BAM Fisher

321 Ashland Pl, Brooklyn NY

THESIS PROPOSAL

MEGANgrant

Lighting | Electrical

Advisor—Dr. Kevin Houser

December 12, 2015

TECHNICAL ASSIGNMENT 4B

EXECUTIVE SUMMARY

The following report defines the senior thesis proposal for the spring semester. An electrical and lighting depth will be studied as well as an acoustical and structural breath.

The lighting depth focuses on a redesign on four key spaces within the BAM Fisher building. The design solutions are built from a lighting concept of **expression** in visual and performance artwork. The concept follows the journey of an artist through a project and the steps involved. Each design solution addresses several quantitative and qualitative criteria and considerations. The quantitative criteria is found from the IES Lighting Handbook and ASHREA 90.1 standard. The four spaces below are studied:

Education and Humanities Office

Rita K. Hillman Dance Studio

Peter Jay Sharp Lobby

Geraldine Stutz Rooftop Gardens

All aspects of lighting redesign will be addressed in this depth. This includes a schematic redesign, design development through virtual 3D modeling (lighting calculation and evaluations), and construction documents.

In addition to a lighting depth, an electrical depth is also conducted. In response to the changes in lighting equipment, a branch circuit redesign is necessary. In addition a Photovolatic system is proposed to be implemented on the rooftop. To comply with and exceed code, a lighting control system will be designed for the four redesigned spaces. Finally, a two part power distribution system is proposed. A DC power system will be used for all low-voltage equipment, such as lighting controls, LED light fixtures, telecommunication systems, and dedicated receptacles for computers. The AC power system will handle all other loads (i.e. typical receptacles, theatrical lighting, etc.)

The breadths will also be studied over the course of the spring semester. A structural breadth will evaluate the effects of replacing the upper existing façade with a living green wall. The building wall section and components will be studied. The effects of this wall on the structure of the building will be analyzed by looking at the change in load, connection to frame, and load distribution. If structural calculations show that the existing spandrel beams and columns are not sufficient to carry the load, these elements will be redesigned to account for the added load. This will also tie in the Building Enclosure Science and Design course (AE 542), to satisfy the utilization of a Master's level course into the Senior thesis project.

The second breadth is an acoustical analysis in the dance studio. The lighting redesign solution in the space incorporates the lighting fixtures into the acoustical panels, effectively removing some of the panels. This will have an effect on the acoustical properties of the room. The acoustical breath will be conducted to ensure adequate acoustical properties between the dance studio and neighboring spaces. If the calculations find that there is not enough acoustical paneling in the space to reach the desired levels, additional panels will be implemented and recalculated until appropriate levels are met.

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BUILDING OVERVIEW

Building Name	BAM Fisher
Location and Site	321 Ashland Place, Brooklyn NY
Building Occupant	Brooklyn Academy of Music
Occupancy/Function	Theater (A-1), Offices (B), Classroom (B), Dance Studio (A-1)
Size	40,000SF
Number of Stories	1 below ground, 7 above ground
Construction Dates	10/1/2010-5/1/2012
Cost Info	Construction Cost $25.2 million | Total Project Cost $52 million
Project Delivery Method	Design Build with CM at Risk with a GMP

Key Players in Lighting Design

Architect | H3 Hardy Collaboration www.h3hc.com

Lighting Designer | Cline Bettridge Bernstein Lighting Design www.cbbld.com

MEPF Engineers | ICOR Associates, LLC www.icorassociates.com

Environmental Consultant | Ambrosino DePinto Schmieder www.adsce.com

Code Consultant | Milrose Consultants, Inc www.milrose.com

Theater Consultant | Auerbach Pollack Friedlander www.auerbachconsulatants.com

LIGHTING DEPTH

The Brooklyn Academy of Music is a educational institution that provides collegiate level training in visual and performance arts. All art is a form of **expression**. As an artist goes through a project, they experience four main stages: spark of passion, preparation and development, climax of performance, and reflection and growth. The spark of passion is the initial interest in the project and the foundation upon which the artist builds upon. The preparation and development stage is the portion which requires the most work and dedication. It may represent learning the routine of a dance performance or even the act of creating the painting for a gallery expedition. The climax of performance represents that moment when an artist shows their talents to the world. Finally, the reflection and growth symbolizes that which the performance is able to learn and take away from the process and grow as an artist moving forward. These four stages of expression will be implemented in four spaces through specific lighting design solutions. Each space has specific main design criteria to fulfill. In addition, all spaces will need to meet required code lighting power density and ASHREA 90.1 lighting controls.

Education and Humanities Office | Large Work Space

The open office space is a collaborative area for the administration employees of BAM Education and Humanities department. These individuals are the foundation of BAM Fisher and are essential in upkeep and function of the building.

This office space is built with an 8' ceiling height with 3' drop ceiling tiles. However, to increase height and comfort in the space, removal of the ceiling is proposed. Opening up the space and exposing the structure and mechanical system (painted matte white), allows for implementation of an indirect pendant lighting system. This will create a diffuse light level throughout the space and aid in a uniform lighting layout. In addition, individual work station task lights will ensure required horizontal illuminance levels are met. Toward the perimeter of the space, where the indirect system will not reach, duel task and ambient work station fixtures will be used in addition to above cabinet uplight in the copy and storage corner.

Quantitative Data

Recommended Illuminance Values for Office Space | IES Handbook

E_h=300lux

E_v= 150lux

Recommended Uniformity Ratio for Office Space | IES Handbook

Avg:Min 2:1

Lighting Power Density for Open Office| ASHRAE 90.1

0.98W/ft^2

LIGHTING DEPTH

Rita K. Hillman Dance Studio | Special Propose Space

The dance studio represents the preparation and development stage of an artist's journey through a project. This double height space is used daily for dance classes and rehearsals. It is occasionally used for small intimate performances as well. This portion of expression is where the behind the scenes extensive work is put in. For a dancer, the rehearsal and learning process is much more difficult than the performance.

The main criteria to be considered for this space is vertical and horizontal illuminance and uniformity. Circular area lights embedded in the acoustical tiles in an array will allow for relatively diffuse lighting to aid in high uniformity and achieving desired horizontal illuminance levels. In addition, the large number of lights in the array create high vertical illuminance levels. Therefore, the dancers will be able to easily see one another and the instructor during rehearsals. In addition, they will able to view themselves in the large mirrors to ensure their movements are correct. The downlight area fixtures, though promoting uniformity, will still create slight shadowing on the face and allow for visual texture. The area fixtures will have a diffuse lens, decreasing glare as to not distract or discomfort dancers during lifts and leaps.

A surface mount downlight and wall wash system will border the catwalk section along three sides of the space and will eliminate dark shadows from occurring below the overhang. A truss system is proposed for theatrical lighting equipment in the event of the space being used for a performance. The two trusses border the windows and down the center of the space. Theatrical equipment can also be mounted to the railings along the catwalk. The proposed lighting design will not interfere with these trusses which have the capability to be lowered for ease of lighting installation.

Quantitative Data

Recommended Illuminance Values for Dance Rehearsal Room | IES Handbook

E_h=300lux

E_v= 500lux

Recommended Uniformity Ratio for Dance Rehearsal Room | IES Handbook

Avg:Min 1.5:1

Lighting Power Density for Classroom | ASHRAE 90.1

1.24W/ft^2

LIGHTING DEPTH

Peter Jay Sharp Lobby, Main Level | Circulation Space

The third space is the climax of performance space. This stage of expression will be visualized through lighting design in the lobby of the BAM Fisher Building. The lobby is the first impression visitors have of the building and therefore is very important to be aesthetically appealing. The lighting design will also achieve a psychological impression of pleasantness by creating non-uniform lighting through a hierarchy of light and by adding peripheral emphasis.

The lobby has four desks that are used for a variety of tasks, from security check-in spaces during the day to information, ticketing, and will-call booth for nighttime performances. As such, each desk will be illuminated using two overhead downlights. This will draw visitors to desks as the enter the space. In addition there are several art pieces in the space. A linear wall wash will brightly illuminate the large mural along the east wall facing patrons as the enter the space to create a focal point. In addition, a combination of downlights and adjustable head fixtures will light a large glass sculpture hanging between the upper and lower level of the lobby adding sparkle to the space. Linear slot lights will be used in the wall to draw attention to signage. The slots will connect to a slot wall wash which will give the peripheral emphasis needed to achieve pleasantness in the space. To further emphasis the perimeter of the space, surface mount linear color changing fixtures will be mounted between wooden panels on the west wall. The color changing capability will allow color to drip from the main lobby down to the lower lobby. These colors will be programmed to match the color scheme for a performance so the experience doesn't end when one leaves the theater space. Finally, cove lighting fixtures will be placed above acoustical tiles in the ceiling coffers to create a dim light to brighten the ceiling and achieve general ambience.

Quantitative Data

Recommended Illuminance Values for Lobby | IES Handbook

Day E_h=100lux

Day E_v= 30lux

Night E_h=50lux

Night E_v= 20lux

Recommended Uniformity Ratio for Lobby | IES Handbook

Avg:Min 4:1

Focal Point (Artwork): 10:1

Lighting Power Density for Lobby of Performing Arts Theater| ASHRAE 90.1

2W/ft^2

LIGHTING DEPTH

Peter Jay Sharp Lobby, Lower Level | Circulation Space

The lower lobby is still a circulation space but functions more as a lounge than the upper lobby. This space contains the bar, seating, and tables for patrons to visit before the start of the performance or at intermission. This is still considered part of the climax of performance stage of expression but more of the lower intensity after the initial burst. Once again, a psychological impression of pleasantness will be implemented by creating non-uniform lighting through a hierarchy of light and by adding peripheral emphasis.

The main attraction of the lower lobby is the bar located on the opposite end of the lobby from the access stairs. To draw patrons attention to the bar, color changing LED lighting positioned underneath the bar counter ledge will wash the front in color. In addition, hanging glass globes or varying sizing behind the bar will catch the light from downlights and add sparkle and a decorative element to the space. This space also has artwork displayed on the east wall which will be illuminated with a linear wall wash to create a focal point. As in the main lobby, linear wall slots will aid in peripheral emphasis along with washing along the north and south navy blue walls. Surface mount LED fixtures on the west wall will allow colored light to drip down from the lobby above. The cove lighting placed in the coffers allow for general illumination and eliminate darkness in the ceiling. This space, though implementing many of the same techniques as the main lobby will likely be dimmed slightly lower to create a more relaxing lounge atmosphere.

Quantitative Data

Recommended Illuminance Values for Lounge | IES Handbook

E_h= 40lux

E_v= 15lux

Low values, likely to exceed to reduce discrepancy from main lobby

Recommended Uniformity Ratio for Lounge | IES Handbook

Avg:Min 2:1

Focal Point (Artwork): 10:1

Lighting Power Density for Lobby of Performing Arts Theater| ASHRAE 90.1

2W/ft^2

LIGHTING DEPTH

Geraldine Stutz Rooftop Gardens | Exterior Space

The reflection and growth stage of expression is shown through the lighting design of the rooftop space. This space is used for intimate gatherings for benefactors of BAM or occasionally student organizations. The main architectural details in the space include a large terrace which borders the west façade of the building and looks out over Brooklyn. The east side of the rooftop garden can be enclosed using a removable, motorized glass partition and ceiling. There are also two planters on the north and south sides, one of which includes several small statues. Along with permanent benches and nonpermanent tables. The act of looking out over Brooklyn represents personal reflection and entertainment for benefactors may result in capital growth of the BAM program.

Through lighting design, it was desired to create several nuclei to encourage interaction and communication between individuals. Portable outdoor space heaters with integral LED fixtures will be placed around the space to create gather spaces. In the winter months, the heater can be turned on and the glow of fire will create warmth and relaxation. In the summer months, the LED lower portion of the heater can create the same effect without the need for a heating element to be in use. Under bench lighting will create extra gathering spaces and keep light levels low and intimate. Uplighting several of the columns of the terrace will create a verticality in the space and draw attention to that architectural detail. Finally, adjustable ground fixtures in the planters will illuminate the statues and cast leaf patterns on the walls adding texture and visual interest to the space. Minimizing the amount of uplighting is desired to reduce light pollution and abide by Dark Sky Association recommendations.

Quantitative Data

Recommended Illuminance Values for Plaza | IES Handbook

E_h= 6lux

E_v= 2lux

Low values as safety minimum

Recommended Uniformity Ratio for Plaza | IES Handbook

Avg:Min 5:1

Lighting Power Density for Plaza Areas| ASHRAE 90.1

1.6W/ft^2

LIGHTING DEPTH

Process and Tools

Schematic

Implement lighting concept in each of the four spaces while working to achieve specified design criteria. Present lighting design solutions through 3D Perspective Photoshop renders and 2D architectural plans.
Revise schematics based on feedback from lighting design professional present at the Technical Report 4A review.

Design Development

Based on schematic designs, select appropriate luminaires with IES photometric files.
Create 3D models of spaces using 3D modeling in AutoCAD.
Import 3D models into AGi32 and add photometric files of luminaires.
Run lighting simulations to analyze light levels, uniformity, and lighting power density.
Modify design solutions to achieve adequate levels as proposed in design criteria from IES handbook and ASHREA 90.1.

Construction Documentation

Draw lighting fixture layout in reflected ceiling plans in AutoCAD.
Organize lighting fixture cutsheet packet along with a complete fixture schedule.
Create final renderings of lighting design solutions using Revit and Photoshop.

Submittal

Produce report which includes all aspects of the lighting design process.
Design final PowerPoint presentation for panel review.

LIGHTING DEPTH

Professional Schematic Design Feedback

Kevin Houser | Thesis Advisor

Ensure all text is legible and not too small.
Simplify concept, the firework metaphor is one step too far, felt forced.
Dance studio is a big improvement from TR #3.
IES does not strictly mandate a luminance ratio of 10:1 for focal points.
Lobby: need even more clear links between design criteria and proposed solution.
Roof garden: good explanation of space and use with architectural features.

Ken Douglas

Slow down pace of presentation, too nervous.
Very well thought out, images well done and used well.
Came away with a nice feeling about the design, sold it well.
Rehearsal with an audience to get pace and get nerves out.

Shawn Good

Presentation was easy to follow.
Followed through exceptionally well with firework concept, however the dancer is a stronger image in this case.
Overall, designs were practical and fit the spaces well.
Suggested acoustical breadth in dance studio.
Controls systems in lobbies, explain how to create the appropriate schemes.
Technical goals too heavily weighted.
Show mechanical system in office space renders.

Lee Waldron

Solutions are serviceable and functional, appear to meet criteria.
Need better pacing in presentation, too fast.
Consider telling a story of each space and how humans would interact with it.
Communicate a more humanistic side.
Presentation was rather antiseptic.

Personal Goals

Revise concept, remove firework and use only dancer image for expression
Work on pace for future presentations. Plan times to take a beat.
Work to be less stiff and calculation based in presentation and more of a designer attitude.
Review future presentations on screens to ensure legibility.
Work to incorporate a more clear link between criteria and solutions.
Include more qualitative considerations.
Show mechanical system in office space renders.

ELECTRICAL DEPTH

Photovoltaic Array

As the BAM Fisher Building is conscious of the environment and energy sustainability, a Photovoltaic array installation is proposed. This array will be located on about 1/3rd of the roof area above the mechanical rooms. The PVs will absorb sunlight to create DC power to reduce overall energy usage needed from the electrical grid. In addition, a battery storage system will be used to allow for energy storage if it cannot be used all at one time.

Branch Circuit Redesign with DC Power

As many new LED fixtures will be installed and load sizes change, a redesign of the branch circuits is necessary. However, rather than using traditional AC power, implementing the use of DC power is proposed. Most low voltage applications can run on DC power. As LED sources are powered using DC current, there will be no need for conversion drivers. In addition, the power provided from the Photovoltaic panels will not lose power through conversion to AC current. In addition, computer equipment also runs on DC power and therefore would not need transformers on the power cables. The proposed design would lead to two power distribution systems. A traditional AC power system for theatrical lighting equipment and traditional plug loads, and a DC power system for all lighting equipment, telecommunication systems, and dedicated plug loads.

Lighting Control System

A lighting control system will be implemented on an entire building level. The four lighting redesign spaces will be specifically used to show the specifics of the system, including one-line diagrams. Occupancy sensors and daylight sensors will be integrated along with scene selection keypads. This not only abides by ASHREA 90.1, but also allows for energy saving.

BREATHS

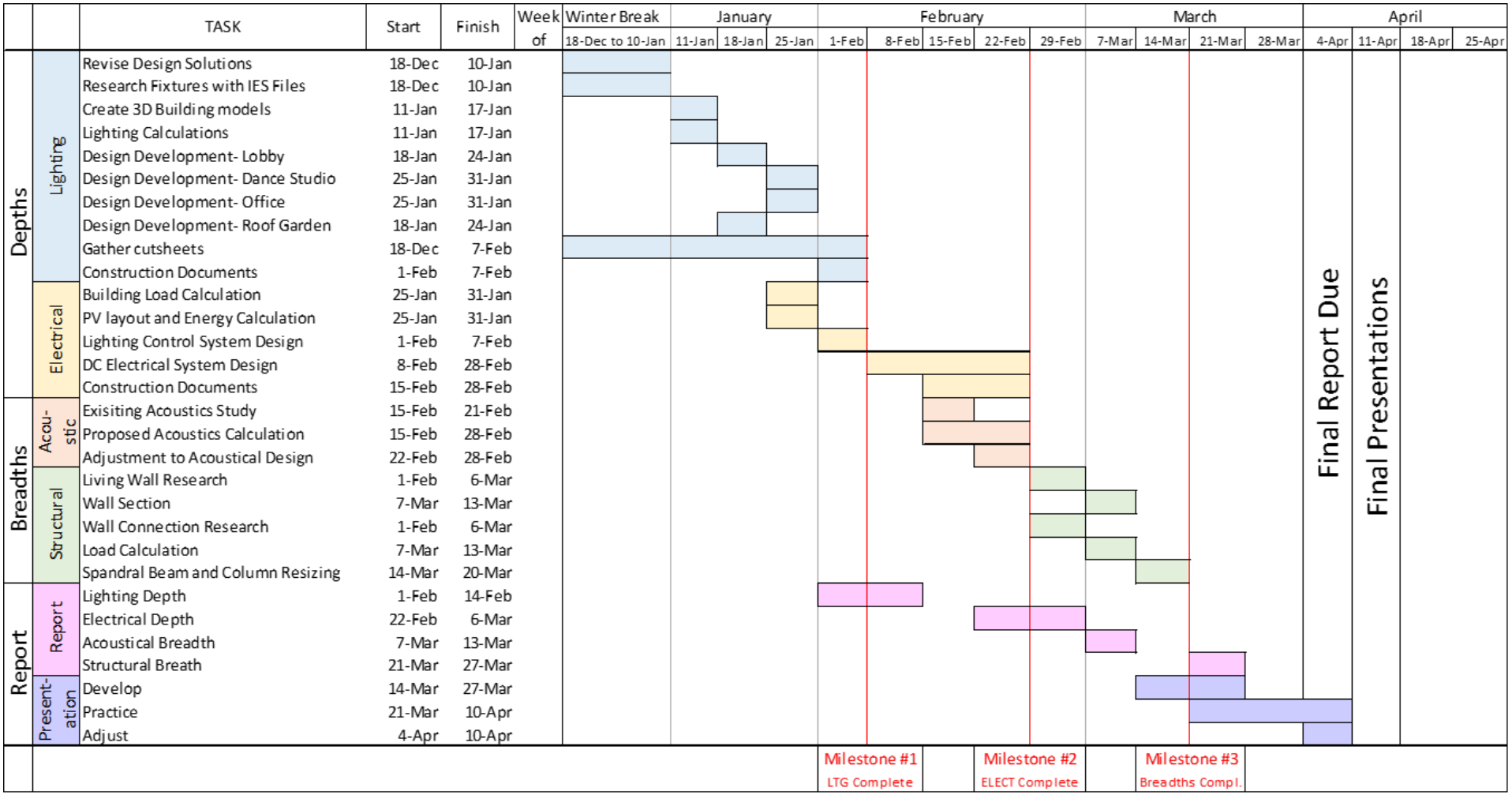
MAE and Structural Breath

To implement an MAE level course into the capstone project, the Building Enclosure Science and Design course (AE 542) will be used to propose a change in building façade. Rather than a hung brick veneer wall on the upper portion of the main façade, a living green wall is proposed. The building wall section and components will be studied. The effects of this wall on the structure of the building will be analyzed by looking at the change in load, connection to frame, and load distribution. If structural calculations show that the existing spandrel beams and columns are not sufficient to carry the load, these elements will be redesigned to account for the added load.

Acoustical Breath

As the proposed lighting solution in the dance studio requires placing luminaires in the acoustical panel, an acoustical breath will be conducted to ensure adequate acoustical properties between the dance studio and neighboring spaces. If the calculations find that there is not enough acoustical paneling in the space to reach the desired levels, additional panels will be implemented and recalculated until appropriate levels are met.

GANTT Chart


Depths
Breadths
Report
Lighting
Electrical
Acou-stic
Structural
Report
Present-ation
TASK
Start
Finish
Week of
Winter Break
January
February
March
April
18-Dec to 10-Jan
11-Jan
18-Jan
25-Jan
1-Feb
8-Feb
15-Feb
22-Feb
29-Feb
7-Mar
14-Mar
21-Mar
28-Mar
4-Apr
11-Apr
18-Apr
25-Apr
Revise Design Solutions 18-Dec 10-Jan
Research Fixtures with IES Files 18-Dec 10-Jan
Create 3D Building models 11-Jan 17-Jan
Lighting Calculations 11-Jan 17-Jan
Design Development- Lobby 18-Jan 24-Jan
Design Development- Dance Studio 25-Jan 31-Jan
Design Development- Office 25-Jan 31-Jan
Design Development- Roof Garden 18-Jan 24-Jan
Gather cutsheets 18-Dec 7-Feb
Construction Documents 1-Feb 7-Feb
Building Load Calculation 25-Jan 31-Jan
PV layout and Energy Calculation 25-Jan 31-Jan
Lighting Control System Design 1-Feb 7-Feb
DC Electrical System Design 8-Feb 28-Feb
Construction Documents 15-Feb 28-Feb
Exisiting Acoustics Study 15-Feb 21-Feb
Proposed Acoustics Calculation 15-Feb 28-Feb
Adjustment to Acoustical Design 22-Feb 28-Feb
Living Wall Research 1-Feb 6-Mar
Wall Section 7-Mar 13-Mar
Wall Connection Research 1-Feb 6-Mar
Load Calculation 7-Mar 13-Mar
Spandral Beam and Column Resizing 14-Mar 20-Mar
Lighting Depth 1-Feb 14-Feb
Electrical Depth 22-Feb 6-Mar
Acoustical Breadth 7-Mar 13-Mar
Structural Breath 21-Mar 27-Mar
Develop 14-Mar 27-Mar
Practice 21-Mar 10-Apr
Adjust 4-Apr 10-Apr
Final Report Due
Final Presentations
Milestone #1
LTG Complete
Milestone #2
ELECT Complete
Milestone #3
Breadths Compl.