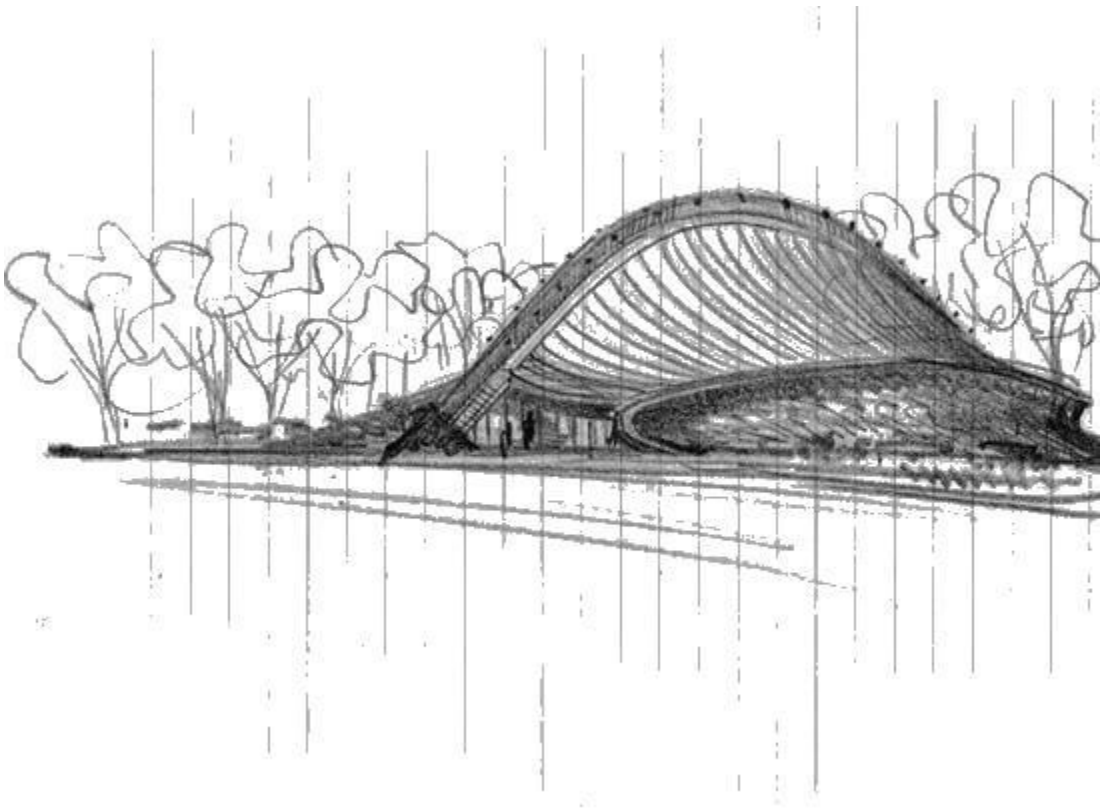

David S. Ingalls Rink

73 Sachem Street, New Haven, CT 06501

Tech Report I

Amy Chengyue Huan

Lighting/Electrical

Faculty Advisor: Dr. Houser

09.09.16

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|Excecutive Summary

The following technical report analyzed four spaces from David S. Ingalls rink through sets of design criteria with qualitative and quantitative considerations. Space geometry was studied through dimension and task analysis. Existing lighting conditions was evaluated through computer modeling and site visit.

Four space analyzed include:

Building Exterior | Outdoor Space
Ice Rink | Special Purpose Space
Concourse and Seating Area | Circulation Space
Schley Memorial Club Room | Special Purpose Space

The overall lighting design for David S. Ingalls rink offers flexible and functional solution which mostly complies with ASHRAE 90.1 Standard and IES recommendation. Potential improvement can be achieved through energy standpoint using LED advanced technology. Further development can be made to help reinforce the architectural appearance to the building exterior and establish unique night time identity as a distinctive and iconic landmark.

|General Building Data

Building name: David S. Ingalls Rink
Date Constructed: 1953 - 1959 (Renovation 2008-2010)
Location: New Haven, CT
Site: 73 Sachem St, New Haven, CT
Building Occupant Name: Yale University
Occupancy or function types: Assembly A-4. The constructed building contains ground floor Rink, Concourse, lower level Locker Rooms, Fitness Center, Schley Club Room and other utility rooms.
Site Area: 1.48 ac
Building Footprint: 47,983 sf
Total gsf: 61,646 sf

|Control

The lighting system is controlled by a Lutron lighting control system that is designed to provide two-level output: full output for varsity practice and games, then 50% output for recreational skating to save further energy. The system was designed to be turned off during unoccupied periods to save energy and preserve lamp life.

|Agi 32

Calculation files are located in Y:\cih5144\Tech\Agi

Tech Report 1

Building Exterior

The exterior of David S. Ingalls Rink establishes its visual identity – "the Yale Whale" with the dramatic sweeping roof. The elliptical shaped building has its main structure of 290 foot long reinforced concrete spine for cable net to hang from to support the iconic roof. The side walls are the same shape in plan as the arch is in section, acting as a counter part of the arch. The exterior walls are also sloped to increase the structural integrity, in the meantime enhance the visual expression of the arch. The rink sits in a quiet neighborhood of residential houses inside Yale Old campus, with several educational buildings on its south side. The parking lot is a place of socialization on the game day with food stands around the arena.

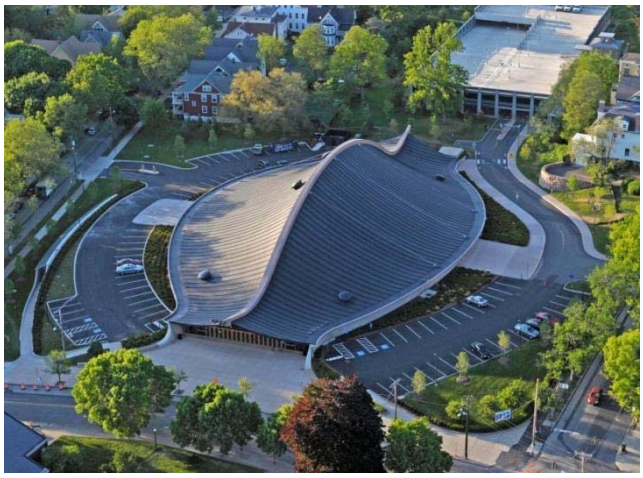


Figure 1 | Arial View

Figure 2 | Building Facade

Geometry

Maximum Length: 335'
Maximum Width: 196'
Maximum Height: 66'
Building Footprint: 47,983 SF

Material Finish

Surface	Material	Description	Reflectance	Transmittance
Roof	Oak Wood	Existing oak wood roof in dark finish	0.2	-
	Aluminum	Metal framing to help resist snow load	0.6	-
Formwork	CMU	Unfinished concrete with wood texture	0.4	-
Façade	Wood Framing	Existing wood frame in light finish	0.7	-
	Glass	Insulated Opaque Spandrel Glass	0.51	0.28

Table 1 | Building Exterior Material Properties

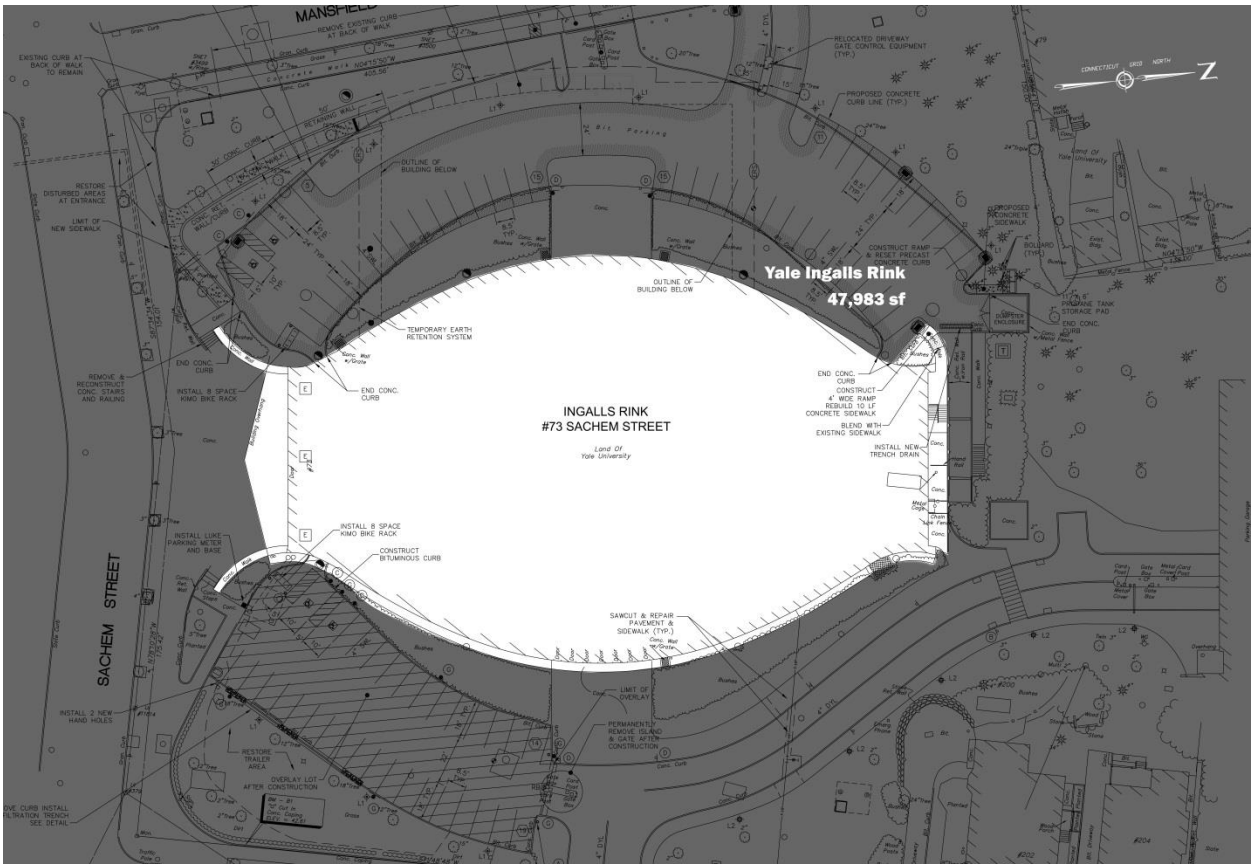


Figure 3 | Site Plan

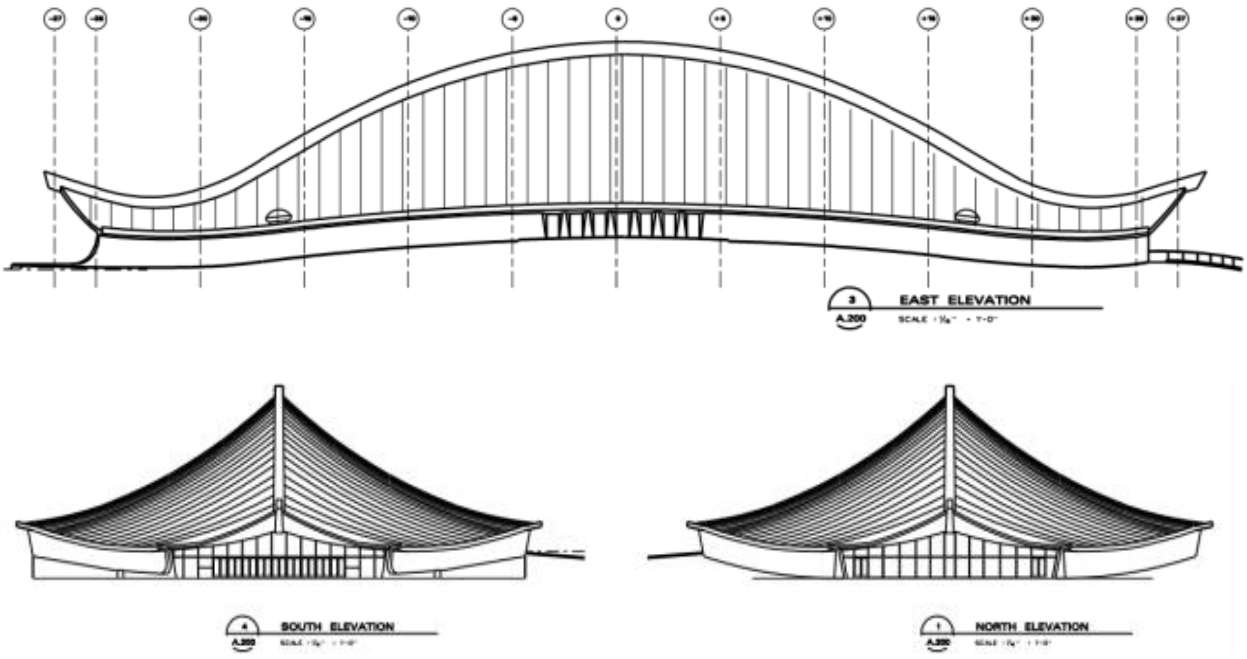


Figure 4| Building Elevations

Existing Lighting Conditions

The existing lighting design for the building exterior included wall mounted puck fixtures on the building east and west to illuminate the entrance and exit. On the west side, a light sculpture created by Oliver Andrews with four 100W Phillips induction lamps added highlight and enhanced the "soaring" effect to the main façade. Three surface mounted downlights were placed on each side of north and south exits. Philips Lumec Oval Series street poles were used to illuminate the parking lot and building exterior. Considering the scale of the project, lighting fixtures used for exterior illumination is minimal.

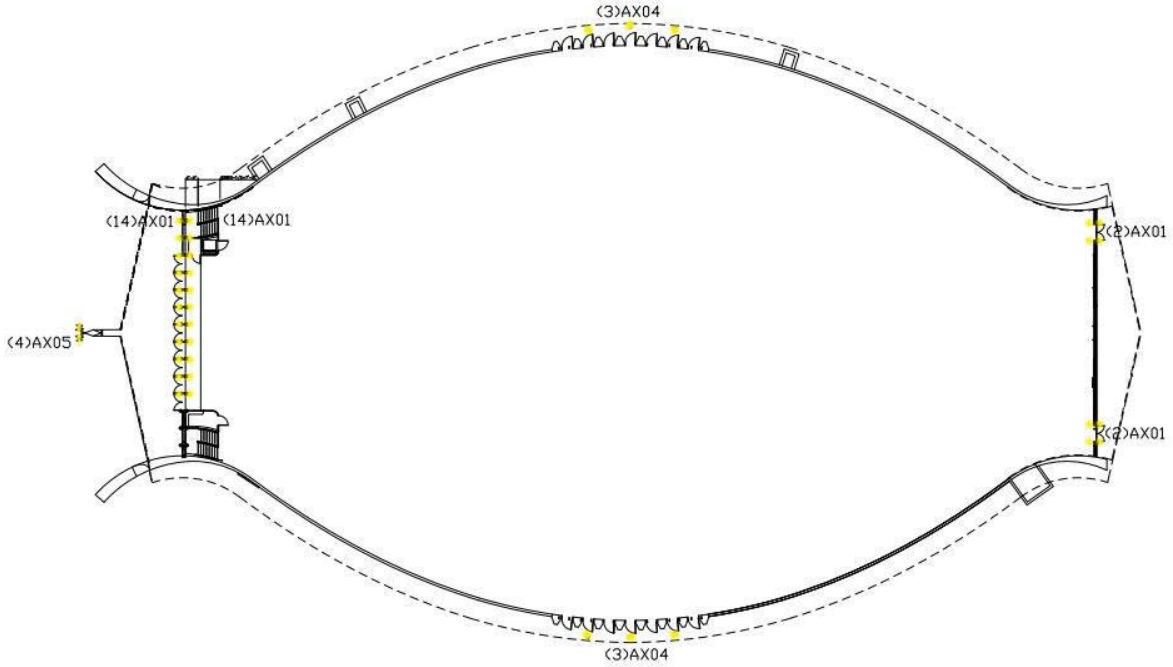


Figure 5| Building Exterior – Existing Lighting Plan

Type	Luminaire	Mounting	Description	Lamps	Model	Remarks
AX01	Exterior Sconce Up/Down Distribution	Surface-mount on Mullion	Nominal 18" H x 6" Diameter x7" projection, cast aluminum housing, up/down reflector, cleared tempered glass lens, integral electronic ballast	(2) 26W TTT (835)	Kirlin FWR-06066-Accessory # 86 (Tempered Glass lens)-Modiifed wall bracket with canopy plate to be mounted on window mullion	U.L. wet location listed EM where required by Engineer
AX04	Exterior Downlight	Surface-mount	Nominal 1'-0" diameter x 4" D, aluminum housing,specular alzak aluminum reflector, prismatic spread lens, and integral electronic ballast	(1) 26W TTT (835)	Kirlin # FSR-12057-17-35	U.L. wet location listed EM where required by Engineer

AX05	Exterior "Dragon Eye"	Surface-mount	Existing lighting fixture designed by Oliver Andrews, a sculptor from UCLA.	100W Induction	Phillips #unknown	It is believed to be manufactured by Sterner Lighting (no longer in business)

Table 2 | Schedule – Building Exterior

Design Considerations and Criteria

David S. Ingalls Rink the home of numerous national championship collegiate hockey teams, and is recognized as the rink with the "best design" across all of America by *New York Times*. As such, it has a venerable history and a reputation as a hallowed spot for the university. The architect Eero Saarinen was very enthusiastic about three common principles of the architecture of his time: function, structure, and being a part of his time. In relation to the neighborhood, the mass and scale of Ingalls Rink together with the dramatic structural elements harmoniously enhanced the surrounding environment. The lighting design of the building exterior needs to respect the historically significant architecture of Ingalls Rink, structurally and visually integrate with existing landscape such as trees and street poles. The design also has to follow city codes, and be able to resist strong winds and snow.

|Illuminance Recommendation

Space Type	E_v
Facades Activity Level [Medium][Low] Lighting Zone[LZ3]	200lux high activity/100lux low activity for darker toned surface materials (reflectance <0.5); 100 lux high activity/50lux low activity for lighter-toned façade materials (reflectance ≥0.5)

IES Lighting Handbook 10th Edition (Table 26.2, 26.4, 22.4)

| Energy Allowance

Space Type(zone3)	Power Density (W/sqf)
Main Entries	30W/linear foot of door width
Entry Canopies	0.4W/ft^2
Building Façade	0.15W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length
Building Grounds	0.8W/linear foot for walkways less than 10 ft wide. 0.16W/$ft^2$for walkway 10 ft wide or greater, plaza areas, and special feature areas.

ASHRAE standard 90.1 – 2010 (Table 9.4.3A, 9.4.3B)

|Sky Glow

Luminaires should be aimed to minimize the upward spread of light near to and above the horizontal.

System Evaluation

Figure 6 | David S. Ingalls Rink – Night Time Photography

For an iconic building at Yale University with long history and reputation, it is necessary to have a lighting system which emphasizes the building architecture, as well as the surrounding environment. To preserve the historic building, the existing lighting system had a minimal touch to the building exterior structure. Only the main façade was accentuated with uplight/downlight distribuition fixtures mounted on the mullion. Besides that, the rest of the building exterior hid its vibrant appearance in the dark. The dramatic roof structure was merely floodlit with street poles, which did not contribute to enhance the historical structure. From the night photography showing above, the mounting height and the characteristic of the wall mounted fixture created several hot spots on the canopy because of the ceiling's curving nature. The existing "dragon eye" fixture established its identity well along with the sharp edges of the sculpture in the darkness, however did not provide enough illuminance on the plaza.

To achieve a lighting solution which creates drama but meanwhile respect building history and aids to the surround environment, lighting techniques can be applied to vary the mounting location of the fixtures and the aiming angles. Through appropriate lighting practices, Ingalls Rink can be celebrated with natural and harmonious feel suitable to the historic site, with soft yet prominent glow to establish its prominent role as an important landmark. A system with flexibility will also help contributing to the energy effectiveness, while creating a pleasant evening environment suitable for public events, private functions or celebrations.

Ice Rink

With 290 feet spine and cables to support the iconic roof, the interior of the rink does not have any columns inside. The curved ceiling looks like the bottom of a boat, giving an open impression with a maximum ceiling height at 70 feet. The materials used for exterior of the building got carried inside, combined together to give a remarkable visual appearance. The arena can be used for purpose of hockey, figure skating and recreational use.

Figure 7 | Ice Rink

Geometry

Length: 200’
Width: 85’
Maximum Height: 70’
Area: 17,000 SF

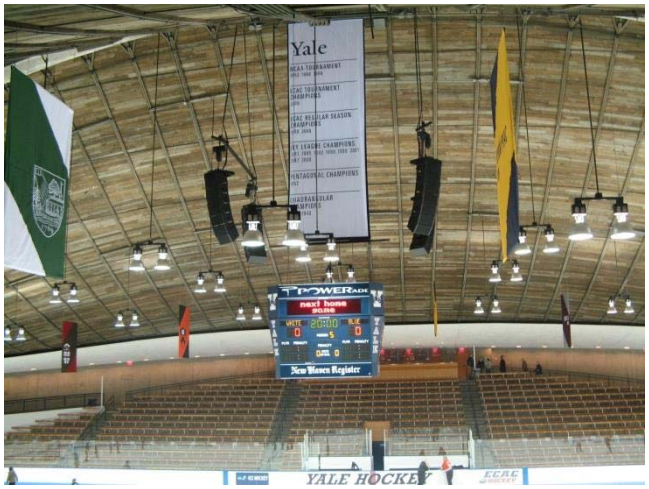


Figure 8 | Ice Rink – Ceiling Detail

Material Finish

Surface	Material	Description	Reflectance
Rink Floor	Concrete	Concrete floor base with ice sheet on top	0.79
Ceiling	Oak Wood	Existing oak wood roof in dark finish	0.2
Hockey Boards	Plexi-Glass	-	0.3

Table 3 | Ice Rink Material Properties

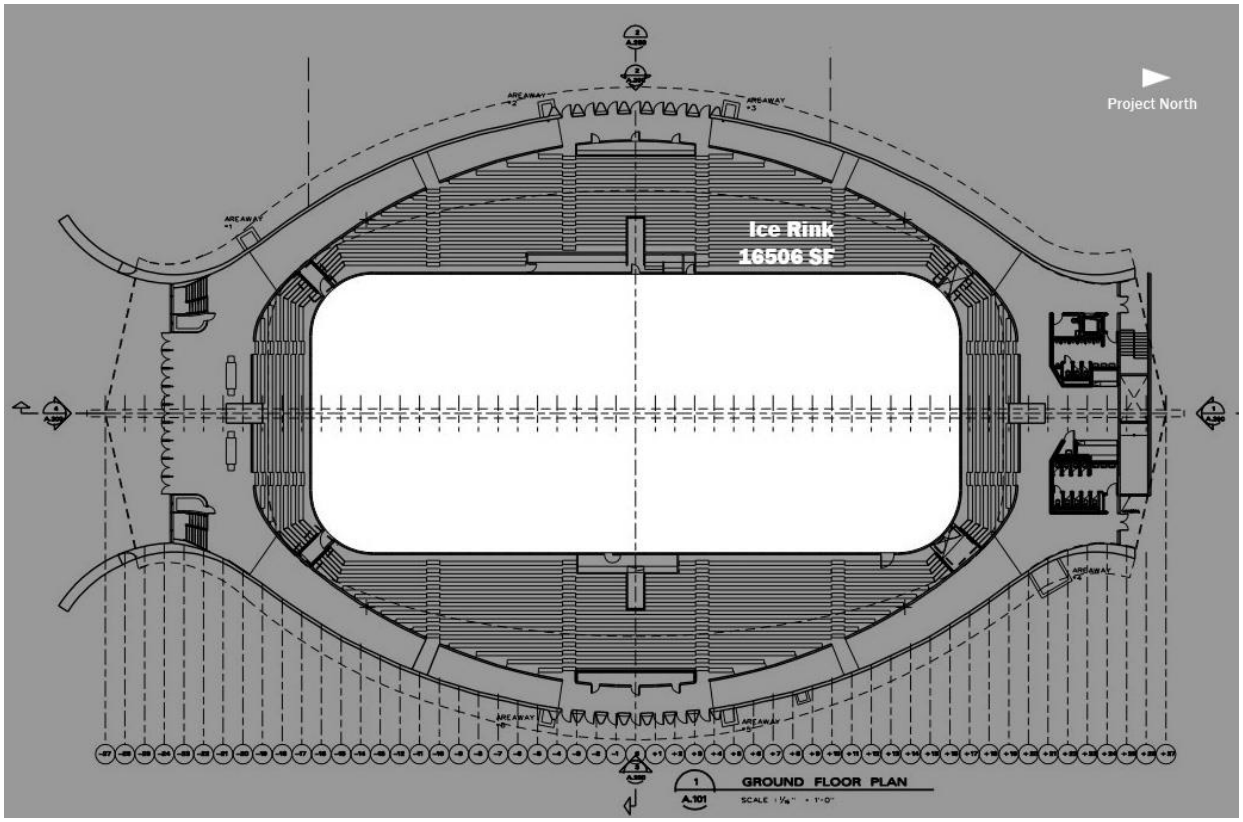


Figure 9 | Ground Floor Plan - Ice Rink

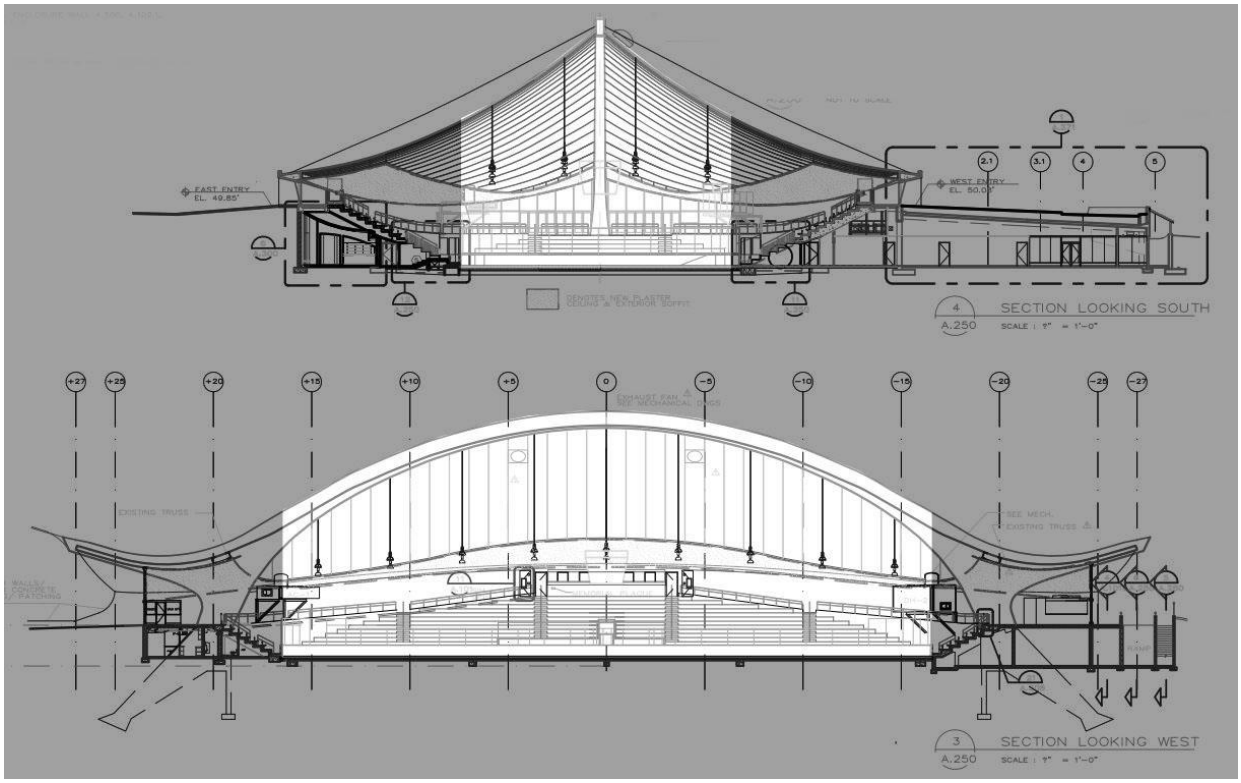


Figure 10 | Building Section - Ice Rink

Existing Lighting Conditions

The rink lighting was designed to meet NCAA "Intercollegiate Play/Regional Broadcast" recommendations as published on the NCAA website in 2008 and IESNA recommended light levels for athletic competition. Permanent lighting was not designed to meet television broadcast levels. The rink lighting consisted of (72) 400 watt metal halide pulse start high-bay luminaires by Hubbell Lighting Mounted in pairs at around 30 feet above the ice with slight changes following the ceiling curve.

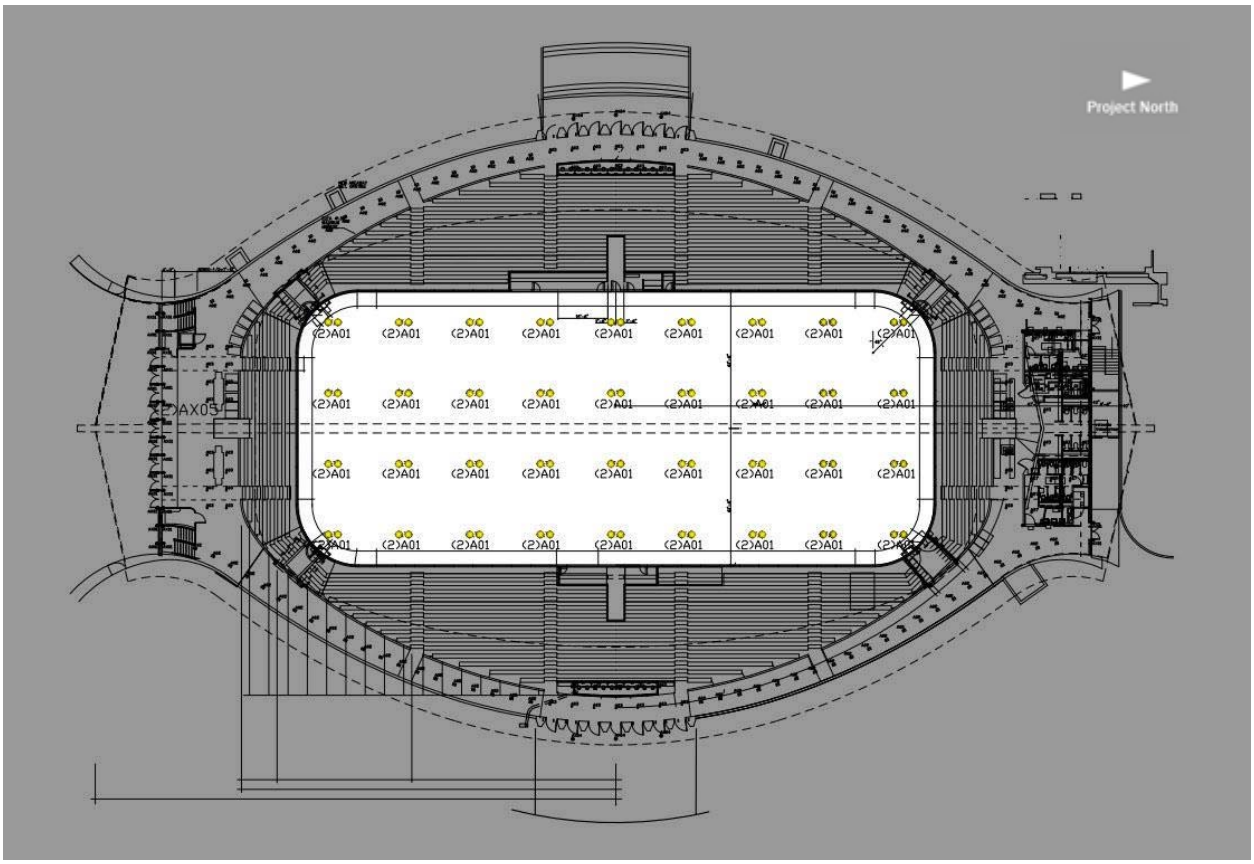


Figure 11 | Ice Rink – Existing Lighting Plan

Type	Luminaire	Mounting	Description	Lamps	Model	Remarks
A01	High Bay Double unit Pendant Assemble	Pendant-Stem Mounted	Nominal 19" diameter x 27" H, Spun Aluminum highbay reflector with uplight, bottom enclosure, electronic 0-10v diimming ballast, Twin mounting bar for (2) units on single stem suspension Luminaire to be located at existing location	(1) 400W PS MH 4000K 65 CRI - GE MVR400/VBU/X HOPA (order code 12642) 44000 lumens	Hubbell Lighting - # EL-40-W-4-M-SU(ETOHLIN001794)-Aluminum-BLLR19-C4HLP4-LRI-TRI6 - Safety cable (Reflector + Ballast Housing)	Metal Halide lamp to operate on electronic ballast Double unit on a twin mounting bar Stem length to be determined. Luminaire controls to be set for Full on - Half On - All Off - Emergency EM where required

A01-e	High Bay Pendant	Pendant-Stem Mounted	To match Type A01 except for Quartz standby system	(1) 400W PS MH 4000K 65 CRI - GE MVR400/VBU/X HOPA (order code 12642) 44000 lumens	Hubbell Lighting - #EL-40-W-4-M-SU(ETOHLIN001794)-Aluminum-BLLR19-QST-C4HLP4-LRI-TRI6 - Safety cable (Reflector + Ballast Housing) - QST with (1) 250W T-3 quartz	EM where required. Type A01-e to be paired with Type A01 unit, refer to Architectural drawings for locations and quantities.

Table 4 | Schedule – Ice Rink

Design Considerations and Criteria

Once inside, public will immediately experience the same dramatic and harmonious design of the interior which got carried inside from outside. The unfinished concrete wall with wood texture continues along the concourse corridor, and the two by eight oak wood ceiling with a maximum ceiling height of 70 feet provides an open impression. To enhance the visual appearance, an appropriate amount of uplight should be provided to accentuate the ceiling. Along with the aesthetic goals, lighting fixtures mounted above the ice also needs to be energy efficient since it generates large portion of radiation heat which can add to the refrigeration load. High-bay sports fixture should be specified with proper spacing and mounting height in order to achieve the desired light level and uniformity with control of direct and reflected glare issue. Typically, the ice arenas are used 18 hours per day on weekends and 12 hours per day during weekdays (Nichols, 2009). Long durability is critical to efficiency and sustainability since resurfacing is required if a lamp accidentally exploded. In addition to that, the fixtures need to be impact resistant for safety consideration.

|Illuminance Recommendation

Space Type	E_h	E_v	CV_{max}	Max:Min
Ice Hockey Class II	1000 lux	300 lux	0.21	2.5:1

College Sports Facility: Class II – Competition play with facilities for up to 5000 spectators.

IES Lighting Handbook 10th Edition (Table 35.3)

| Energy Allowance

Space Type	Power Density (W/sqf)
Sports Arena - Class II	1.92

ASHRAE standard 90.1 – 2010 (Table 9.6.1)

| NCAA Best Lighting Practice: Ice Hockey/Roller Hockey

With a horizontal light level of 100 fc and uniformity of 2.5:1, the level of facility will provide standard intercollegiate play with no requirements for television broadcasts. Following the recommended best

practices will help ensure quality of light needed for the safety of participants and the enjoyment of spectators.

|Control

- Interior lighting in buildings shall be controlled with an automatic control device to shut off building lighting in all spaces.
- Automatic control devices should be manually or automatically on for 50% of the light output
- Multi-level control is required for the space

System Evaluation

The original outmoded lighting system consisted of (36) 1000 watt standard metal halide luminaires, provided light levels ranging from 57fc on center of ice to 42 fc along the perimeter. Based on the Agi analysis report (showing next page), the new renovated lighting system with (72) 400 W Hubbell pulse-start metal halide high bay luminaires paired in 36 locations created a uniform distribution of illuminance on the ice, while providing adequate amount of ambient light to the ceiling. Light level on ice surface achieved the IES recommendations, ranged from 118fc to 70fc, with a max:min ratio of 1.68. The lighting power density also met the ASHRAE requirements, resulted at 1.077 W/sqft with assumption of .86 LLD and .95 LDD according to *OSRAM Sylvania Lamp and Ballast Catalog*. Ballast information for lamps was found in *Phillips Lamp Ballast Catalog.*

Compared to the old lighting performance, the renovated system provided 50% more light than the original design. The design met both illuminance and power density criteria from IES and ASHRAE, gave adequate amount of illuminance to support the activities such as hockey games, figure skating and recreational usage.

The LED technology was not widely adopted in the lighting design field by the time of renovation. Today, as the LED source is broadly accepted and used by lighting designers for its effective heat dissipation performances and long life span, it can get introduced to the rink from a more sustainable energy standpoint. At a decreased lumen output, the LED light may remain operational for a long time, in the meantime generates less heat to the surrounding atmosphere, which can make a great difference to the system refrigeration load and overall energy usage.

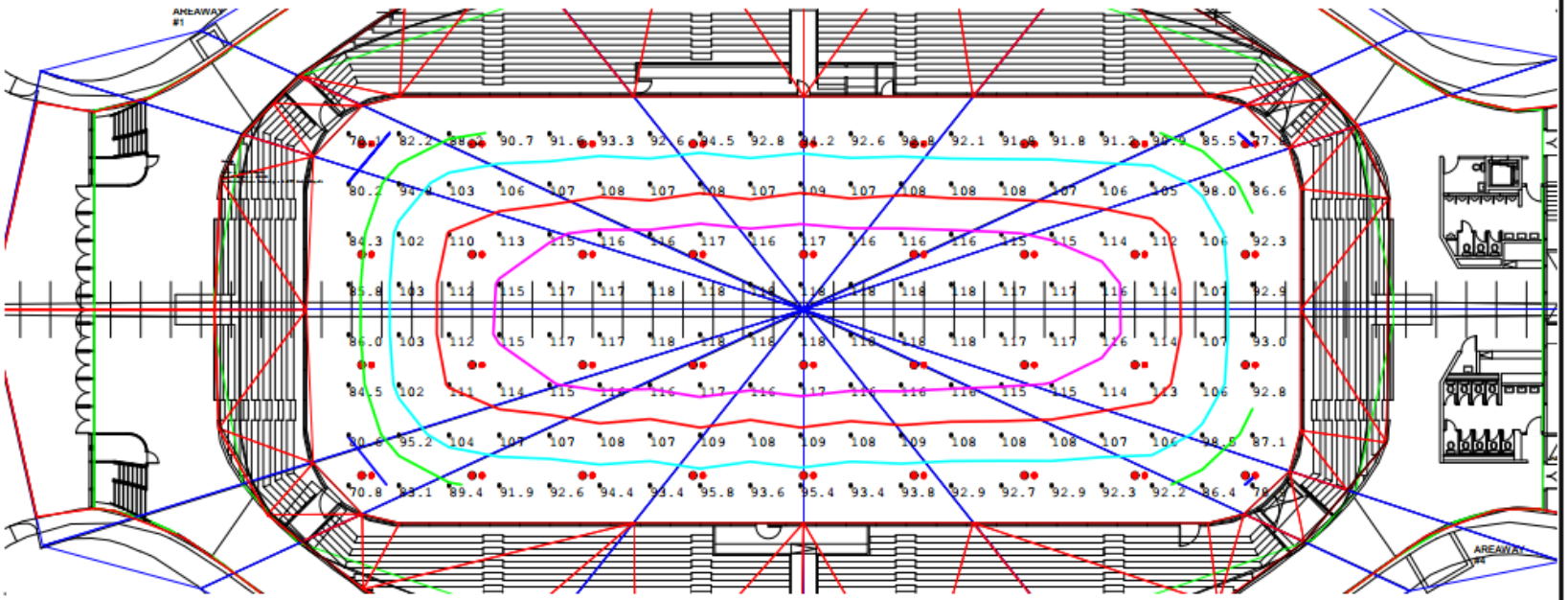
Luminaire Schedule									
Symbol	Qty	Label	Arrangement	Lumens/Lamp	No. Lamps	Description	LLD	LDD	BF
●	72	a01	SINGLE	42000	1	SuperBay BL400HX-SU	0.860	0.900	1.000

Numeric Summary									
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min	PtSpcLr	PtSpcTb
Ice	Illuminance	Fc	104.21	118	70.1	1.49	1.68	10	10

LPD Area Summary			
Label	Area	Total Watts	LPD
Arena	30757	33120	1.077

SUMMARY

Reflectances:
30% Wood Ceiling
80% Lower Ceiling
50% Walls
80% Rink
20% Floor
Mounting Ht:
Varies
Spacing:
22' O.C.
Style Used:
(72) Hubbell SuperBay
2-400W



Ice Rink

David S. Ingalls Rink - Ice Rink

Agi Study

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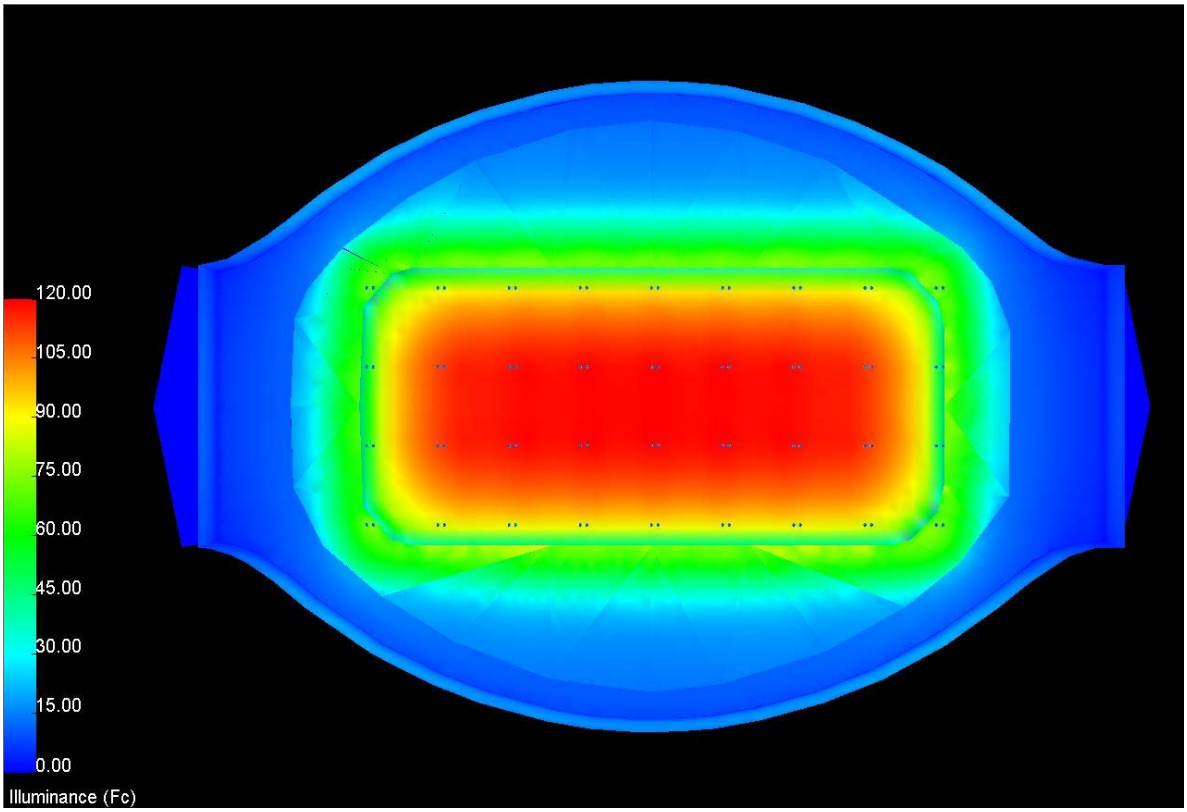


Figure 12 | Ice Rink Pseudo Color

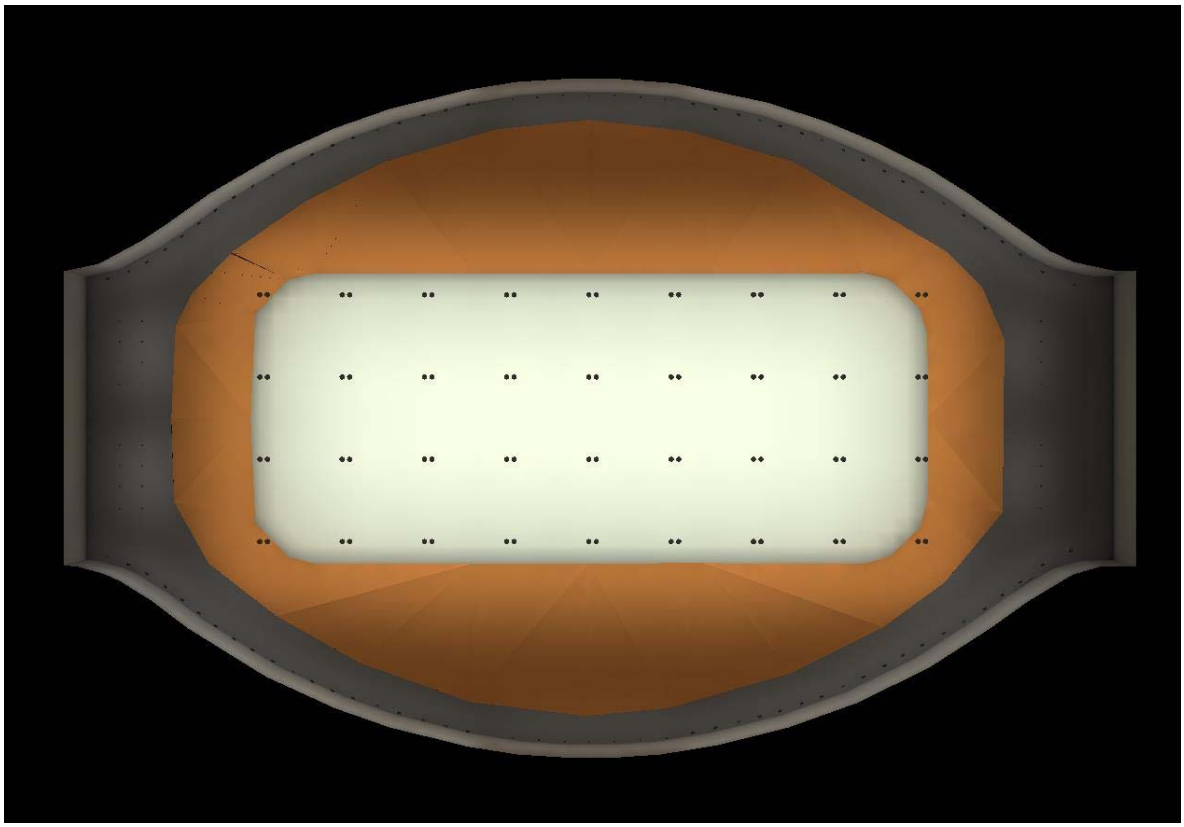


Figure 13| Ice Rink Agi Rendering Top View

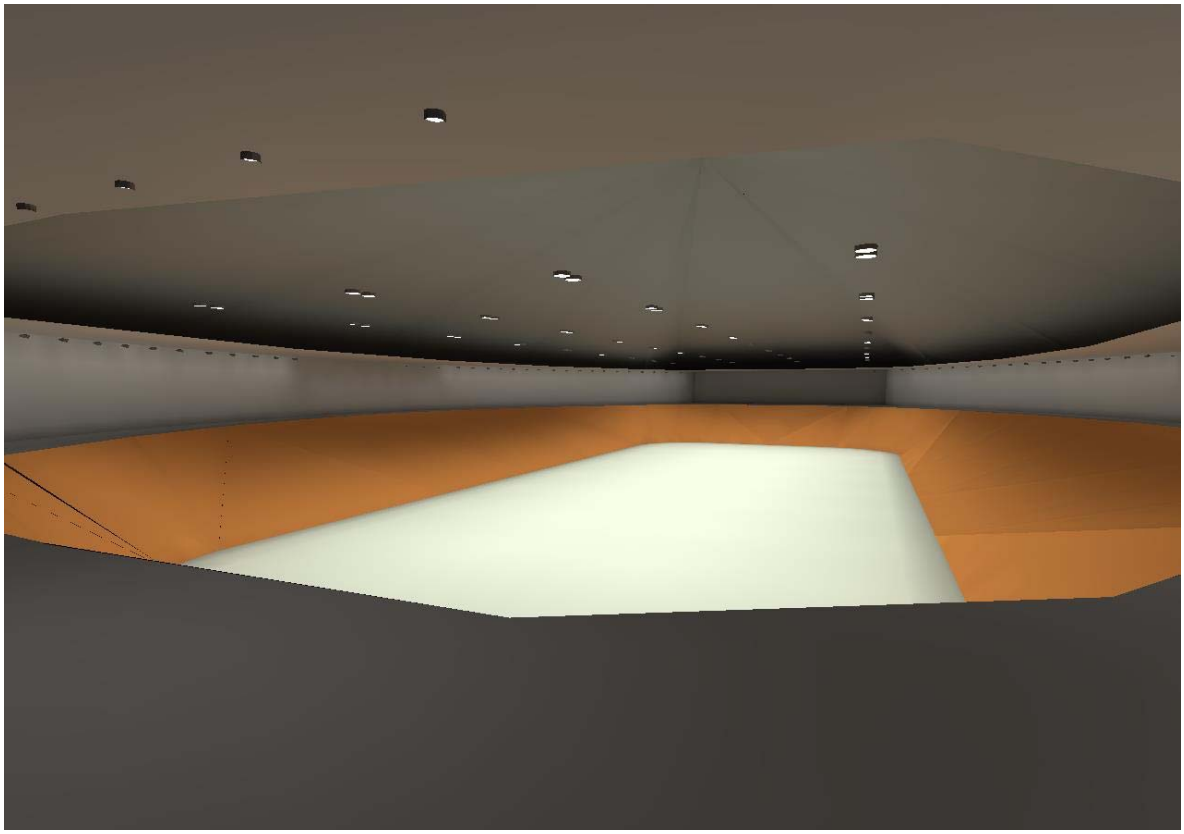


Figure 14 | Ice Rink Agi Rendering

Concourse and Seating Floor

The concourse surrounds the rink and provides main circulation to the public. Building entrances are located on the east and west end, whereas seven exit doors are located on the north and south. There are a total of fifteen rows of benches, with press box located on the back row of north and south side. There are four isles each lead to the seating on the north and south and two on the east and west. During any event, public enter through the main entrance, then follow the concourse corridor to individual seats.

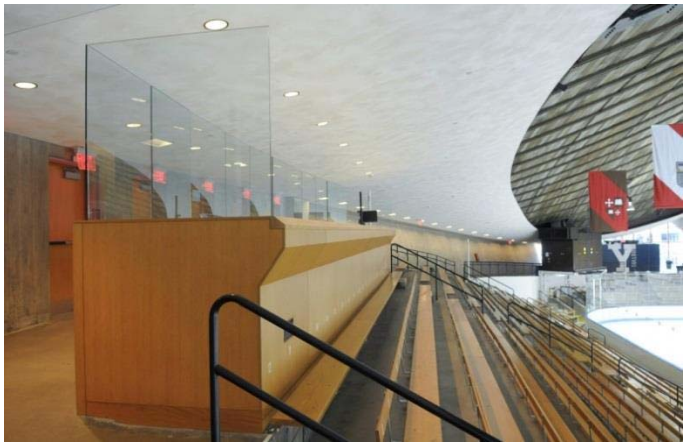


Figure 15 | Press Box

Figure 16 | Concourse

Geometry

Concourse Width: 8’
Isle Width: 4’
Sloped Ceiling: 10’ max
Concourse Area: 8274 SF

Material Finish

- Perimeter Corridor

Surface	Material	Reflectance
Floor	Sealed Concrete	0.2
Walls	Concrete	0.5
Ceiling	Plaster	0.8

Table 5 | Perimeter Corridor Material Properties

- Press Box

Surface	Material	Reflectance
Floor	Resilient Flooring	0.2
Walls	CMU Paint Type B	0.5
Ceiling	Painted gyp board	0.6

Table 6 | Press Box Material Properties

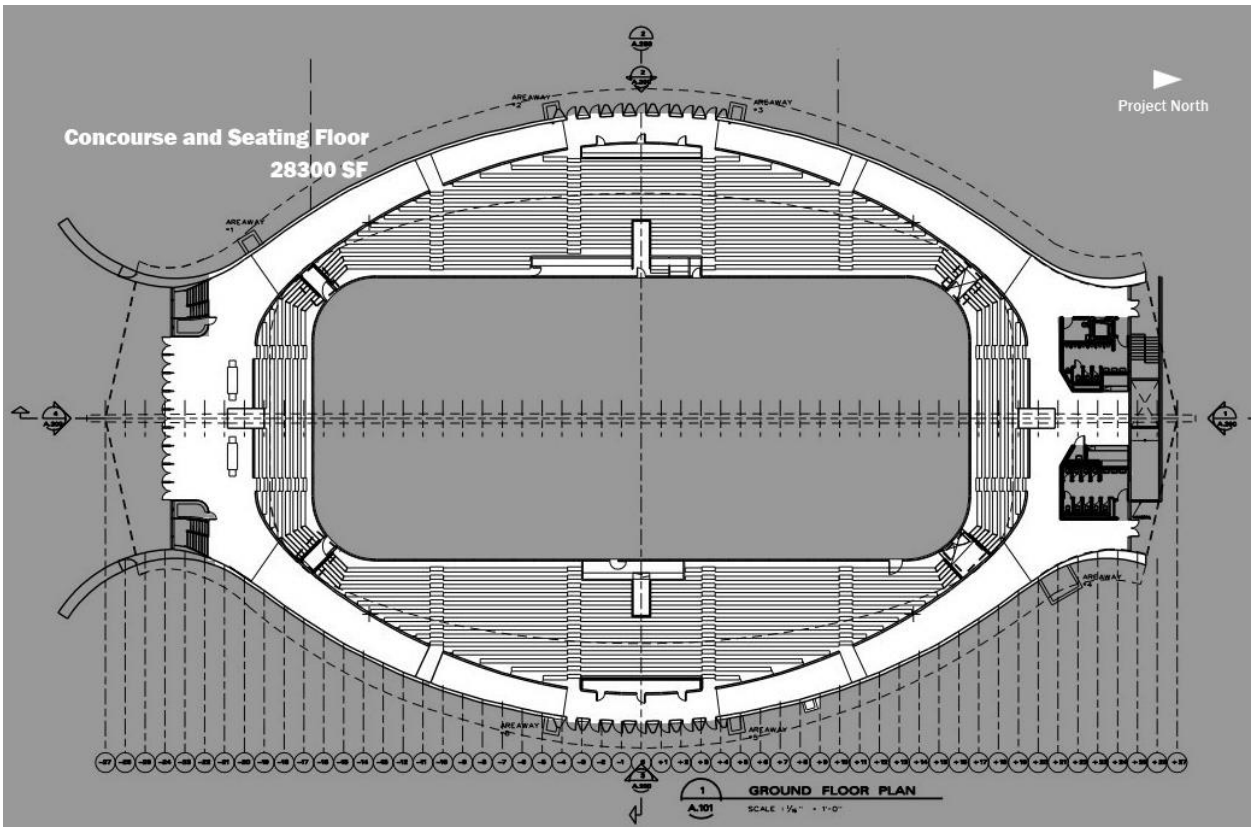


Figure 17 | Ground Floor Plan – Concourse and Seating Floor

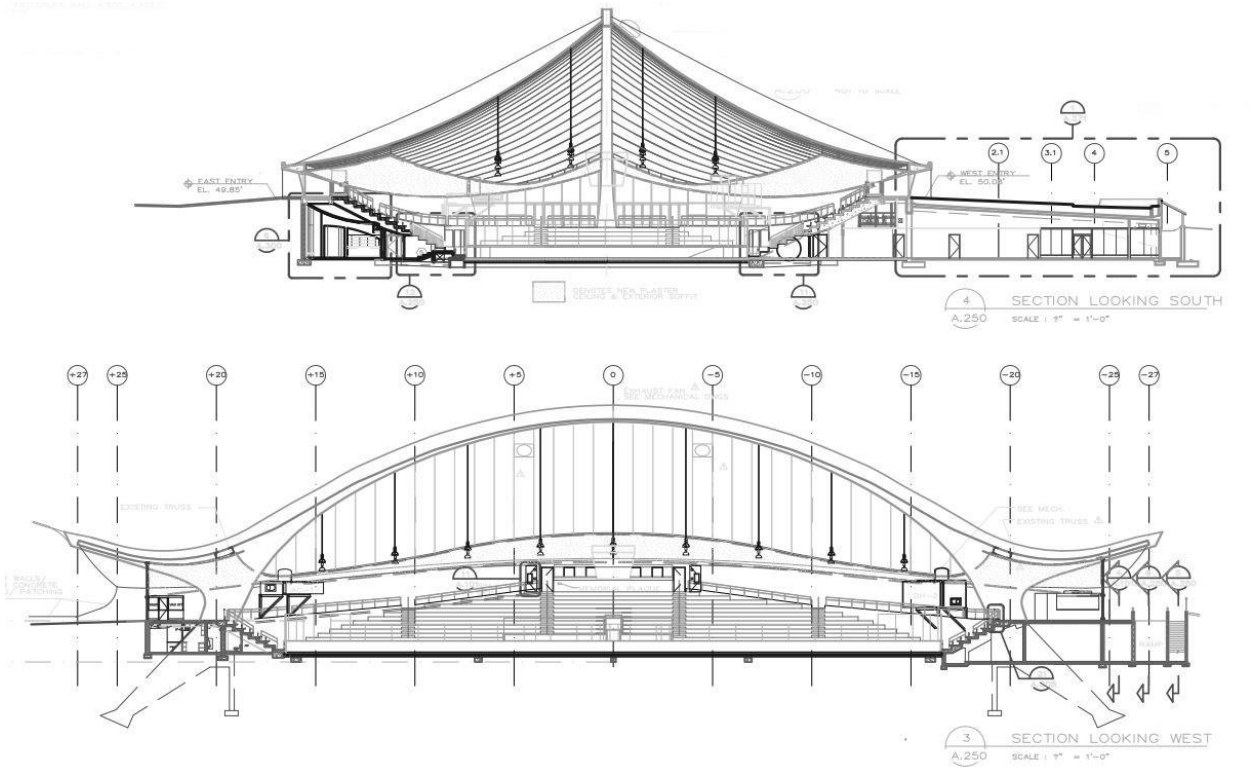


Figure 18 | Building Section- Concourse and Seating Floor

Existing Lighting Conditions

One lamp 32W triple tube rectangular compact fluorescent wall washers were placed around the building perimeter to provide lighting along the main circulation path. The fixture has a matte white finish housing to match the appearance and color of the plaster ceiling. Every third fixture was adequate to provide emergency lighting. Above the press box, recessed compact fluorescent downlight fixtures with the same output were placed to provide basic task illumination for reading, writing, and computer usage. The same type of downlight was also placed at the exits on building north and south instead of wall washers to avoid direct glare.

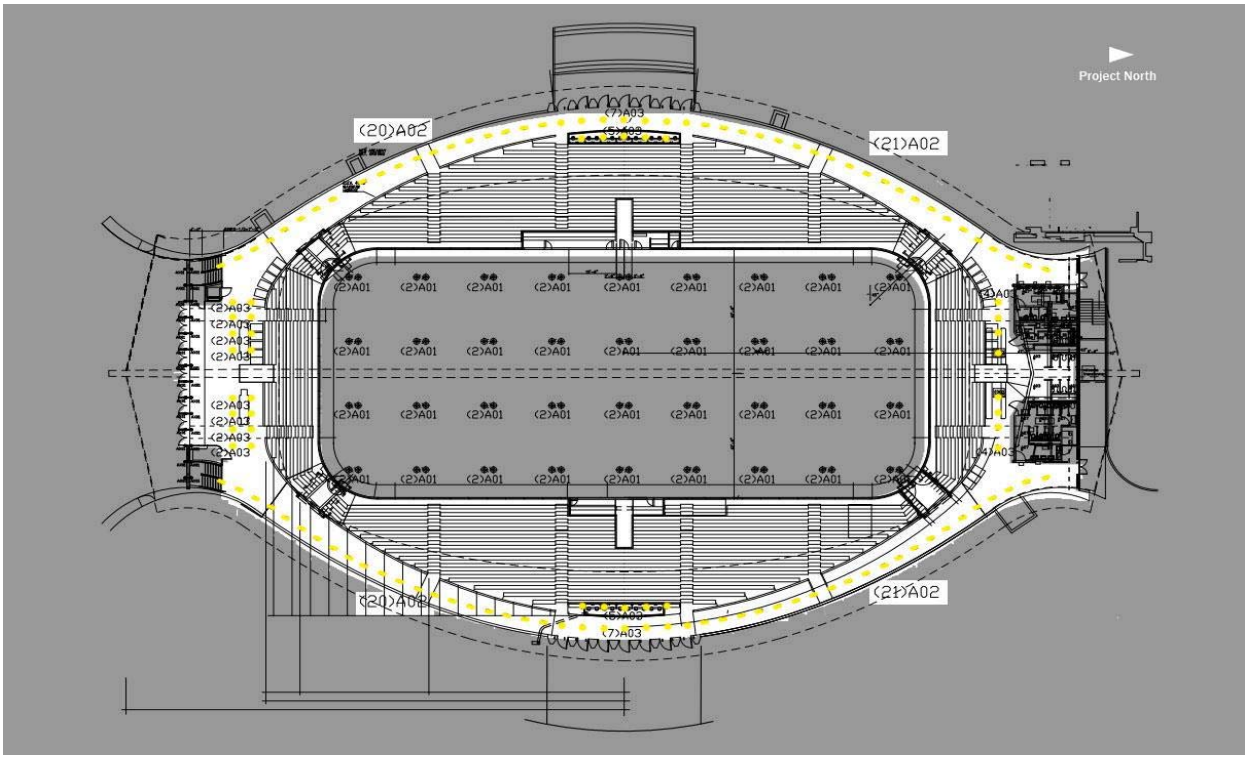


Figure 19| Concourse and Seating Floor - Existing Lighting Plan

Type	Luminaire	Mounting	Description	Lamps	Model	Remarks
A02	Rectangular Wall-washer CFL	Recessed	Nominal 13" W x 13" L extruded aluminum housing with frosted glass lens, integral electronic ballast.	(1) 32W TTT (830)	Belfer 1341 Reflex Series # 1341-32-Volts TBD-E-MWR-Trim Accessory #1341A-DTS-WH	EM where required by Engineer
A03	Downlight CFL	Recessed	6" aperture 9" h with spun aluminum reflector, integral electronic ballast, even tone reflector finish	(1) 32W TTT (830) 3000K lamps for downlights in Concourse (835) 3500K lamps for all other downlights	Edison Price TRPV Series #TRPV32-6-Volts TBD-VOL	EM where required. Kelvin Temperature 3000K lamps to be used at concourse only.

Table 7 | Concourse - Existing Lighting Schedule

Design Considerations and Criteria

Corridor serves its main role as a circulation space to direct and guide pedestrians to their point of interest. The lighting should illuminate the walkways, defines the boundaries and provide a clean and simple rendering. In an effort to keep the lighting clear, the fixture around the perimeter should provide just enough illuminance to guide audience to individual isles. Excessive light levels may lead to confusion and inconvenience since it lowers the contrast between seating floor and playfield. For a functional space as this, the lighting fixture is to disappear and unnoticeable. An evenly lit solution will serve its purpose by creating a comforting environment and embrace the slightly sloped architecture wall. Appropriate amount of illuminance should be provided on the work plane height for press box area to support reading, writing, and computer usage.

|Illuminance Recommendation

-Circulation Corridors

Space Type	E_h	E_v	Avg:Min
Public adjacency passageway	avg ≥0.2 times task E_h of adjascent space or as cameras require, but with min≥10lx	avg ≥0.2 times task E_h of adjascent space or as cameras require	3:01

IES Lighting Handbook 10th Edition (Table 22.2)

-Reading and Writing

Space Type	E_h	E_v	Avg:Min
CSA/ISO types I and II Positive Polarity	300	150	1.5:1

IES Lighting Handbook 10th Edition (Table 22.2)

| Energy Allowance

Space Type	Power Density (W/sqf)
Corridor/Transtion	0.66

ASHRAE standard 90.1 – 2010 (Table 9.6.1)

System Evaluation

Figure 16 | Concourse

The corridor was effectively lit with wall washers accenting the wall. The fixtures provided the space with a simple, yet uniform illumination. The reflected light from theunfinished concrete and plaster ceiling provided just enough illuminance for way finding without interruption to the seating area. The seating area was filled with light reflected from the concourse wall, ice, and spilled illumination above the ice. Simple recessed downlight was mounted above the press box to provide task lighting to the news reporters for reading, writing and computer usage. The same type of light was also mounted on the building north and south exit area to avoid direct glare which can be possibly caused by wall washers used for the wall. Slight improvement can be made to the fixture selection and aiming angle in order to get rid of the dark line which was left dark by the original wall washers at the intersection of wall and ceiling (see photography above). Moving the fixtures to the wall can help make the space appear wider and more spacious with appropriate light strategy.

Schley Memorial Club Room

The Schley Memorial Club Room provides an intimate atmosphere for visitors to sit and rest. There are display cases and timeline photos spanned across the entire wall highlighted by wall mounted accent fixtures, telling the story of Yale hockey history dated back to 1895. This space will be designed to give a lighting solution with unique psychological reinforcement. The room locates directly below the seating area on building south. The original room had an exposed ceiling, whereas the renovation added a new customized wood ceiling to enhance the welcome environment and adds warmth to the room.

Figure 20 | Schley Memorial Club Room Original

Figure 21| Schley Memorial Club Room Present

Geometry

Length: 77’
Width: 22’
Height: 14’ max

Material Finish

Surface	Material	Reflectance
Floor	Carpet Type B1&B2	0.2
Walls	Painted Gyp Board	0.6
Ceiling	Plaster	0.8
	Custom Wood Panels	0.4

Table 8| Schley Memorial Club Room Material Properties

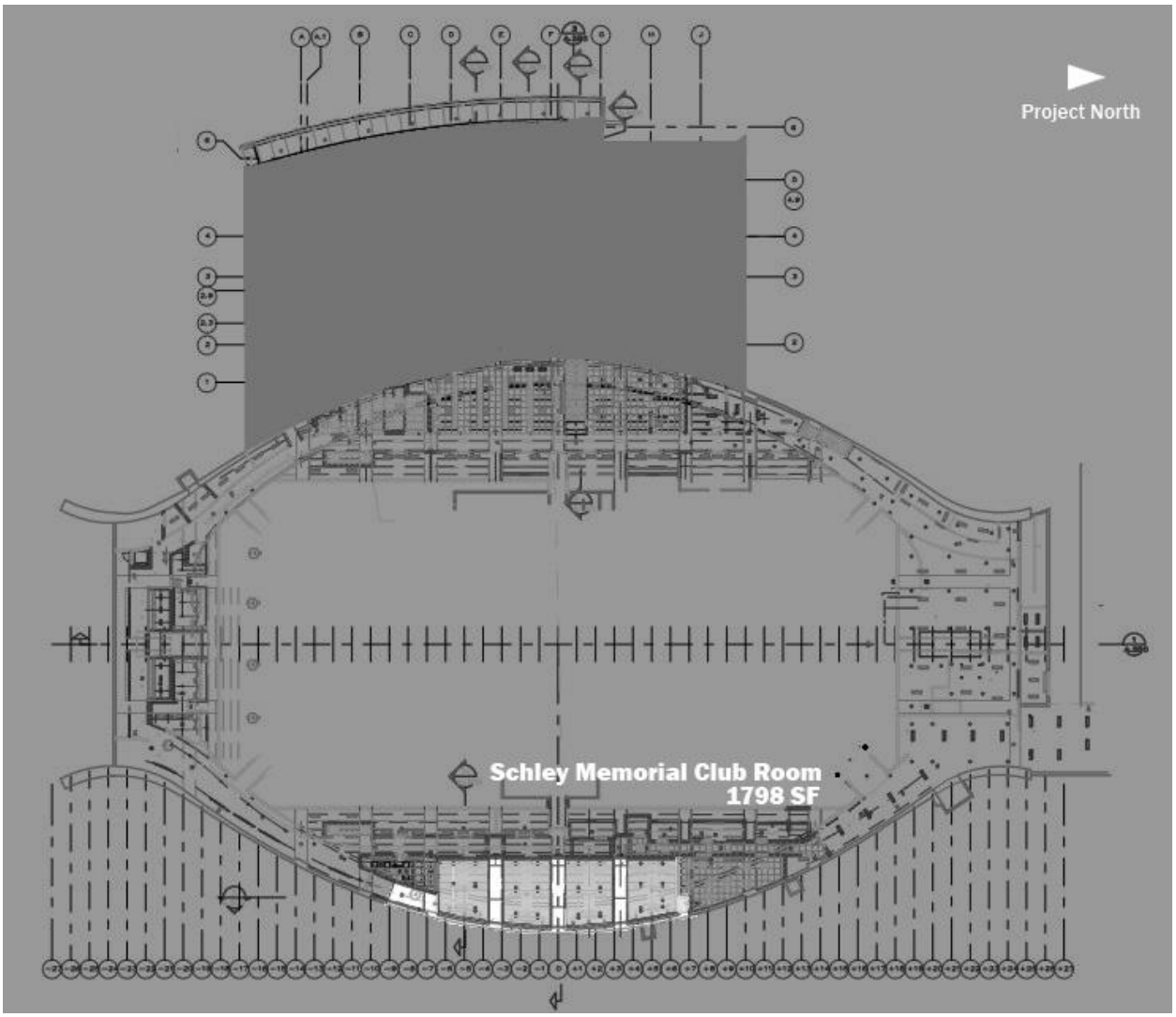


Figure 22 | Basement Floor Plan – Schley Memorial Club Rom

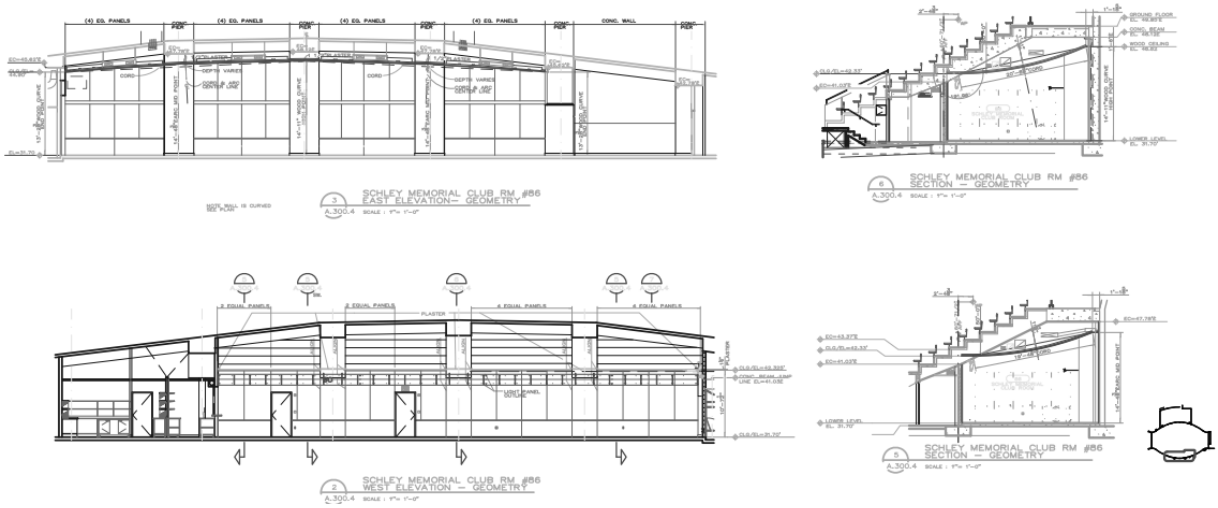


Figure 23| Building Section- Schley Memorial Club Room

Existing Lighting Conditions

The existing lighting for the Schley Memorial Club Room included (24)75 W PAR30 recessed adjustable accent light for task illuminance, cantilever mounted wall washers to highlight the art pieces with uplight to accent the ceiling, and strip channels. Two rows of strip channels were placed behind the bulkhead for purpose of downlighting the painted gyp wall and uplight the ceiling.

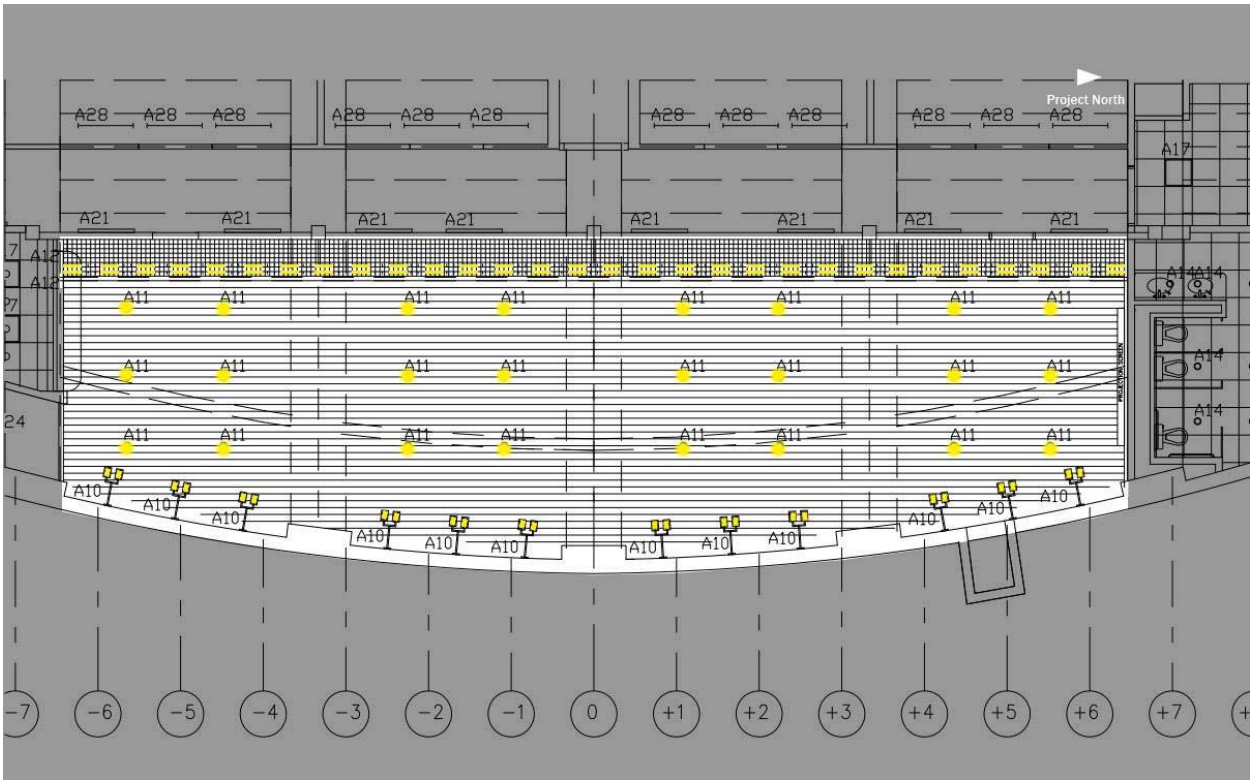


Figure 24| Existing Lighting Plan – Schley Memorial Club Room

Type	Luminaire	Mounting	Description	Lamps	Model	Remarks
A10	Cantilever Mount Double Unit Wall-washer with Uplight component	Arm mount	Nominal 4" W x 5" H x 12" L extruded aluminum housing, snap in louvers, double unit on a 30" arm cantilever , remote electronic ballast	(1) 26W Quad Tube (835)	Elliptipar F122-P126-X-finish to be selected-Volt TBD-XX-0 Arm Accessory # VCV-finish-30-0	Double Unit assemble, upper unit to be in uplight orientation and lower unit to be in wall washer orientation. Fixture to be wired to separate circuit. Remote electronic ballast
A11	Adjustable Accent light	Recessed	Nominal 5" aperture, 11"W x 15" L x 8" H steel housing, spun aluminum semi-specular reflector. Step-down transformer 277/120 Volt	75 W PAR 30 flood	Edison Price Darklite Series # DL30/5AA-ECOL Accessory# 277/120 XFMR	EM where required

A12	Strip channel	Surface-mount	Nominal 1-7/16" W x 2-7/16" H x 46-1/16" L strip channel, 20 gauge steel housing, asymmetrical reflector, and integral electronic ballast.	(1) 28W T5 (835)	Columbia Lighting CN-4-1-28-EP-U-CNSARA

Table 9| Schley Memorial Club Room – Existing Light Schedule

Design Considerations and Criteria

The multi-functional Club Room was used for socialization and display. It is important to create focal point on art works and timelines with aiming strategy on each side of north and south to emphasis the significance of the historical building. The general seating area should have a lower illuminance compared to the timeline/art display in order for it to appear dramatically lit. The light levels should also appear balanced for seating area to create a comforting atmosphere. Across the space, ambient illumination can be added to the sloped customized wood ceiling panel, which helps creating a comforting atmosphere and resembles an upscale lounge. Since this space will be designed and studied with progress based off from John Flynn's psychological mode, characterization of visual tasks will be given to create a theme and sense of being involved.

|Illuminance Recommendations

- Club Room

Space Type	E_h	E_v	Avg:Min
Social/Waiting Areas	40	15	2:01

IES Lighting Handbook 10th Edition (Table 22.2)

- Timeline Display

Attraction	Role	Illuminance Ratio	Application Notes
Moderate	Feature	5:1 focal point to task	Used on focal points or features for visual interest. Long-term exposure may fade-degrade focal. Focal plane may be different from takes plane.

IES Lighting Handbook 10th Edition (Table 15.2)

|Accent lighting

Accent lighting is necessary in many situations.it can address some spatial and psychological factors and establish boundaries of space without the visual monotony and equipment.

System Evaluation

From the Agi report showing next page, the general seating area has a maximum light level of 46 fc and an average of 24fc, which is under the IES recommended illuminance value for club room social area. The timeline wall on the room north has a high max:min ratio of 8.63, which exceeded the 5:1 ratio for a moderate attraction. Strong light level also spilled to part of the seating area, resulting unevenness on the workplane. The lighting solution for the curved art display wall on the building south was effective. The wall was well lit with good max:min ratio of 3:1, created desired focal point yet also providing ambient for the architectural feature. Double head wall mounted fixture also provided adequate amount of ambient to the wood ceiling which contributed to the total pleasantness.

The Agi rendering appears similar to the real life photography. The strip channels on the north side coupled with the painted gyp wall created comparably strong visual attraction, whereas the artpieces on the opposite side appeared more suitable for the total environment. Fixtures with a different distribution and lumen output can be used improve this problem. For the future proposal, brightness of each display wall will be balanced to avoid hot spots that appears too standout. To apply Flynn's psychological impression, lighting in this space will be involved in the total atmosphere, with emphasis to create visual interest and adds to the theme.

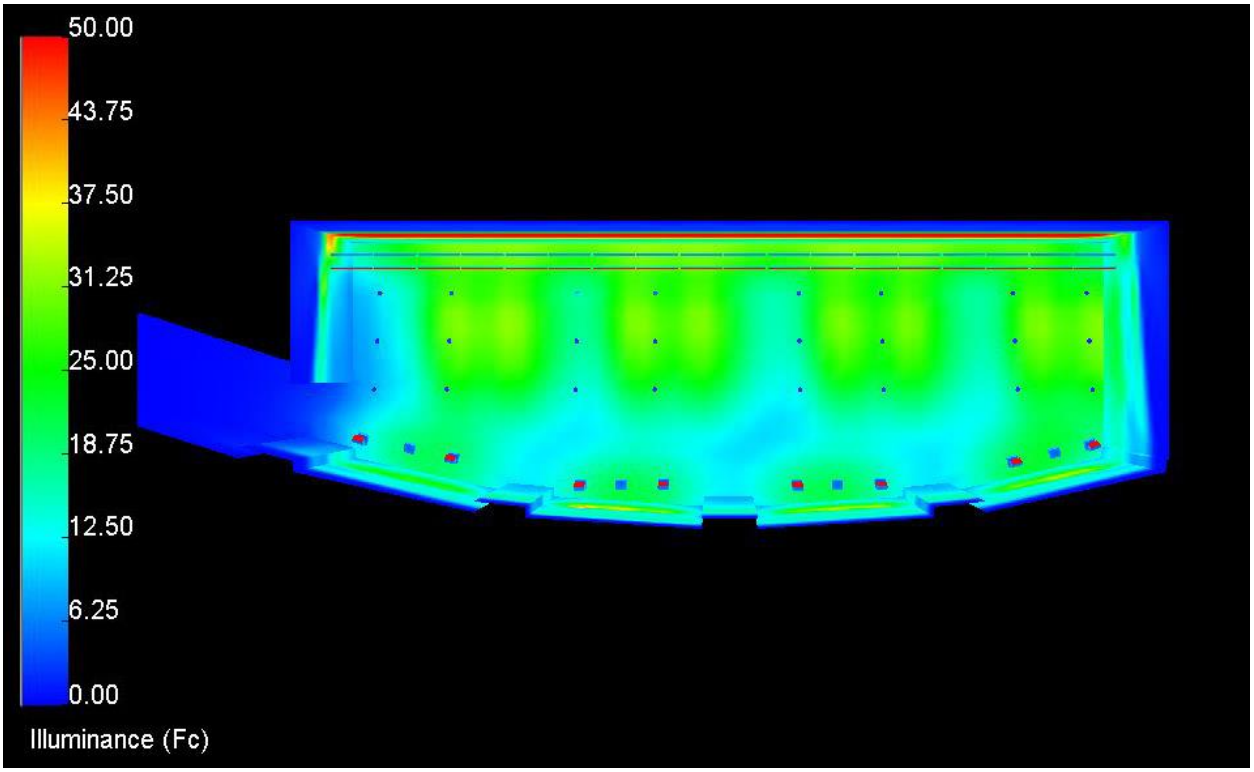


Figure 25| Schley Memorial Club Room – Pseudo Color

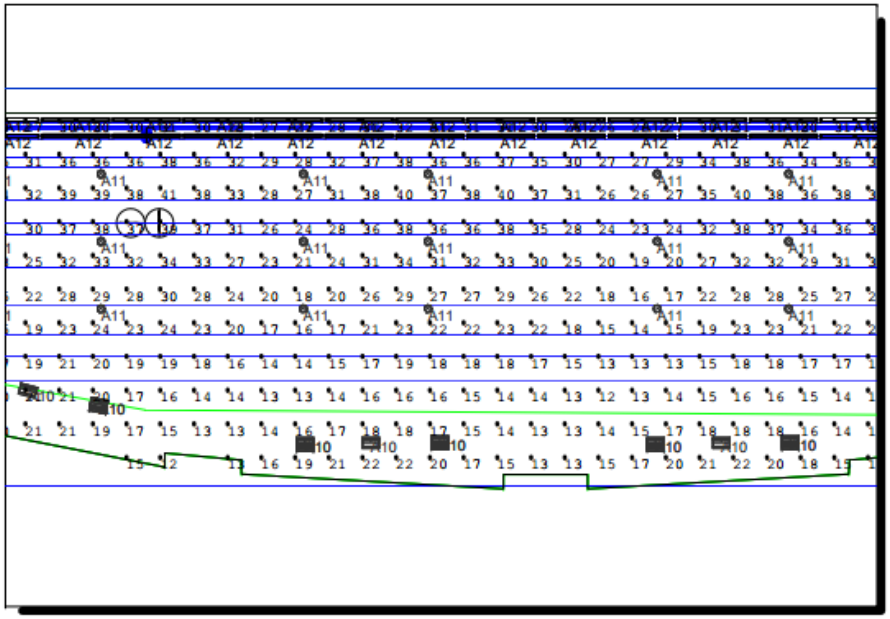
Luminaire Schedule									
Symbol	Qty	Label	Arrangement	Lumens/Lamp	No. Lamps	Description	LLD	LDD	BF
	24	A11	SINGLE	1130	1	DARKLITE 30_5 AA FL	0.900	0.950	1.000
	20	A10	SINGLE	1800	1	F114 - 26W TTT	0.860	0.950	1.000
	36	A12	SINGLE	1450	2	CN4-254-EP-PAF	0.930	0.950	1.050

Numeric Summary									
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min	PtSpcLr	PtSpcTb
Model_Floor	Illuminance	Fc	24.17	41	10	2.42	4.10	2	2
Model_Wall_10	Illuminance	Fc	21.71	45	12	1.81	3.75	2	2
Model_Wall_22	Illuminance	Fc	25.79	69	8	3.22	8.63	2	2
Model_Workplane	Illuminance	Fc	23.63	46	8	2.95	5.75	2	2
Model_TotalWalls	Illuminance	Fc	25.03	69	8	3.13	8.63	0	0

LPD Area Summary			
Label	Area	Total Watts	LPD
Model_Club Room	1754	3400	1.938

Summary
30% Wood Ceiling
80% Plaster Ceiling
50% Gyp Walls
30% Painted Walls
20% Floor
Mounting Ht:
A10 8'
A11 Varies
A12 8.5'

Render Image - View Name : Render



Plan

David S. Ingalls Rink - Schley Memorial Club Room

Agi Study
130915

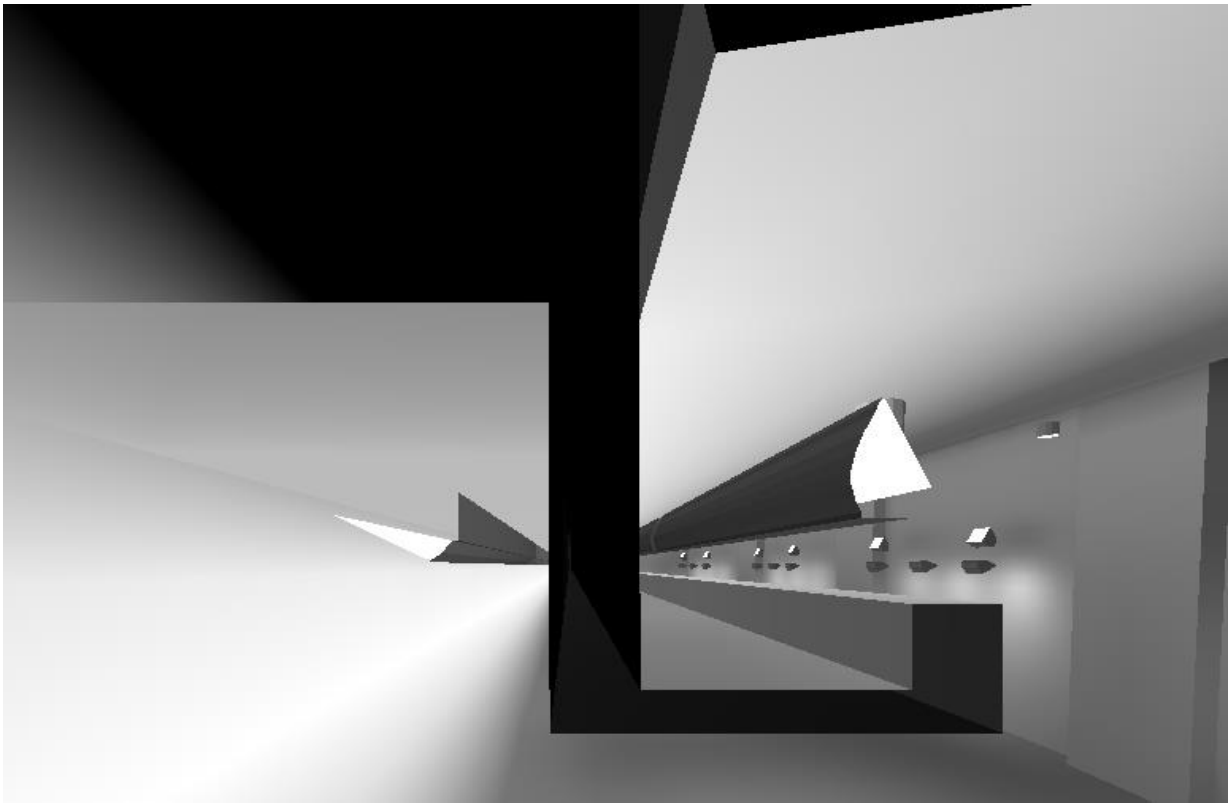


Figure 26| Schley Memorial Club Room – Bulkhead Detail

Figure 27| Schley Memorial Club Room – East Section

Reference

ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings 2010th ed.

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