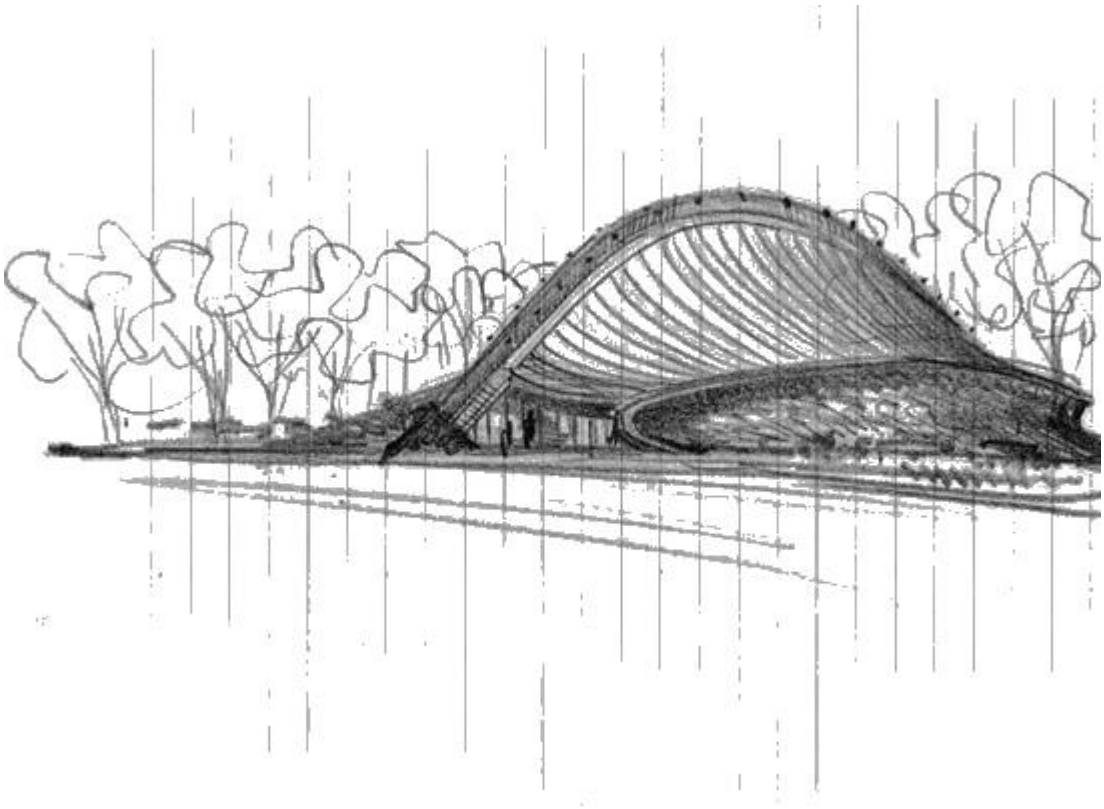


David S. Ingalls Rink

73 Sachem Street, New Haven, CT 06501

Thesis Proposal

Amy Chengyue Huan
Lighting/Electrical
Faculty Advisor: Dr. Houser

12.13.13

Table of Contents

EXECUTIVE SUMMARY

This proposal introduces the details of works to be completed in the spring of 2014. It contains in depth description of the redesign of lighting and electrical systems for David S. Ingalls Rink. In addition, an architectural breadth and acoustical breath will be conducted.

The lighting depth presents new design concepts in four building spaces: the building exterior, the circulation corridor, the ice rink and the lower level Schley clubroom. The new design aims to create an aesthetically comfortable solution which allows occupants to experience and react to the atmosphere by connect and embrace the architecture and functionality together.

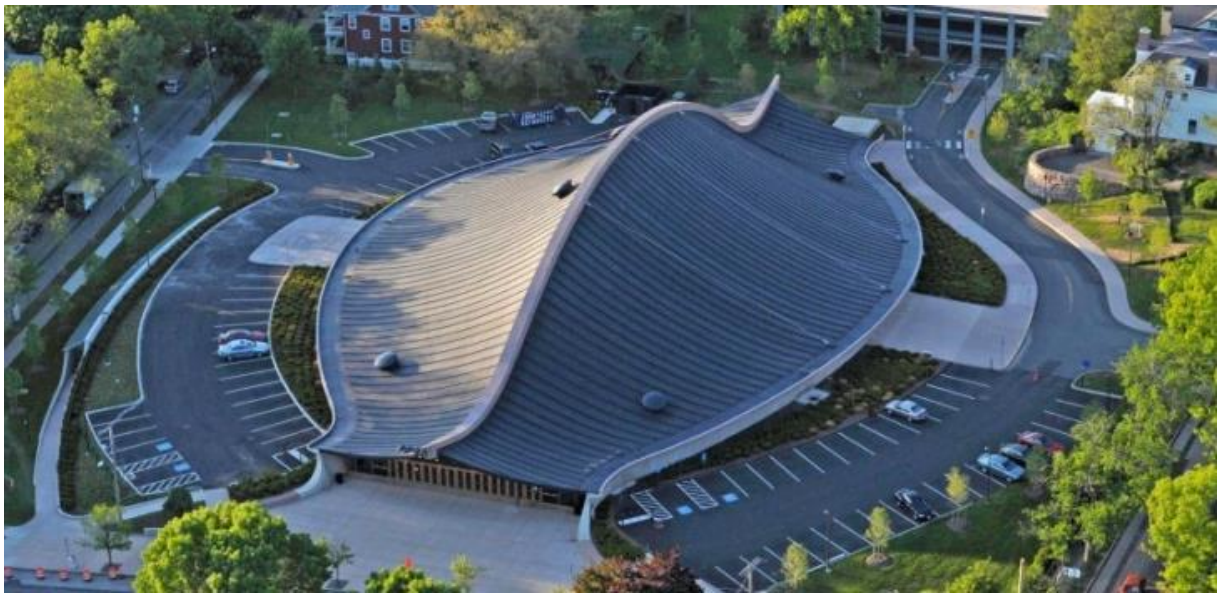
The electrical depth includes the redesign of branch circuit distribution for the four spaces with new lighting solutions. A short circuit analysis will also be conducted in accordance with the changes in overall electrical system. Possibilities of energy reduction technologies will be researched and studied to reduce the space load and reduce operation cost.

The acoustical breath will be conducted with studies reverberation time and changes of acoustical roof and wall materials to enable better performance for TV broadcasting and audience.

The iconic architectural structure spine will be studied in aspects of construction load and stress checks for further understanding of the structural system. Alternate bracing and framing will be proposed to allow greater stability and lower construction cost.

BUILDING BACKGROUND

The David S. Ingalls Rink, also known as the Yale Whale, is one of the most distinctive college hockey rinks in the country. The rink was designed by the famous architect Eero Saarinen and built in 1959. It is famous for its dramatic sweeping roof which reaches 76 feet at its zenith and is supported by a 300ft backbone of reinforced concrete. The multi – million dollar renovation taken in 2008 included a renovation to the existing press box, and a 14,000 square foot underground addition with Locker Rooms, Fitness Center, Schley Club room, Concession area, Offices and other utility rooms. The new rink today holds 3,500 spectators to watch the hockey game, recreational skating and figure skating.



Building name:	David S. Ingalls Rink
Location:	New Haven, CT
Site:	73 Sachem St, New Haven, CT
Building Occupant Name:	Yale University
Date Constructed:	1953 - 1959 (Renovation 2008-2010)
Building Footprint:	47,983 sf
Total gsf:	61,646 sf
Total Levels:	2
Client:	Yale University
Architect:	Kevin Roche John Dinkeloo and Associates LLC
Landscape Architect:	Towers | Golde
Lighting Consultant:	Atelier Ten Consulting Designers
Structure Engineers:	Severud Associates Consulting Engineers, P.C.
Mechanical Consultants:	AltieriSeborWieber LLC
Construction Manager:	Turner Construction Company
Civil Engineer / Landscape Architect:	Tighe & Bond
Acoustics, Audio Visual and Sound System:	Cavanaugh Tocci Associates, Incorporated

For a complete overview of the existing building system, please visit:
http://www.engr.psu.edu/ae/thesis/portfolios/2014/cih5144/Building%20Stat.html

LIGHTING DEPTH

|Overview

The lighting depth will focus on the lighting design for four chosen spaces in the David S. Ingalls Rink: the building exterior, the circulation corridor, the rink and lower level Schley Club Room.

The main design concept is habitation, which describes the relationship between the building and surrounding environment, as well as the relationship between occupants and the building. The philosophy that lies behind the concept is to create a living environment with an overall ocean scheme for the "Yale whale" – light for the building. By connecting and embracing the architectural elements of each space, different lighting techniques will be used to enhance the spatial appearance and celebrate the historical importance of the building. On the other hand, the lighting design also aims to create a comforting atmosphere for skaters who "habitats" in the ice rink – light for people. With specific design criteria in mind, the design is intended to achieve different functionalities and provide accessibility as well, which enables the human body to experience and react to lighting in each space.

|Designer Comments

Charles Stone:
Overall

- Good presentation
- Can see the effort of practice
- Take out the Pinocchio in the concept page
- Edit down metaphor and talk more about solution for further stages
- Good graphics, liked the closing slides, brings back all concept designs

Building Exterior

- Do more research on the "dragon eye" sculpture
- Think about using application pictures for fixtures instead of fixture itself
- Increase the contrast in sketch to make them more visible
- Use perspective from parking lot when considering which schematic design to choose from in the future

Corridor

- Favorite slide: detailed sections shown with scaled people sketch

Rink

- Too many concept images can be distractive
- Think about the TV criteria in further stages of development
- Recreational purpose: Think about light output, angle of theatrical fixtures

Schley Clubroom

- Brighten the sketch, current one looks dingy
- Outline the guy in detail section to make him less prominent
- Light levels in design criteria seems low

Mike Barber:
Overall

- Enjoyed the presentation

- Liked the Pinocchio, make the clients more involved
- Look at slides less

Building Exterior

- Use stronger contrast for sketches
- Slow down on each schematic presentation
- Consider perspective from eyelevel

Corridor

- Grazing technique for interior wall won't give shadow to ceiling above, light soffit

Schley Clubroom

- Brighten the sketch
- Use uplight instead of grazing

|Building Exterior

Lighting design for building exterior was inspired by the motion of whale jump. The design solution with linear and minimal luminaires will be used to enhance the curvature of the spine structure, as well as the roof outline. The flow of curvature will then be reinforced again with the highlight of existing light sculpture illuminating the front plaza. The chosen solution will have the minimum touch to the existing appearance of the building with respect to history. In the meantime, the grazing technique allows control of light trespass regarding neighborhood and dark sky.

|Circulation Corridor

The circulation surrounds the whole rink and seating area. The goal of lighting design of this space is to lead directions for people and provide appropriate light level for safety. Step lights will be used to create repetitive vertical patterns on the floor to mimic the verticality of coral reef concept. Additional illuminance will be provided on the wooden textured concrete interior wall which will be accented with in-ground up light. The design solution will provide accessibility and enhances the dimensional appearance of the whole space.

|Rink

Lighting design for this space intends to provide adequate light level for both sports and recreational functions. Key element to be lit also includes the interior ceiling which echoes the drama of exterior sweeping roof. With the approach of playing with a sense of the space to give a sense of dimension, the lighting solution will embrace the expansion and curvature of the ceiling, as well as offering different sensations and perceptions for both skaters and audience. Uniform illuminance will be used to create an environment for the speedy and strong hockey players. A more expressive solution will be applied in response to the beauty of figure skating and fun recreational occasion.

|Schley Club Room

The Schley Club Room is a gathering lounge and display room for special guests and gathering events. The room has customized curved wood ceiling panels to enhance the welcome environment and adds warmth to the room. There are display cases and timeline photos spanned across all three sides of interior walls. Since the lighting will be designed with a private impression, strong contrast between highlighted spots and shadows will be applied. The curved wooden ceiling will be lit with a similar approach as the ceiling of the rink area to expand the room dimension and connect the upper ground floor with lower level.

|Task and Tools

Schematic Design

- Conceptual design will be illustrated with hand sketch and photoshop renderings.

Design Development

- 3D models will be constructed using Agi 32. Fixture selections and locations will be justified according to the calculated light levels and lighting power densities.
- Detailed 3D models for specific lighting effect can be constructed with 3Ds max if necessary

Construction Document

- Fixture specifications will be created using Microsoft Excel.
- Fixture cut sheets will be obtained from the manufacture's website and combined to a packet
- Final renderings will be generated for final report

ELECTRICAL DEPTH

|Overview

Yale' Central Power Plant provides steam, chilled water and electricity to the building. Self-supporting switchboards with independent surge protection devices supports for equipment rated 1200 amperes. Automated Transfer Switches (ATS) was used to switch the emergency panels to emergency power in the case of main power failure. A step-down transformer with a secondary end of 208Y/120V was installed to provide lower voltage for the emergency receptacle panel. The main distribution panelboard has a configuration of 480Y/277V, 3 phase and 4 wire with 1600 Amp bus and 100,000 A.I.C rating.
The electrical depth will involve a redesign of the branch circuits for each of the four proposed spaces and detailed studies of energy reduction technologies and approaches.

|Branch Circuit Distribution

Branch circuits will be redesigned for the building exterior, circulation corridor, rink and the Schley clubroom. There no lighting dedicated particularly to the exterior roof, but linear LED fixture will be considered as a part of the solution. The current lighting system for the rink area consists of 36) 1000 watt standard metal halide luminaires, the proposed solution will consider the possibility of LED lamp source to help with zone cooling load with less heat generation. A variety of light sources are also proposed to replace the compact fluorescent fixtures in the corridor and lower level clubroom. Modification to panelboard connections will be made together with resizing of corresponding feeders electrical equipment.

Different selection of wires and conduits will be adjusted to the current propose lighting design and compared to the existing conditions in aspects like efficiency, safety and initial cost.

|Energy Reduction

Regarding the historical identity and the location of the building, PV arrays and wind generation are not the ideal approach for building energy reduction. This depth will examine energy reduction techniques like tri-generation, demand shifting or other technology possibilities to reduce the refrigeration and ventilation cost and the overall operation cost for the ice arena.

|Task and Tools

- All adjustment of electrical systems will be made in accordance with NEC 2009.

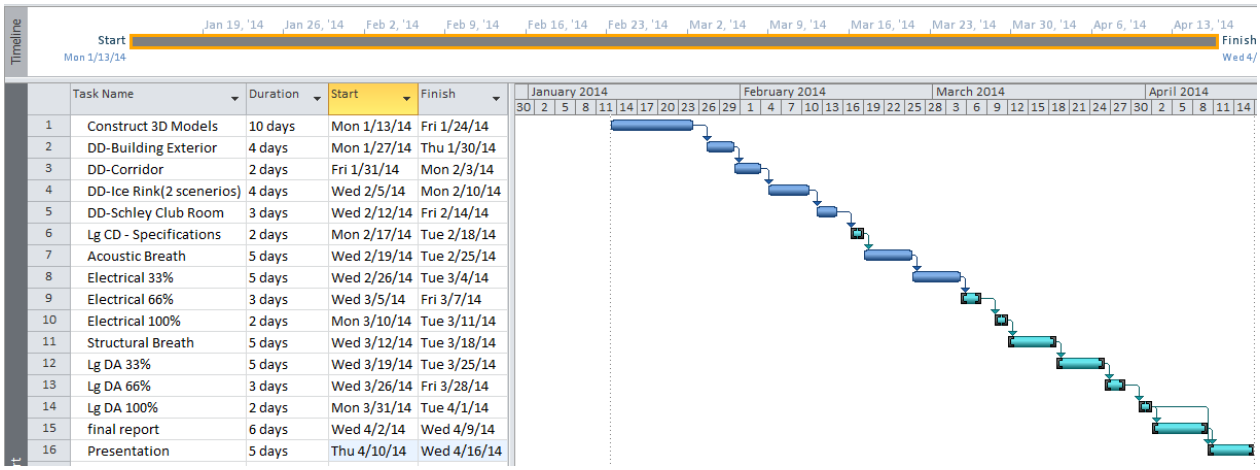
ACOUSTIC BREATH

Main function of the Ingalls Rink is to provide a training ground for the skaters. Besides serving the hockey players, it could also serve as an event place for workshops or performances. For an open space with its highest zenith at 76 feet, intelligent acoustic design is relatively important. A reverberation time and NC analysis will be performed for this breath for the ground level which contains the ice rink and circulation are. Background noise level NC targets will be set for the rink area for television broadcasting. Changes in roof and wall materials will then be proposed to reduce the reverberant time and optimize the acoustical performance with better sound absorbing properties.

STRUCTURAL BREATH

David S. Ingalls Rink is famous for its 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 structure of the spine allows the building to stand without any interior columns on the ground floor. A detailed construction loadings and intermediate stress checks calculations will be performed for the long span roof elements for understanding of the structural system for this building. Alternate framing type and connections will also be studied for different framing erection sequence and lower construction cost.

PROPOSED SCHEDULE



	Task Name	Duration	Start	Finish
1	Construct 3D Models	10 days	Mon 1/13/14	Fri 1/24/14
2	DD-Building Exterior	4 days	Mon 1/27/14	Thu 1/30/14
3	DD-Corridor	2 days	Fri 1/31/14	Mon 2/3/14
4	DD-Ice Rink(2 scenerios)	4 days	Wed 2/5/14	Mon 2/10/14
5	DD-Schley Club Room	3 days	Wed 2/12/14	Fri 2/14/14
6	Lg CD - Specifications	2 days	Mon 2/17/14	Tue 2/18/14
7	Acoustic Breath	5 days	Wed 2/19/14	Tue 2/25/14
8	Electrical 33%	5 days	Wed 2/26/14	Tue 3/4/14
9	Electrical 66%	3 days	Wed 3/5/14	Fri 3/7/14
10	Electrical 100%	2 days	Mon 3/10/14	Tue 3/11/14
11	Structural Breath	5 days	Wed 3/12/14	Tue 3/18/14
12	Lg DA 33%	5 days	Wed 3/19/14	Tue 3/25/14
13	Lg DA 66%	3 days	Wed 3/26/14	Fri 3/28/14
14	Lg DA 100%	2 days	Mon 3/31/14	Tue 4/1/14
15	final report	6 days	Wed 4/2/14	Wed 4/9/14
16	Presentation	5 days	Thu 4/10/14	Wed 4/16/14