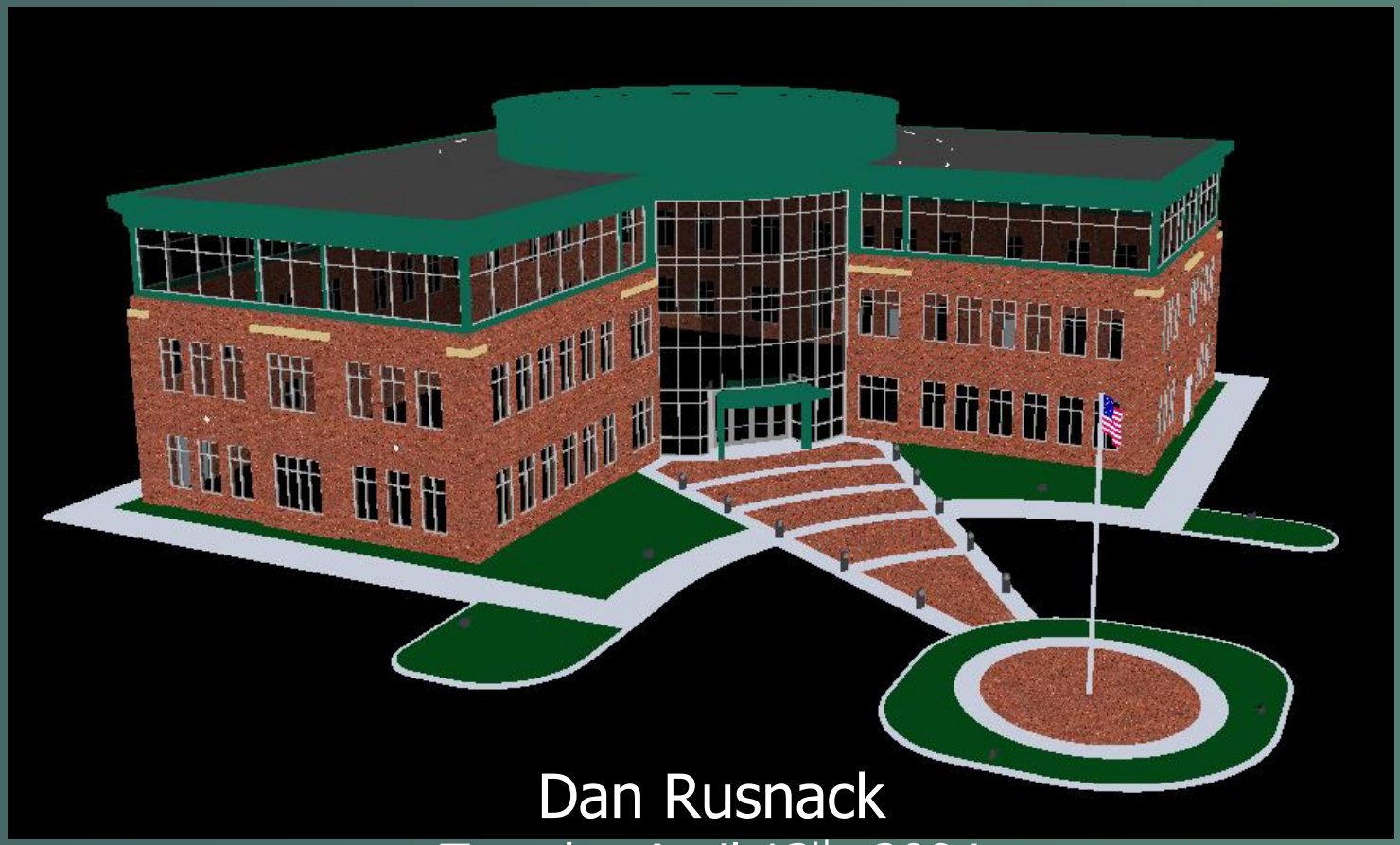
Thesis Presentation
Hall Corporate Headquarters



Dan Rusnack

Tuesday April 13th, 2004

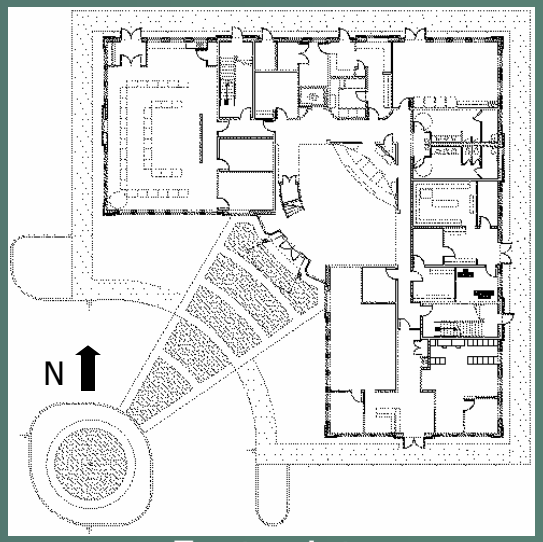
Lighting/Electrical Emphasis

Hall Corporate Headquarters

- Location
  - Virginia Beach, Virginia
- Building Stats
  - 30,000 Sq. Ft. , 3 stories
  - Construction cost $ 2.5 million

Project Team

- Occupant
  - Hall Automotive Car Dealership
  - Owner Kenneth Hall Senior
- Architects & Engineers
  - Clark Nexsen
    - Norfolk, Virginia
- Contractor
  - Commonwealth Construction

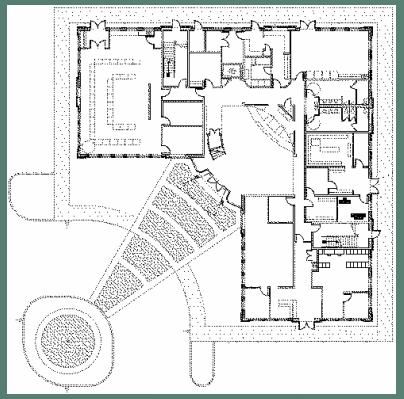


Foot print

North elevation

Hall Corporate Headquarters

- Architecture
  - Building footprint is an L shape
  - Brick façade with large amounts of glazing
  - Circular structure on roof to hide the mechanical equipment
- Structural
  - Steel wide-flange beams and steel joists
  - Concrete slab over (non-composite) steel deck
- Mechanical
  - Two roof top air handling units
  - Fan powered VAV system to circulate air in spaces
- Lighting / Electrical
  - Recessed linear fluorescent, compact fluorescent and metal halide lamps
  - Main distribution panel 480Y/277 V, 800 A Bus, 3 phase, 4 wire, 25 KAIC
  - 3-Transformers 480 to 208Y/120 V, 2@75KVA, 1@45KVA



Hall Corporate Headquarters
Virginia Beach, Virginia

Dan Rusnack
Lighting / Electrical Emphasis

Topics for Discussion

- Lighting Depth
  - Boardroom
  - Main Lobby
  - Exterior
- Skylights
  - Structural Breadth
  - Mechanical Breadth
- Conclusions & Questions

- Topics not discussed today but are in my final thesis report
  - Lighting redesign in training room
  - Electrical: circuiting, panel sizing and inverter panel system

"Light, God's eldest daughter, is a principal beauty in a building"

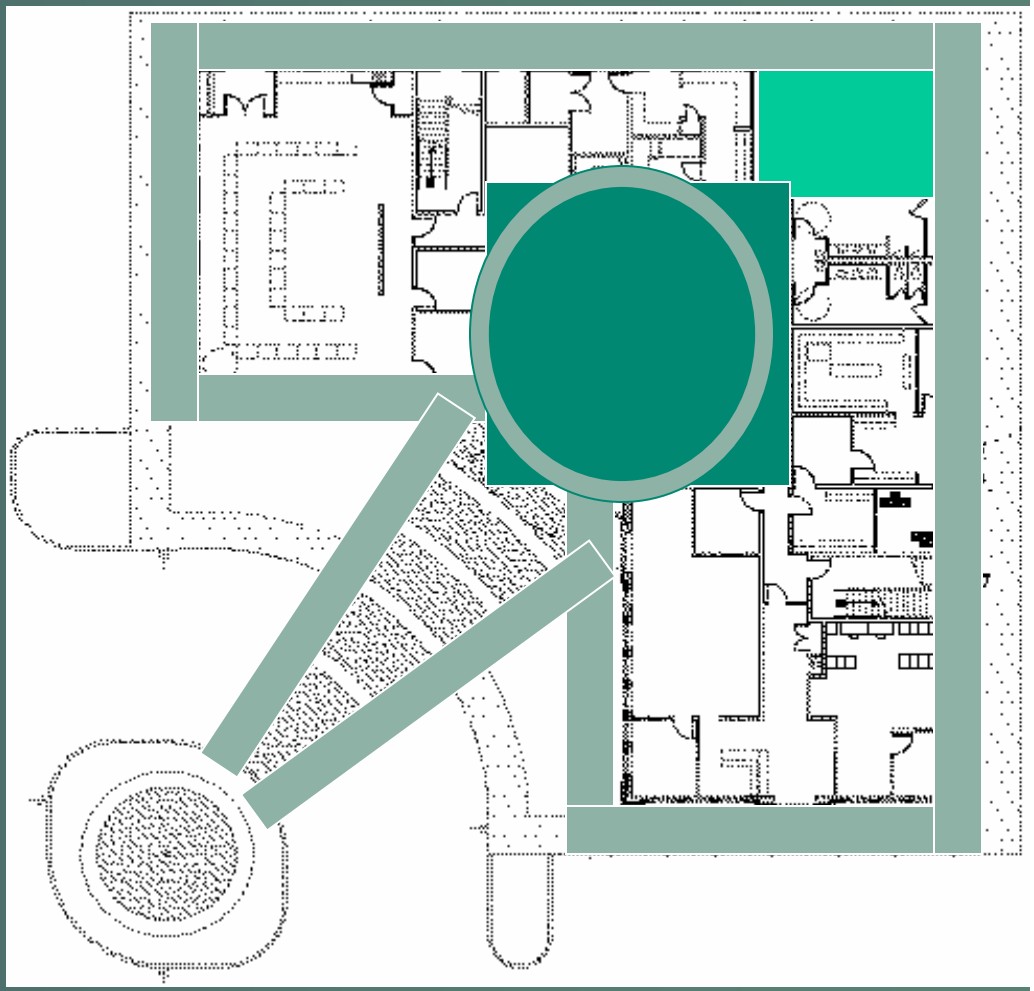
Thomas Fuller (1608-1661) English Cleric and Writer

Hall Corporate Headquarters
Virginia Beach, Virginia

Dan Rusnack
Lighting / Electrical Emphasis

Lighting Depth

- **Board Room**
  - Second Floor
  - 800 Ft^2
- **Lobby**
  - Main entrance to building
  - Open space to the second floor
  - 2700 Ft^2
- **Exterior Facade**
  - Walkway, front of building and circular roof structure

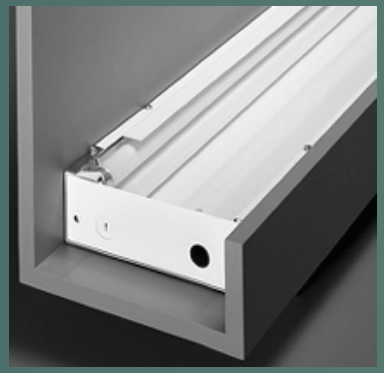


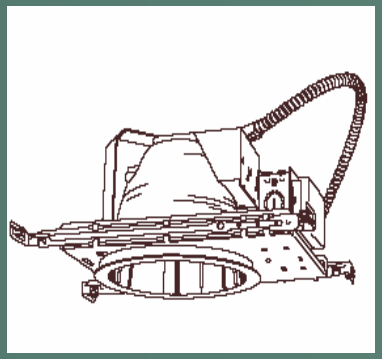
Boardroom

- **Room Characteristics**
  - Ceiling is 2'x2' acoustical tile in around perimeter of room with plaster section in cove, Ref = 0.9
  - Walls are a light beige color, Ref = 0.52
  - Carpet is a gray steel color, Ref = 0.21
  - Ceiling height is 9' with cove being 9'-6"
- **Design criteria**
  - Integration of daylight
    - Large amount of windows located on north and east walls
    - Use of motorized shading to control amount of daylight entering space
  - Meeting place for employees
    - Multi levels of light controlled by dimming switches
    - Close interaction between occupants
    - Luminance ratios between faces and background 3:1
  - Horizontal illuminance
    - Approximately 50 Fc on the conference table to allow for ease of reading and discussing paper work

Boardroom Lighting System

- Pendant
  - 4 - CFTRT32W Lamps
- Cove
  - 1 - F32WT8 Lamp
- Downlights
  - 1 - CFTRT32W Lamps



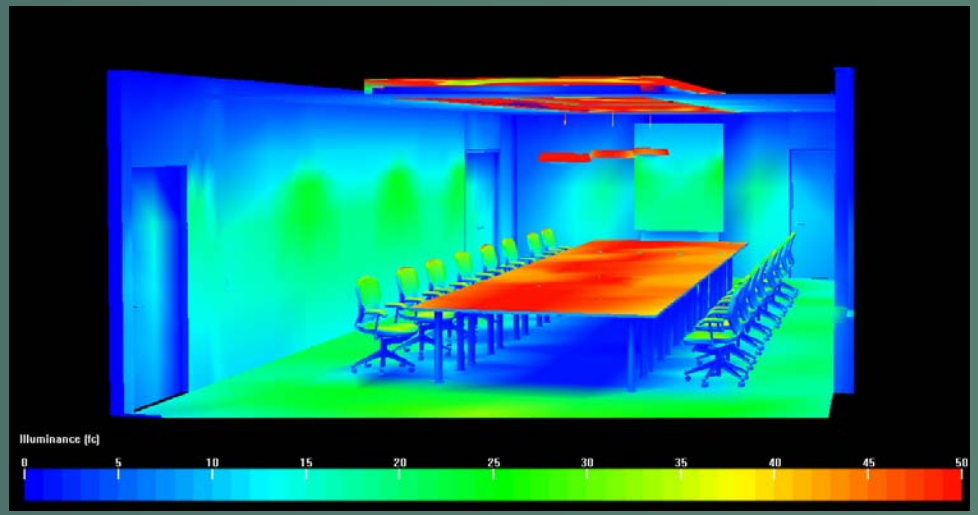


Boardroom Lighting Analysis

- Light Analysis
  - 50 Fc on the work plane
  - Uniform distribution due to indirect lighting in space
- Power density

  ASHREA 90.1 allows for 1.5 W/Sq.Ft

  Lighting Design uses 1.83 W/Sq.Ft
- Justifiable?
  - Importance of space …extra light is needed
  - W/Sq.Ft saving can be made in other spaces



Lobby

- **Room Characteristics**
  - Floor has a beige and black marble tile , Ref = 0.8
  - Walls are a light beige color, Ref = 0.52
  - Ceiling is 2’ x 2’ acoustical tile with plaster, Ref = 0.9
- **Design criteria**
  - Appearance
    - Welcoming space to the building, lighting should set a standard for the rest of the building
  - Points of interest
    - Reception desk located to the rear of the lobby should be well lit to attract attention of visitors and clients
    - Cars located in lobby will be lit uniformly to show off their paint
  - Horizontal illuminance
    - 20 Fc for lobby area
    - 40 Fc for reception area

Car Lighting

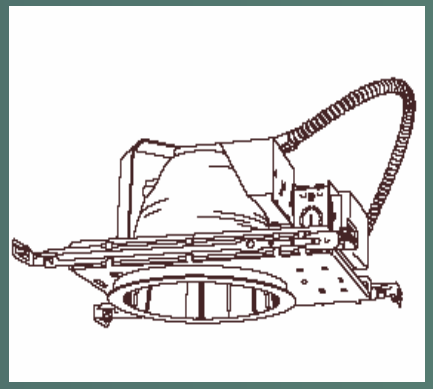
- Design Issues
  - Metal paint is highly reflective
    - Downlights will create hot spots which are bad
  - Want to create flawless look to paint
- Design Solution
  - Indirect system
  - Floor uplight to wash side of car with light
  - Smooth gradient emphasizes body shape

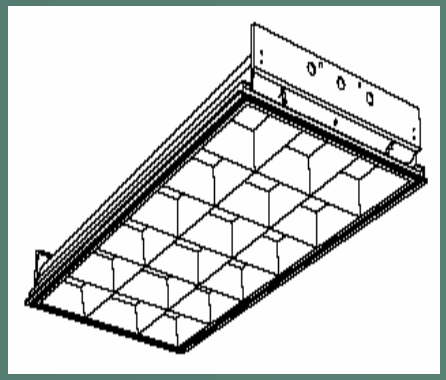
The Bad and the Ugly

Lobby Lighting System

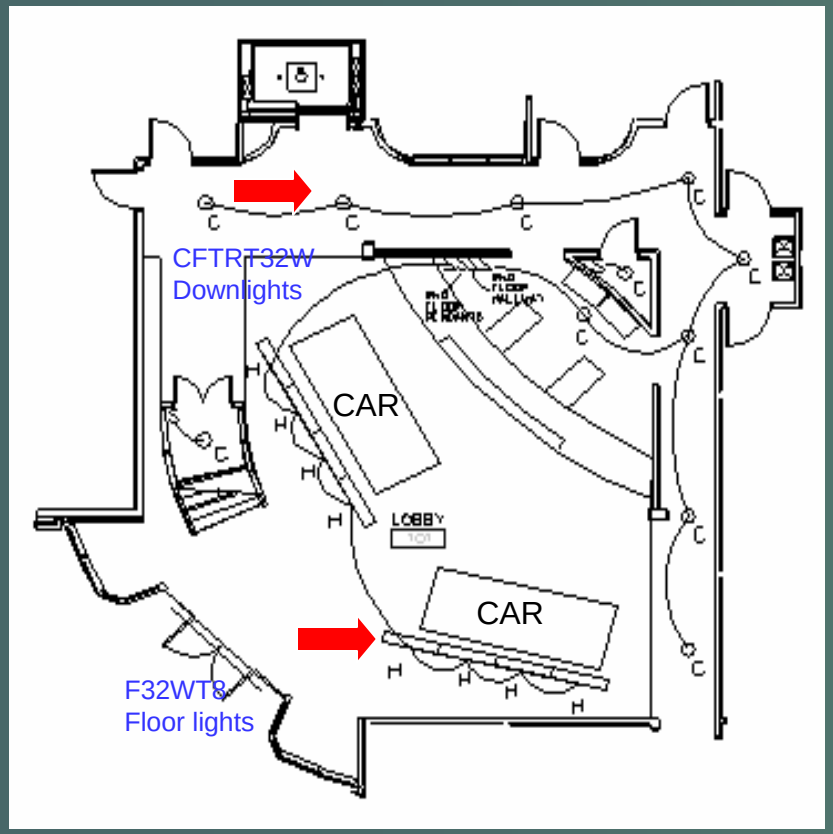
- Indirect system
  - 2 - F54WT5HO lamps
- Floor uplight on Cars
  - 1 - F32WT8 lamps
- Downlights
  - 1 - CFTRT32W Lamps
- Recessed Troffer
  - 3 - F32WT8 Lamps

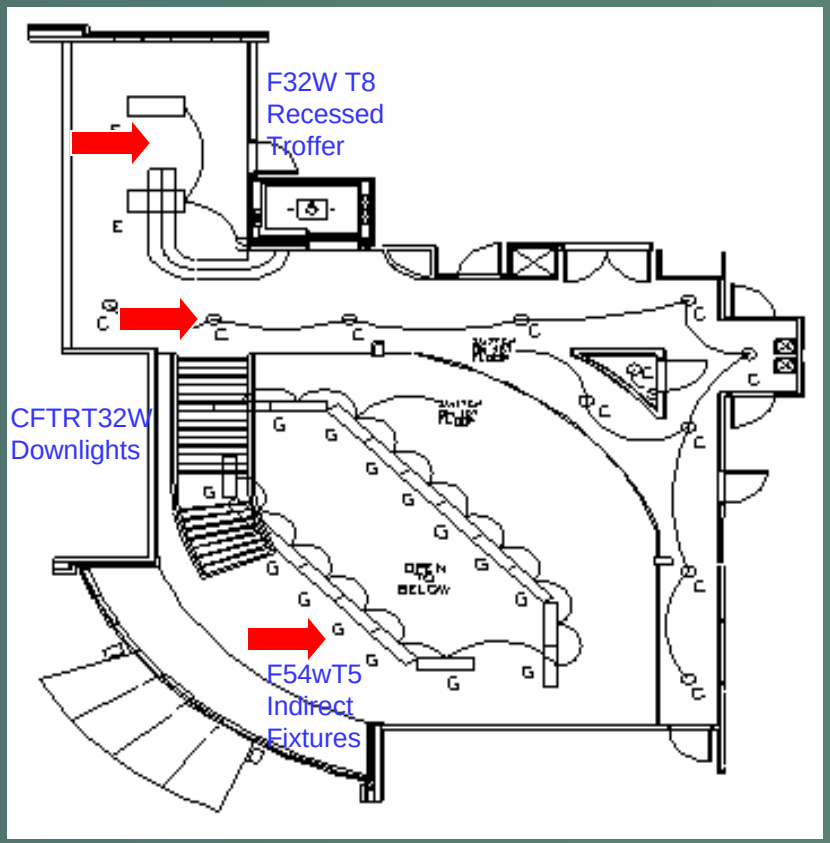
- Fixtures





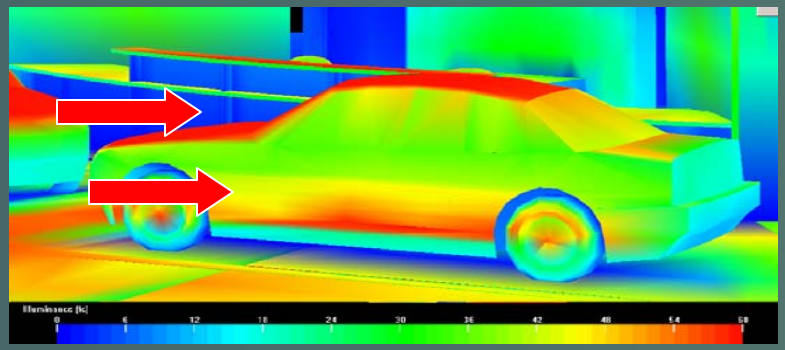
Lobby Lighting Layout





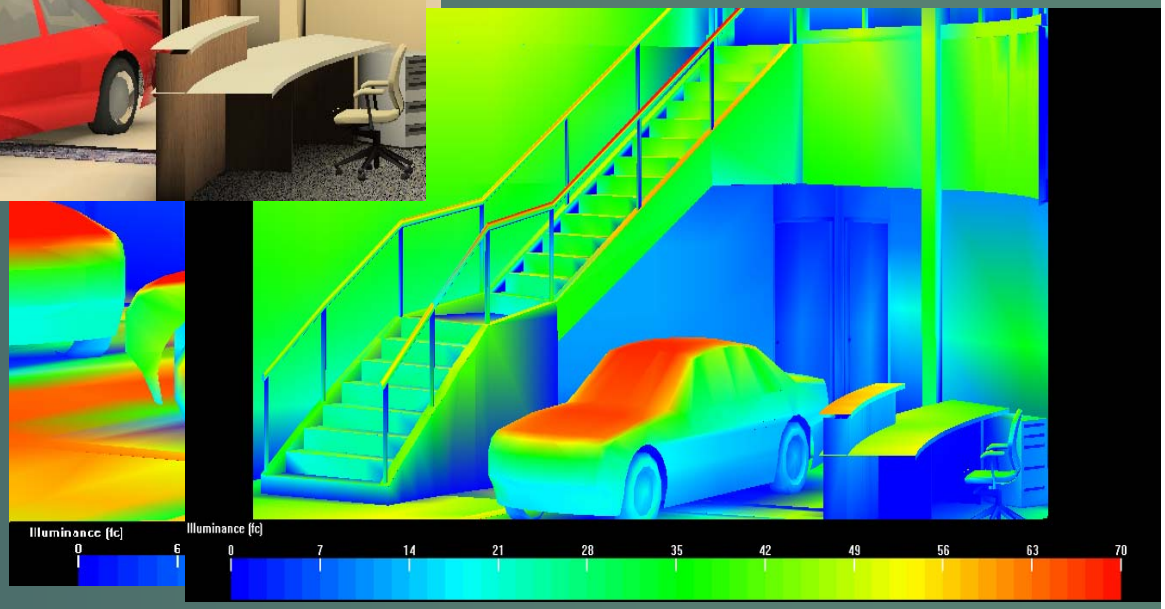
Lobby Lighting Analysis

- Light Analysis
  - Good distribution throughout space
  - 40+ Fc on the reception desk
  - Even distribution on car, no hot spots
- Power Density
  - Allowed by ASHREA 90.1
    1.8 W/Sq.Ft
  - Lighting redesign
    1.21 W/Sq.Ft



Lobby Lighting Analysis

- Background
- Topics
- Lighting
- Boardroom
- Lobby
- Exterior
- Skylights
- Structural
- Mechanical
- Conclusion
- Thank You



Hall Corporate Headquarters
Virginia Beach, Virginia

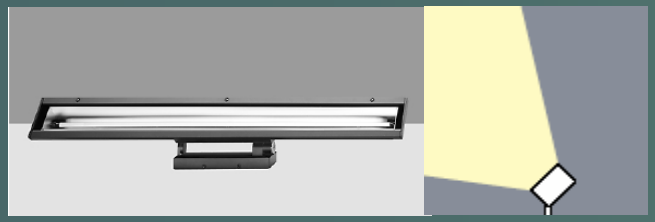
Dan Rusnack
Lighting / Electrical Emphasis

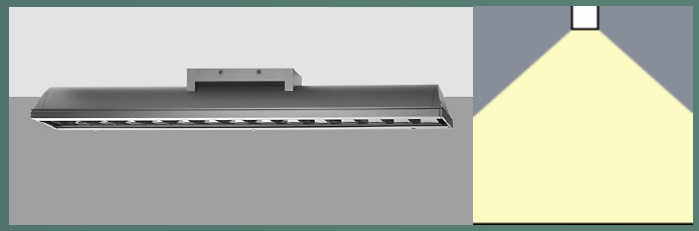
Exterior

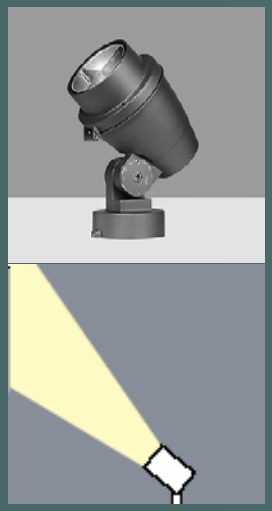
- Design criteria
  - Appearance
    - Accent architectural features, building should look prominent compared to dark background
  - Luminance ratio
    - Ratio of 20:1 between building and surrounding neighboring sites
  - Points of interest
    - The main entrance door and canopy over the door
    - Circular architectural feature atop of roof
    - Walkway leading to building
  - Vertical illuminance
    - 5 – 10 FC average on façade

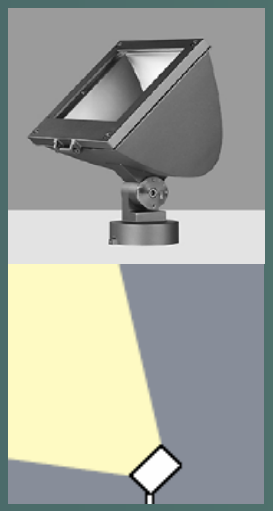
Exterior Lighting system

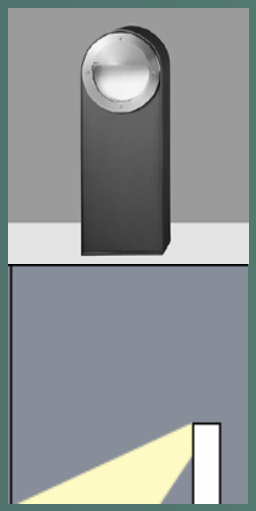
- Fixtures

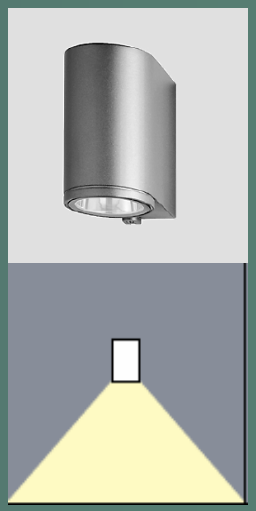


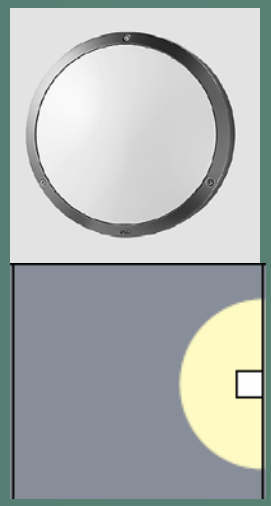




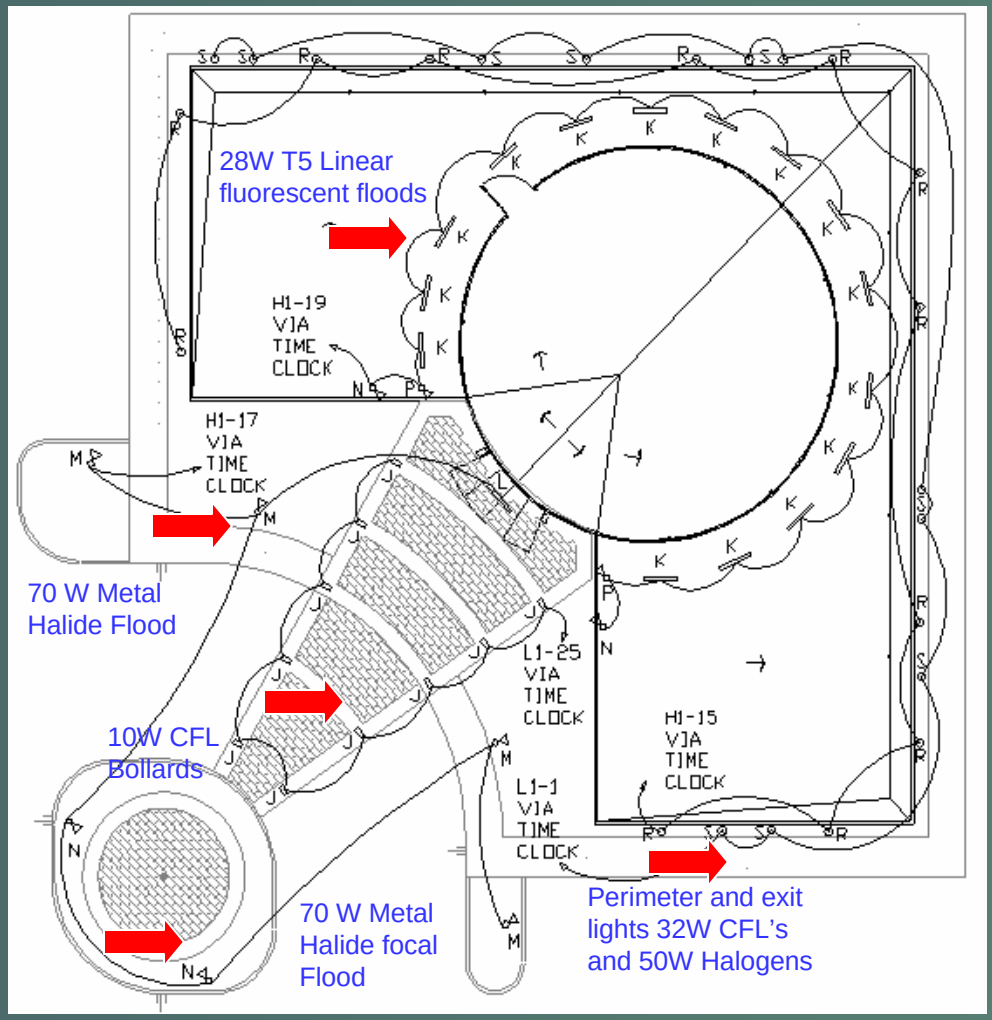








Exterior Lighting layout

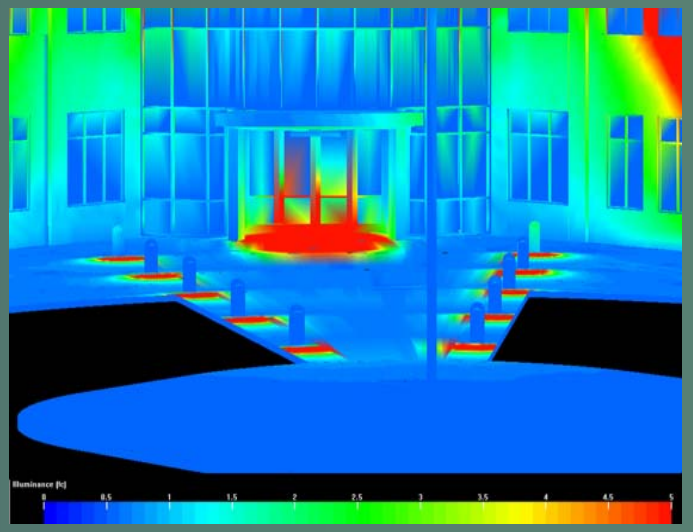


Exterior Lighting analysis

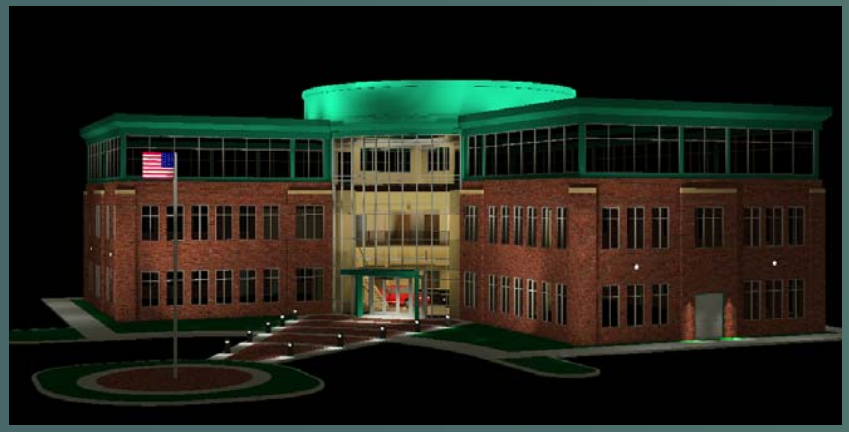
- Power density
  - Exterior façade allowed by ASHREA 90.1 to have 0.25 W/Sq.Ft
  - Lighting design
    - 0.24 W/Sq.Ft just under the allowed amount

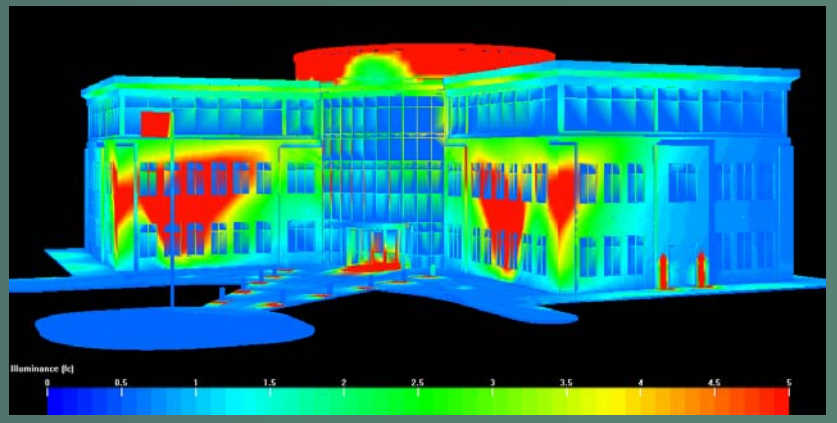
Exterior Lighting Analysis

Lobby lights dimmed at night



Entrance canopy and walkway



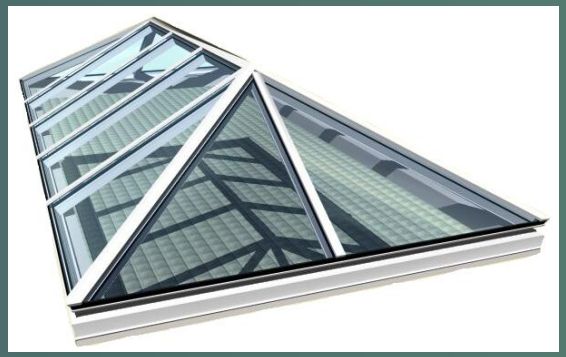


Hall Corporate Headquarters
Virginia Beach, Virginia

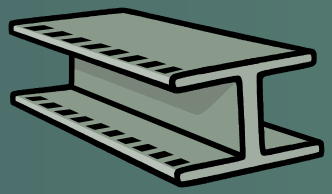
Dan Rusnack
Lighting / Electrical Emphasis

Breadth Work

- Skylight



- Structural



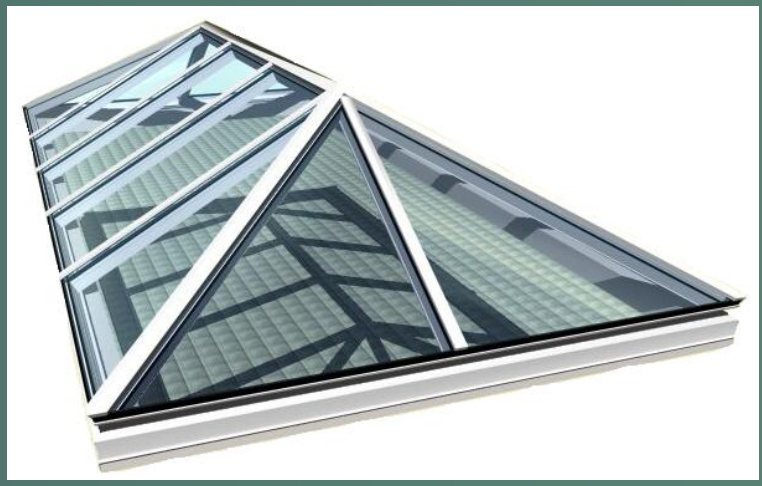
- Mechanical

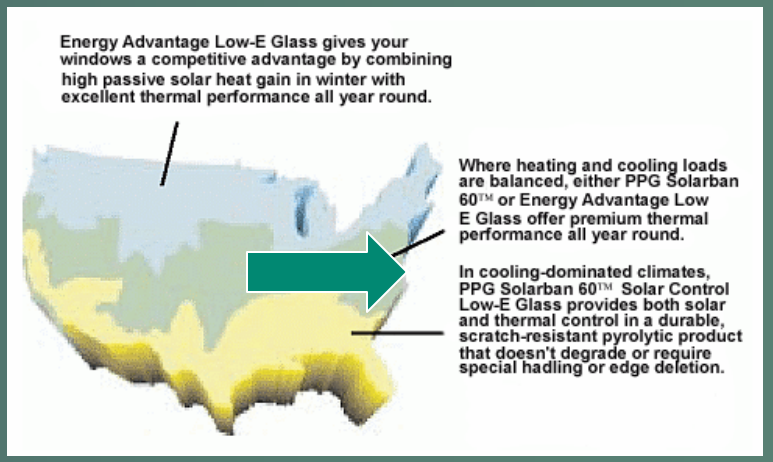
Skylights

- Skylights
  - Use parallel rectangular formula

$$E_{\parallel} = \frac{L}{2}\left(\frac{h}{\sqrt{h^2+q^2}}\tan^{-1}\frac{w}{\sqrt{h^2+q^2}} + \frac{w}{\sqrt{w^2+q^2}}\tan^{-1}\frac{h}{\sqrt{w^2+q^2}}\right)$$

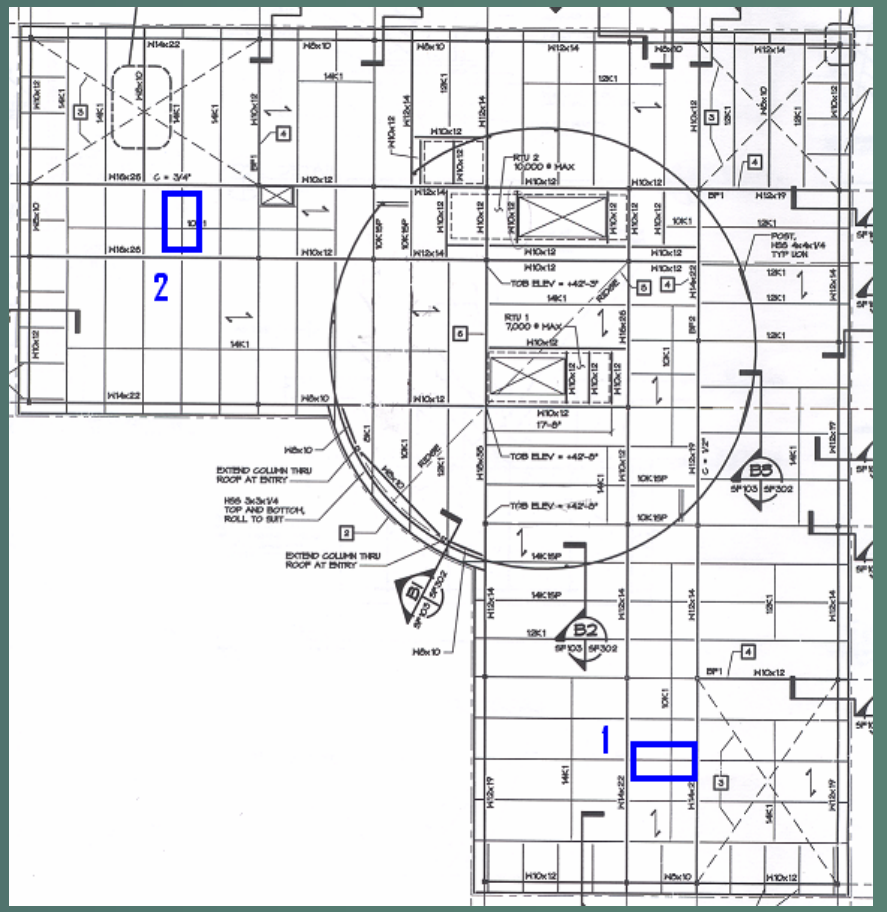
    - Considers ceiling height and dimensions of skylight
    - Assumed illuminance of sky =10,000Fc
    - Looking for approx. 30 Fc on work plane from skylight
  - Hipped ridge shape
  - Cooling and Heating loads, mostly balanced throughout year
  - Glass
    - PPG Solarban 60
    - Transmittance 0.6
  - Design size calculated
    - 9′ x 5′





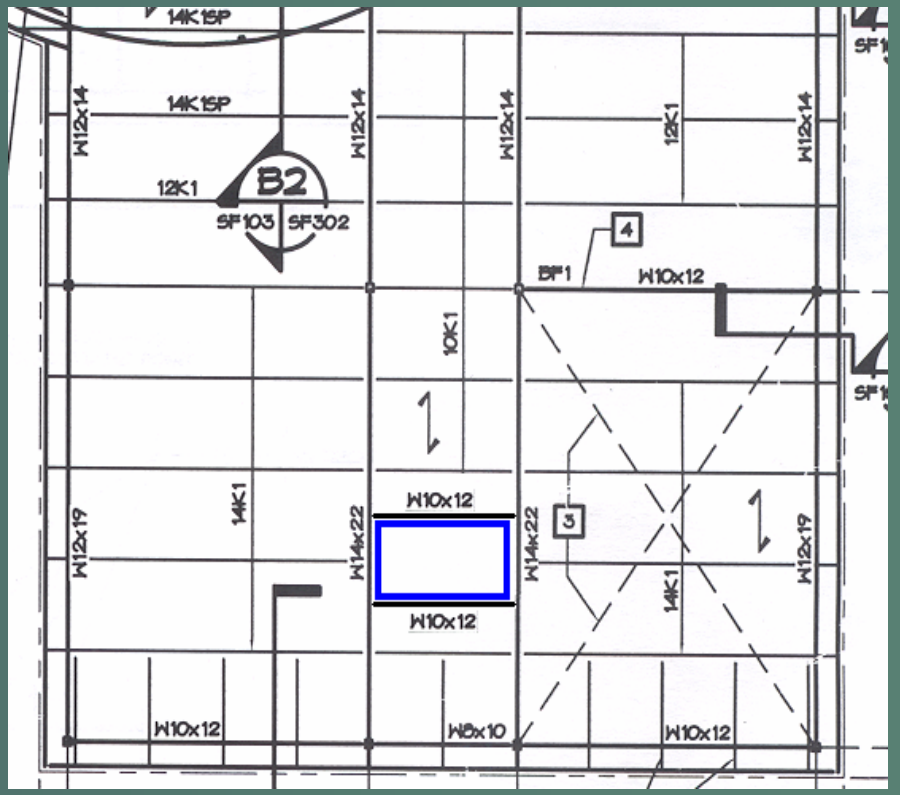
Structural

- Location of Skylights
  - Above open office circulation space
  - One on each corner of third floor
- Structural Change
  - Design location has a joist in the way
  - Alter structural system, replace joist with beams due to increased load
  - Frame in skylight for complete support and attachment purposes



Structural

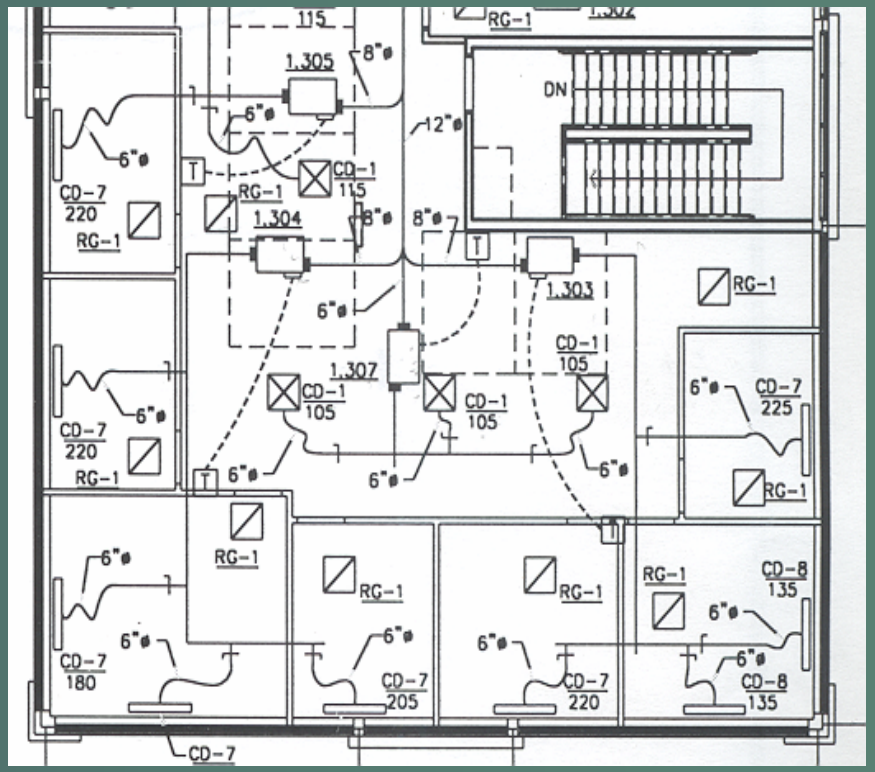
- Beam sizing
  - Moment calculated at new beam locations
  - Sized a W 10 x 12 beam on either side of the skylight due to this moment
  - System now supports skylights along all dimensions



Mechanical

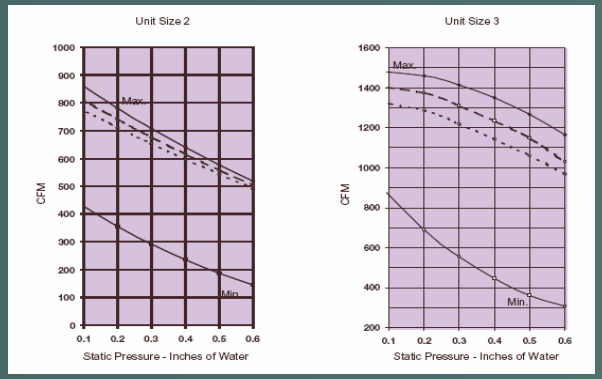
- Cooling loads
  - Solar heat gain from skylight
  - Glass u-value
  - Consider occupancy and heat coming through skylight
- Current system design
  - Has 315 cfm supply
- HAP (Hourly Analysis Program)
  - Output load 1.2 tons
  - Q = 1.08 (cfm) * (ΔT)

  Tons * 12,000 = 1.08 (cfm) * (ΔT)
  - Results show need 740 cfm at peak load
  - Increase size of fan power VAV box!



Mechanical

- Fan powered VAV box
  - Current design
    - unit size 2, 1/6 Hp fan, size 8 inlet
  - In order to supply new load, need next size up
    - New VAV box is a unit size 3, 1/4 Hp fan, size 10 inlet



Titus — Fan Powered Terminals ➤ Performance Data

Models: PTQS, ATQS, DTQS ■ Radiated Sound Application Data ■ NC Values

Unit Size	Inlet Size	CFM	Min. ΔPs	Noise Criteria (NC) Fan Only	ΔPs 0.5"	ΔPs 1.0"	ΔPs 2.0"
2	8	300	0.036	21	21	24	26
		400	0.065	25	25	27	30
		500	0.101	29	29	30	33
		625	0.158	33	33	34	38
		750	0.228	37	37	38	40
3	10	600	0.072	24	24	27	30
		750	0.112	27	27	30	34
		1000	0.199	31	31	34	38
		1200	0.286	33	35	38	40
		1400	0.390	35	36	40	43
4	12	850	0.072	29	31	32	33
		1000	0.099	31	34	34	35
		1100	0.120	33	35	35	38
		1300	0.168	35	37	38	41
		1500	0.223	38	38	40	45

Conclusions

- Lighting
  - New design allows for multiple scenes and ease of controllability
  - Reduction of overall power density saves on electric costs
  - Achieved design goals, produce quality light levels in spaces
  - Building much more prominent at night with redesigned exterior lighting
- Skylights
  - Allow natural light to enter space
  - Reduced the electric lighting load in open office space
  - Create a up lifting feeling for occupants

The End

Questions