HALF MOONE CRUISE & CELEBRATION CENTER

Jonathan Walker
Lighting / Electrical Option
4/15/09

Personal Information

- Internship
- Clark Nexsen full-time

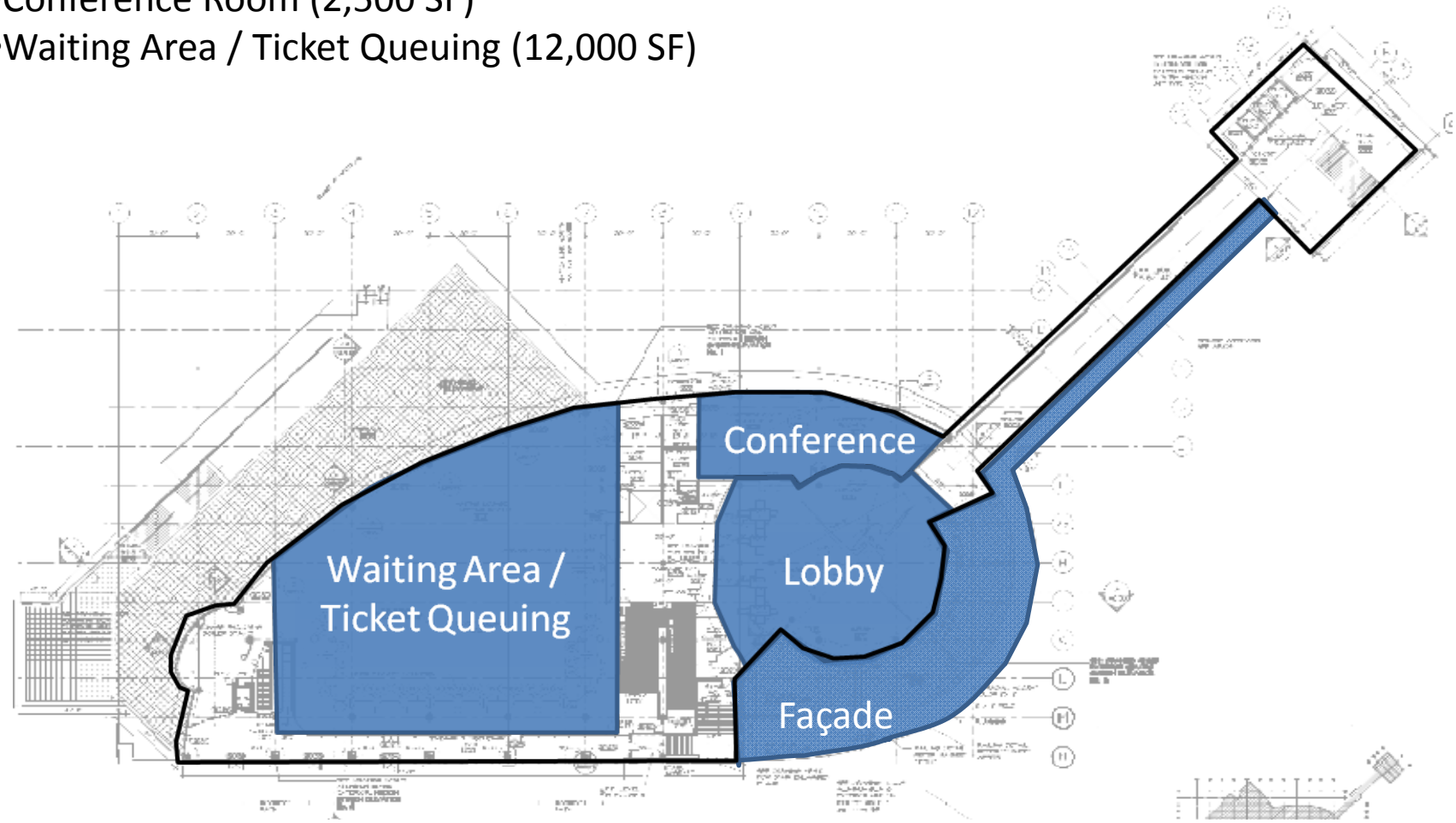
Building and Site Information

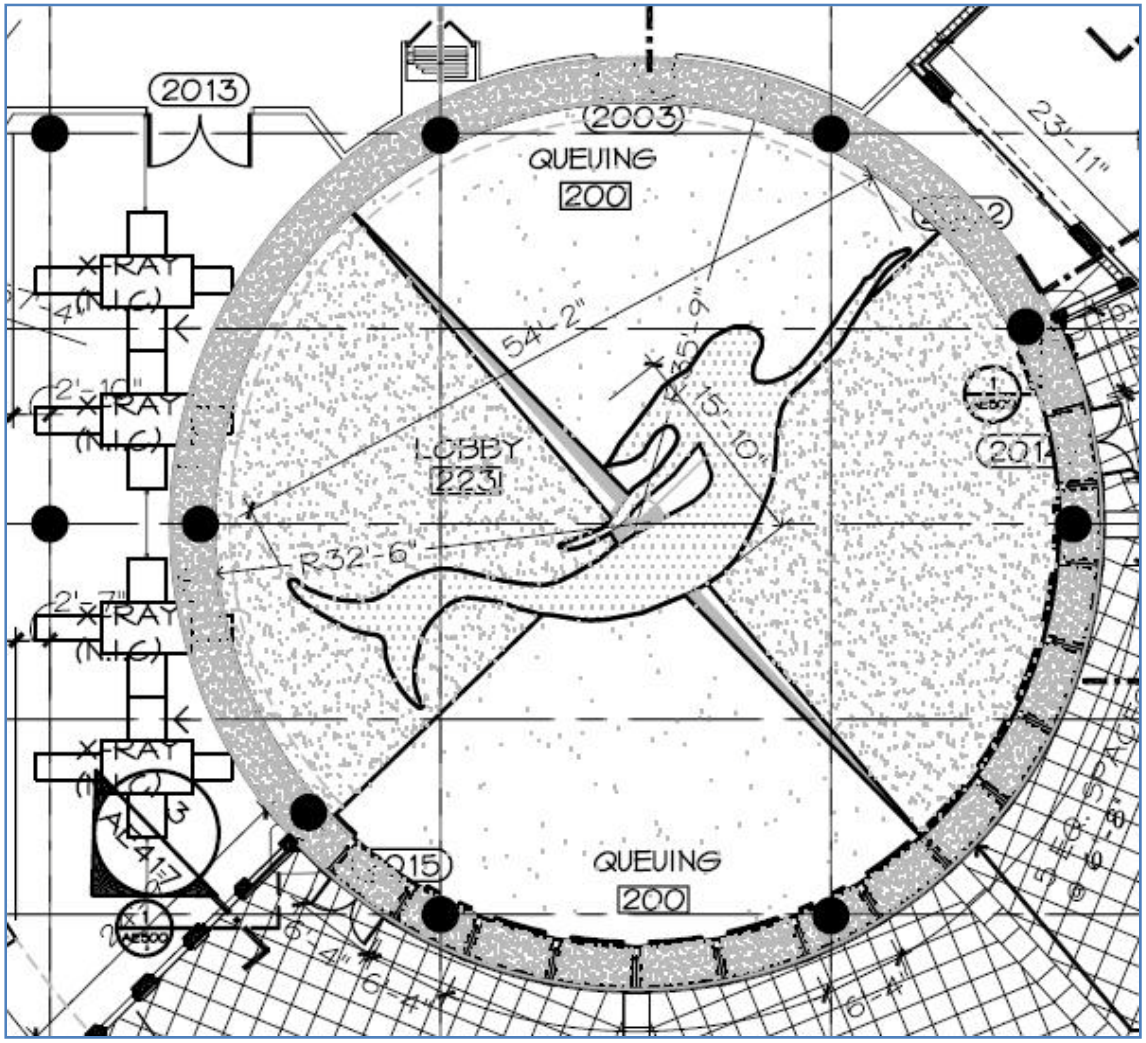
- Norfolk, Virginia
- 89,000 SF
- $21 million
- 2 levels
- Built on pier
- Near Town Point Park

Architectural Context

- Large multi-purpose space
- Cruise terminal
- Relate to the Nauticus

- Lobby (5,300 SF)
- Façade
- Conference Room (2,500 SF)
- Waiting Area / Ticket Queuing (12,000 SF)

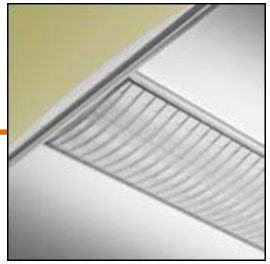




Design Criteria

- Illuminance: 5 fc
- Transition space from outside to inside
- Accent displays on northwest wall
- High CRI
- Psychological Aspects: spacious feeling
- Controls: scene settings

Lobby Lighting



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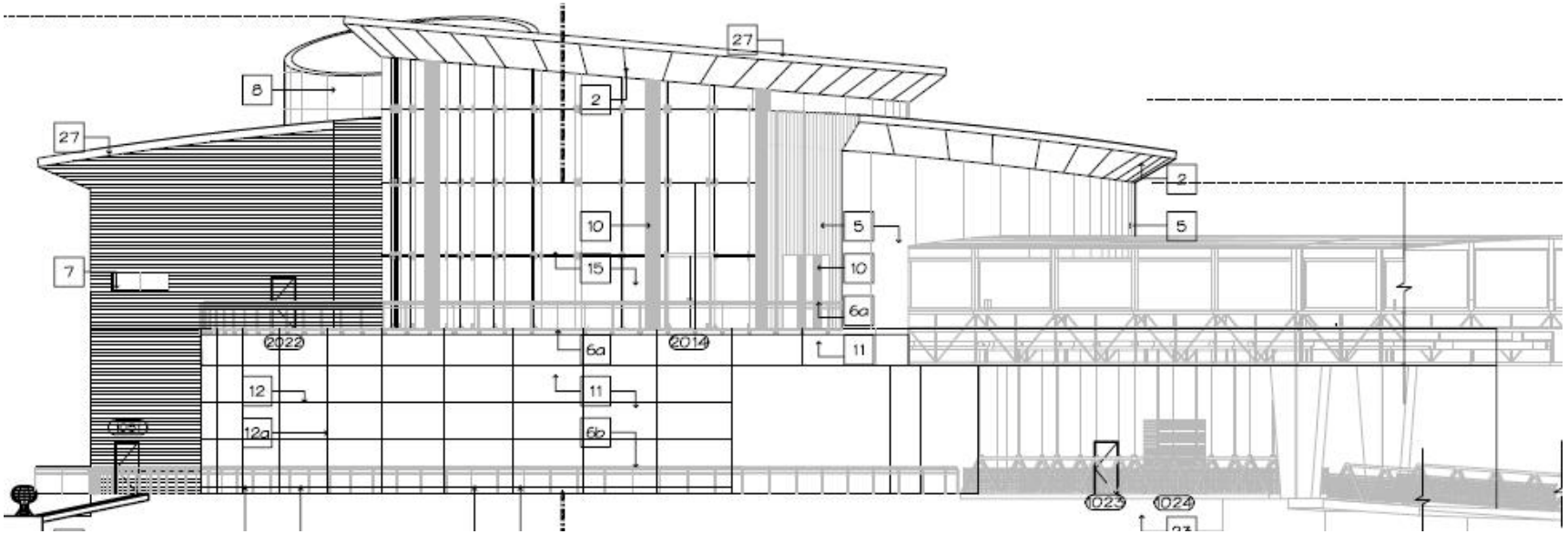
Design Criteria

- Illuminance: Not critical
- Avoid visual clutter
- Emphasize architectural and structural elements
- Transparency to Lobby



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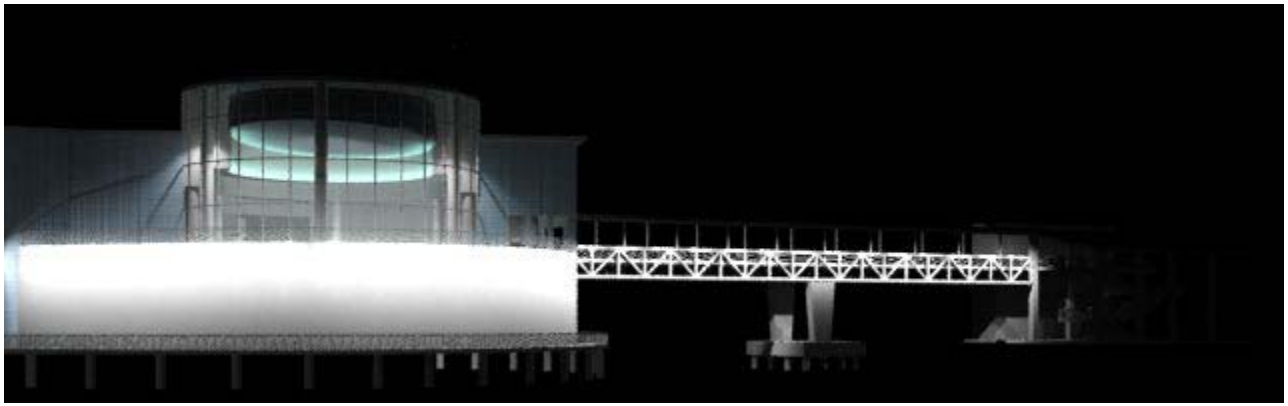

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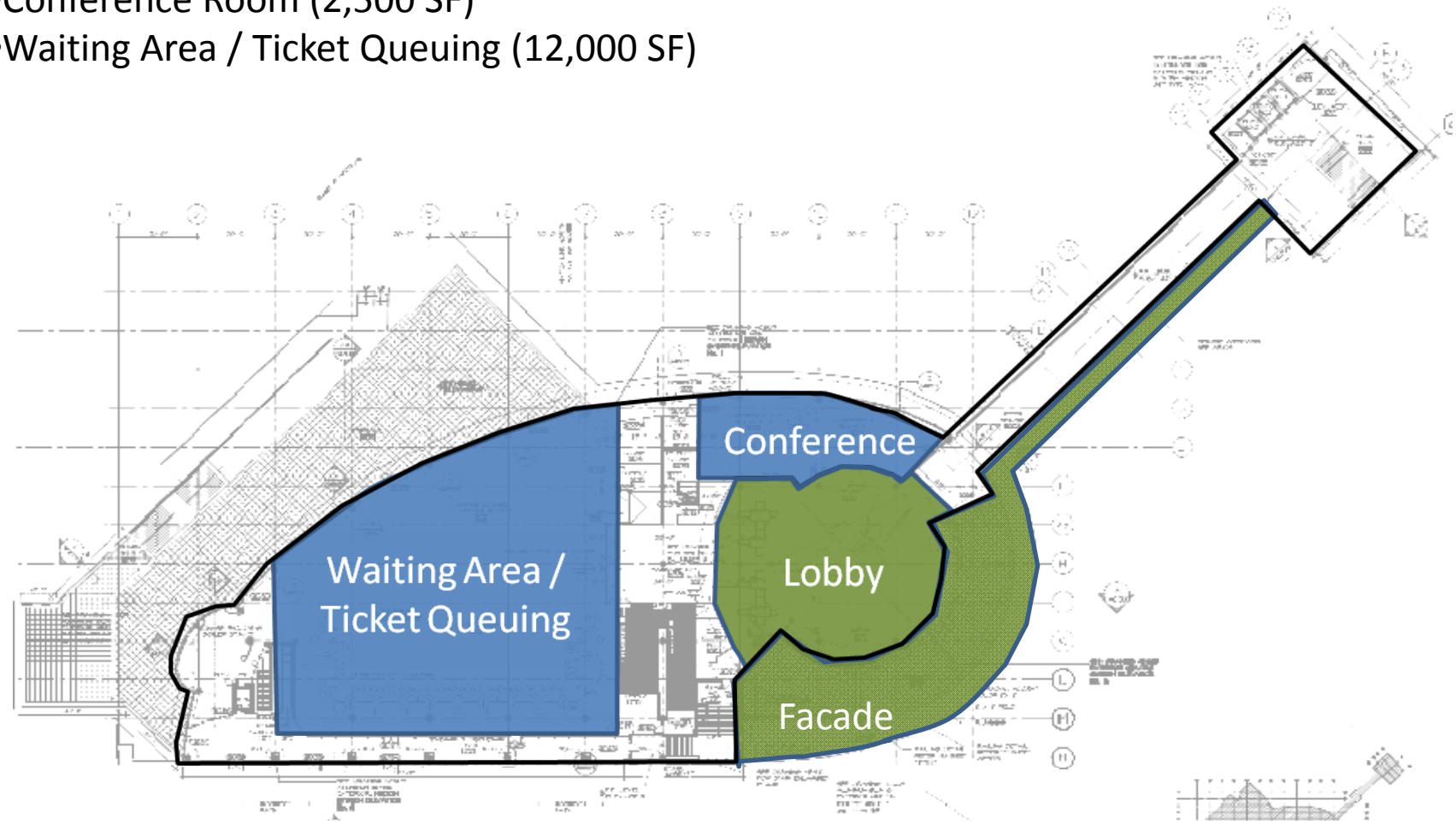

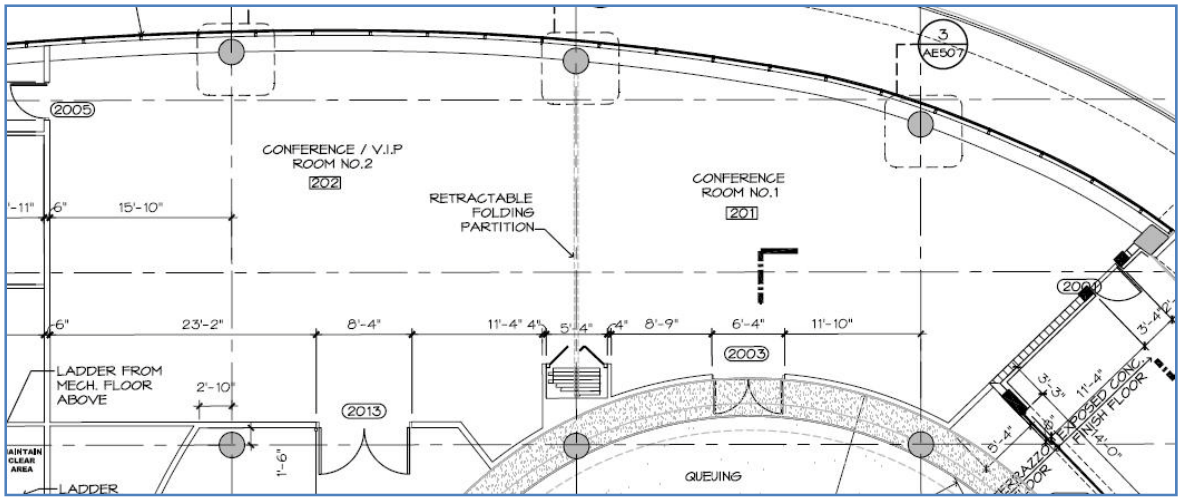

Design Criteria

- Illuminance: 30 fc
- Video performance
- Psychological Aspects: pleasantness
- Visual clarity
- Controls

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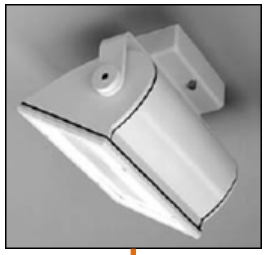
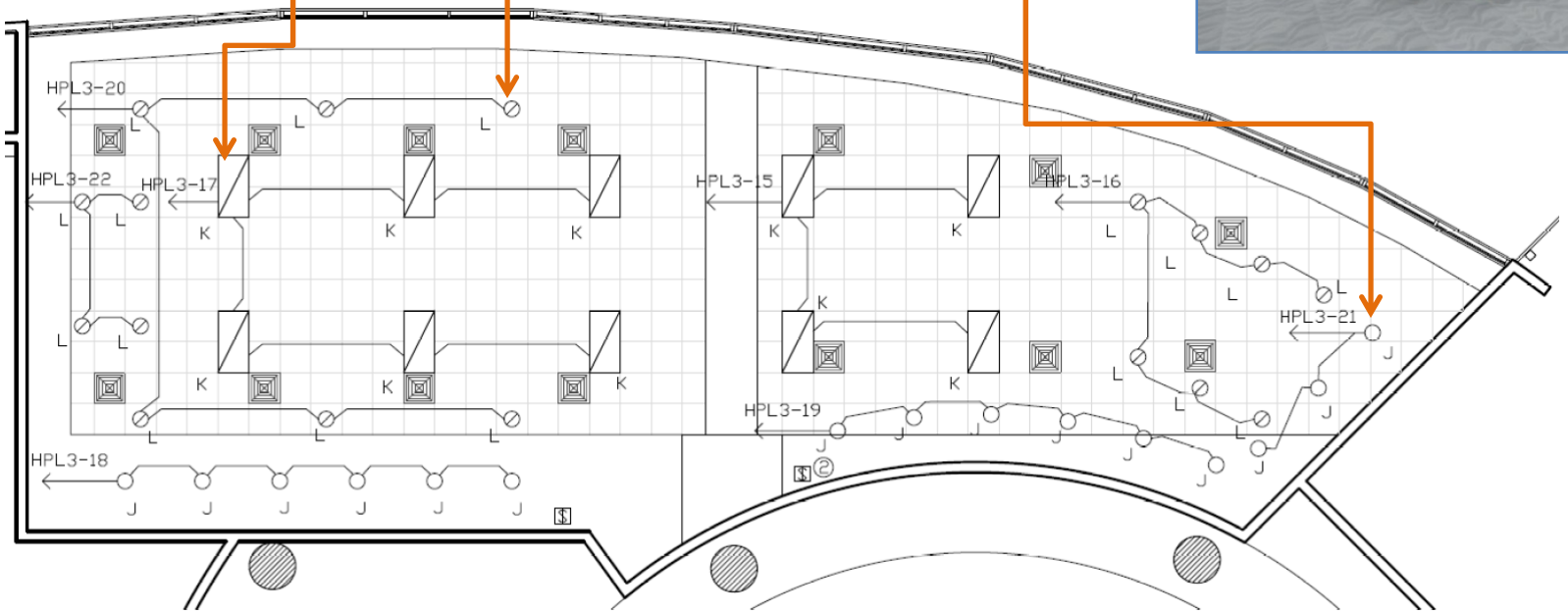
Conference Lighting





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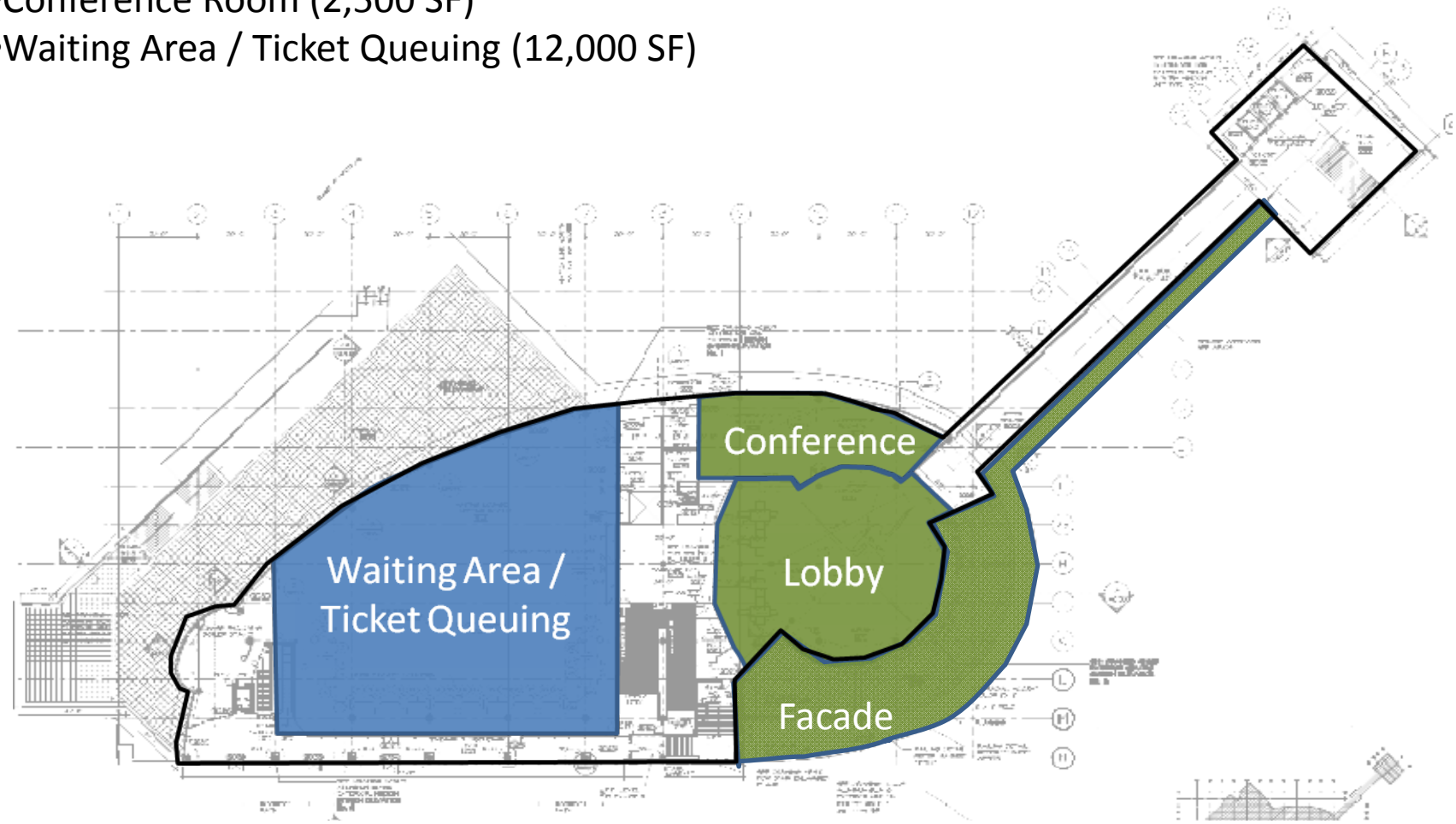
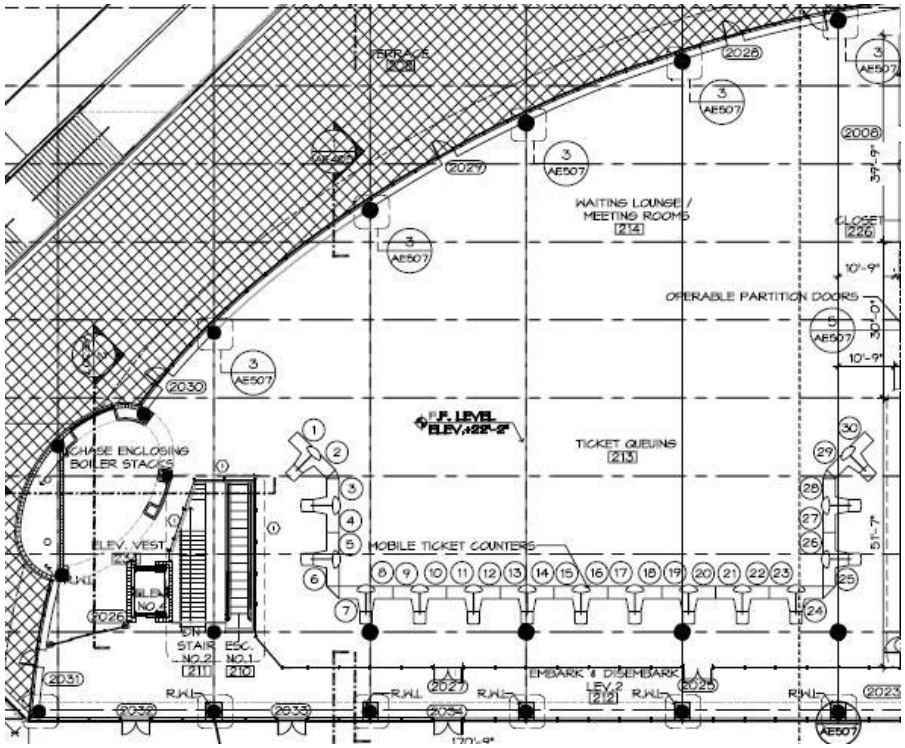
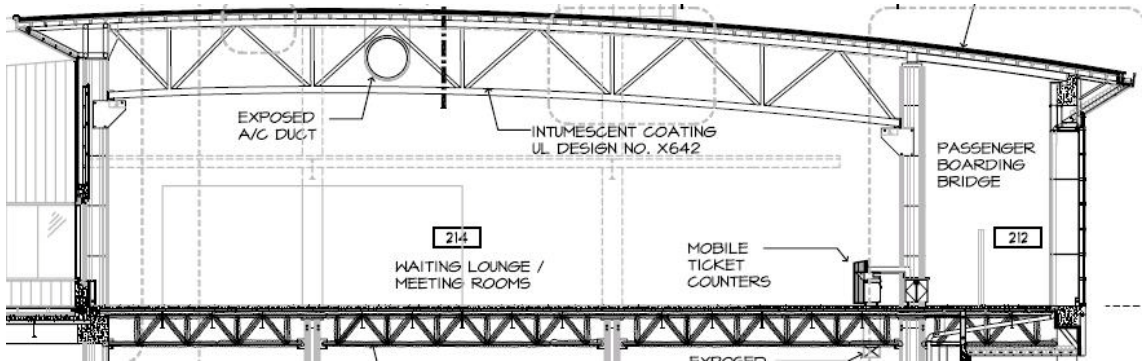


Waiting Area / Ticket Queuing Lighting





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- Illuminance: 30 fc
- Psychological Aspects: spacious and pleasant
- High CRI, medium CCT
- Daylight
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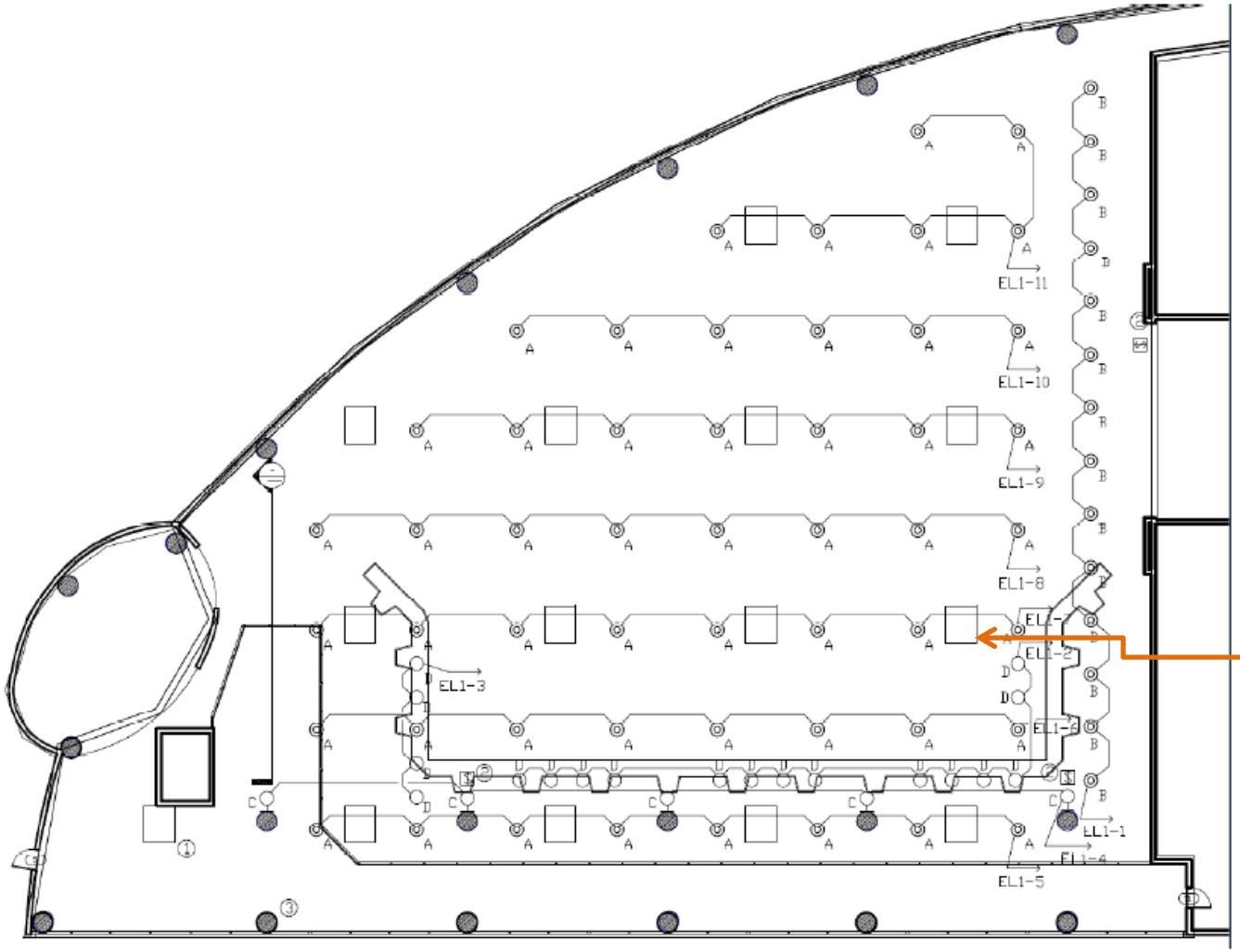
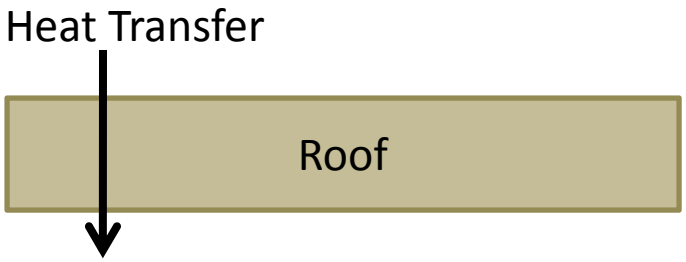


Daylighting

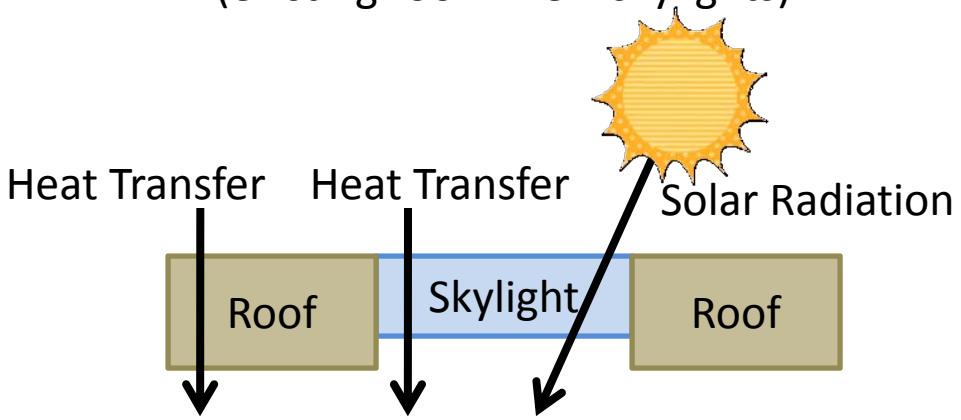
- 15 skylights
- Lighting & Electrical impact
- Mechanical impact
- Structural impact

Scenario #1
(existing roof only)



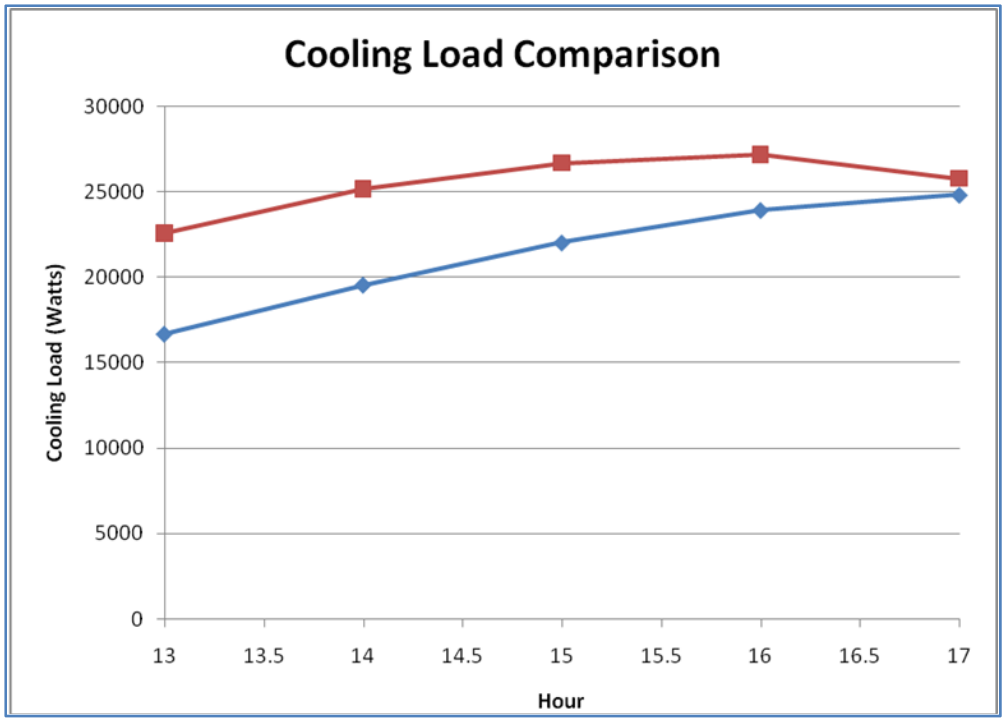
Roof: q=U*A*(CLTD)

Scenario #2
(existing roof + new skylights)



Roof: q=U*A*(CLTD)
+
Skylight: q(cond) = U*A*(CLTD)
+
Skylight: q=A*SC*SCL

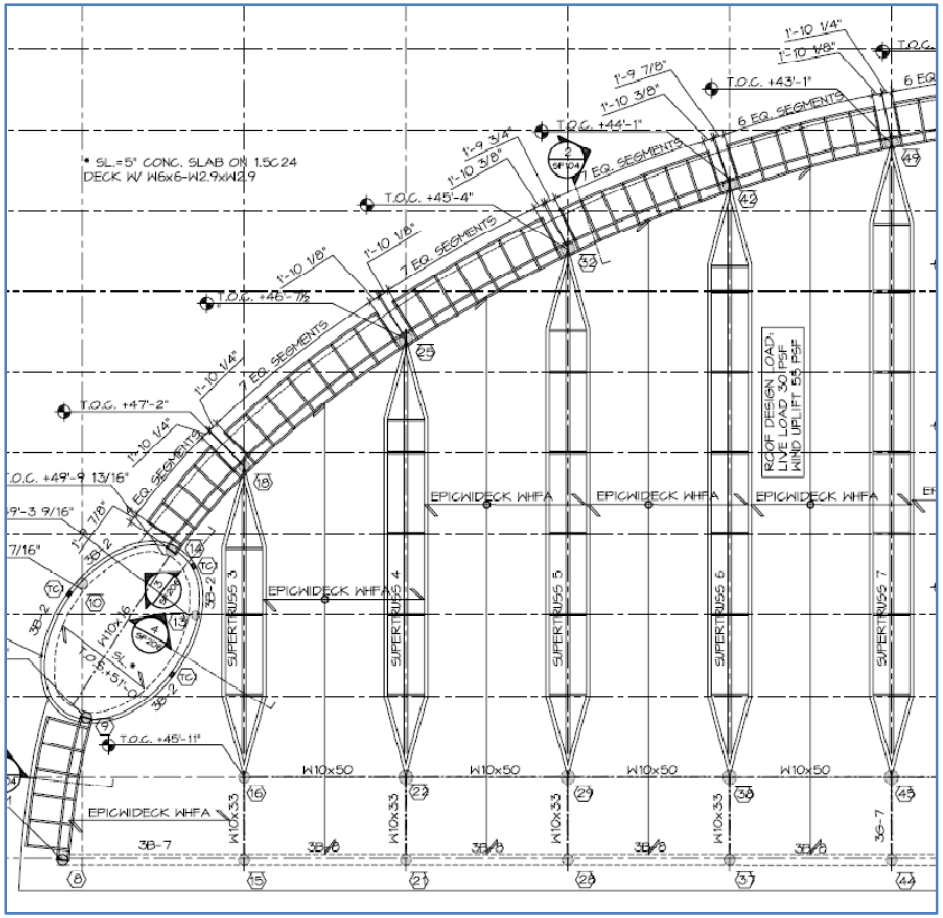
q = cooling load (W)
U = U-value (W/m^2K)
A = Area (m^2)
CLTD = Cooling Load Temperature Differences (K)
SC = Shading Coefficient of Skylight (unitless)
SCL = Solar Cooling Load (W/ m^2)

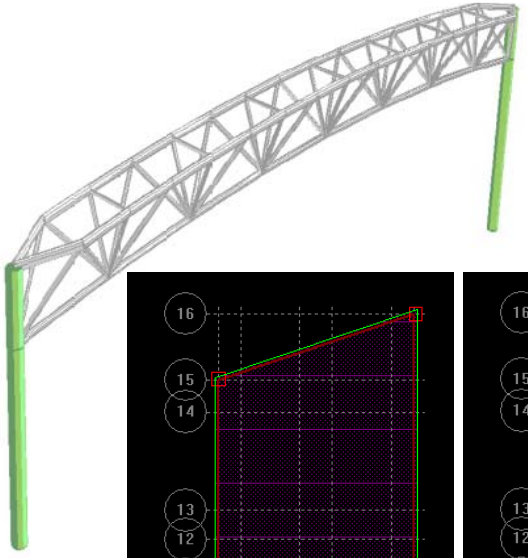


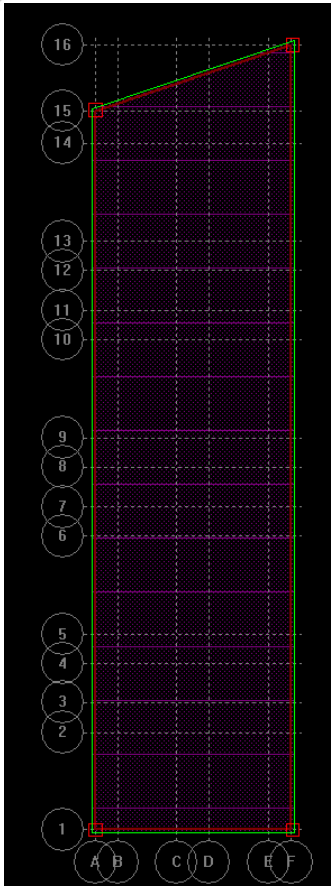
Cooling Load Comparison (Watts)					
Hour:	13	14	15	16	17
Existing Roof (no skylights):	16700	19570	22040	23940	24830
Proposed Roof (with skylights):	22600	25200	26700	27200	25800
Difference:	5900	5630	4660	3260	970

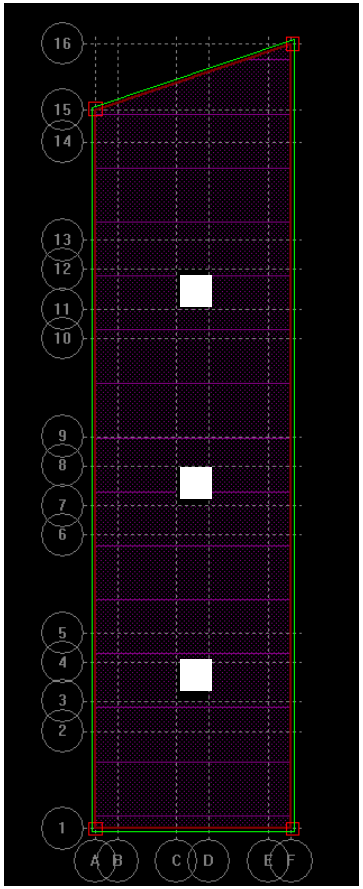
- At 100%, lighting power is 9,486 watts
- Skylights should be added to this space.

Waiting Area / Ticket Queuing – Structural Analysis









- Structurally acceptable, as modeled
- No significant additional structural elements necessary

Electrical Redesign: Panelboards

Existing Panelboards			
Panel Name	**Type**	**Voltage**	**Locations Served**
ELPL4	Dimming	120	Waiting Area, Lobby
LPL3	Dimming	120	Lobby, Conference, Waiting Area, Waiting Area (LEDS)
HPL3	Switching	277	Waiting Area, Conference
EHPL4	Switching	277	Conference, Waiting Area, Façade
ELPL2	Dimming	120	Façade
EHPLP	Switching	277	Façade
EHPL2	Switching	277	Façade

Software Designer Solution			
Panel Name	**Type**	**Voltage**	**Locations Served**
Panel Unit 1	Dimming	277	Waiting Area
Panel Unit 2	Switching	120	Waiting Area
Panel Unit 3	Dimming	120	Lobby
Panel Unit 4	Dimming	277	Lobby
Panel Unit 5	Switching	120	Lobby
Panel Unit 6	Dimming	277	Conference
Panel Unit 7	Switching	120	Façade

Proposed Consolidation of loads
ELPL4
EHPL4
ELPL2
EHPLP
EHPL2
HPL3, Panel Unit 1, Panel Unit 4, Panel Unit 6
LPL3, Panel Unit 2, Panel Unit 5, Panel Unit 7, Panel Unit 3

Electrical Analysis – Feeder Comparison: Copper versus Aluminum

Copper Analysis

			Existing Feeder and Conduit								
Panelboard	Main Size	Length (feet)	# of Sets	# of Wires	Wire Size	Total Ampacity	Conduit Size (in.)	Cost (Wire per 100 ft)	Cost (Wire)	Cost (Conduit per ft)	Cost (Conduit)
HP1	400A	48	2	4	3/0	400	2	560	$2,150	$6.94	$666
HP2	400A	308	2	4	3/0	400	2	560	$13,798	$6.94	$4,275
HP3	600A	270	2	4	300	570	3	923	$19,937	$16.00	$8,640
HP4	100A	25	1	4	1	130	2	307	$307	$6.94	$174
LPC	400A	25	2	4	250	510	2.5	798	$1,596	$13.59	$680

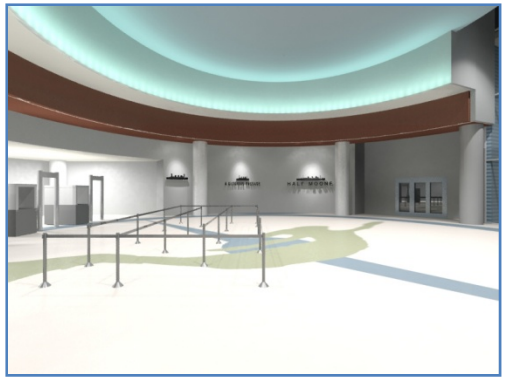
Aluminum Analysis

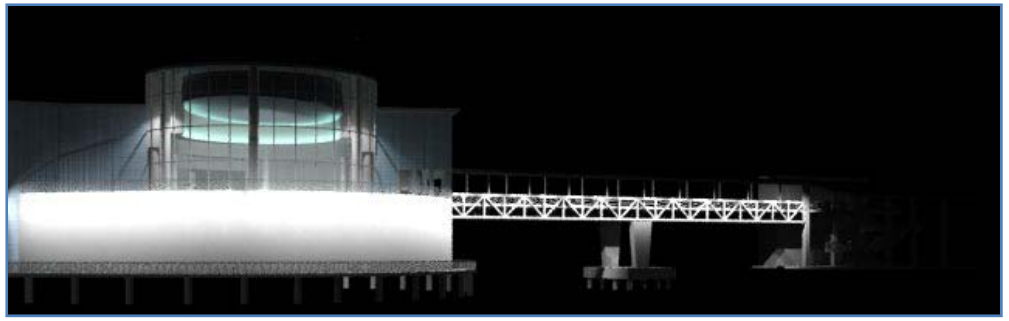
			Theoretical Aluminum Feeder and Conduit								
Panelboard	Main Size	Length (feet)	# of Sets	# of Wires	Wire Size	Total Ampacity	Conduit Size (in.)	Cost (Wire per 100 ft)	Cost (Wire)	Cost (Conduit per ft)	Cost (Conduit)
HP1	400A	48	2	4	250	410	2.5	318	$1,221	$13.59	$1,304.64
HP2	400A	308	2	4	250	410	2.5	318	$7,836	$13.59	$8,371.44
HP3	600A	270	2	4	500	620	3	528	$11,405	$16.00	$8,640.00
HP4	100A	25	1	4	2/0	135	2	216	$216	$6.94	$173.50
LPC	400A	25	2	4	400	540	2.5	473	$946	$13.59	$679.50

	Conductor Cost	Conduit Cost	Total Cost
Copper	$ 81,500	$ 34,100	**$ 115,600**
Aluminum	$ 41,600	$ 35,200	**$ 76,800**

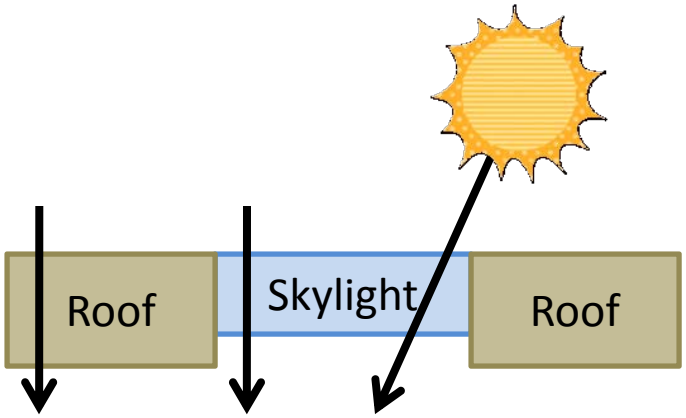
- Less cost for Aluminum feeders
- Expansion properties affect connections

Conclusion: Lighting of 4 Spaces





- Dynamic Environment
- Versatile
- Reduction in power consumption



Skylights

- Cost and energy savings from skylights
- No significant additional structural elements necessary
- Creates dynamic environment

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Special thanks to:

- Clark Nexsen
- Scott Schwerin and Dan Rusnack
- Penn State Department of Architectural Engineering
- Professors Mistrick, Houser, Dannerth
- Family and Friends

Questions?