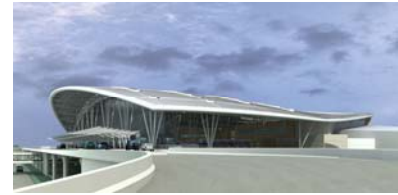


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## Lighting Depth Study

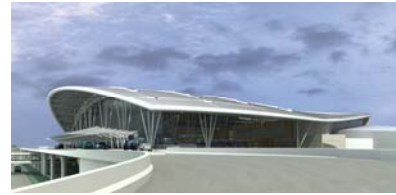
### Ticket Hall/Check-in Area



#### Overview

The Ticket Check-in Counter Hall is the first space one will encounter upon entering the airport through four available vestibules. This great hall consists of four identical Ticket Counter modules, each accompanied by an overhanging glass and steel canopy spreading 120 ft across each other. There are a total of 96 check-in counters with extensive VDT displays. The ticket canopy overhangs a VDT displays as well as a signage with luminaire integrated inside. On the underside of the giant arched roof is filled with 50 linear stripes of skylights ranging in different lengths, allowing plentiful of natural daylight and skylight entering the Ticket Hall. The skylights all equipped with a retractable/operable shade that is fully closable at night to shield off interior uplighting, prevent any light spills into the night sky environment. Despite the task lighting (linear pendant downlight) are required to be turned on at all time, the curtainwall along the perimeter also allows sufficient daylight entering the Ticket Hall during daytime, providing a naturally daylight ambient and high enough light level for task work. Security areas are also located within the Ticket Hall. However, per a non-disclosure agreement termed, I am not allowed to include that into part of my lighting study nor can I discuss any details related to this secured area.

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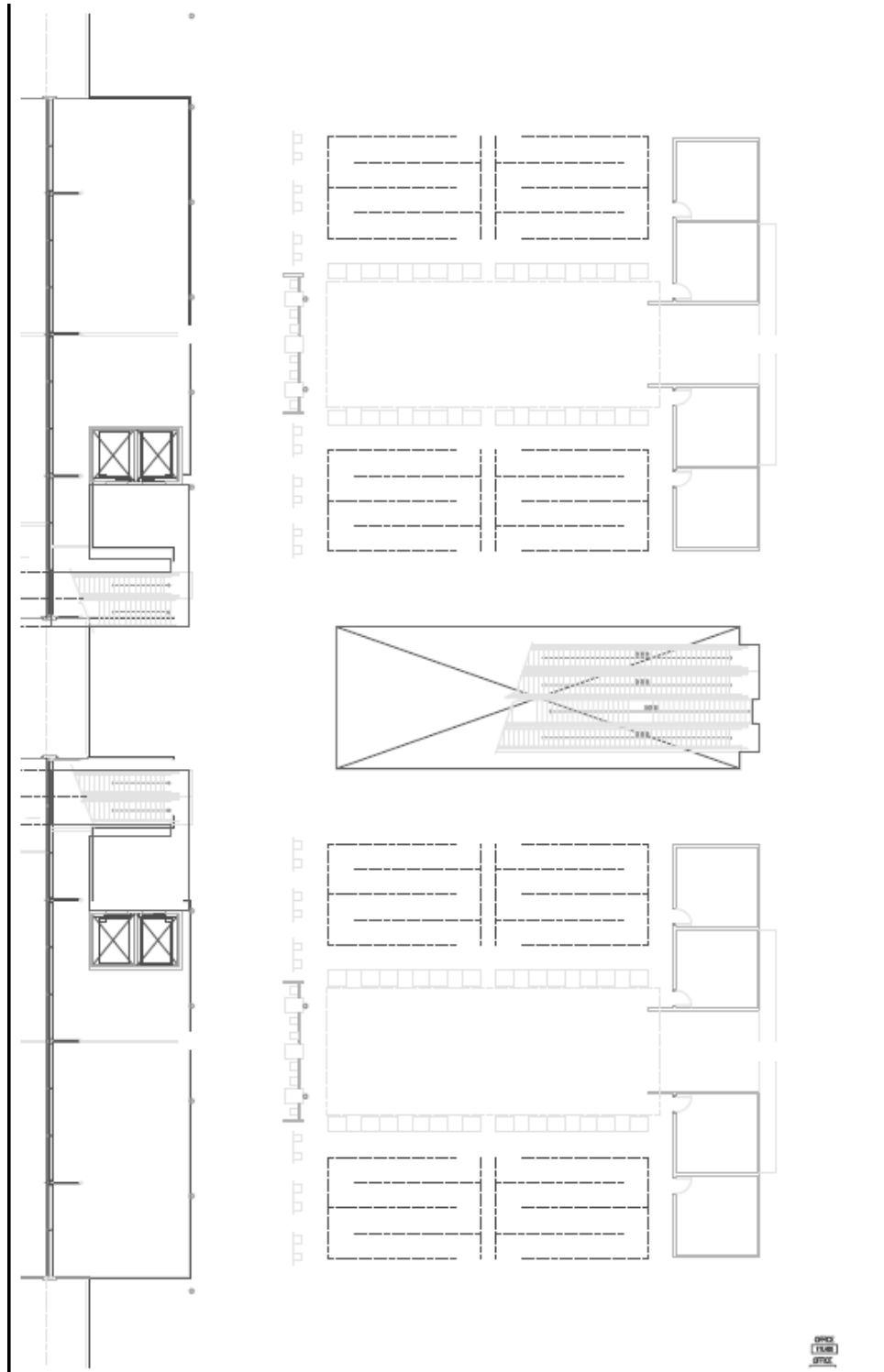
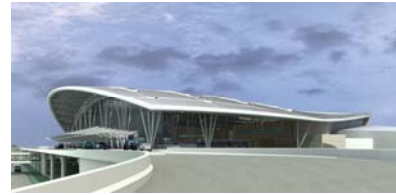


Plans and Sections below will give you a general overview of this space:



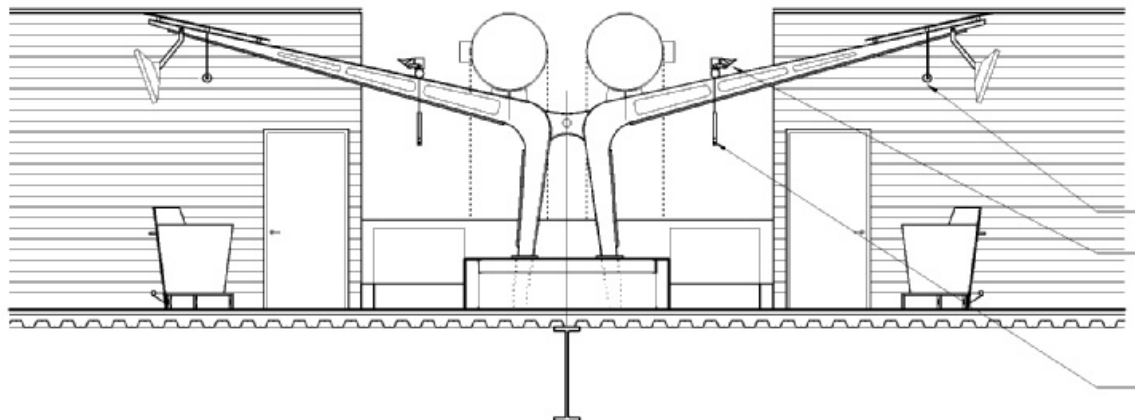
**Perspective rendering of the Ticket Hall**

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Half of Ticket Counter Hall in Plan View

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### **Ticket Canopy Section**

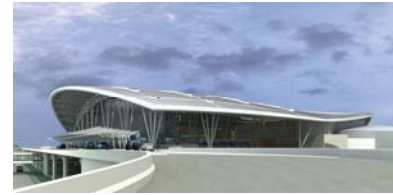
#### **Design Goal**

To design a visually pleasing Ticket Hall, utilizing the same theory, metaphoric approach to serve as a continuation of the previous space. Secondly, utilizing interior uplights to illuminate the inside roof ceiling, when light reflects off of the ceiling back down into the ticket hall, the ambient brightens, and I intent to create a glowing appearance when viewed from outside.

#### **Design Criteria**

1. Color Appearance and Color Contrast
  - Color appearance and color contrast is very important, considering that an appropriate level of illuminance ratio should be established for the application of task lighting.
2. Glare
  - Direct glare is very important and must be avoided in order to provide maximum end user visual comfort.
3. Uniformity of Light Distribution
  - Light distribution(uniformity) on surface is very important for this space because of the extensive task application is involved. We must avoid shadow.
4. Points of Interest
  - Points of interest is quite important. Intuitively, the lighting function itself should be able to direct passenger to this location for check-in activities. When check-in activities are completed, the lighting should be able to direct passengers elsewhere to where they need to be at next.
5. Reflected Glare
  - Reflected glare is very important, and should avoid it from occurring on VDT displays at check in counters as well as flight info screen areas.
6. Shadow
  - Shadow issues is very important in this space since large amount of task lighting are in place for its purposes, must avoid harsh/sharp obstructing shadows that interferes with task visibility.
7. Source/Task/Eye geometry

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- Source/task/eye geometry is important that an appropriate angular relationship between the viewer, task(VDT displays) and the luminaire(signage luminaire) should be established.

### Daylighting Design Criteria

1. Quantity
  - Provide ambient lighting of at least 30fc over the entire workplane for the majority of the year under both clear and overcast skies.
2. Quality
  - Use contrast ratios to add visual interest and to visually define the shape of the roof
  - Brighten dark areas of the ceiling to improve uniformity while maintaining acceptable contrast ratios on the ceiling
  - Create sparkle with instances of direct sunlight in selected areas on the ticketing floor, perhaps on the rear limestone wall or floor openings
  - Manage the contrast ratio created by the adjacency to Indy Place
3. Quality/Useability
  - Minimize glare and discomfort from direct light through south-west glazing
4. Useability/Integration
  - Minimize summertime solar heat gains / maximize wintertime solar heat gains to the occupied zones and appropriately with mechanical systems
5. Integration
  - Integrate skylights with structural system
6. Integration/Cost
  - Minimize cost and complexity of the daylighting design

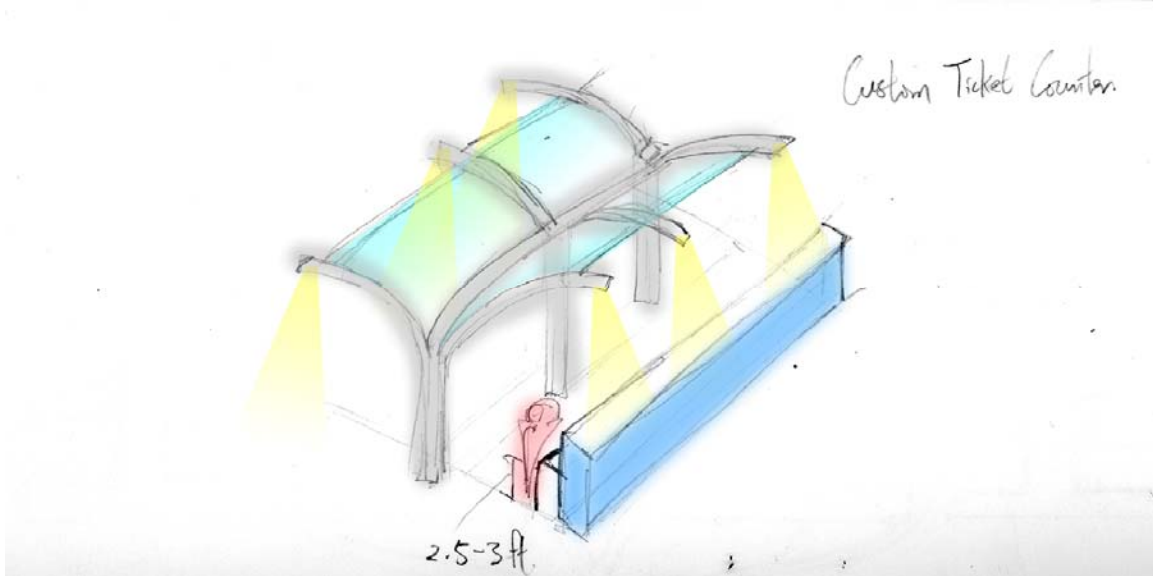
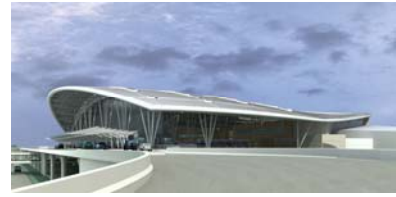
### Design Adjustments

Based on my Schematic Design Report (Technical Assignment 3) and my initial proposal, I have initiated a redesign of the Ticket Hall Canopy (see illustration below). The custom-designed ticket canopy would ideally should morphed into a more organically shaped structure that has a tree-like appearance in order to break free of right angles. Schreder fixtures were utilized explicitly in this scenario. However, this idea has proven to be very expensive and not quite economical.

In addition to the redesign of the ticket hall canopy, I have also proposed to redesign the ticket counters. My design has revised the material used for each of the ticket counter, changing them from brushed aluminum to sandblasted or etched glass panels, backlit by dynamic color changing LED fixtures. However, after adding in the in-grade LED upright fixtures on the Ticket Hall floors, I realized this solution is not only un-economical, on top of the costliness, it is not very sustainable.

These design idea will add an estimated one million dollar to the budget, adding more percentage of high VOC material and lowering percentage of recycled and local material being utilized in the construction. Last but not least, it has certain identified maintenance problems. Although this design will add more visual and aesthetic coherence to the overall design idea, nonetheless, as a practical and energy conscious lighting design student, I have decided to no longer pursue this idea.

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**Custom Designed Ticket Canopy**

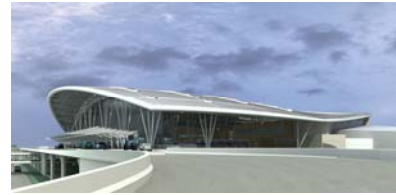


**Ticket Canopy Support  
(proposed light fixture branch)**



**Ticket Counter Design Concept**

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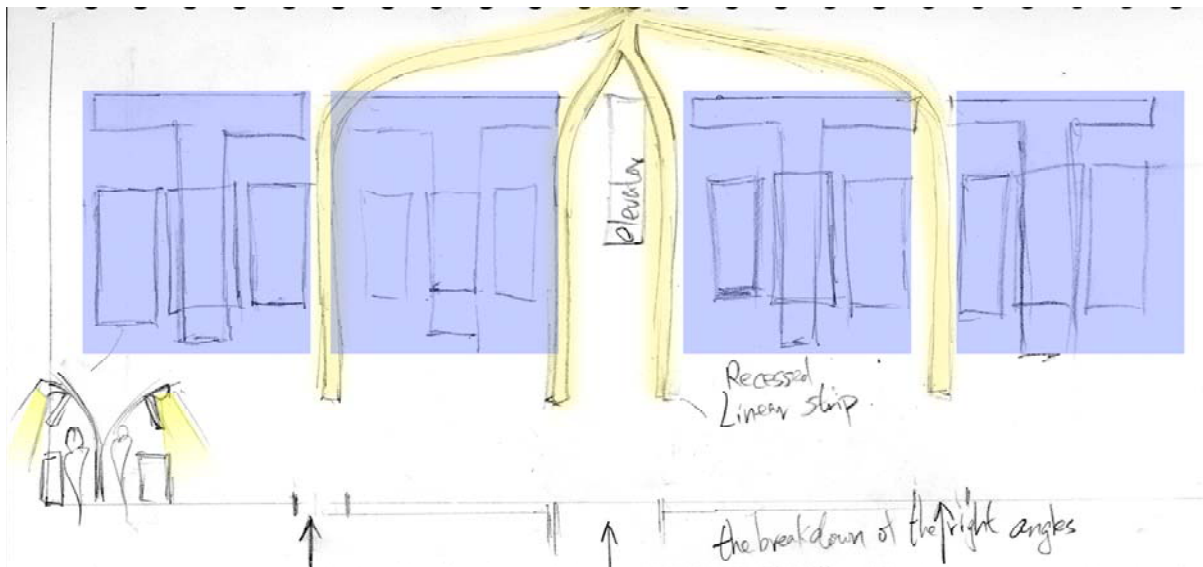


**Design Concept**

The existing ticket canopy overhangs a VDT displays as well as a signage with luminaire integrated inside. This design has already greatly reduced the chance of having direct/reflected glare cast to/from the glass canopy as well as glares that interferes the views toward the VDT displays. Linear fluorescent luminaires are utilized to ensure soft shadowing as well as uniformity of light distribution over the work plane. For the ceiling, utilizing asymmetric canopy mounted uplights to illuminate the interior roof ceiling, when light reflects off of the ceiling back down into the ticket hall, the ambient brightens, and it should create a glowing appearance when viewed from outside. On the ground plane, as a continuation of previous space, instead of light columns, I have taken the same kind of approach, same interpretation of my theme, following the same streamlined contour, utilizing in-grade LED fixtures, to mimic the runway's guidance lights. These in-grade LED lights produce a very subtle yet pronounced effect of converging the path from a massive open Ticket Hall, into one singular path that leads them toward the next stop – Civic Plaza.

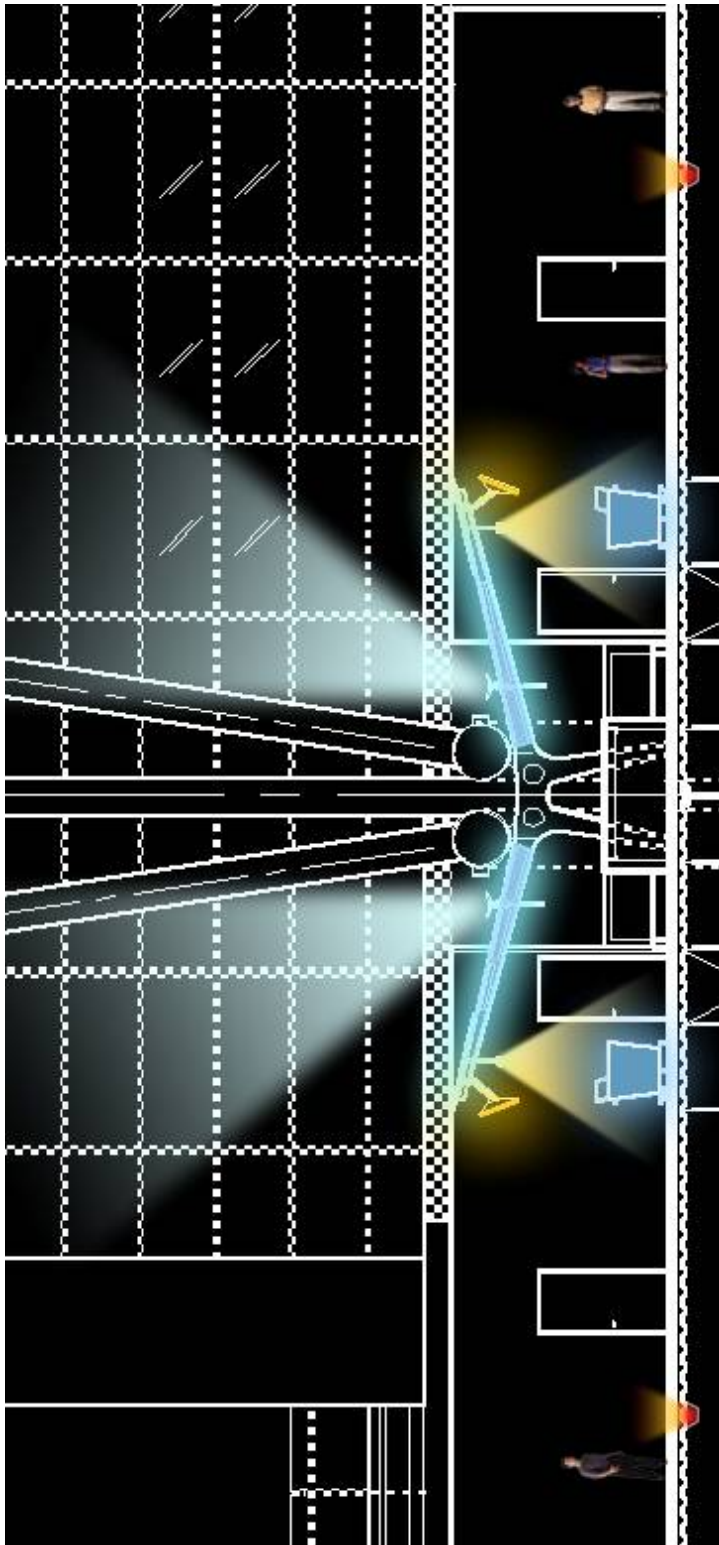
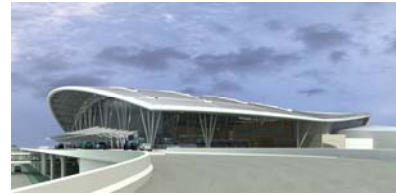
Please see Appendix B for Daylighting Study on the Ticket Hall

Schematic sketches and finalized design solution are illustrated below:



**Schematic Sketch of the Ticket Hall in Plan View**

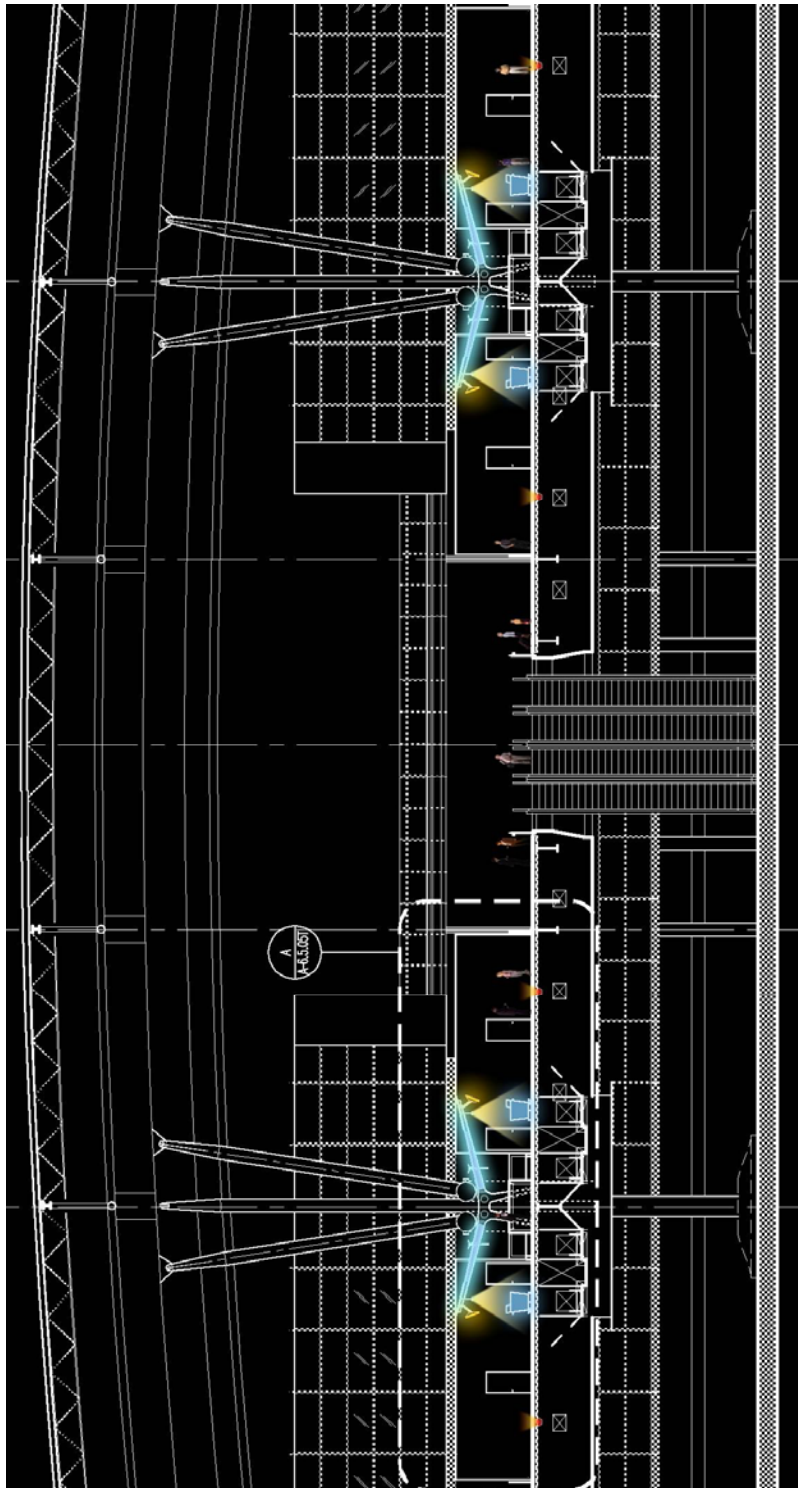
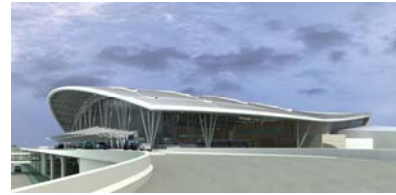
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Finalized Design Concept (Full)

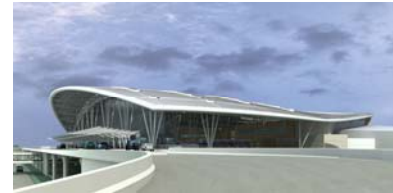


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Finalized Design Concept (Half)

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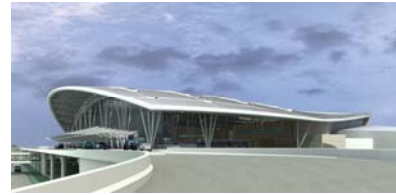
**Material Reflectance**

Material Reflectance Table	Exterior	Ticket Hall
<b>Columns (aluminum)</b>	55%	55%
<b>Curtain Wall (Glazing)</b>	10%	15%
<b>Skylight (Glazing)</b>	N/A	15%
<b>Concrete</b>	20%	N/A
<b>Flooring (Marble)</b>	N/A	30%
<b>Ceiling (aluminum)</b>	75%	75%
<b>Furniture Fabric</b>	N/A	20%
<b>Sandblasted Panels (Glass)</b>	N/A	N/A
<b>Panorama Animation Screen</b>	N/A	N/A

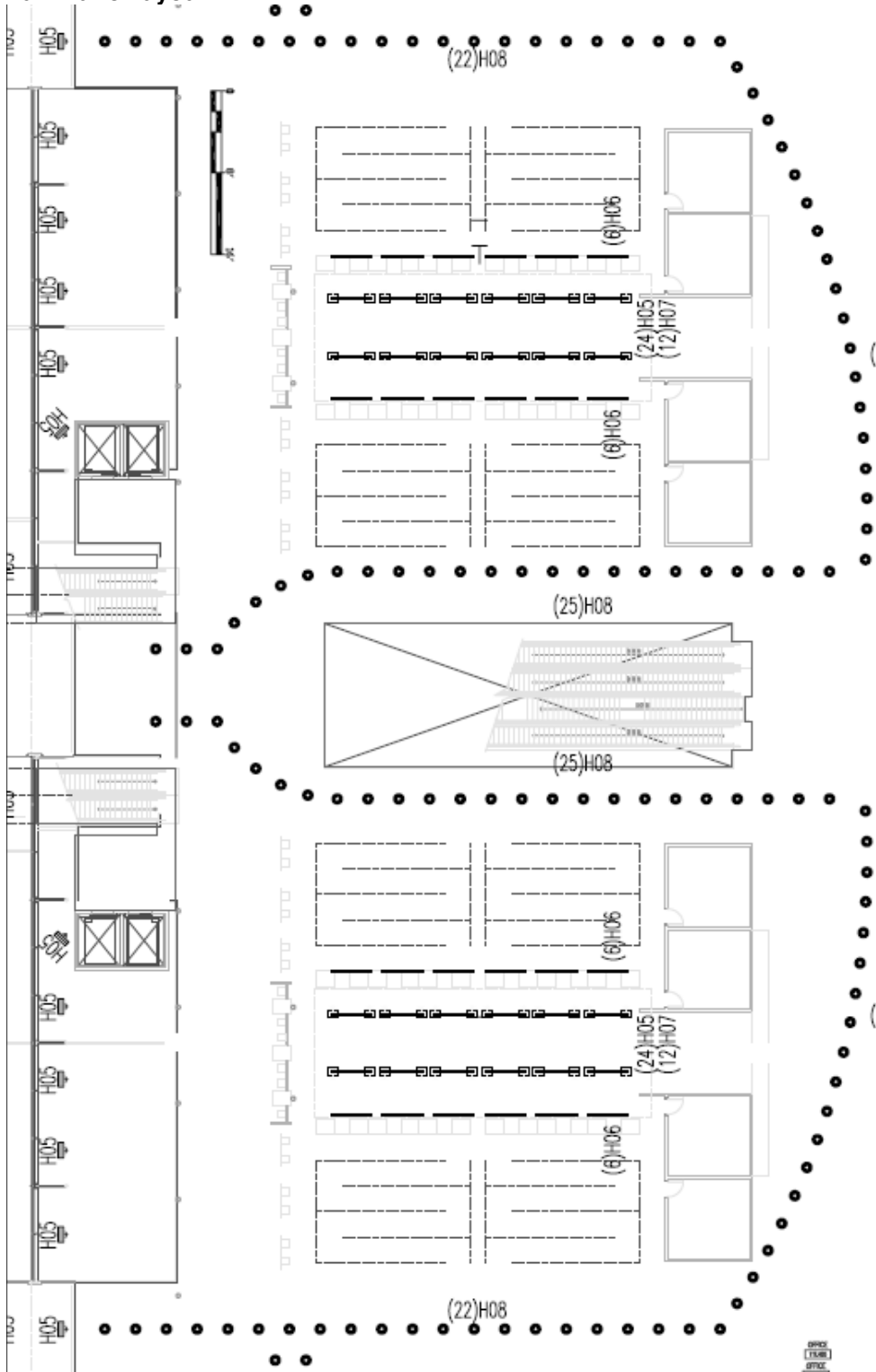
**Glazing Specification**

Glazing Spec		
Location	Curtain Wall	Skylight Glazing
<b>Brand</b>	Pilkington Solar E	Visionwall 3-element Glazing System
<b>Type</b>	Insulated	Insulated
<b>Total Thickness</b>	1"	1"
	24 mm	24 mm
<b>Space Filler</b>	Argon-Filled	
<b>Outboard Lite</b>	1/4" Pilkington Solar E™	Low E Coating (optional)
<b>Inboard Lite</b>	1/4" Pilkington Optifloat™	Low E Coating (optional)
<b>Reflective Surface</b>	2nd	n/a
<b>Low-E Surface</b>	2nd	n/a
<b>Visible Light Transmittance (%)</b>	53%	66%
<b>Visible Lite Exterior Reflectance (%)</b>	10%	n/a
<b>Visible Lite Interior Reflectance (%)</b>	15%	n/a
<b>Total Solar Energy Transmittance (%)</b>	33%	n/a
<b>Total Solar Energy Reflectance (%)</b>	9%	n/a
<b>U-V Transmittance (%)</b>	31%	n/a
<b>U-Value - Summer</b>	0.27	0.21
<b>U-Value - Winter</b>	0.28	0.22
<b>Solar Heat Gain Coefficient</b>	0.43	0.18
<b>Shading Coefficient</b>	0.49	0.19

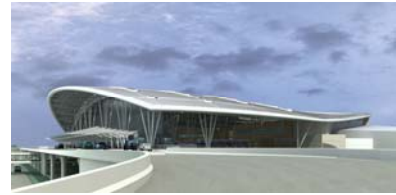
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Luminaire Layout



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**Lighting Fixture Schedule**

Ticket Hall								
Fixture #	Brand	Luminaire	Lamp Type	Lamp Wattage (watts)	Lamps/Fixture	Quantity	Watts/L-ft or Watts/Fixture	Total Watts
H05	Elliptipar Style 152	Canopy/Roof Mount Asymmetric Uplight	Metal Halide T6	150	2	116	350	40600
H06	Neoray 6dip	Linear Pendant Direct	Flourescent T8	32	2	48	59	2832
H07	Selux M60 Mod	Signature Integrated Linear Pendant Direct	Flourescent T5	28	1	48	30	1440
H08	Erco Nadir Amber, Blue, Green	Ingrade LED Uplights	LED	2.1	1	170	4	680
<b>Total Watts</b>								<b>45552</b>
<b>Total Area</b>								<b>108000</b>
<b>Overall LPD</b>								<b>0.42</b>

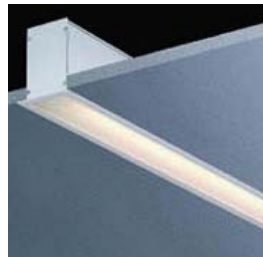
H05



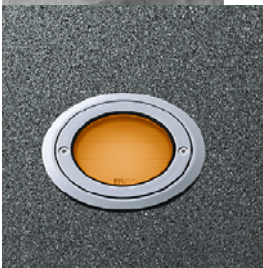
H06



H07

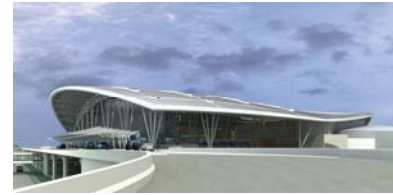


H08



For Ballast and Lamp Schedule, please see Appendix A.

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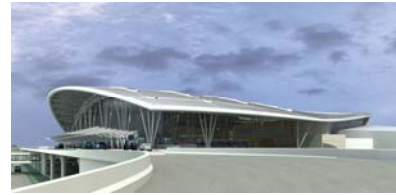
**Light Loss Factor**

Ticket Hall								
Fixture #	Maintenance Category	Dirt Condition	Cleaning Interval	Ballast Factor	RSDD	LLD	LDD	Total LLF
H05	VI	Very Clean	6 Months	0.8	0.9	0.8	0.82	0.47
H06	IV	Very Clean	6 Months	0.88	0.9	0.8	0.88	0.56
H07	IV	Very Clean	6 Months	0.98	0.9	0.8	0.88	0.62
H08	VI	Very Clean	6 Months	1	0.9	0.8	0.82	0.59

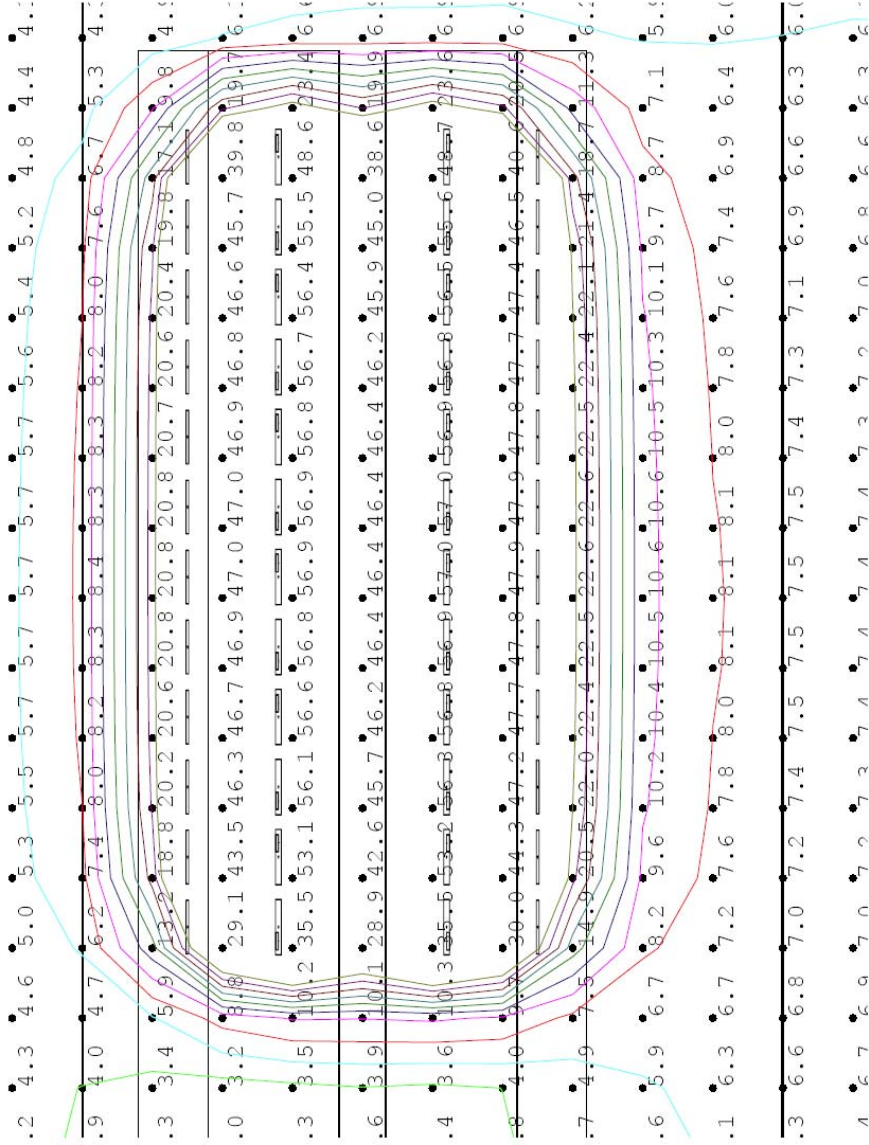
**Lighting Power Density**

Lighting Power Density (watts/sq.ft)	Area (sq.ft)	Obtained LPD (watts/sq.ft)	Illuminance Category	Recommended Illuminance Level (fc)	Obtained Illuminance (fc)	
Ticket Hall						
Corridor/Transition Area	0.46 W/sq.ft	108000	0.42	C	10	9.32
Airport Ticket Counter	1.8 W/sq.ft*	8064	0.53	B	50	57

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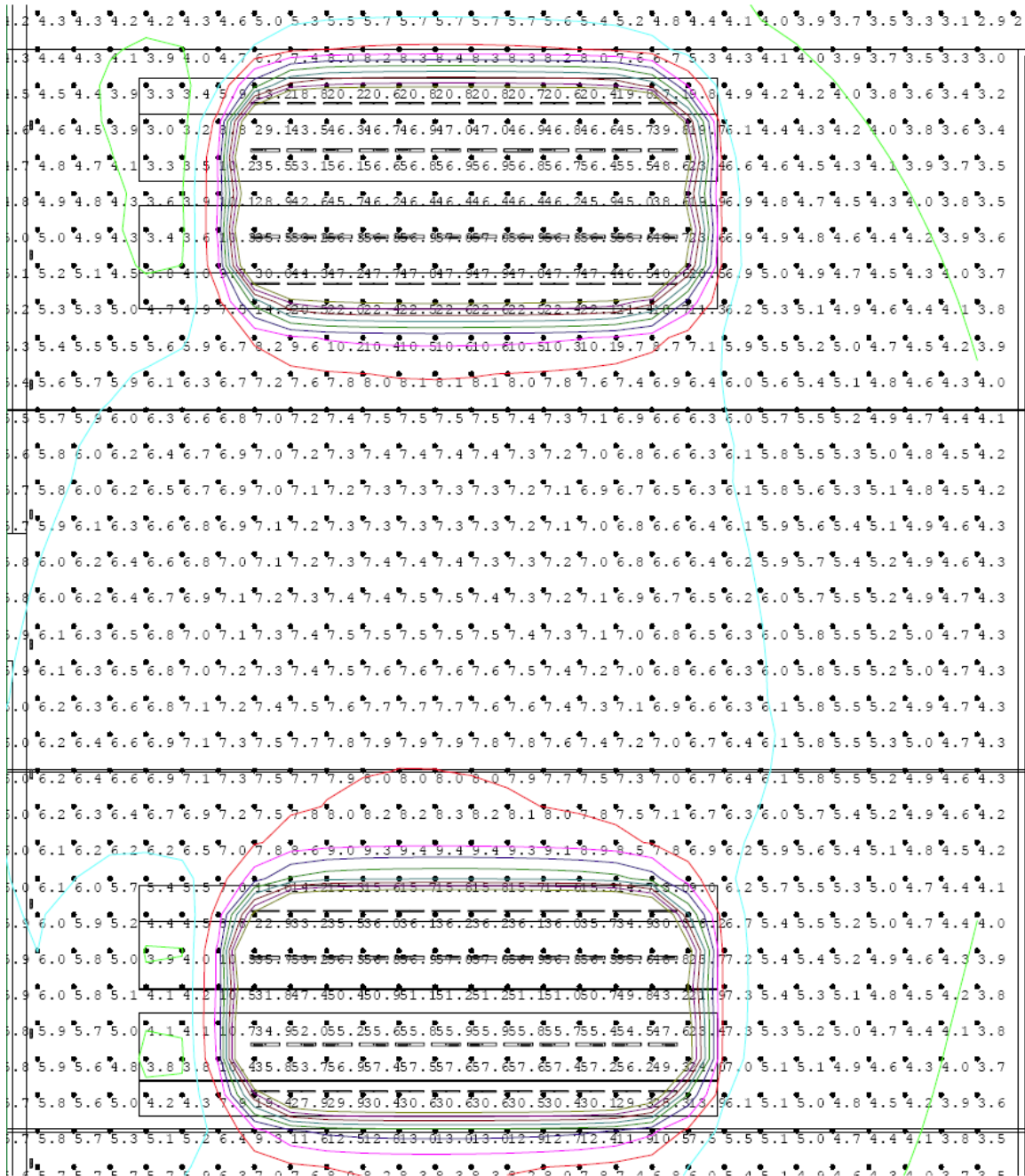
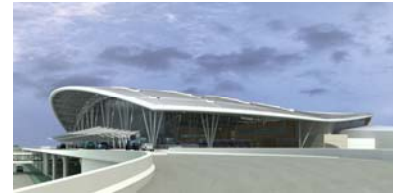


**Illuminance Value**



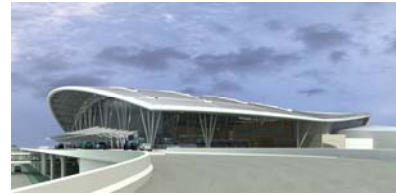
**Illuminance for Ticket Canopy Area**

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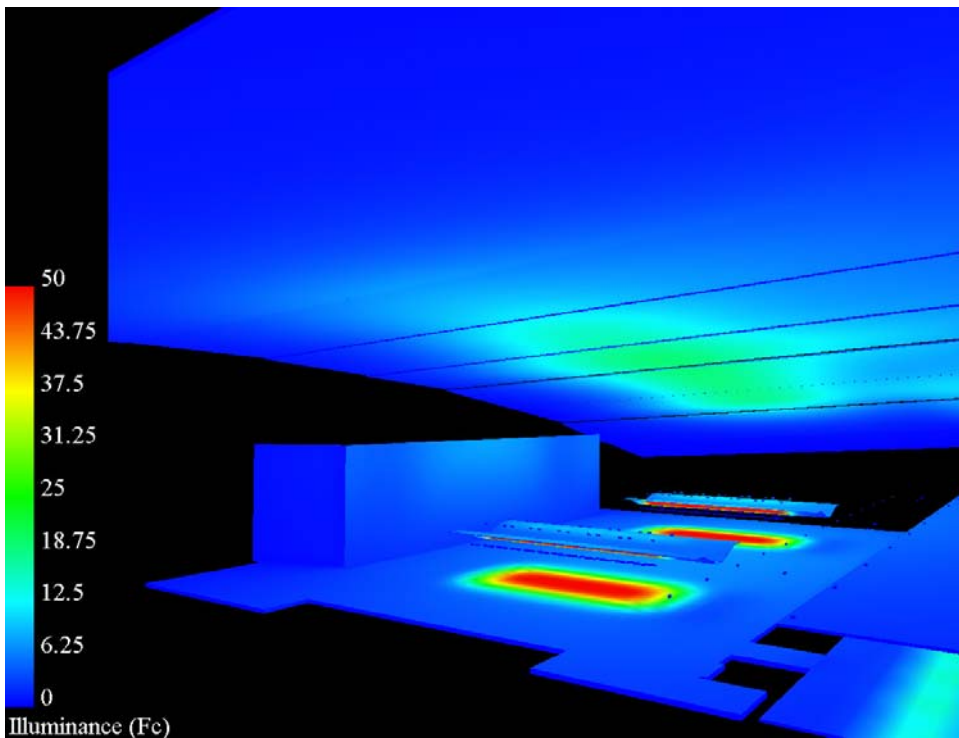
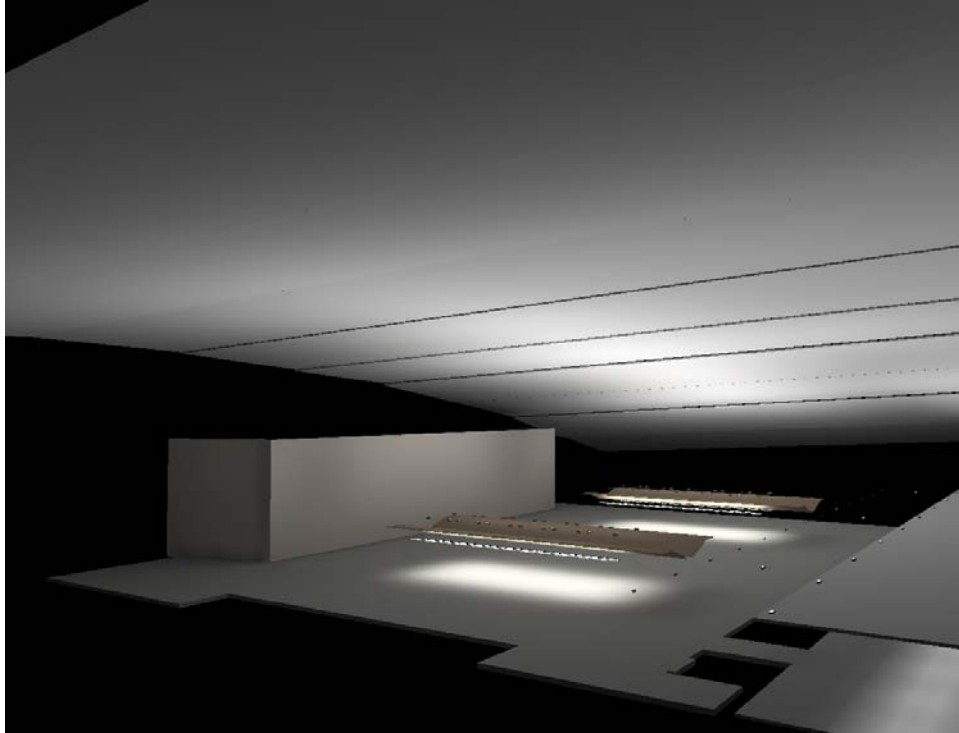


Overall illuminance distribution

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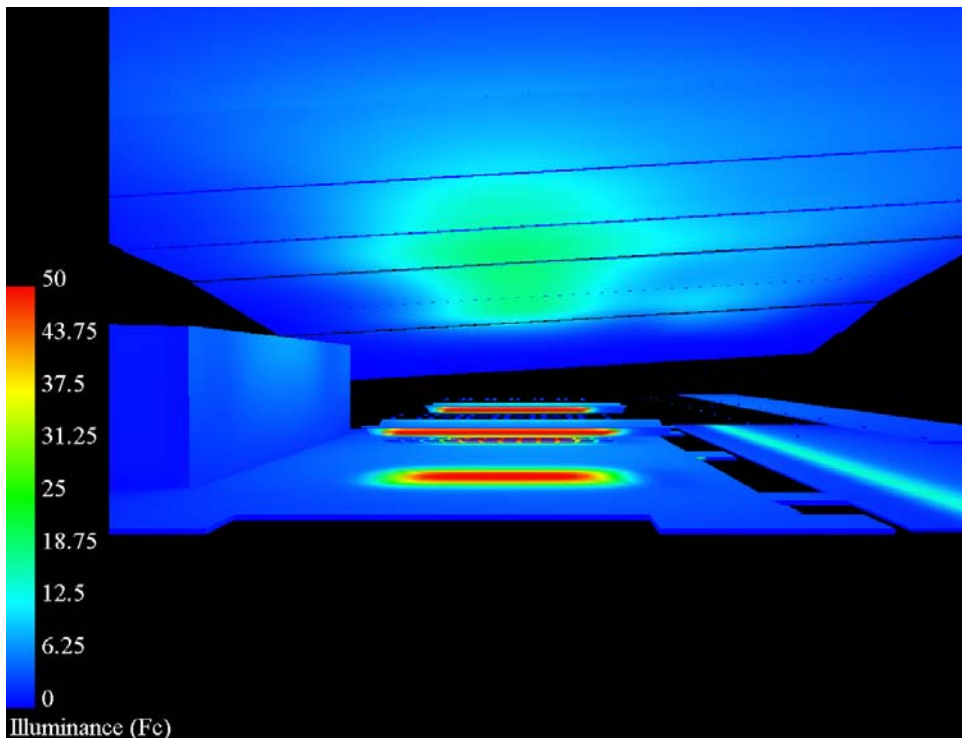
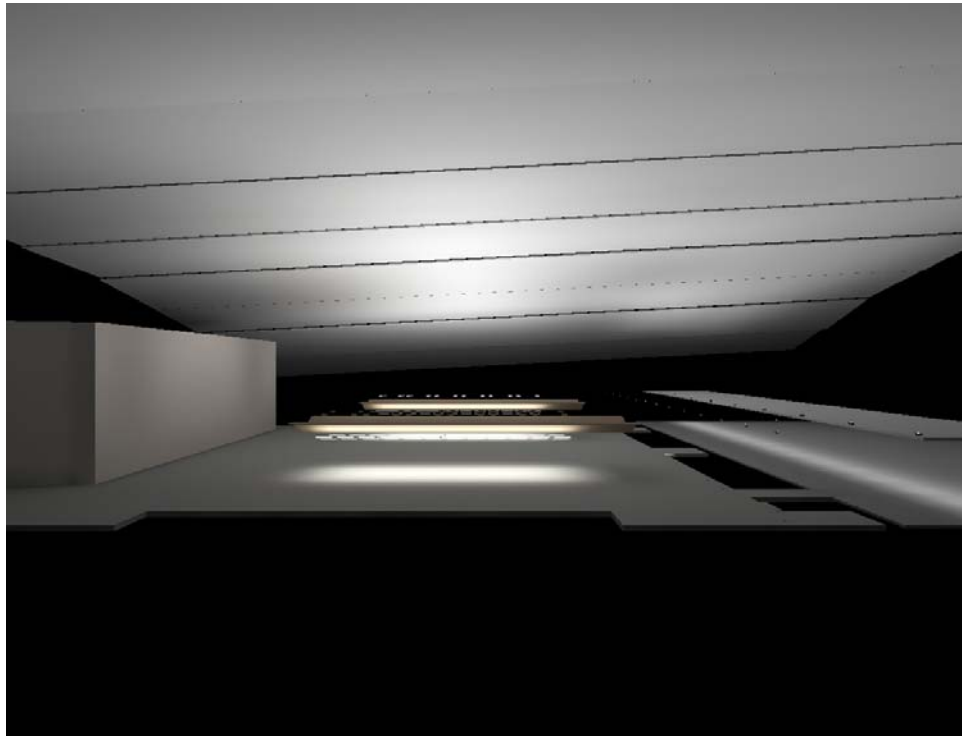
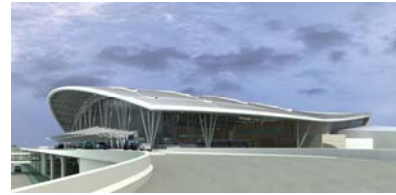
Rendering



Perspective View

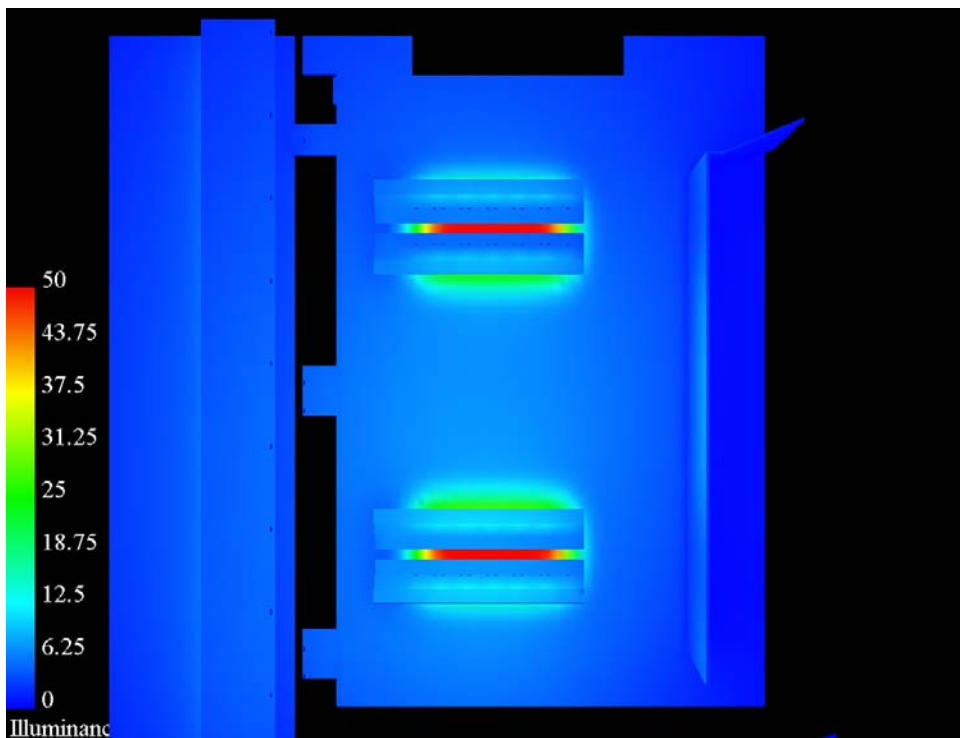
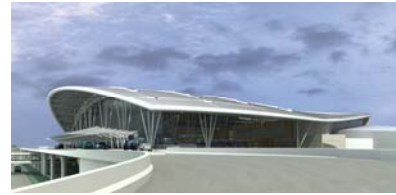


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Side View

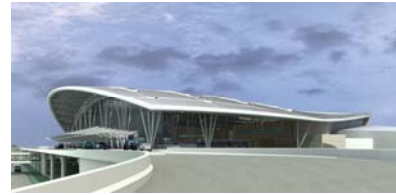
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Illuminanc

Top View

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**Conclusion**

Most of the lighting system are preserved to the existing condition. More than half of the interior upright fixtures near the entrance vestibules are taken out in consideration of LEED's Lighting Pollution Credit (luminaires located at less than 2.5 times the mounting distance to the exterior). The major addition are the addition of the in-grade LED luminaires. The light path results should creates a smooth environment that gives passengers a fantasia rendezvous of the flight take off experience. It also serves the metaphor I originally proposed, which entering the ticket hall is entering this "glass and steel" bird, acting as the throats that channeling a wide area into a single path, leading them toward the heart of this Bird – the Civic Plaza.