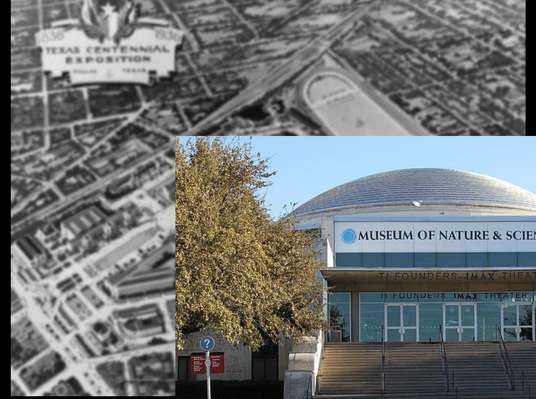
Perot Museum of Nature and Science

Final Lighting Design Presentation

Yucheng Lu, Lighting|Electrical, Adviser: Shawn Good

Dallas Museum of Natural History

- Established in 1936, Dallas Museum of Natural History is a collections-based, research-driven public natural history museum dedicated to document and describe Texas' vast natural diversity.



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Dallas Museum of Nature and Science

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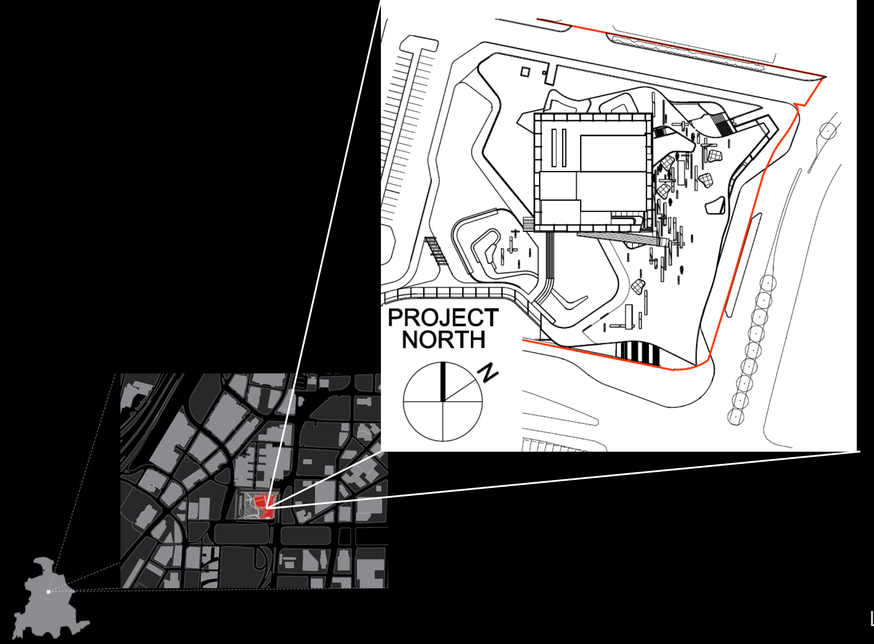
Perot Museum of Nature and Science

- The merge turns out to be successful and allowed the museum to relocate into its new victory park campus in 2012.



Building name: Perot Museum of Nature and Science

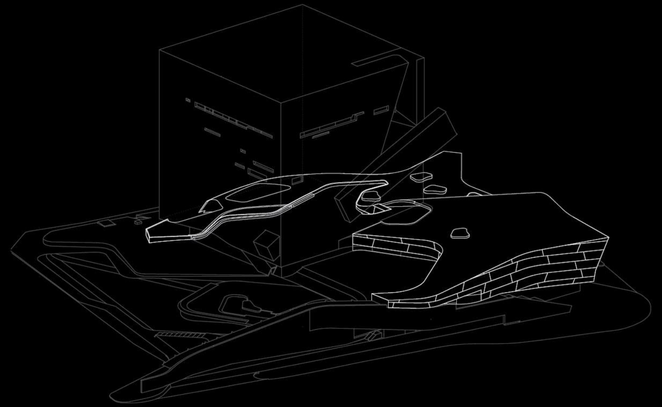
Location and site: 2201 N Field St, Dallas, TX 75201

Occupancy : Public Museum

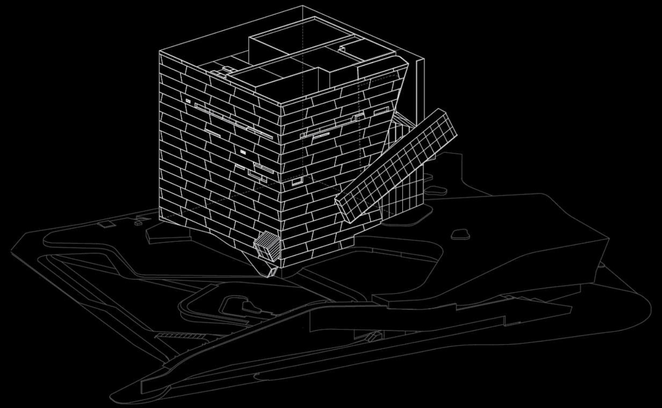
Size: 180,000 ft^2

Total Levels: 5

Dates of construction: 05/2010 – 12/2012



- Artificial landscape plinth is built around the museum, serving as the roof of basement and theater.



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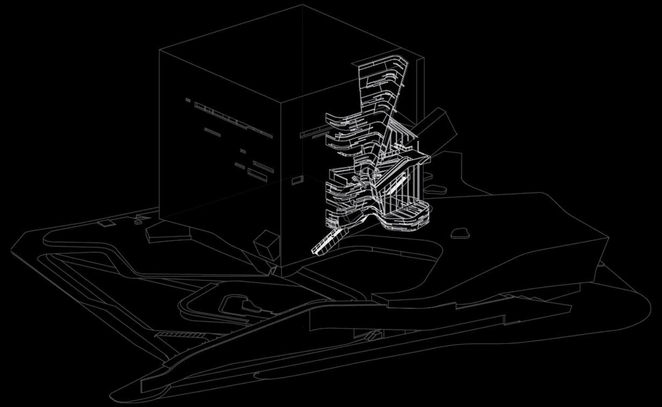

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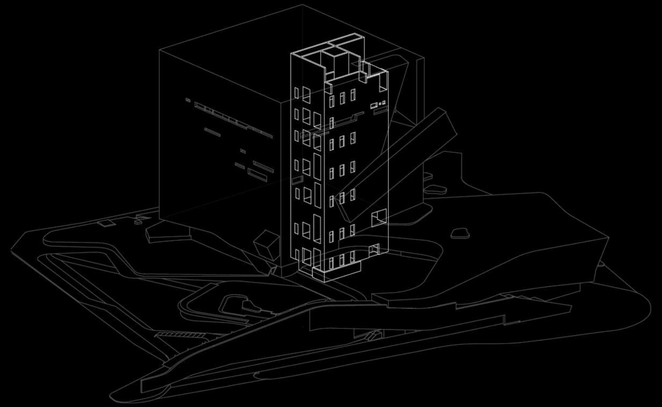

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- Atrium on the south east corner of the building replaced precast concrete with glazings, brings daylight into the space as well as a excellent view.
- Core structure of the building formed an isolated space from the open exhibition hall to host electrical and mechanical devices as well as elevator well.

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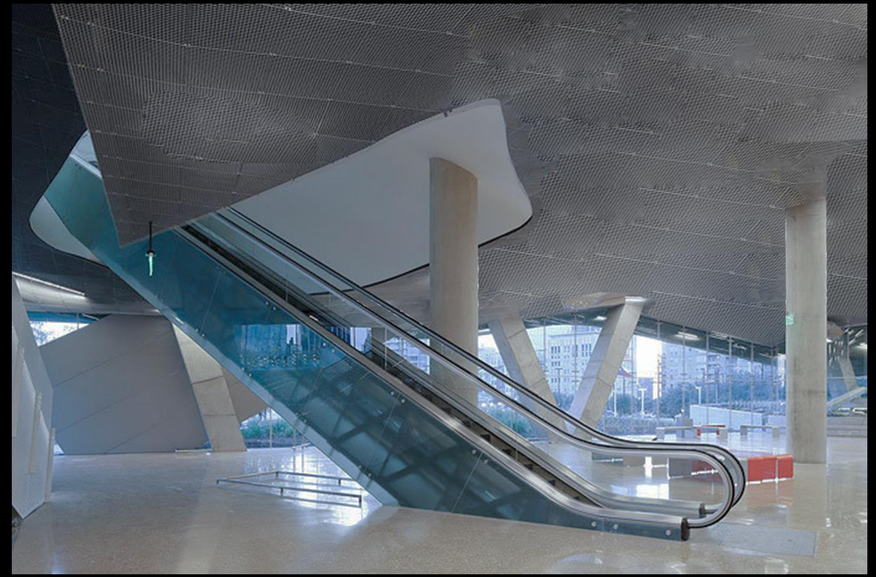
"We are Excited to bring some amazing **family attractions**"

- Nicole Small, Museum CEO



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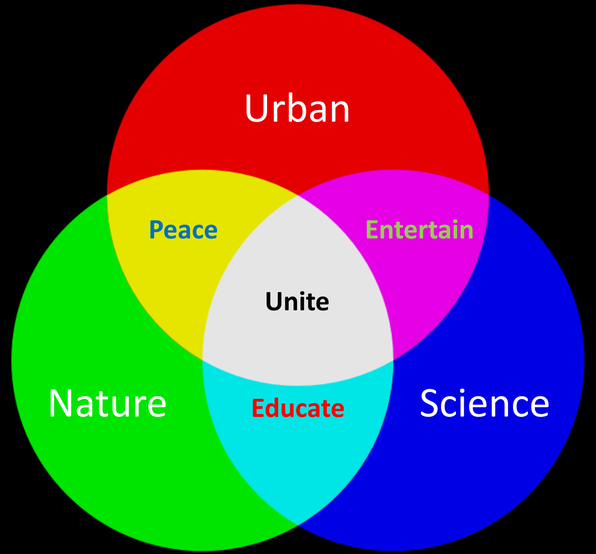
"The experience is about a sequence of moving, a journey. The whole building is about being didactic and itself is an exhibit."

"The building is compelling and will expand user's imagination. Everywhere in the building will be left transparent and you will understand architecture"

- Thom Mayne, Morphosis Architect



Educate

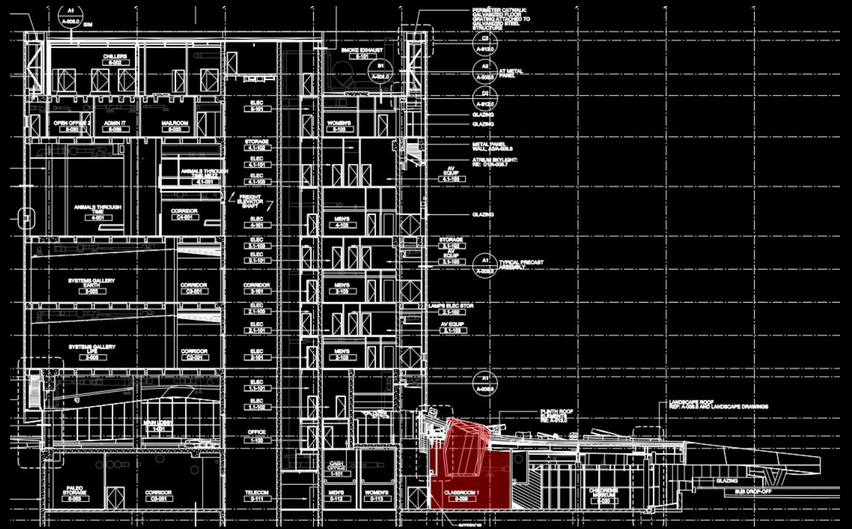
- Design lighting solutions that help demonstrate unique architectural features and inspire visitors.

Peace

- Create a relaxing atmosphere, allow the museum to function as a retreat from fast paced urban life.

Entertain

- Treat lighting system as part of the exhibition, adding visual interest into the museum.



Classroom

Dimensions:

Length = 31 ft

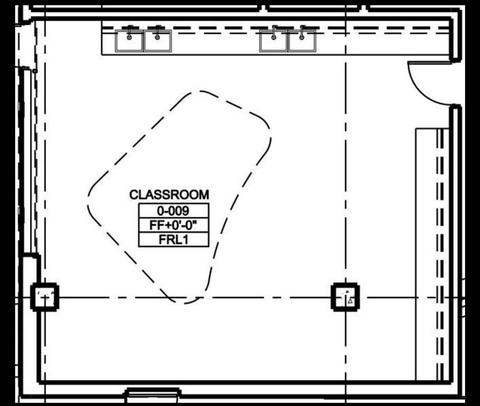
Width = 25 ft

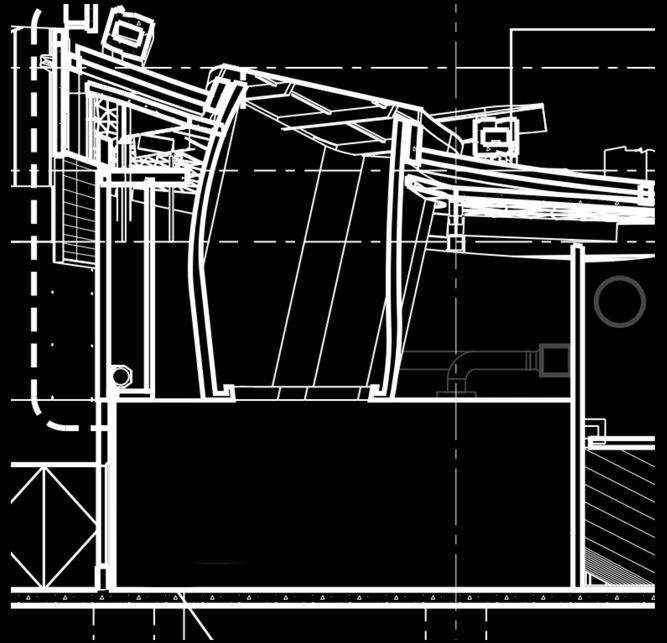
Area = 735 ft^2

Ceiling Height = 12 ft

Roof Height = 28 ft in average

Light Well Height = 16 ft





Design Criteria

Create an atmosphere remarkably distinct from typical education facilities to offer an **exciting learning experience**.

Incorporate light well system into the design to create a three dimensional lighting scheme that **demonstrates Architectural feature**.

Space Type	E_h	E_v	Avg : Min
Classroom	200 lux	75 lux	2:1
White Board		150 lux	3:1

Target Power Density: 1.28 W/SF

Design Approach

Lighting design focus on simulating an underground cave theme, using the light well as the only natural light.

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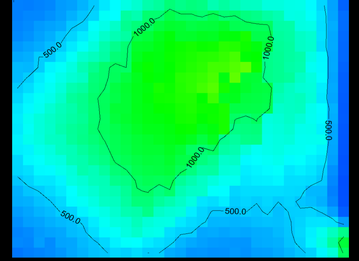
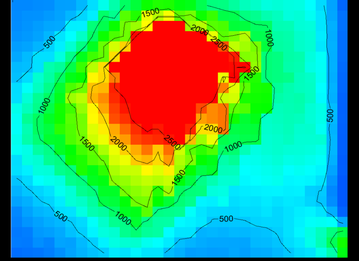
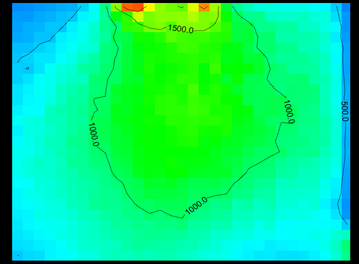
Typical cave elements such as stalactites and Cave plants are simulated though luminaire and finishing to enhance the theme.



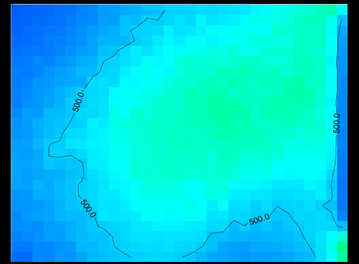
Spring Equinox, 12 PM



Summer Solstice, 12 PM



Fall Equinox, 12 PM



Winter Solstice, 12 PM

Design Approach

Lighting design focus on simulating an underground cave theme, using the light well as the only natural light.

Typical cave elements such as stalactites and Cave plants are simulated though luminaire and finishing to enhance the theme.

Program based daylighting simulation is also used to assist with lighting layout and control strategy design.

Design Result

LED tubes are arranged in a way to surround the light well, gathering attention on it.

Wide distribution floodlight inside the light well made the entire structure itself a luminaire, distributing light throughout the space uniformly.

Whiteboard is illuminated by wall washer to guarantees sufficient light level.

Space Type	E_h	E_v	Avg : Min
Classroom	268 lux	128 lux	2.19 : 1
White Board		215 lux	2.17 : 1

Actual Power Density: 1.05 W/SF

Introduction

Classroom

Theater

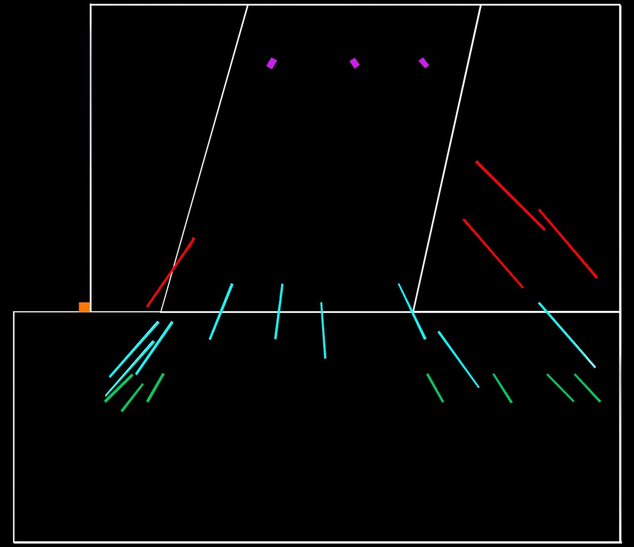
Façade

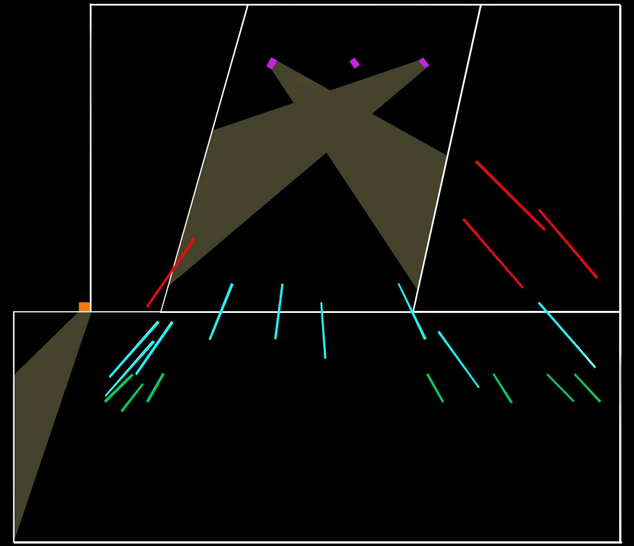
Summary

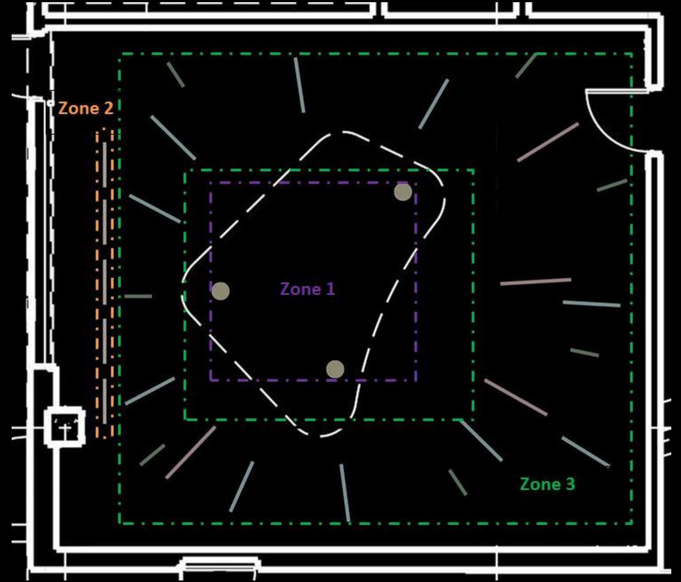
Design Criteria

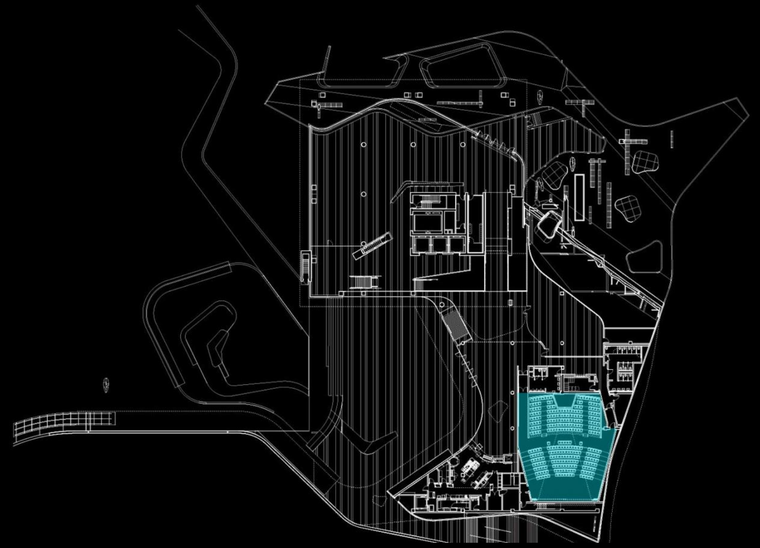
Design Approach

Design Result









Theater

Dimensions

Approximate Area = 3726 ft^2

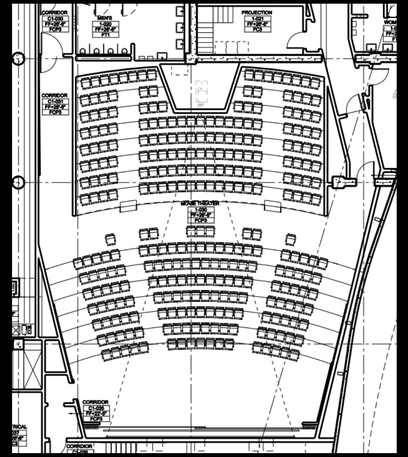
Length = 69 ft

Width at Front Row = 43 ft

Width at Back Row = 64 ft

Ceiling Height at Front Row = 22 ft

Ceiling Height at Back Row = 18 ft



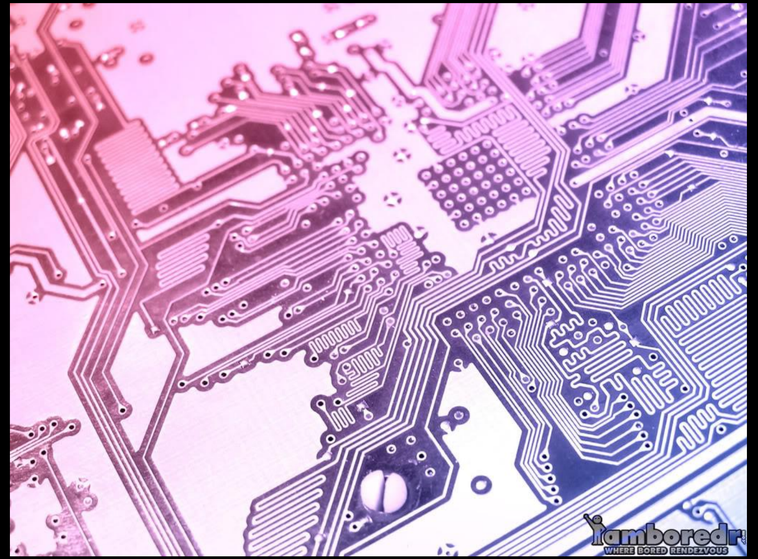
Design Criteria

Lighting design should be integrated with acoustic feature and reinforces its **visual impact**.

Lighting solution should dominate the space with a **inspiring theme**, allow audience to see things from an unusual perspective.

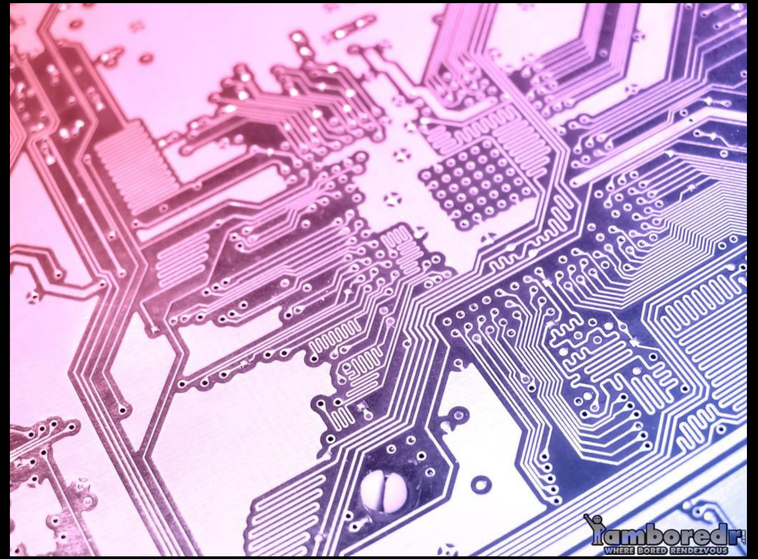
Space Type	E_h	E_v	Avg : Min
Theater	50 lux	30 lux	2:1

Target Power Density: 0.52 W/SF



Design Approach

Lighting features are used to mimic a integrated circuit, demonstrating the working philosophy of electronic devices.



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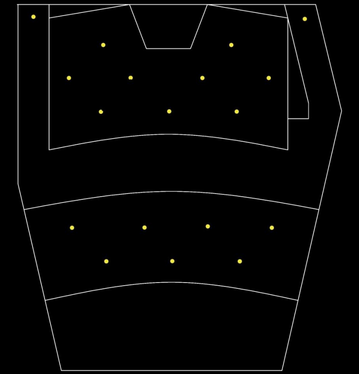

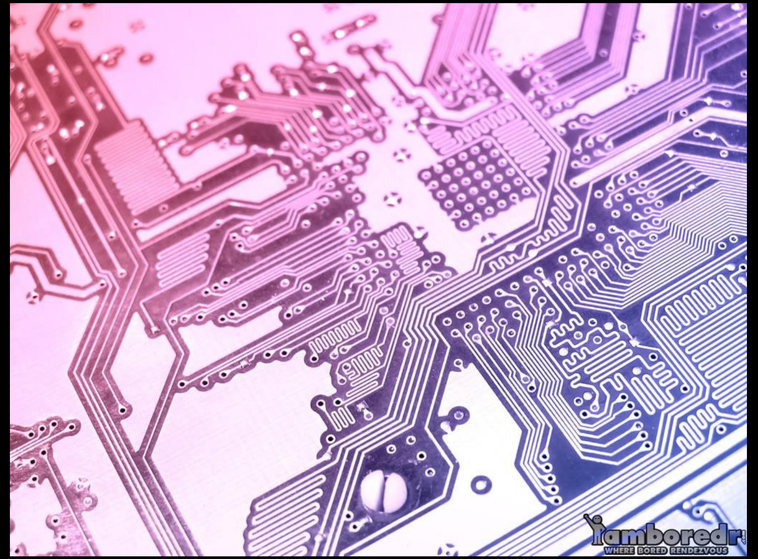

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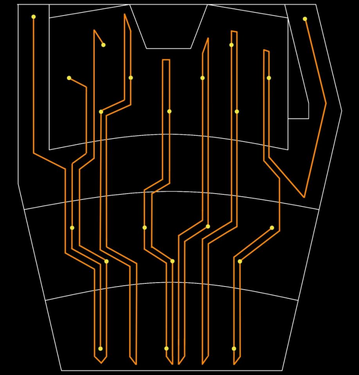
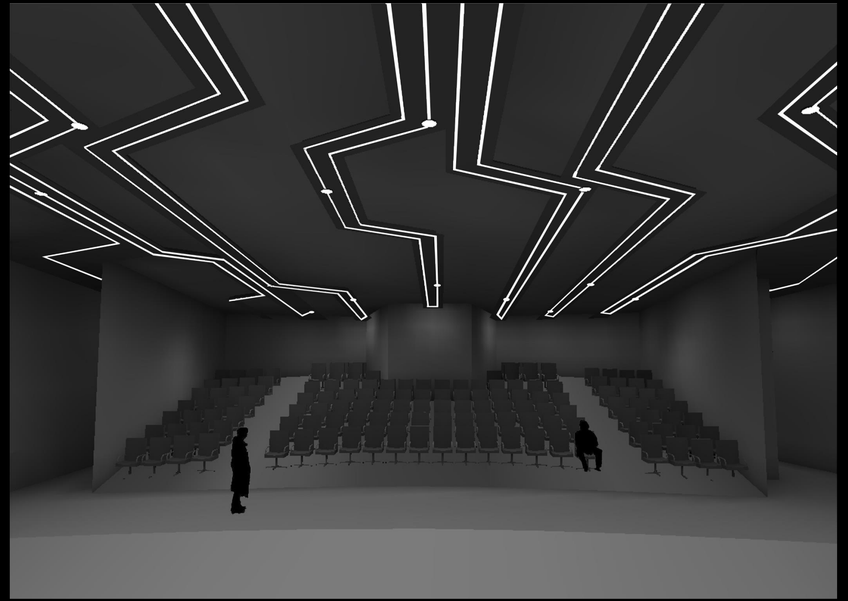


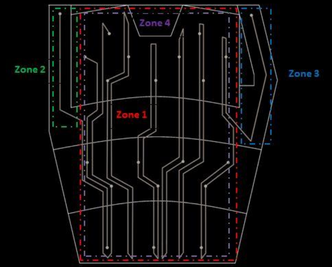


Design Result

Linear LED distributed in a seemingly random pattern to provide visual impact. Uniformly distributed downlights regulates the flow of 'circuit' from being too random and create hot spot.

Space Type	E_h	E_v	Avg : Min
Theater	124 lux	44 lux	1.5 : 1

Actual Power Density: 0.52 W/SF



Facade

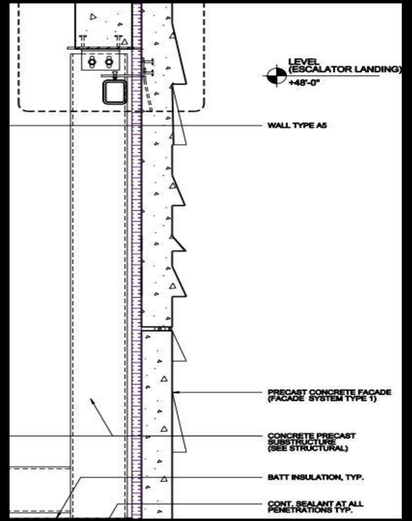
The iconic façade texture of this building is definitely one of the most popular features known by public. During the day textures on the façade cast shadow under sun lighting and from unique scenery. To make those texture properly lighted at night is no doubt a challenge for exterior lighting practice.

Dimensions

Approximate Area = 19856 ft^2

Length = 146 ft

Height = 136 ft



Design Criteria

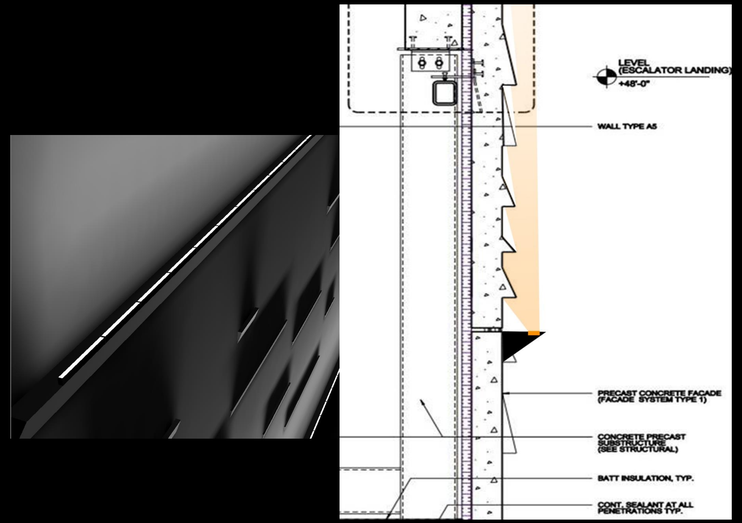
Lighting design should highlight the facade texture for **visual interest**.

Non-uniform distribution is preferred to create a **relaxing atmosphere** according to John Flynn's model.

To maintain the nighttime identity of the museum, lighting solution should also guarantee a majority of the facade is illuminated.

Space Type	E_h	E_v	Avg : Min
Facade		20 lux	5:1

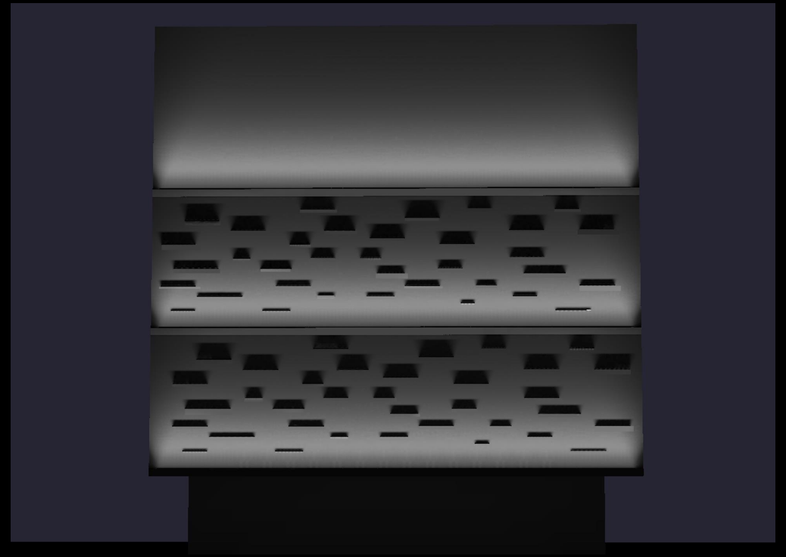
Target Power Density: 0.75 W/SF



Design Approach

The façade is made of precast concrete panels 6 inch thick. Texture on the panel varies from 2 to 4 inch wide. Textures can be easily observed under daylight because the shadow they can formed a contrast with the bright façade itself. Beam with large incident angle can easily eliminate the shadow and make texture hard to be detected. Design for this space should somehow simulate the daytime situation in a different way.

To maintain the nighttime identity of the museum, lighting solution should also provide sufficient amount of light level on the façade surface.



Design Result

The design solution did achieve the target of highlight façade texture at nighttime. However there are also many issues exist with this solution.

First, with most luminaire aiming towards the sky, about 20% of the lighting output is released into the night sky, causing energy waste and might even face code issue for certain district.

Also, narrow distribution require in this design is only available in a high wattage, making the solution provide twice as much light as needed.

Space Type	E_h	E_v	Avg : Min
Facade		39 lux	11:1

Actual Power Density: 1.28 W/SF

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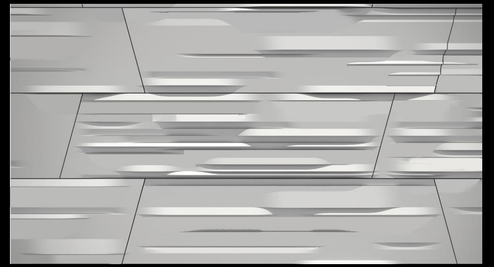

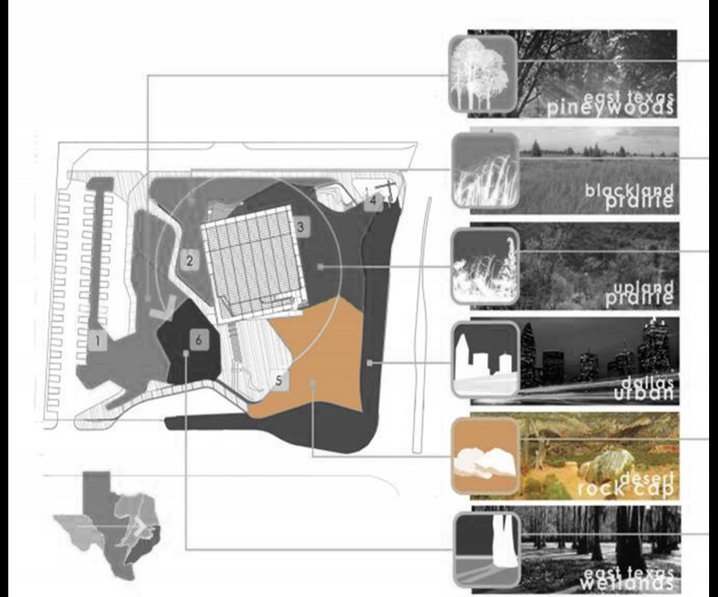

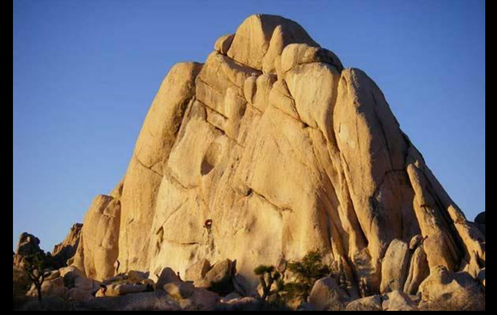

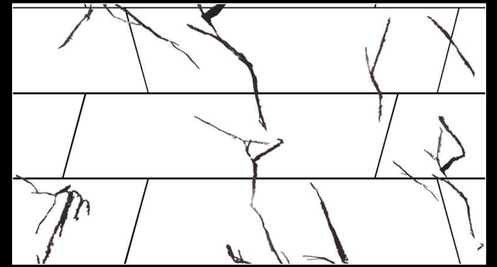

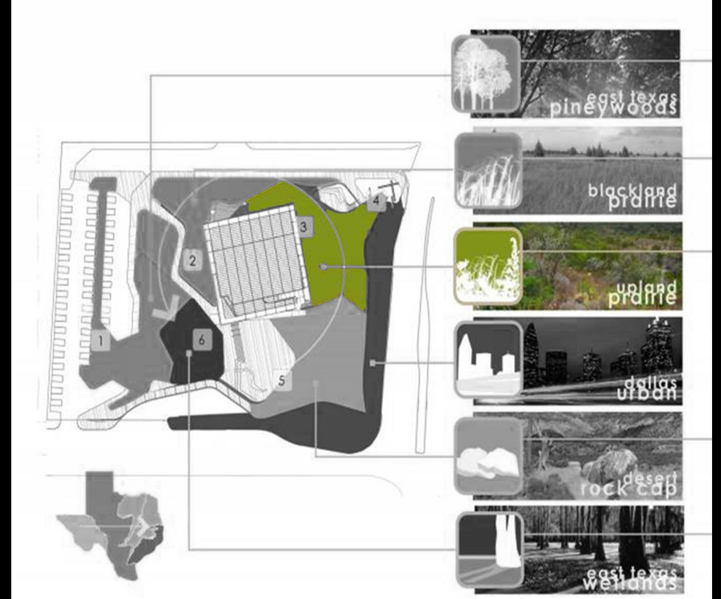

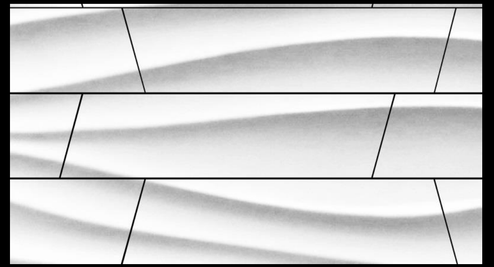

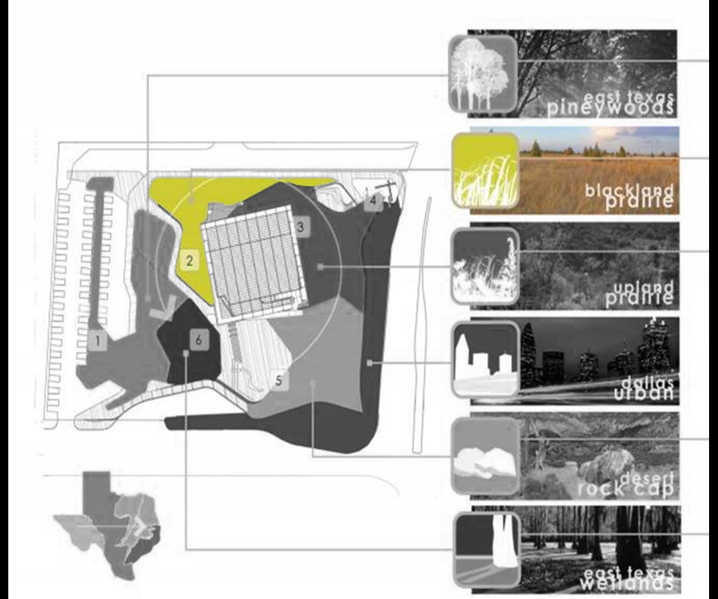

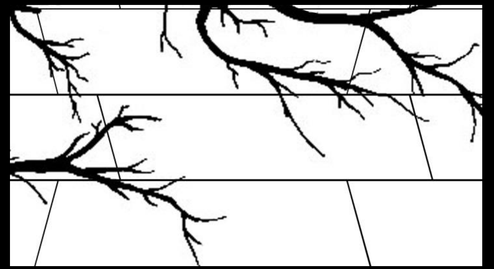

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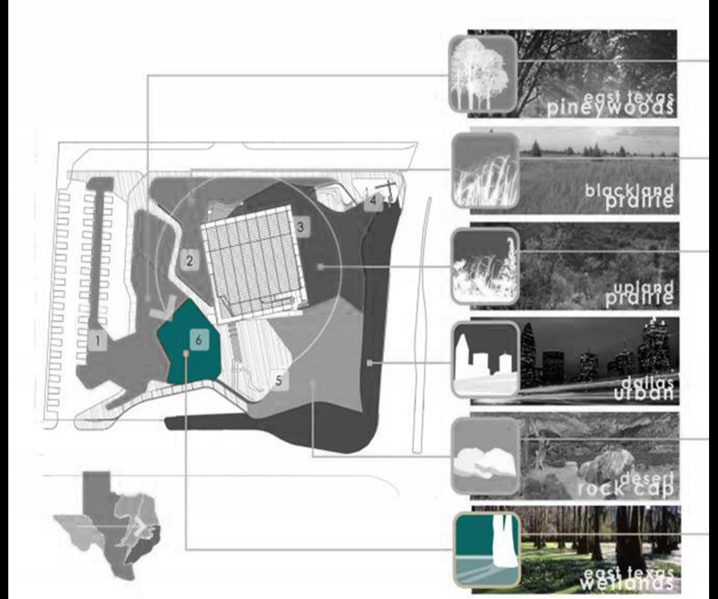
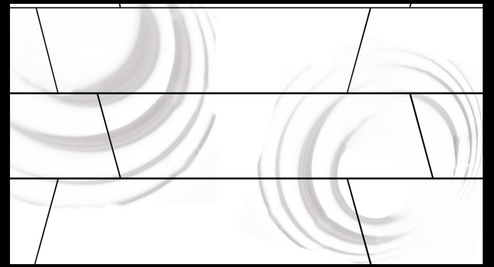
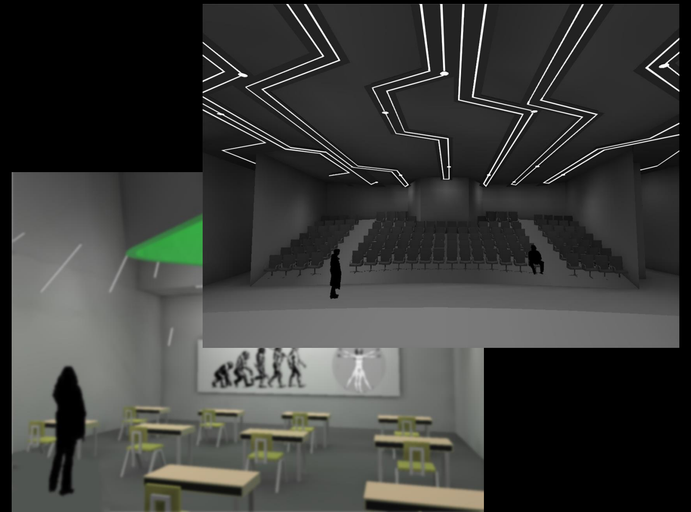




Summary

Lighting design for classroom is intended to highlight the unique light well system, creating a **natural** cave theme.



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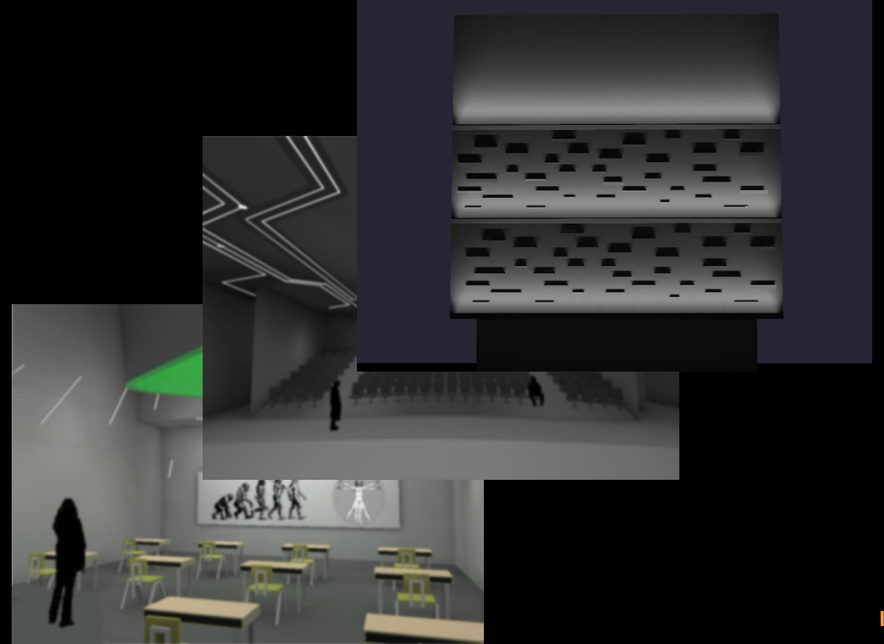
Theater space employed a lighting scheme that simulating integrated circuit, telling the story of how modern **science** discovery have changed the world.



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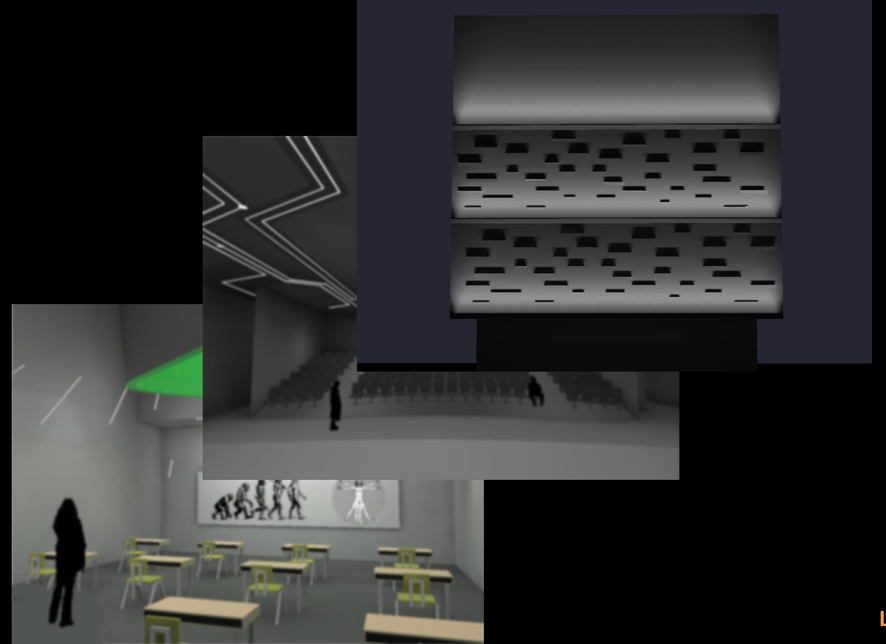

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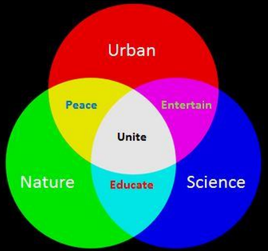
Theater space employed a lighting scheme that simulating integrated circuit, telling the story of how modern **science** discovery have changed the world.

Façade lighting is designed to achieve an iconic visual effect, promoting the nighttime identity of the building in a **urban** environment.



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and YOU

Thanks for your support!

Type	Unit	Lamp/Wattage	Manufacturer	Description	Location	Quantity
C1	Per 2'-0" lengths	LED 13 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	7
C2	Per 4'-0" lengths	LED 22 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	10
C3	Per 5'-0" lengths	LED 27 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	4
C4	Per 4'-0" lengths	T5HO Fluorescent 57 W	COOPER	Neo-Ray recessed wallwasher	Classroom	4
C5	Each	LED 42 W	WE-EF	FLC 142 Surface mounted floodlight installed inside the skylight structure to simulate daylight.	Classroom	3
E1	Per 4'-0" lengths	LED 20 W	ELECTRIX	L101 recessed linear LED, high output	Escalator Cartridge	32
F1	Per 3'-0" lengths	LED 45 W	PHILIPS	Vaya Linear LED with 10 deg narrow distribution	Façade	560
L1	Per 4'-0" lengths	T5HO Fluorescent 32 W	REGENT	FLOW pendant luminaire with direct light emission and translucent housing	Main Lobby	59
L2	Each	Compact Fluorescent 46 W	BEGA	L5211 pendant sphere luminaires with three-ply opal glass with satin matte finish. Integral electronic ballasts included. 1ft in diameter.	Main Lobby	31
L3	Each	Compact Fluorescent 62 W	BEGA	L5212 pendant sphere luminaires with three-ply opal glass with satin matte finish. Integral electronic ballasts included. 1.5ft in diameter.	Main Lobby	18
L4	Each	Metal Halide 70 W	WE-EF	FLC 132 floodlight mounted on track	Main Lobby	3
T1	Per 1'-0" lengths	LED 2.2 W	ELECTRIX	L101 recessed linear LED, standard output	Theater	925
T2	Each	Compact Fluorescent 18 W	Edison Price	DTT 13/6 recessed combination downlight.	Theater	21

LED T8 tubular lamps

Product information

The GE LED T8 range offers safe, reliable and affordable energy saving alternatives to standard Fluorescent T8 lamps.

Available in 2'/60cm, 4'/120cm and 5'/150cm lengths, GE LED T8s can be quickly fitted as a replacement into luminaires operating on electro-magnetic control gear or on electronic gear with a simple re-wire (for further details see intallation guide).

Features

- Energy saving up to 60% (on mains connection versus T8 fluorescent lamps on electro-magnetic gear)
- High light output up to 3000Lm
- Instant-on light
- Long lifetime: up to 50,000 hours L70
- High Power Factor: 0.9
- Wide 130° light distribution
- Compatible with existing installations

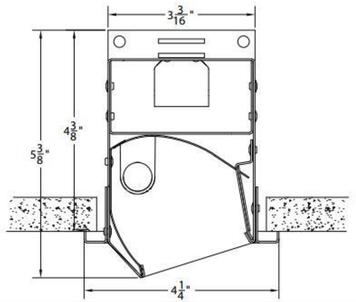
SPECIFICATION FEATURES

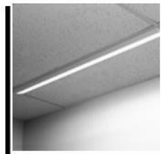
Construction
Housing is one-piece, die-formed, cold rolled steel. Standard 2', 3', 4'and 5' fixture lengths.

Electrical
120, 277, 347 or Universal Voltage electronic ballast. Fixtures and electrical components certified to UL and CUL standards. Note: Please consult factory, Fifthlight may not be available in some configured options.

Finish
Durable, low gloss, white, powder coat acrylic. Optional custom finish.

Mounting
Recessed.





WALL WASH
23XR
Gen II

1T5
1T5HO

Wall Wash
Direct-Indirect

Light Distribution:
Indirect = 1%
Direct = 99%

powered by fifthlight technology

Type	Unit	Lamp/Wattage	Manufacturer	Description	Location	Quantity
C1	Per 2'-0" lengths	LED 13 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	7
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C3	Per 5'-0" lengths	LED 27 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	4
C4	Per 4'-0" lengths	T5HO Fluorescent 57 W	COOPER	Neo-Ray recessed wallwasher	Classroom	4
C5	Each	LED 42 W	WE-EF	FLC 142 Surface mounted floodlight instaled inside the skylight structure to simulate daylight.	Classroom	3
E1	Per 4'-0" lengths	LED 20 W	ELECTRIX	L101 recessed linear LED, high output	Escalator Cartridge	32
F1	Per 3'-0" lengths	LED 45 W	PHILIPS	Vaya Linear LED with 10 deg narrow distribution	Façade	560
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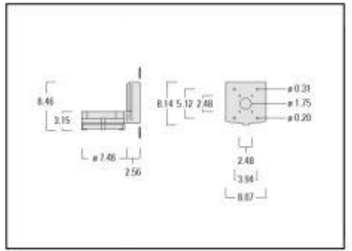

PRODUCT DESCRIPTION

DESCRIPTION	663-4622 FLC142 LED Wall Luminaires / Surface Mounted
BEAM TYPE	symmetric, wide beam
LAMP TYPE	24 LED white 36W (4000K)
LUMENS	3777
CONTROL GEAR	electronic gear

Vaya Linear

BCP420 18xLED-HB/RD 100-240V 10 CE CQC

Vaya Linear - 18 pcs - LED High Brightness - Narrow beam angle 10°

With budgets under pressure, property owners and developers are looking, more than ever, for value for money when it comes to capital expenditures.Vaya Linear is a cost-effective and reliable fixture that minimizes the initial investment, while offering extreme flexibility to create grazing lighting effects. It features a discreet design and is available in two different lengths to suit the application. The robust Vaya Linear also offers a choice of two tones of white with a simple on-off switch, and changing colors with a standard DMX512 controller. It is extremely easy to install and to aim thanks to its adjustable mounting bracket.

Type	Unit	Lamp/Wattage	Manufacturer	Description	Location	Quantity
C1	Per 2'-0" lengths	LED 13 W	GE	LED T8 tube suspended 45 degrees from horizontal facing towards the center of the room. Suspention cable varies from 6' to 20' in length.	Classroom	7
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C5	Each	LED 42 W	WE-EF	FLC 142 Surface mounted floodlight instaled inside the skylight structure to simulate daylight.	Classroom	3
E1	Per 4'-0" lengths	LED 20 W	ELECTRIX	L101 recessed linear LED, high output	Escalator Cartridge	32
F1	Per 3'-0" lengths	LED 45 W	PHILIPS	Vaya Linear LED with 10 deg narrow distribution	Façade	560
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T1	Per 1'-0" lengths	LED 2.2 W	ELECTRIX	L101 recessed linear LED, standard output	Theater	925
T2	Each	Compact Fluorescent 18 W	Edison Price	DTT 13/6 recessed combination downlight.	Theater	21

electrix
ILLUMINATION

PROJECT NAME :

LUMINAIRE TYPE :

L101 LumiLine | Dry

Construction:
- Extruded aluminum housing with satin anodized finish
- Low profile design with lengths ranging from 12" to 96"
- Proprietary optics are UV stable and optimized for transmission
- Numerous stainless steel and aluminum mounting solutions

Electrical:
- Dimmable, high quality light availalble in either 3000K or 4000K
- Solid state low voltage luminaires powered with 24V DC
- Luminaires can be wired in series up to 32' with standard power and 9.75' with high power
- Electronic power supplies can be remotely mounted up to 32' **
- UL listed for dry locations

Performance:
- Average rated LED life of 50,000 hours @ 70% lumen output*
- IES files can be downloaded at www.electrix.com
- All values below are based on initial lumens per foot

Output	Watts/Ft	3000K white	4000K white
Standard	2.2 watts/ft	65 lumens/ft	84 lumens/ft
High	7.4 watts/ft	275 lumens/ft	354 lumens/ft

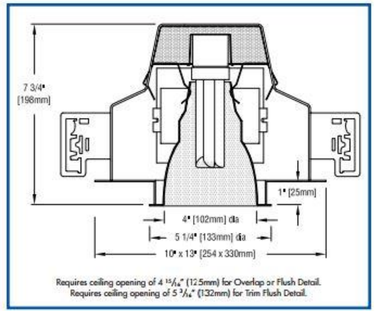
FEATURES

DTT13/4 is an efficient 4" aperture recessed low brightness downlight designed for use with a 13-watt compact fluorescent lamp. The fixture provides a shielding angle of 32°. One basic housing allows interchangeable use of the downlight and wallwash reflectors. This permits housings to be installed first and reflectors installed or changed at any time.

DTT13/4 uses a 13-watt, 4-pin lamp providing 900 lumens, and it consumes only 16 watts when operated at 120 volts. Compact fluorescent lamps have a 10,000-hour life, a color rendering index (CRI) of 85, and are available in a range of color temperatures as warm as 2700°K (nearly duplicating the color qualities of incandescent).

Reflectors are available in clear, natural aluminum in two finishes: **EvenTone**, our standard clear finish, partially diffuse, anti-iridescent and gently luminous in appearance; and **EasyTone**, diffuse and luminous. Additionally, reflectors are available in champagne gold, wheat, pewter and bronze. Wallwash (120°), corner wallwash (210°) and double wallwash (2x120°) reflectors are also available.

DTT13/4 includes a pair of mounting bars (¾" x 27" C channel). Specialty bars for wood joist and T-bar installations are available as accessories.



Requires ceiling opening of 4 15/16" (125mm) for Overlap or Flush Detail.
Requires ceiling opening of 5 3/16" (132mm) for Trim Flush Detail.

PRODUCT CODE

For complete product code, list basic unit and select one item from each following box.

Basic Unit	DTT13/4

Reflector Type

Downlight	no suffix	Corner Wallwash	CWW
Wallwash	WW	Double Wallwash	DWW

L0A

ROOM BASEMENT TELECOM RM-0-111
MOUNTING SURFACE
FED FROM M0C
NOTE

VOLTS 480Y/277V 3P 4W
BUS AMPS 100
NEUTRAL 100%

AIC 65,000
MAIN BKR MLO
LUGS STANDARD

NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C	NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C
	1	20/1	AL4	1.32				2	20/1	AL18, AL12	0.74		
	3	20/1	AL55		0.275			4	20/1	C5		0.16	
	5	20/1	E5			0.11		6	20/1	AL44			0.6
	7	20/1	AL30	1.38				8	20/1	AL18	0.04		
	9	20/1	AL16, AL49, AL9		1.33			10	20/1	E5		1.54	
	11	20/1	AL30			1.08		12	20/1	AL43			1.2
	13	20/1	AL21	0.5				14	20/1	AL9	0.06		
	15	20/1	E1, LN. FL.		0.585			16	20/1	AL9		0.48	
	17	20/1	AL9			0.48		18	20/1	E1			0.195
	19	20/1	AL43	0.15				20	20/1	C1, C2, C3	0.52		
	21	20/1	C4		0.29			22	20/1	SPACE		0	
	23	20/1	SPACE			0		24	20/1	SPACE			0
	25	20/1	SPACE	0				26	20/1	SPACE	0		
	27	20/1	SPACE		0			28	20/1	SPACE		0	
	29	20/1	SPACE			0		30	20/1	SPACE			0
	31	20/1	SPACE	0				32	20/1	SPACE	0		
	33	20/1	SPACE		0			34	20/1	SPACE		0	
	35	20/1	SPACE			0		36	20/1	SPACE			0
	37	20/1	SPACE	0				38	20/1	SPACE	0		
	39	20/1	SPACE		0			40	20/1	SPACE		0	
	41	20/1	SPACE			0		42	20/1	SPACE			0
										TOTAL CONNECTED KVA BY PHASE	4.71	4.66	3.67
										TOTAL CONNECTED AMPS BY PHASE	17	16.8	13.2

	CONN. KVA	CALC. KVA	
LIGHTING	13	16.3	(125%)
LARGEST MOTOR	0	0	(125%)
OTHER MOTORS	0	0	(100%)
RECEPTACLES	0	0	(50%>10)

	CONN. KVA	CALC. KVA	
CONTINUOUS	0	0	(125%)
HEATING	0	0	(100%)
NONCONTINUOUS	0	0	(100%)
KITCHEN EQUIP	0	0	(N/A)
NONCOIN/DIVERSE	0	0	(N/A)
TOTAL KVA	13	16.3	

BALANCED THREE PHASE AMPS 19.6

ELS1B

ROOM RESTAURANT-1ST FLOOR
MOUNTING SURFACE
FED FROM ELS2
NOTE

VOLTS 480Y/277V 3P 4W
BUS AMPS 100
NEUTRAL 100%

AIC 22,000
MAIN BKR MLO
LUGS STANDARD

NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C	NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C
	1	20/1	(EGRESS LTG) AL27B	1.41				2	20/1	(EGRESS LTG) AL27A	0.57		
	3	20/1	(EGRESS LTG) AL44, AL27A		1.83			4	20/1	AL18		0.28	
	5	20/1	(EGRESS LTG) AL27A			1.02		6	20/1	EXIT LTGS (LIFE SAFETY)			0.085
	7	30/3	XFMR TEP1B	1.54				8	20/1	(EGRESS LTG) AL27A	0.18		
	9	|			2.07			10	20/1	(EMERGENCY) E4, E2, E5		0.7	
	11	|				1.83		12	20/1	AL62, AL18			0.144
	13	20/1	T1, EXIT	0.12				14	20/1	E4	0.165		
	15	20/1	T1, ENTRANCE		0.1			16	20/1	(EGRESS LTG) AL18, E4		0.355	
	17	20/1	T1			2.34		18	20/1	(EGRESS LTG) AL62			0.32
	19	20/1	T2	0.45				20	20/1	AL62	0.224		
	21	20/1	SPACE		0			22	20/1	E4, E2		0.37	
	23	20/1	SPACE			0		24	20/1	AL62			0.256
	25	20/1	SPACE	0				26	20/1	E2	0.455		
	27	20/1	SPACE		0			28	20/1	(EGRESS LTG) AL27A		0.21	
	29	20/1	SPACE			0		30	20/1	SPACE			0
	31	20/1	SPACE	0				32	20/1	SPACE	0		
	33	20/1	SPACE		0			34	20/1	SPACE		0	
	35	20/1	SPACE			0		36	20/1	SPACE			0
	37	20/1	SPACE	0				38	20/1	SPACE	0		
	39	20/1	SPACE		0			40	20/1	SPACE		0	
	41	20/1	SPACE			0		42	20/1	SPACE			0
										TOTAL CONNECTED KVA BY PHASE	5.11	5.92	6
										TOTAL CONNECTED AMPS BY PHASE	18.4	21.49	21.7

	CONN. KVA	CALC. KVA	
LIGHTING	17	21.3	(125%)
LARGEST MOTOR	0	0	(125%)
OTHER MOTORS	0	0	(100%)
RECEPTACLES	1.72	1.72	(50%>10)

	CONN. KVA	CALC. KVA	
CONTINUOUS	0	0	(125%)
HEATING	0	0	(100%)
NONCONTINUOUS	0.8	0.8	(100%)
KITCHEN EQUIP	0	0	(N/A)
NONCOIN/DIVERSE	0	0	(N/A)
TOTAL KVA	19.5	23.8	

BALANCED THREE PHASE AMPS 28.6

ELS0A

ROOM
MOUNTING SURFACE
FED FROM ELS2
NOTE

VOLTS 480Y/277V 3P 4W
BUS AMPS 100
NEUTRAL 100%

AIC 14,000
MAIN BKR 100
LUGS STANDARD

NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C	NOTE	CKT #	CKT BKR	CIRCUIT DESCRIPTION	KVA LOAD A	B	C
	1	20/1	AL61A, AL46B	1.4				2	20/1	AL59	0.88		
	3	20/1	AL61A, AL46B		1.58			4	20/1	AL59		0.64	
	5	20/1	AL61A, AL61B			1.75		6	20/1	AL54			1.4
	7	20/1	AL15	0.75				8	20/1	(EGRESS LTG) E3	0.32		
	9	20/1	AL50		0.825			10	20/1	AL59		0.16	
	11	20/1	(EGRESS LTG) AL47A			0.945		12	20/1	AL45			0.15
	13	20/1	AL47A	0.945				14	20/1	AL56	1.95		
	15	20/1	(EGRESS LTG) AL47A		0.945			16	20/1	AL56		0.6	
	17	20/1	F1			2.2		18	20/1	AL21			0.5
	19	20/1	F1	4.5				20	20/1	AL55	0.175		
	21	20/1	F1		2.2			22	20/1	F1		4.5	
	23	20/1	F1			2.2		24	20/1	SPACE			0
	25	20/1	SPACE	0				26	50/3	XFMR TEP0A	4.59		
	27	20/1	F1		2.2			28	|			4.37	
	29	20/1	AL45			0.15		30	|				5.09
	31	20/1	E5	1.21				32	20/1	EXIT LTGS (LIFE SAFETY)	0.125		
	33	20/1	AL49		0.144			34	20/1	E5, E2		0.435	
	35	20/1	AL21			0.5		36	20/1	(EGRESS LTG) AL62, AL7			0.808
	37	20/1	AL55	0.5				38	20/1	AL62, AL18	0.808		
	39	20/1	(EMERGENCY) E8, E3		0.632			40	20/1	AL57		0.19	
	41	20/1	(EGRESS LTG) AL4			0.99		42	20/1	AL47A			1.13
	43	20/1	(EGRESS LTG) AL9	1.26				44	20/1	(EMERGENCY) E2	0.325		
	45	20/1	SPACE		0			46	20/1	SPACE		0	
	47	20/1	SPACE			0		48	20/1	SPACE			0
										TOTAL CONNECTED KVA BY PHASE	19.7	21.7	20.1
										TOTAL CONNECTED AMPS BY PHASE	71	78.4	72.5

	CONN. KVA	CALC. KVA	
LIGHTING	51.9	64.9	(125%)
LARGEST MOTOR	0.1	0.125	(125%)
OTHER MOTORS	0	0	(100%)
RECEPTACLES	7.32	7.32	(50%>10)

	CONN. KVA	CALC. KVA	
CONTINUOUS	0	0	(125%)
HEATING	0	0	(100%)
NONCONTINUOUS	6.63	6.63	(100%)
KITCHEN EQUIP	0	0	(N/A)
NONCOIN/DIVERSE	0	0	(N/A)
TOTAL KVA	66	80.1	

BALANCED THREE PHASE AMPS 96.3

Reverberation time is the most commonly applied standard for acoustic performance evaluation.

RT = 0.05*V/Sum(S* α)

V = room volume
S = surface area, per material
α = absorption coefficients

Floor, wall and ceiling area are calculated form the AutoCAD model, while the surface area of seated audience Assume a 60% occupancy, 5 ft^2 per seated seat and 2 ft^2 per unoccupied seat.

$A_{occupied}$ = 0.6 * 300 * 5 = **900 ft^2**
$Aun_{occupied}$ = 0.6 * 300 * 2 = **360 ft^2**

	Area	$S\alpha_{125}$	125 HZ	$S\alpha_{250}$	250 HZ	$S\alpha_{500}$	500 HZ	$S\alpha_{1000}$	1000 HZ	$S\alpha_{2000}$	2000 HZ	$S\alpha_{4000}$	4000 HZ
J+J Invision carpet tiles	4031	161.2	0.04	120.9	0.03	241.9	0.06	403.1	0.1	80.62	0.02	80.62	0.02
Fabritrak system with Knoll and Maharem fabric acoustic wall	3761	564.2	0.15	488.9	0.13	902.6	0.24	1692	0.45	3084	0.82	2407	0.64
Fabritrak system with Knoll and Maharem fabric acoustic ceiling	6028	180.8	0.03	241.1	0.04	663.1	0.11	1025	0.17	1447	0.24	2110	0.35
Occupied Seats	900	414	0.46	612	0.68	531	0.59	477	0.53	594	0.66	594	0.66
Unoccupied Seats	360	126	0.35	198	0.55	169.2	0.47	147.6	0.41	212.4	0.59	198	0.55
SUM S*α		1446		1661		2508		3745		5418		5389	
RT		2.39		2.08		**1.38**		0.92		0.64		0.64