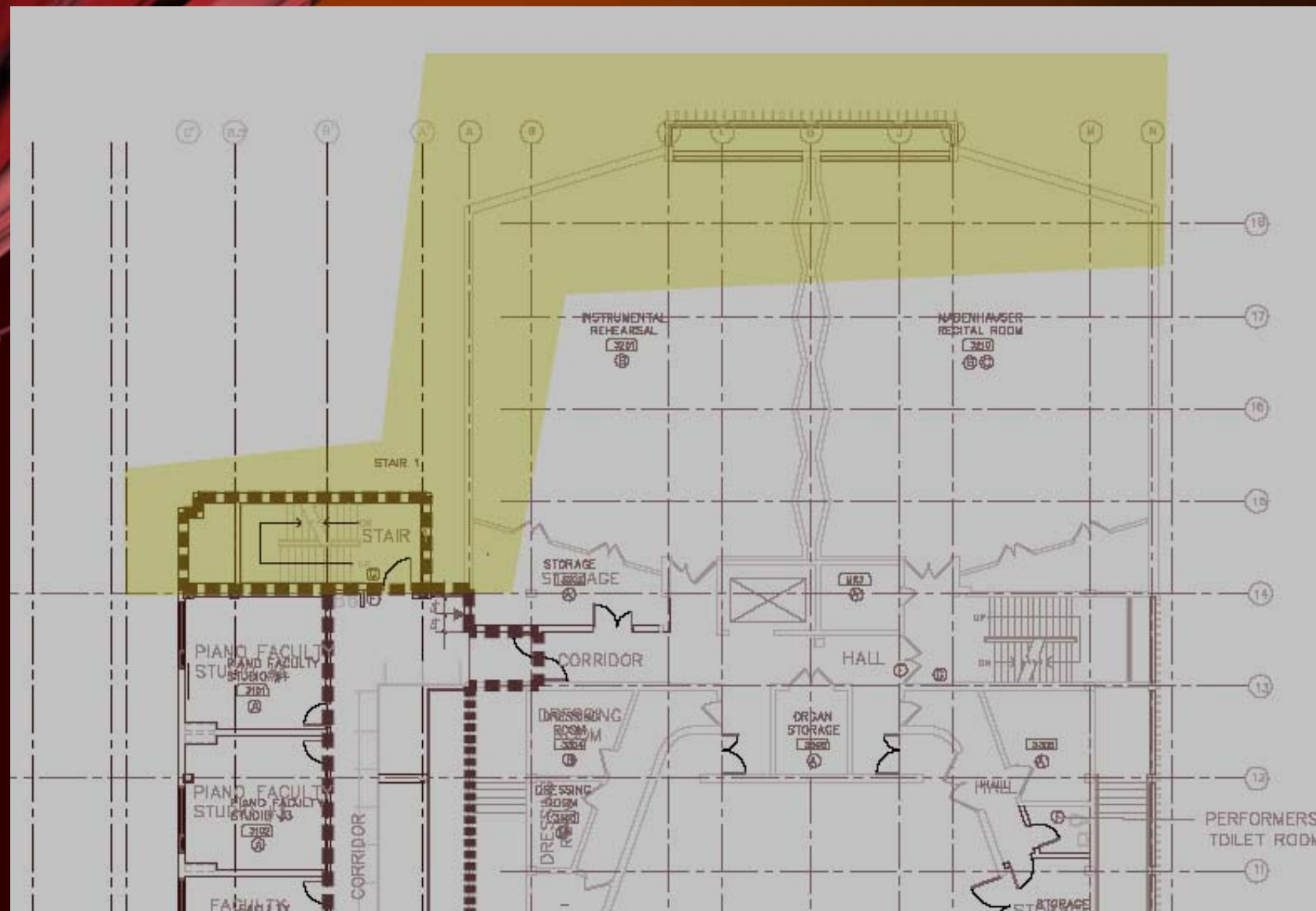
exclusions

- electrical system design
- recital hall lighting design
- structural breadth
- more information at my CPEP
 - <http://www.arche.psu.edu/thesis/2004/bmh157>

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exterior



exterior





exterior

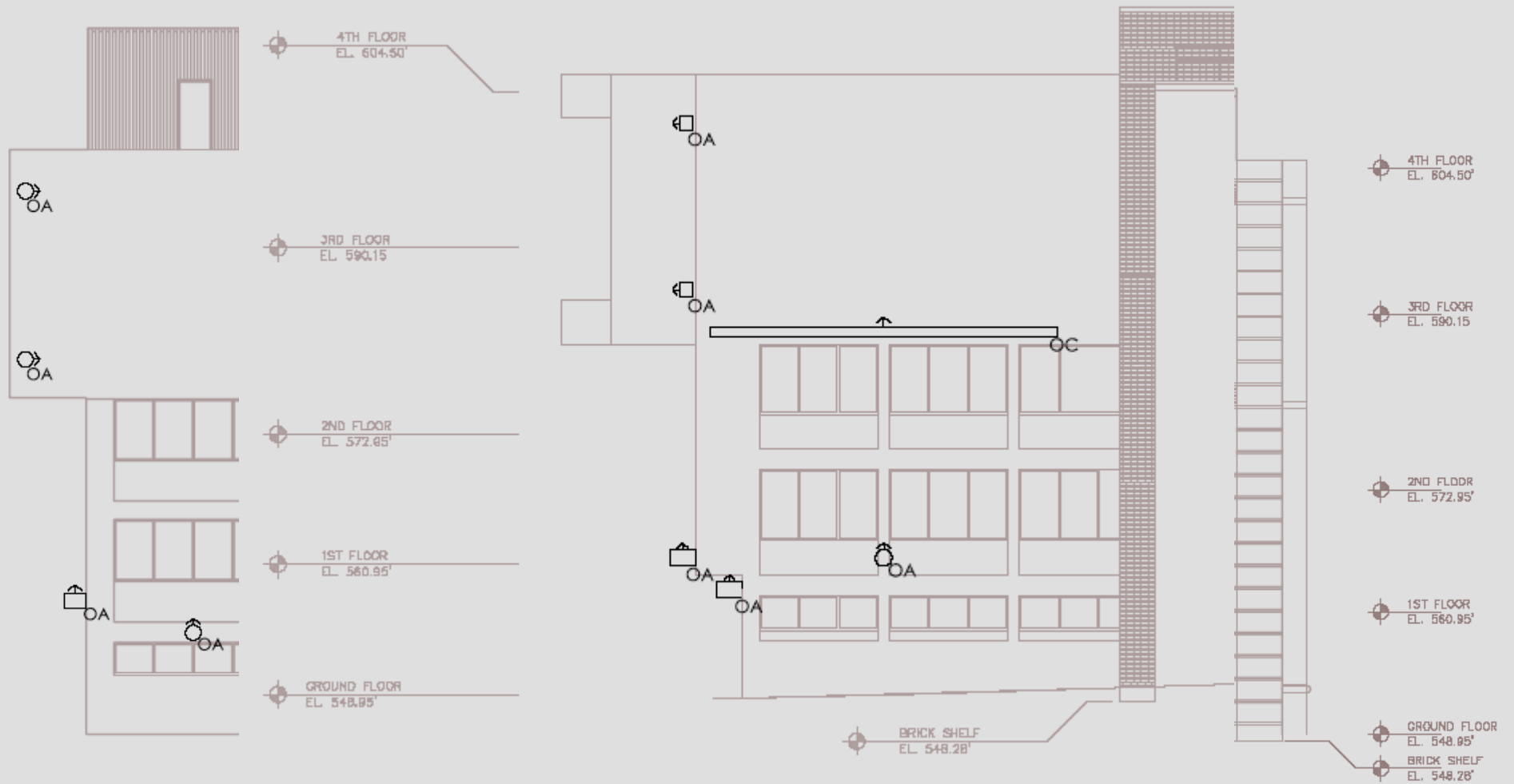
icon

stability

attraction

context

exterior



WEST ELEVATION

ASHRAE/IESNA 90.1-1999 Compliance Façade Illumination (9.3.2)

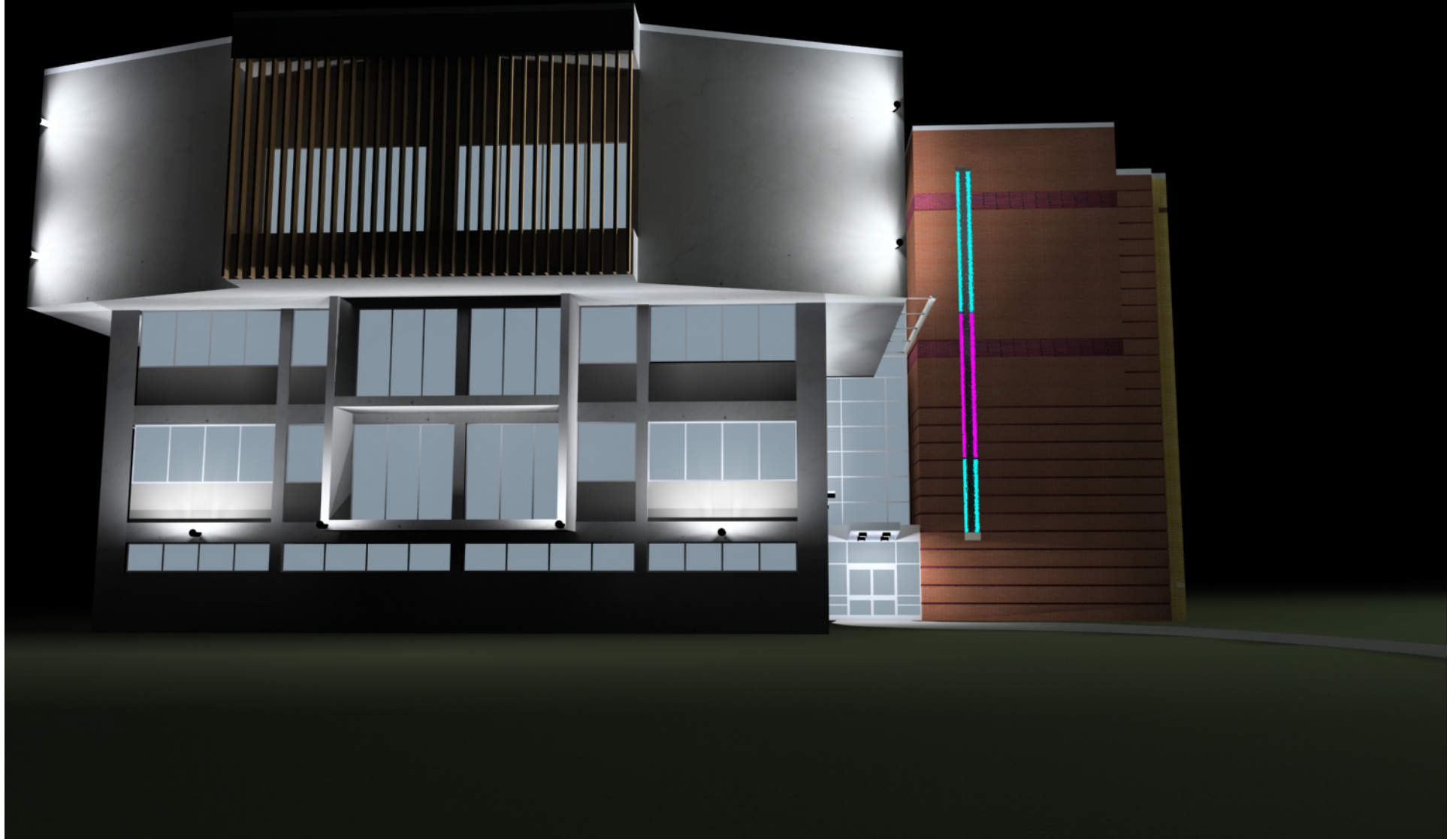
Area Illuminated	9500	sf
Allowed Density	0.25	W/sf
Allowed Wattage	2375	W
Luminaire Count	12	ea
Ballast Input Watts	185	W
Actual Wattage	2220	W
Actual Density	0.23	W/sf
% Difference	6.53	% Below 90.1

Canopied Illumination (9.3.2)

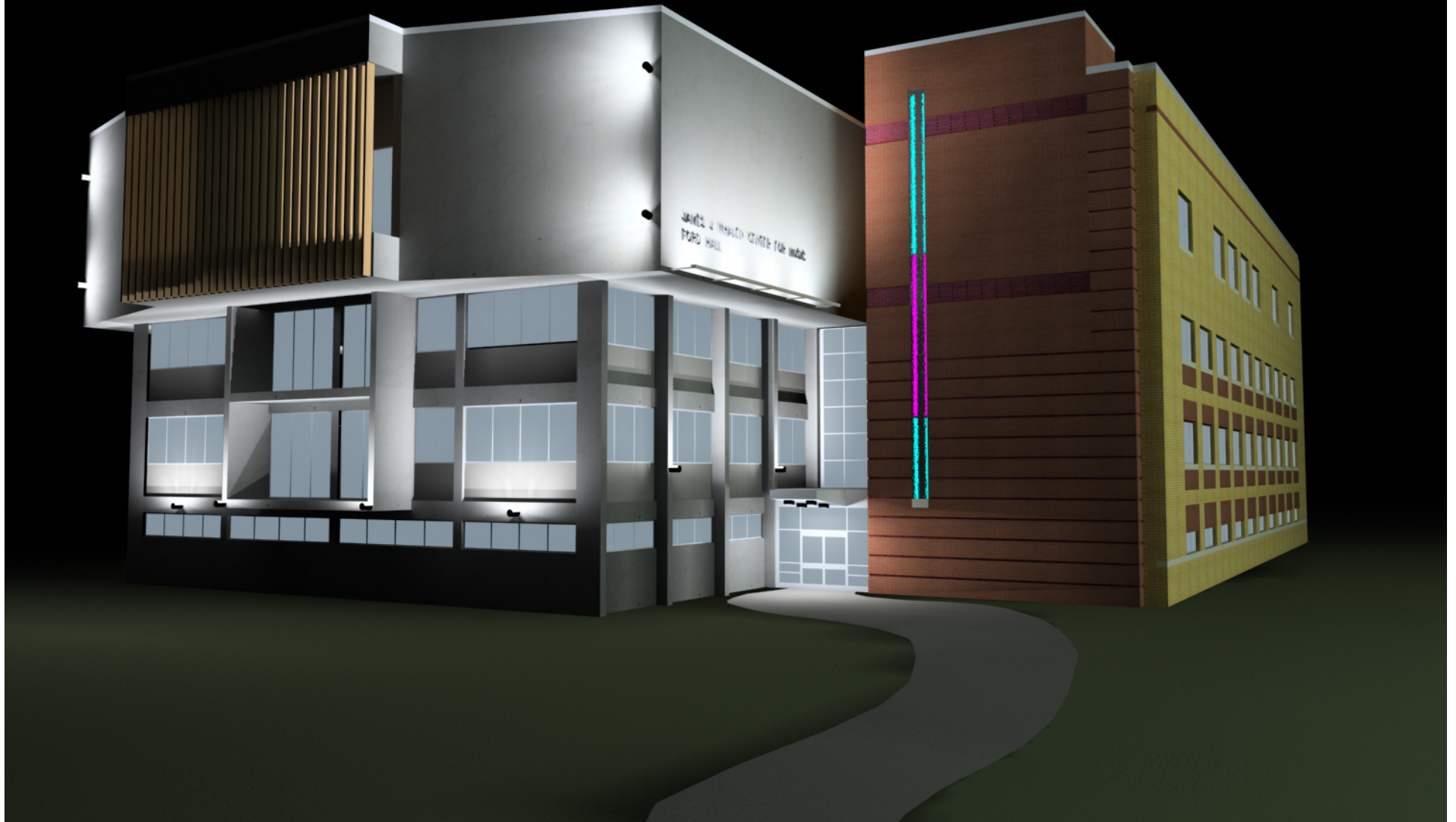
Canopy Area	48	sf
Allowed Density	3	W/sf
Allowed Wattage	144	W
Luminaire Count	4	ea
Ballast Input Watts	27	W
Actual Wattage	108	W
Actual Density	2.25	W/sf
% Difference	25.00	% Below 90.1

Advertising/Sign Lighting Exempt 9.2.3(c)

exterior



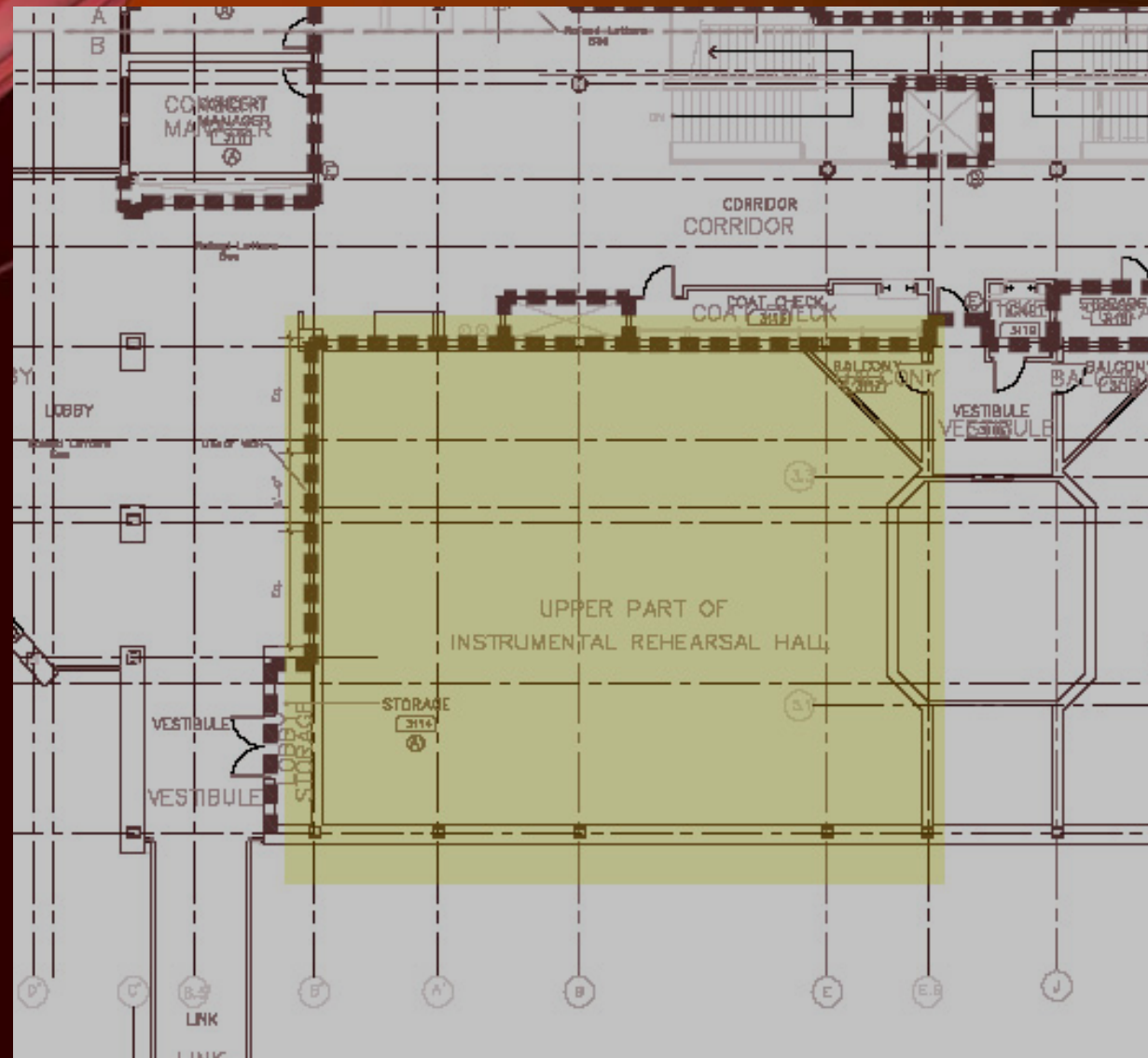
exterior



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open



open



An abstract architectural rendering featuring a dark background with a prominent red, faceted geometric structure on the left side. A horizontal orange band runs across the middle. The word "open" is written in yellow in the top right corner. Below it, the words "detail", "function", "mood", and "daylight" are written in white, arranged in a staggered, overlapping layout.

open

detail

function

mood

daylight

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open

DESIGN COMPARISON

lightshelf
vs.
skylights

March 21, Clear Sky, 12:00 PM



SKYLIGHTS



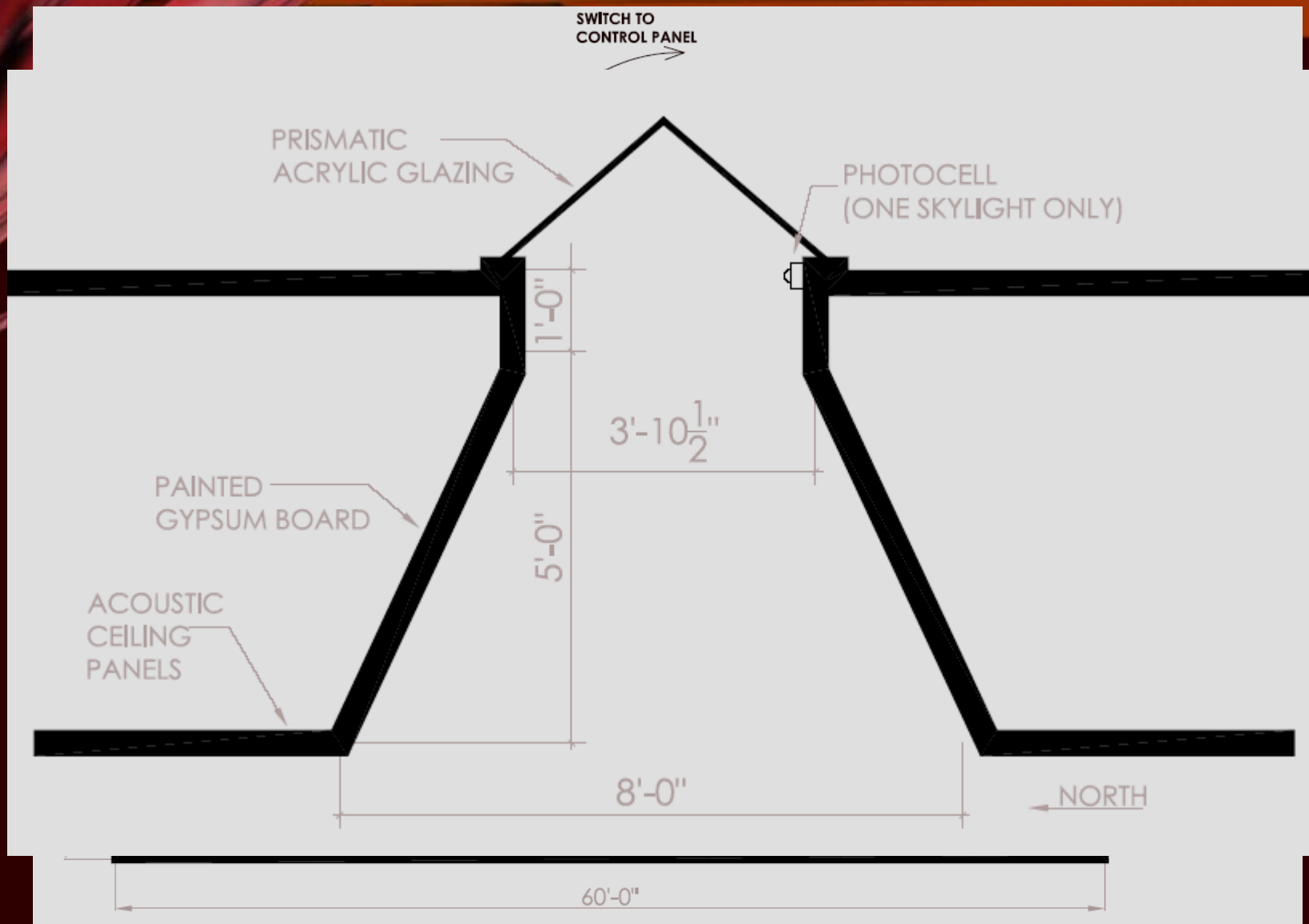
LIGHTSHELF

144glazing area.....	244
975 luxavailable daylight.....	366 lux
65%daylight well efficiency.....	47%

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open



	% Electric Lighting Output	Dimmed Power Density	Yearly %	Monthly %	Weighted Power Density
jan+s	0.04	0.06	0.25	0.16129	0.002499
jan+i	0.63	0.46	0.25	0.258065	0.02949
jan-c	0.82	0.59	0.25	0.580645	0.085278
mar+s	0.00	0.04	0.5	0.193548	0.003435
mar+i	0.43	0.32	0.5	0.258065	0.041608
mar-c	0.71	0.52	0.5	0.548387	0.141789
may+s	0.00	0.04	0.25	0.166667	0.001479
may+i	0.50	0.37	0.25	0.3	0.027941
may-c	0.55	0.41	0.25	0.533333	0.054383
Average Dimmed Noon Power Density					0.39 W/sf
Non-Dimmed Power Density					0.72 W/sf

+s = clear sky

+i = partly cloudy sky

-c = cloudy sky

ASHRAE/IESNA 90.1-1999 Compliance University Classroom (9.3.1.2)

Room Area	2850	sf
Allowed Density	1.6	W/sf
Allowed Wattage	4560	W
Luminaire Count	41	ea
Ballast Input Watts	50	W
Actual Wattage	2050	W
Actual Density	0.72	W/sf
% Difference	55.04	% Below 90.1



open

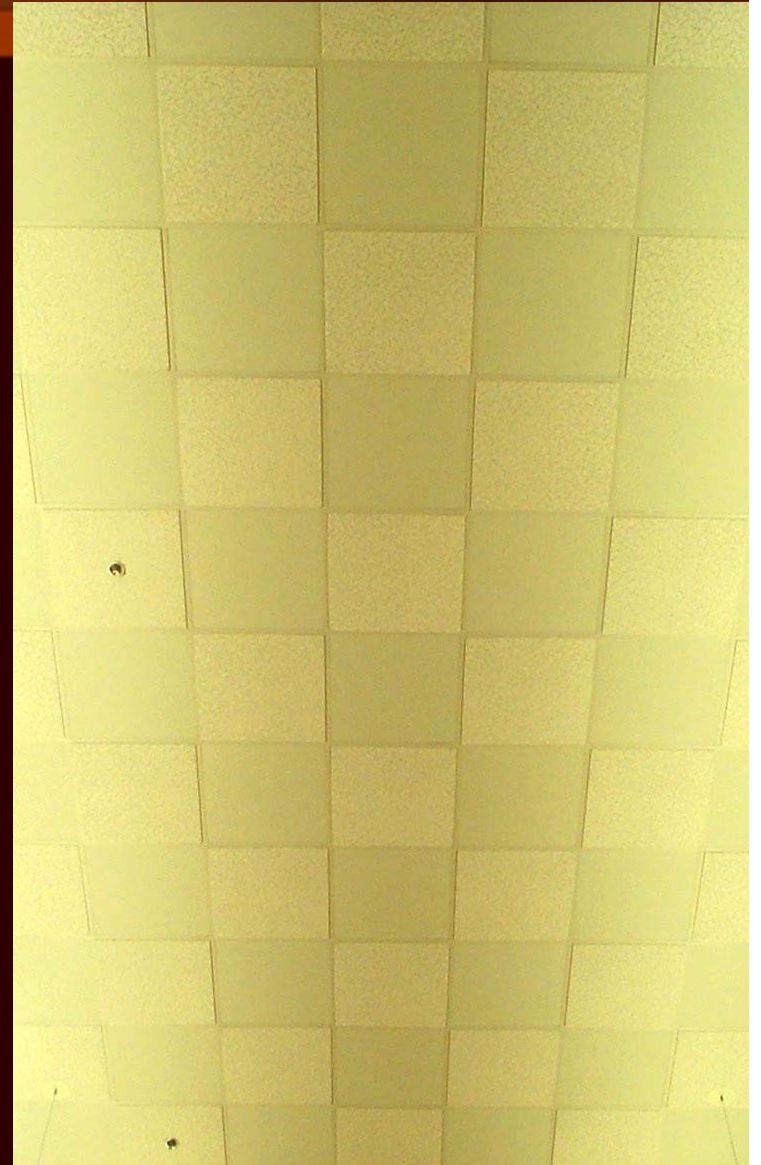


open

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- acoustic sensitivity
 - daylight glazing likely avoided for acoustic reasons
- reverberation time
 - 0.8 seconds – Classroom
 - 1.8 seconds – Concert Hall
 - 0.5 seconds – Recording Studio
- existing 'checkerboard' pattern in ceiling tiles of alternating ACP and gypsum



- approach
 - Sabine equation, only if $\alpha < .2$ (very live)
 - Eyring equation;

$$T_{60} = \frac{55.2 * V}{c * S * \ln(1 - \overline{\alpha}_{sab})^{-1}}$$

$$\overline{\alpha}_{sab} = \frac{\sum (S_i * \alpha_i)}{\sum S_i}$$

T_{60} = reverberation time

V = room volume

c = speed of sound

S = total surface area

$\overline{\alpha}_{sab}$ = sabine absorption coefficient

No Curtains - Before Skylights

 $\Sigma S\alpha$ by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
2613.363	2822.974	3199.281	3919.984	4213.05	4223.986

 ΣS 11518.37 α avg. by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
0.226886	0.245084	0.277755	0.340324	0.365768	0.366717

T60 by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1.139833	1.043262	0.901418	0.705066	0.644162	0.642049

 α avg. 0.303756

T60 avg 0.810133 seconds

No Curtains - With Skylights

 $\Sigma S\alpha$ by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
2836.407	2935.816	3298.882	4027.907	4313.127	4330.593

 ΣS 12413.67 α avg. by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
0.228491	0.236499	0.265746	0.324473	0.34745	0.348857

T60 by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1.049158	1.00859	0.881056	0.693816	0.637572	0.634364

 α avg. 0.291919

T60 avg 0.81143 seconds

Curtains Drawn - Before Skylights

 $\Sigma S\alpha$ by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
2728.963	3689.974	4615.381	5798.484	5975.95	5871.286

 ΣS 11518.37 α avg. by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
0.236923	0.320356	0.400697	0.503412	0.518819	0.509732

T60 by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1.084753	0.759512	0.572889	0.419022	0.400968	0.411491

 α avg. 0.41499

T60 avg 0.547097 seconds

Curtains Drawn - With Skylights

 $\Sigma S\alpha$ by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
2952.007	3802.816	4714.982	5906.407	6076.027	5977.893

 ΣS 12413.67 α avg. by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
0.237803	0.306341	0.379822	0.475799	0.489463	0.481557

T60 by Frequency

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
1.00224	0.74406	0.569669	0.421376	0.404822	0.414291

 α avg. 0.395131

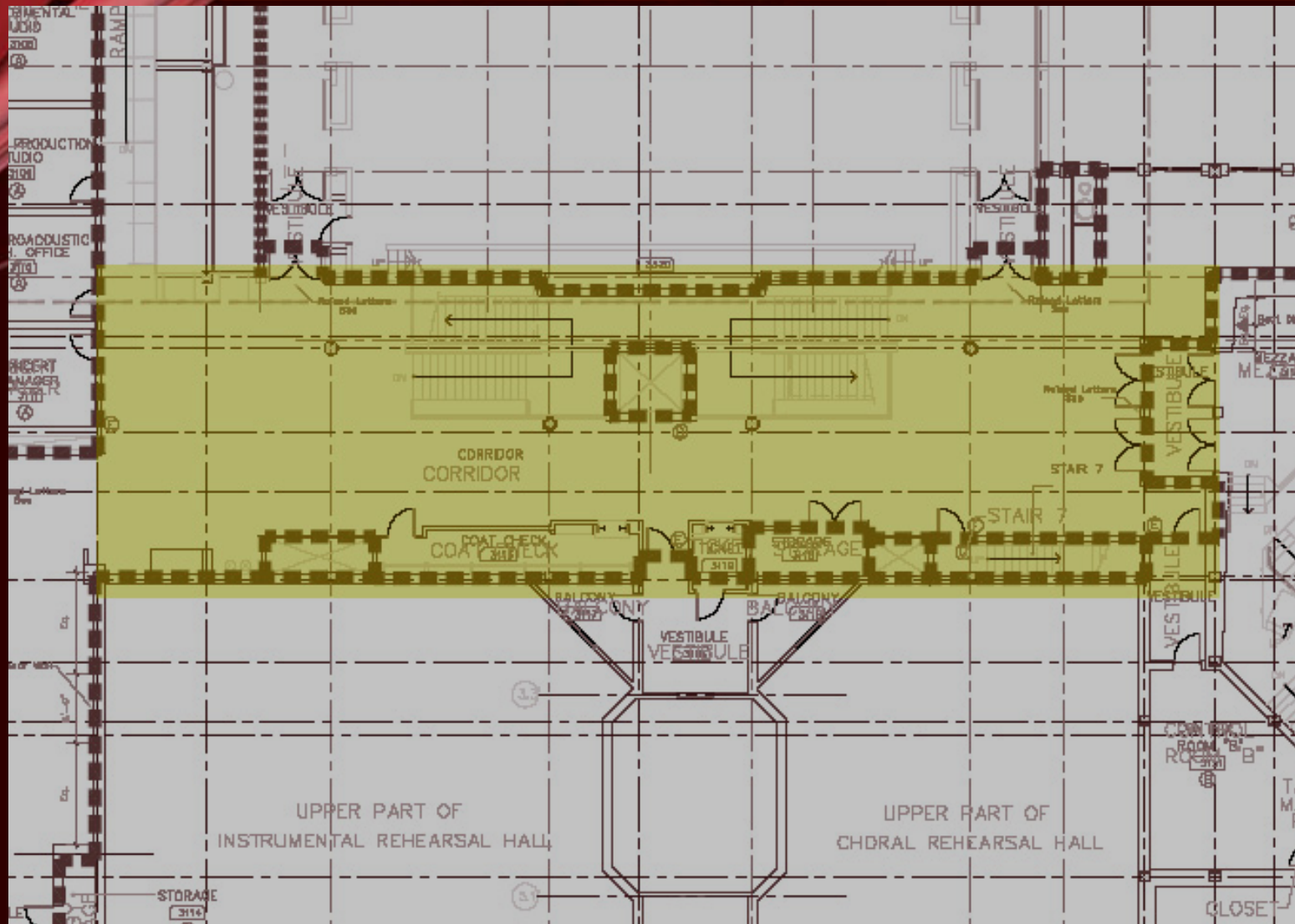
T60 avg 0.55715 seconds

- even with ceiling tile adjustment, reverberation time still slightly longer
- noticeable difference in reverberation time around 0.1 seconds
- no noticeable difference in acoustic properties of room if remaining drop ceiling area filled with ACP

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circulation



circulation





circulation

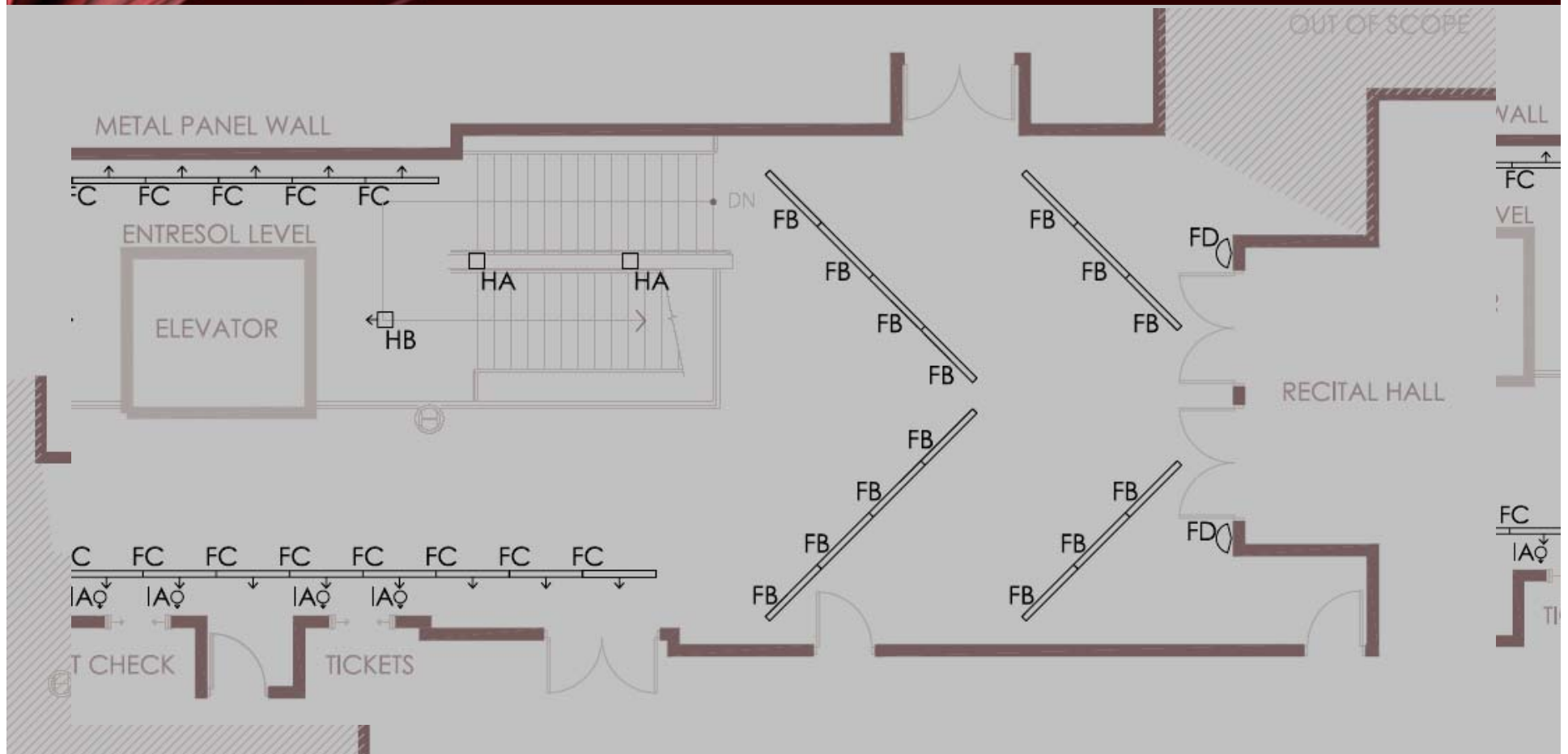
duty

paths

anticipation

architecture

circulation – 3rd floor plan



circulation

ASHRAE/IESNA 90.1-1999 Compliance

University Corridor (9.3.1.2)

Performing Arts Center Lobby (9.3.1.2)

Corridor Area	4030	sf
Lobby Area	2885	sf
Corridor Allowed Density	0.7	W/sf
Lobby Allowed Density	1.2	W/sf
Total Allowed Wattage	6283	W
Luminaire FB	65	ea
FB Input Watts	33	W
Luminaire FC	45	ea
FC Input Watts	33	W
Luminaire FD	11	ea
FD Input Watts	34	W
Luminaire IA	11	ea
IA Input Watts	20	W
Luminaire HA	4	ea
HA Input Watts	94	W
Luminaire HB	2	ea
HB Input Watts	88	W
Total Wattage	4776	W
Total Density	0.69	W/sf
% Difference	23.99	% Below 90.1

circulation



circulation





summary

summary

- ford façade presence
- daylight integration
- balance

appreciation

- Dr. Mistrick
- Dr. Moeck

- Roommates Dave & Jackson
- AE Faculty & Staff
- Classmates
- Family



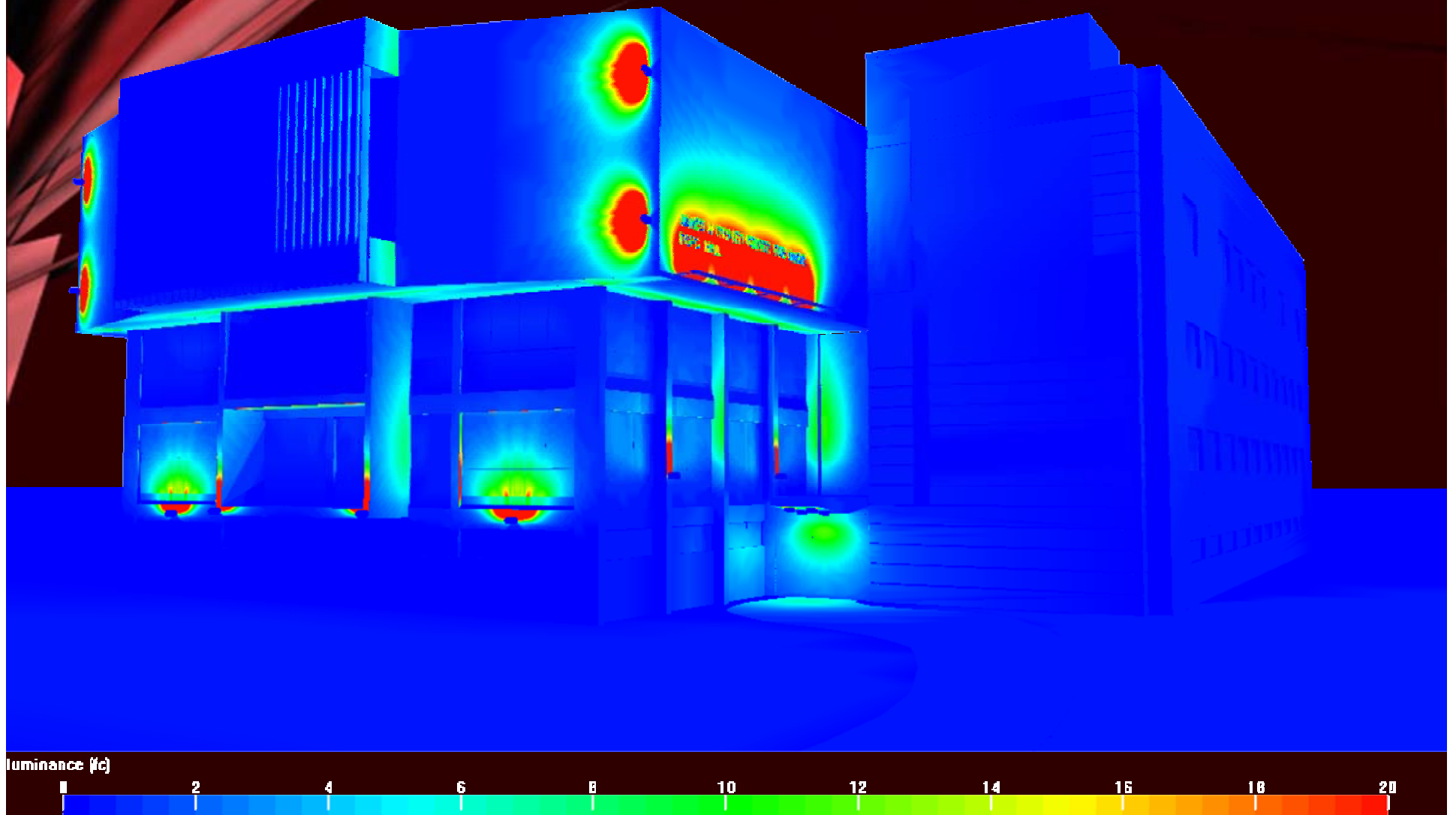


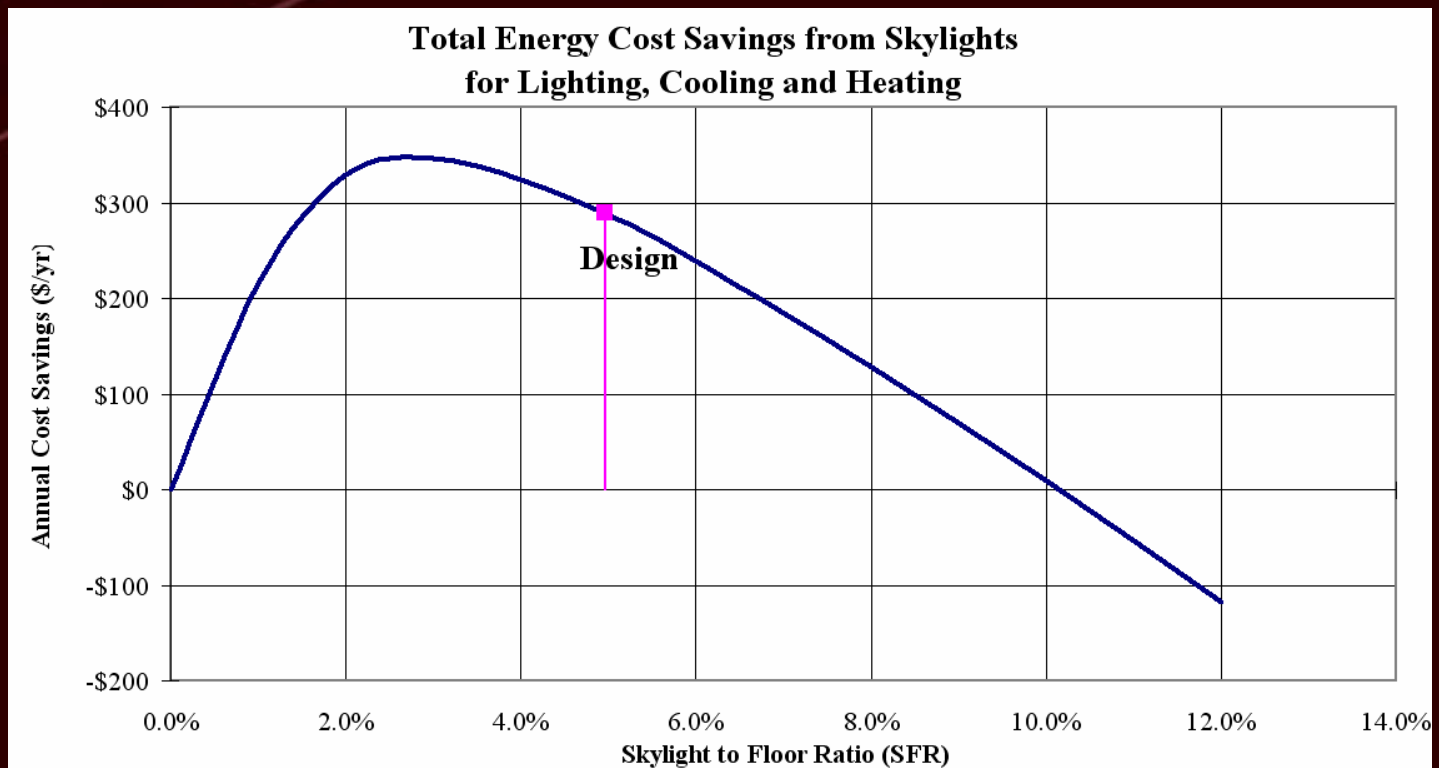
questions?

facility introduction

- 69,000 sf
- \$11.5 million
- Architect and PM
 - HOLT Architects PC, Ithaca, NY
- General Contractor
 - Welliver McGuire, Inc., Elmira, NY
- Electrical/Mechanical Engineer
 - M/E Engineering PC, Rochester, NY
- Structural Engineer
 - Ryan-Biggs Associates, Skaneateles, NY

exterior





graphics

- background image taken from the RA website
 - <http://www.raband.net>



presentation outline

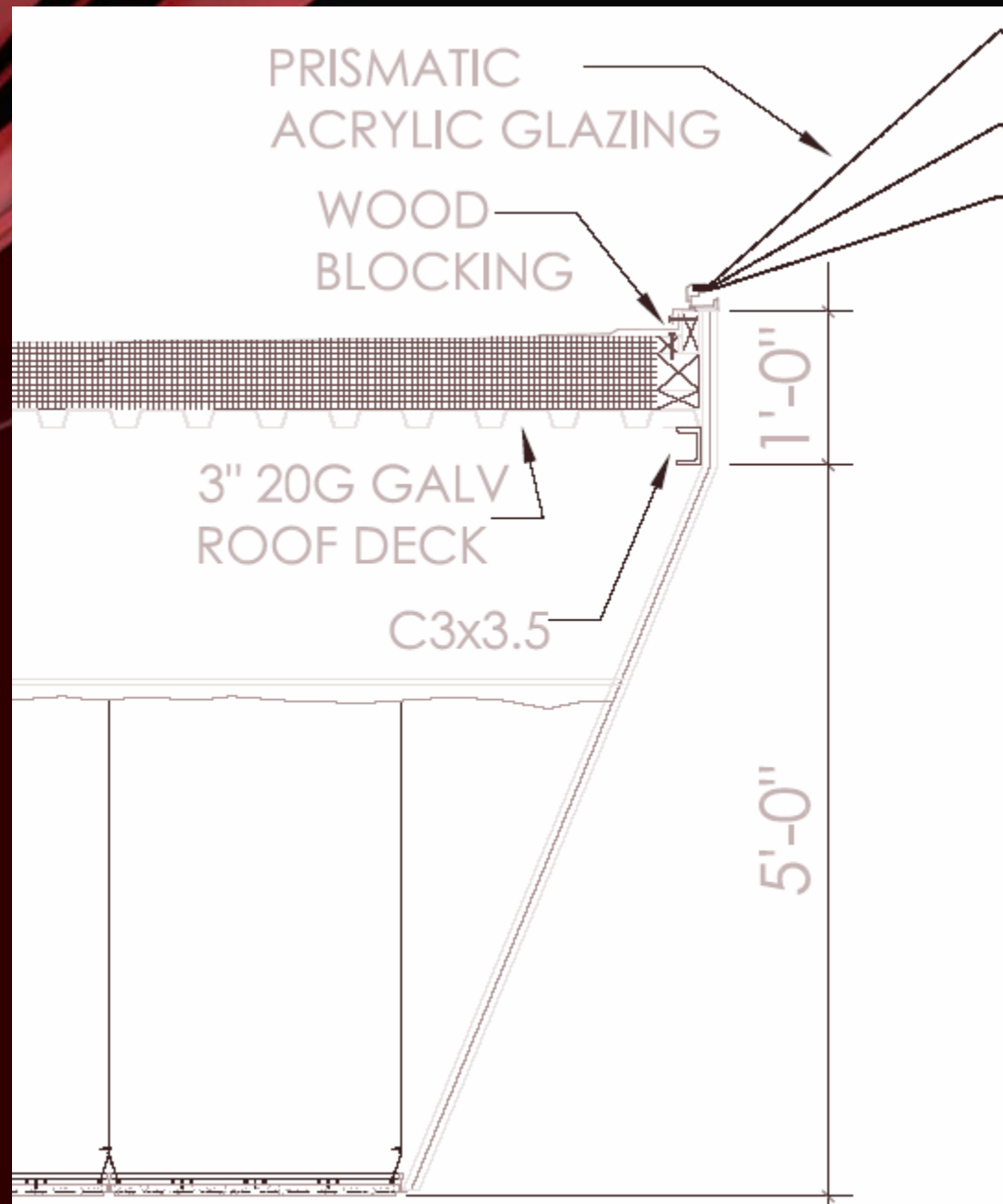
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open

- addition of fabricated skylight units
- framing between beams
- new beam spacing
- new decking spans
- new girder loading

open

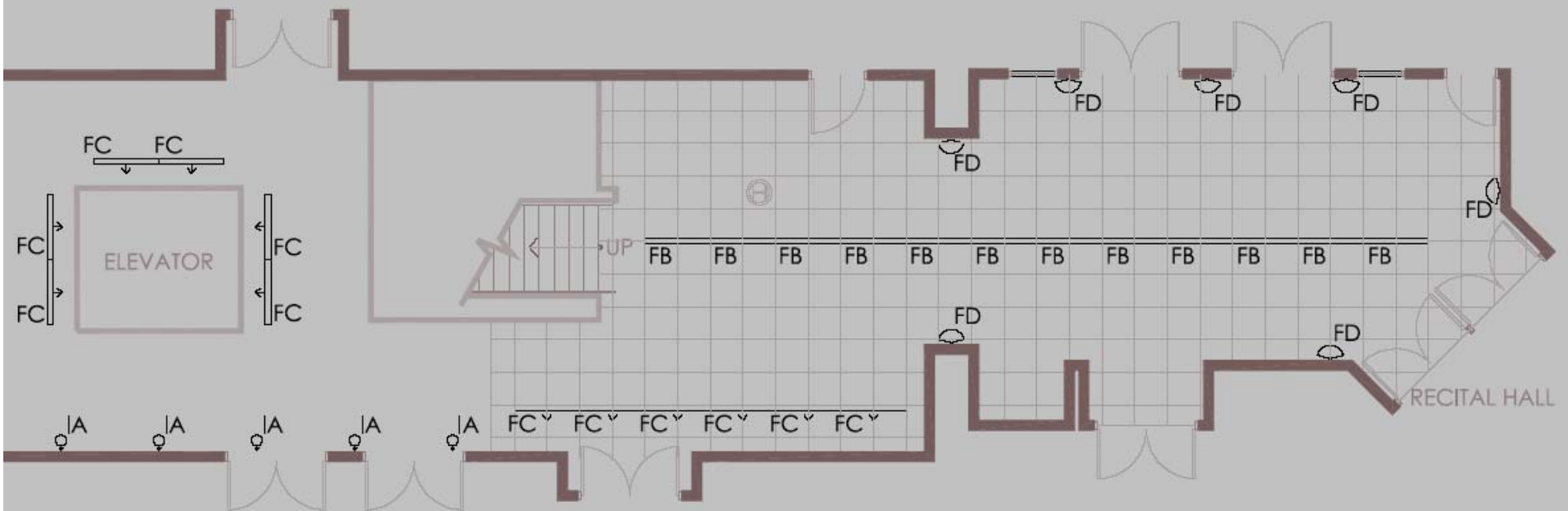




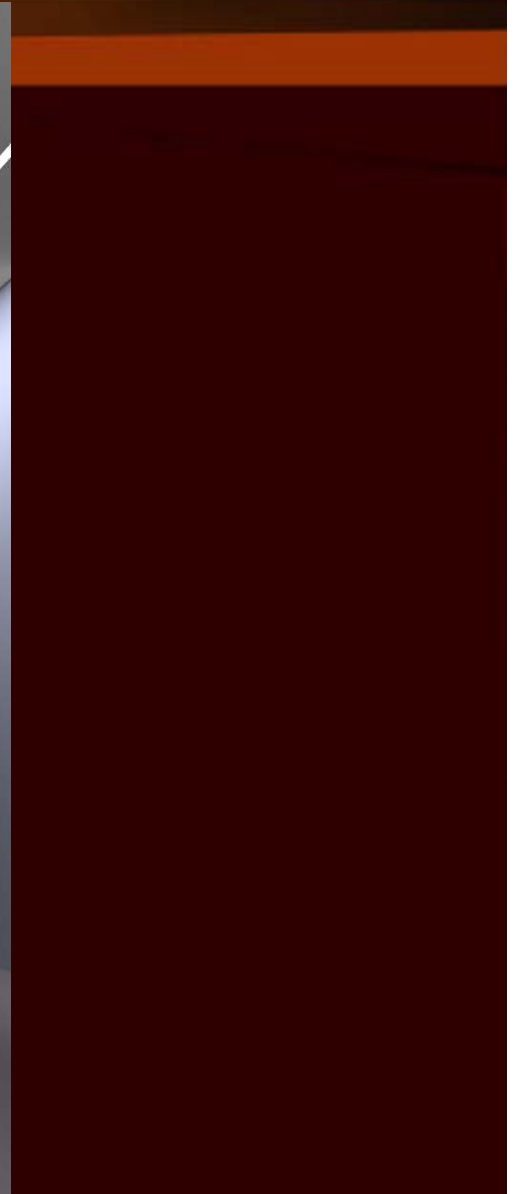
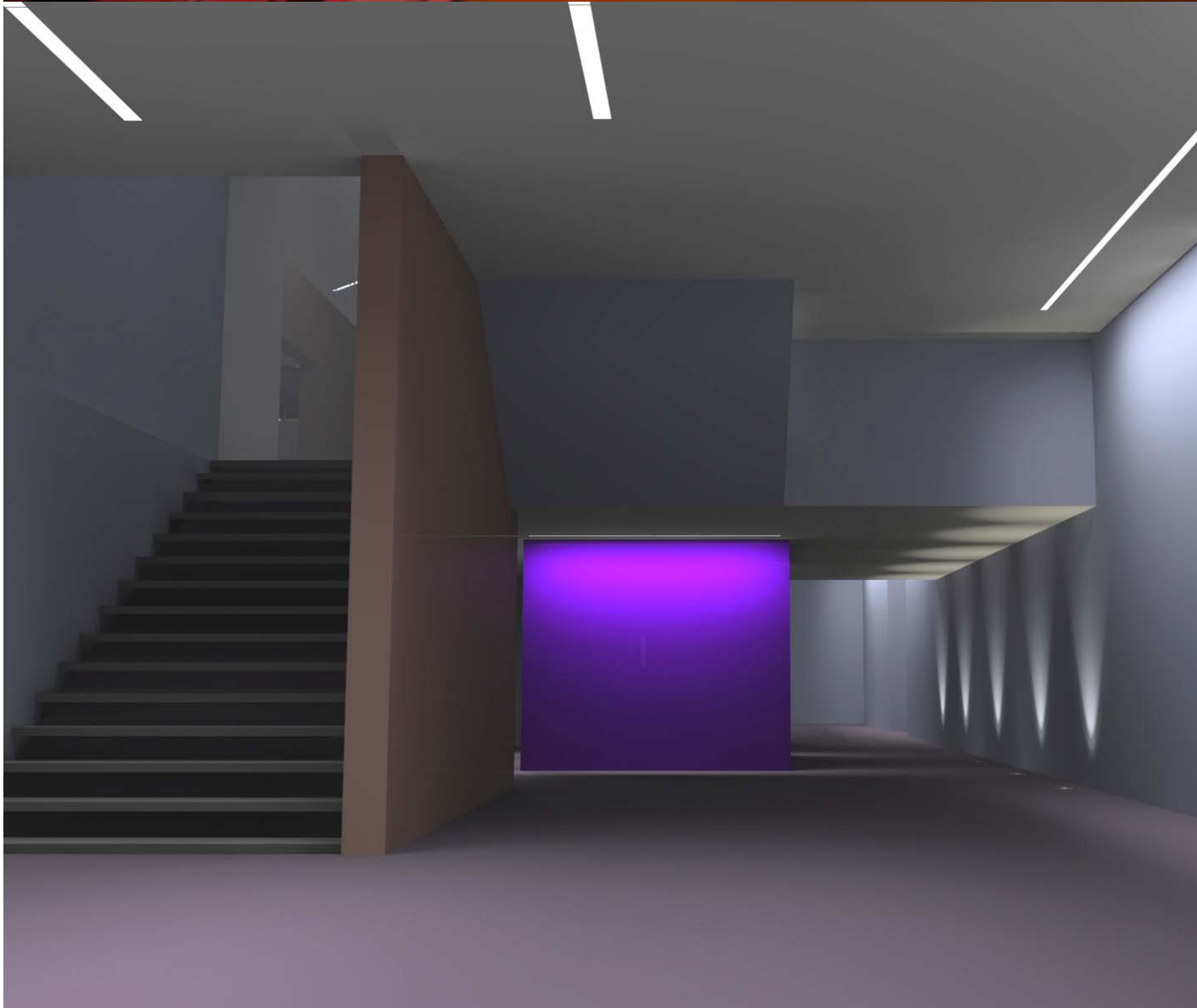
open

- addition of C3x3.5 framing
- beam size unaffected
- girder size unaffected
- critical single 8' span of deck
 - requires 3" 20ga steel roof decking

circulation – 2nd floor plan



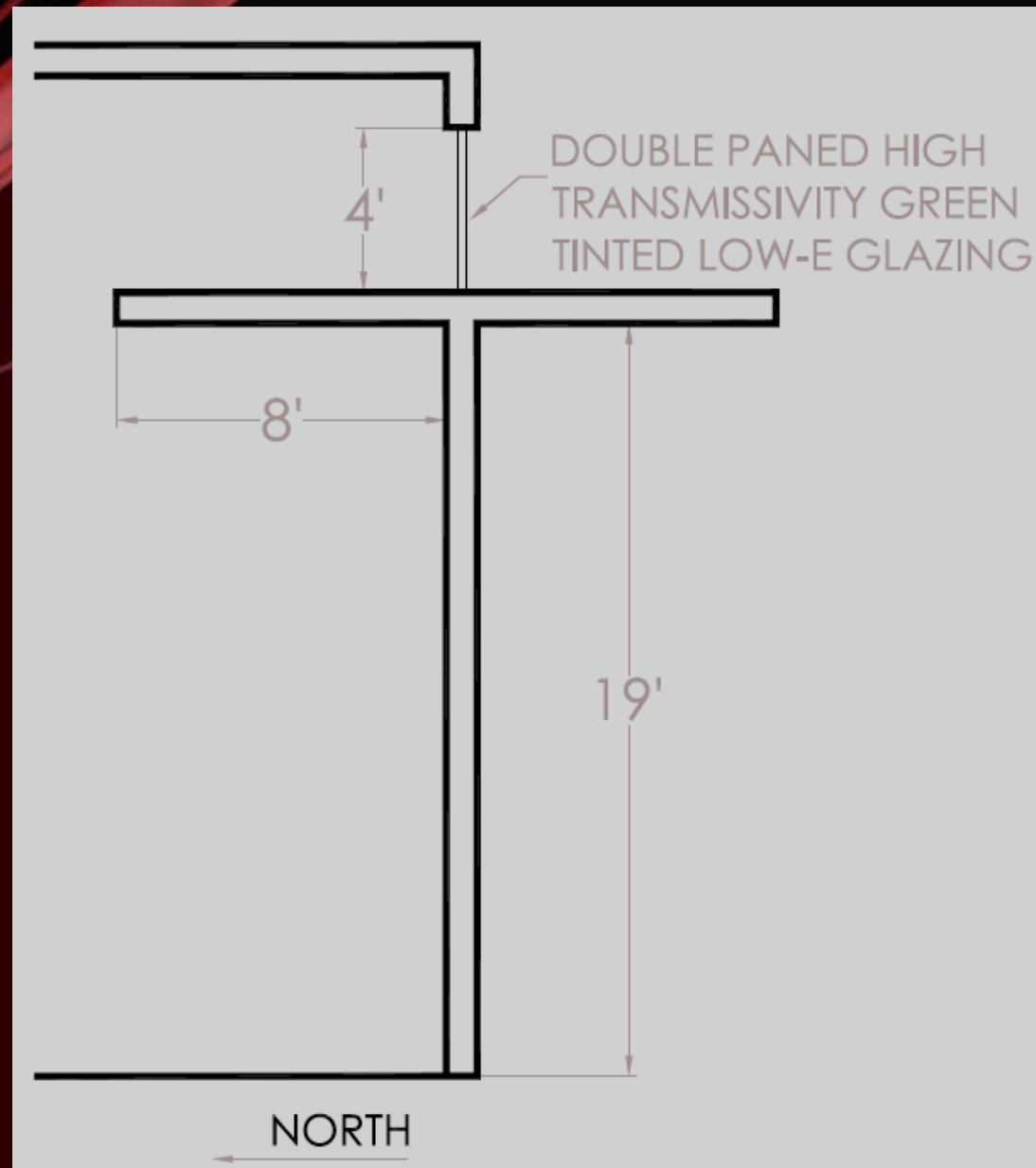
circulation



circulation



open



open

