TECHNICAL REPORT 4B | PROPOSAL

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Lighting + Electrical Option
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Oakland University Engineering Center | Rochester, MI
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EXECUTIVE SUMMARY

This Senior Thesis Proposal outlines the efforts to be taken towards the senior thesis presentation and report in the spring 2015 semester. The spring semester will further the lighting design of four selected areas of the Engineering Center at Oakland University, study the implication on the electrical systems, two engineering breadth areas of study (mechanical and structural), and implement topics from master's level courses in the architectural engineering department at Penn State.

The four spaces that are the focus of the senior project studies and redesigns are:

The exterior walkway

The southern lobby + atrium

The 200-seat lecture hall auditorium

Then project labs workspace

The lighting design is focused on the overall concept that the students and faculty in Oakland University's School of Engineering and Computer Science are closely working with the automotive industries in southeastern Michigan and that the work and research they are doing are "paving the road to progress". Initial schematic lighting design presentations were given for these four spaces. With the feedback from these presentations, the designs will be altered while moving onto design development work in the spring 2015 semester.

The electrical depth will include a branch circuit redesign, a short circuit analysis, and an energy usage comparison analysis of systems changed.

The daylighting will be analyzed in terms of comfort, usability, and integration with the electric lighting systems and changes in the architectural envelope will be suggested.

The breadth topics will delve into the implications on the HVAC and structural systems from changes in the architecture from the daylighting analyses.

The spring semester will be a time to bring together the knowledge acquired while in the architectural engineering major and provide a comprehensive look into the redesign of systems within the Engineering Center at Oakland University.

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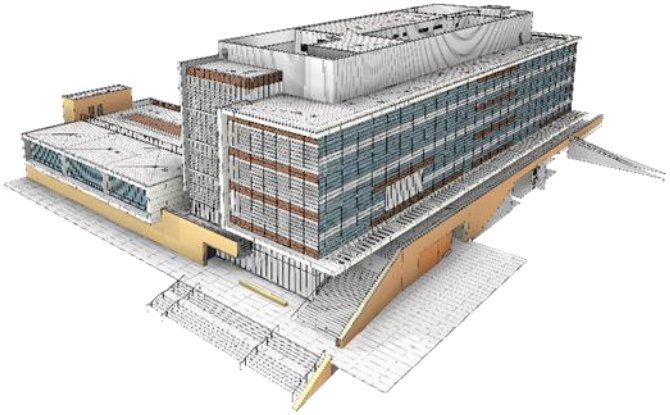
BUILDING OVERVIEW



Building name | Engineering Center

Location and Site | Oakland University, Rochester, Michigan

Building Occupant Name | Oakland University, School of Engineering and Computer Science

Occupancy or function types | 2 Buildings separated by firewall; Building A is MBC TYPE IIB, NFPA TYPE II(000) and Building B is MBC TYPE IB, NFPA TYPE II(222)

Size | 136,653 SF (Gross)

Number of stories above grade / total levels | 5 / 5

Primary project team |

Owner	Oakland University (http://www.oakland.edu/)
Architect	SmithGroup JJR (http://www.smithgroupjjr.com/)
Lighting Designer	
MEP Engineer	
Structural Engineer	
Civil Engineer	Johnson & Anderson (http://ja-engr.com/)
Audiovisual, Telecommunications, Security, Acoustics	Convergent Technologies (http://www.cti-usa.net/)
Construction Manager	Walbridge Aldinger Company (http://www.walbridge.com/)

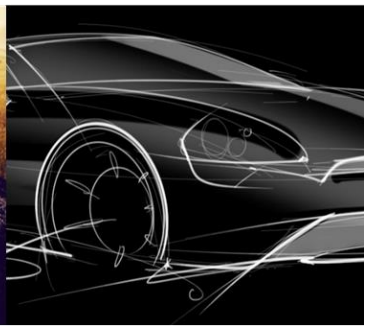
Dates of construction | January 2013 – September 2014

Actual cost information | $57 Million Construction Cost

Project delivery method | Design-bid-build

LIGHTING DEPTH

| CONCEPT



The lighting depth will include the electric lighting design for four selected spaces in the new Engineering Center: the exterior walkway, the transition area of the southern lobby and atrium spaces, the 200-seat lecture hall auditorium, and the project labs large workspace.

The design of these spaces will be unified by a design concept that embodies the essence of the building and the goals of the occupants. Oakland University's engineering program has a close interaction with the automotive industry in southeastern Michigan and the work that they are doing in the engineering programs there is important as they hold the ability to ensure a more promising future in the automotive industry. They are "paving the road to progress" with the research and studies they undergo at school, building on the successes of the past in southeastern Michigan, and starting a new generation of engineers for the future of the automotive industry. The concept "paving the road to progress" focuses on automobile related ideas and the importance of collaboration, research, and innovation in the work that will be conducted in the new Engineering Center.

| LUTRON PRESENTATION FEEDBACK

Shawn Good (Tech 3)

- 15 minutes
- Calm down, practice, project your voice.
- Project set-up took too long, the slides are good, but you need to pick up the pace in this section.
- Exterior walkway – Show the interior light bleeding out and contributing to the perceived brightness of the space.
- Lobby – The design or at least the presentation of the design appears difficult for a visitor to know where to go. Work on way finding a bit more.
- Auditorium – Do not be so literal with your concepts, rather provide the "feel" of the environment. Which design is your favorite and why?
- Project Lab – In your sketch the addition of the high bays did not brighten your sketch much.

Shawn Good (Lutron)

- 17 minutes
- Presentation style was slow and not confident or exciting. Relax.
- Images and concepts were much better than Tech 3.

Lee Waldron

- Take hand out of pocket and present with confidence and excitement.
- Exterior – Concerned about the line of light on the walkway
- Atrium – "Dappled" lighting did not come across in the image.
- Auditorium – Felt divided and suggest focusing less on the existing ceiling. Don't let the architecture limit what you choose to do.
- Project Labs – Work harder on the studio, be more high-end showroom / museum.
- You don't need a lot of light to be directed. Consider points of light to create lines or broken lines.
- Photoshopped images seemed like cartoon lighting. You could go into animation, you're halfway there.

Helen Diemer

- Liked style and concepts.
- Exterior – Walkway criteria seemed confusing.
- Would you want to walk down a path with street lighting? Consider explaining this differently.
- Auditorium – Felt too literal with the concept. With the crash test concept, you would have to explain why this is a good idea for the space. Didn't tie back to why you used the lighting the way you did in the space.

| TASKS + TOOLS

Schematic Design

- Conceptual sketches done on paper or in Photoshop CS6 to show the schematic designs based on lighting design concepts.
- Use faculty and designer feedback to improve on the design of the spaces as the design progresses into the design development phase.

Design Development

- Revit model will be the central model for design.
- The Revit models will be used as basis for AGI32 calculations or to import into 3D Studio Max for calculations and renders.
- For daylighting calculations and renders, one or more of the following will be used: DaysimPS, Radiance, 3D Studio Max, and Grasshopper with Rhino.

Construction Documents

- Fixture schedules will be created in Microsoft Excel.
- Fixture cut sheets will be taken from manufacturer websites and used in conjunction with the schedule to specify luminaires.
- Reflected ceiling plans will be created in Revit Architecture and color-coded in Photoshop CS6.
- Renderings for presentation will be created from 3D Studio Max for interior lighting and from one or more of the programs listed above for Daylighting.

Final Submittal

- Final report will be compiled in Microsoft Word.
- Final presentation will be created in Microsoft PowerPoint.

| EXTERIOR WALKWAY

The exterior walkway stretches from the southern side of the building to the north and elevates from the first level of the building to the second. This is a major transition area for the building, with three entrances off of this walkway, and for the campus, with intersections with other paths and the connection to the parking lot in the south. With the heavy traffic potential and the importance of this main walkway for the building and the campus, the idea of an intersection is going to be used to emphasize the lighting design. Recessed fixtures in the ground and stairways will be used to direct pedestrians to each "intersection" with the path including building entrances and other paths that coincide with the walkway. Lines of light will also be used to accentuate the architecture and the boundaries of the walkway. Downlighting for the walkway will be provided from the architectural overhang in-between the fins. An overall sense of safety for pedestrians as well as low light trespass to the surroundings will be key considerations when furthering the design.

| LOBBY + ATRIUM

The lobby and atrium spaces off of the southern entrance are going to be heavily trafficked areas within the building providing a transition space through which most people will see when traveling to specific parts of the building. Because of the high level of use and visibility in the building, this space needs to provide a visual statement as well as provide ease of way finding and places for occupants to feel comfortable in.

The lobby will have multiple layers of lighting to create visual interest in the space. To provide ease of way finding and areas of tension for the purpose of movement, scattered lines of recessed linear luminaires will provide downlighting to the hallways on the first and second levels adjacent to the lobby. To bring attention to the staircase, recessed fixtures will travel up the wall behind the stair to show vertical transition through the space and a decorative pendant will hover above the stair as a statement piece. To bring attention to the architecture of the study niches on the western side of the lobby linear LED tape lights will be used to line these forms and provide low level light to the niches for relaxing places to study and congregate. And finally, to indicate the spaces of respite within all of the busyness of the space, recessed circular lights will provide perimeter lighting for a relaxing feel to the areas for congregation.

The stairway goes up to the second floor café seating area and four story atrium space. This space lends itself to being a great place for social interaction outside of the classroom. To create an area of relaxation, perimeter lighting will be provided from the floors above the seating and non-uniform lighting will be provided from pendants hung asymmetrically throughout the space.

| AUDITORIUM

The 200-seat lecture hall auditorium, located on the first level, is the largest space in the building for the instruction of students and is thus very important to the program of the building. This space will be used for classes, presentations, guest lectures, and any multitude of other uses to the school of engineering and computer science. Because of this multiuse aspect of the space, the lighting design, scene control, and AV schemes are very important and will need to be coordinated. The lighting design needs to have multiple layers of functionality as well as providing appropriate lighting levels for reading, writing, presentations and safe travel through the space. Multiple schemes were formulated during the schematic design phase and the general principles of all schemes will be used to further the design of this space with versatility and scene control in mind.

| PROJECT LABS

The project labs space is the largest workspace in the building and will be used for the production of formula cars as well as a multitude of other products in the school of engineering. This is where the ideas of the students and the knowledge they have obtained are put together to create and to show off and test their ideas which is why this space deserves to be a place that is comfortable to work in as well as functional. The design will have layers of stylized light to make the space visually appealing and layers of high level lighting for the visually intensive tasks of using machinery.

ELECTRICAL DEPTH

| ELECTRICAL SYSTEMS OVERVIEW

The electrical depth will involve the redesign of the lighting branch circuits, a short circuit analysis of the new design, and an analysis of energy usage that looks at cost comparisons for a more economical design.

Power enters the building at 13.2kV and is stepped down by two transformers in the ground level substation room. Here the 480/277V 3 PH, 4 W power is distributed throughout the building to branch panel boards for the lighting and other electrical needs at either 277V or stepped down 120V power. A penthouse generator is used in the event that emergency power is needed.

| BRANCH CIRCUIT DESIGN

With the designing of the lighting for the four selected spaces outlined in this proposal, the lighting branch circuits will have to be adjusted accordingly. The panels, as well as the circuit breakers, feeders, and wiring will have to be resized to make sure that the new lighting design will be properly implemented in the building.

| SHORT CIRCUIT ANALYSIS

Along with the resizing of the branch circuits analyzed in the electrical depth, there will need to be a proper short circuit analysis to ensure the equipment is protected through a series of calculations.

| ENERGY USAGE ANALYSIS

The electrical changes will be analyzed according to the energy usage changes as well as the cost implications of these changes to ensure that the new design is economical and efficient.

MAE DEPTH ADDITIONAL WORK

| DAYLIGHTING (AE 565 + AE 562)

Since the lobby and atrium spaces are surrounded by large areas of architectural glazing and are located on the southern end of the building, they are areas of concern for daylighting and daylight integration. A study will be conducted regarding this daylighting and the possible negative aspects of glare, unwanted solar penetration, and solar heat gain will be analyzed. If there are problems with the daylighting here, methods for blocking or harnessing the daylight will be tested and recommended.

Another daylighting study will be conducted for the project labs space on the first floor with the purpose of adding well-designed skylights into the space. The addition of skylights will hopefully increase the quality of the space and save on mechanical loads as well as electric lighting loads in the space and provide the basis for the two breadth topics that will be studied.

Topics and software used in AE 565 (Daylighting) and AE 562 (Luminous Flux) can be implemented for these studies.

MECHANICAL BREADTH

| OVERVIEW

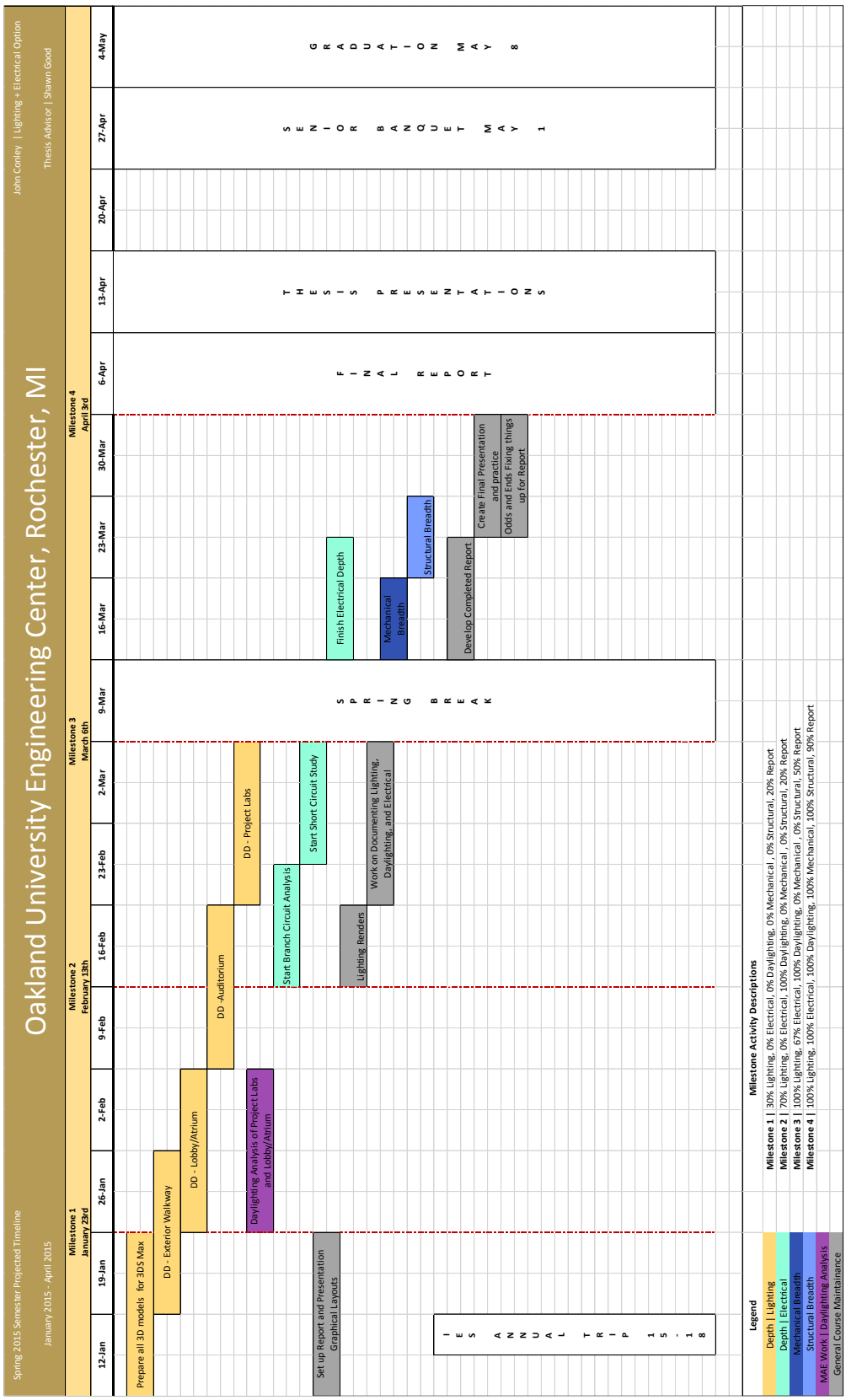
With the implementation of skylights in the project labs there will certainly be additional solar loads on the space. A mechanical analysis will be done with eQUEST, or a similar software, to assess the change in the exterior loads on the spaces. Depending on the extent of the change, alternate HVAC systems or updated HVAC systems will be implemented for the space. The changes will be documented in plan and elevation for the new mechanical equipment and a comparison will be made in terms of energy use and cost effects. The overall cost of the architectural, mechanical and structural change will also be weighed against the daylight and energy use benefits of the change to give a recommendation to the owner.

STRUCTURAL BREADTH

| OVERVIEW

When the architectural change is made by adding a skylighting system to the project labs, the structural implications on space available and structural load on the building will be studied. Here, load calculations will need to be performed to assess the extent of the change and steel members will be resized. The implication of the change will be analyzed based on the overall benefits of the change and the cost to the building owner that this change will incur. A final recommendation to the owner will be presented and the changes will be documented in plan and steel beam schedule.

SPRING SEMESTER SCHEDULE


Spring 2015 Semester Projected Timeline
January 2015 - April 2015
Oakland University Engineering Center, Rochester, MI
John Conley | Lighting + Electrical Option
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Milestone 1 January 23rd
Milestone 2 February 13th
Milestone 3 March 6th
Milestone 4 April 3rd
12-Jan
19-Jan
26-Jan
2-Feb
9-Feb
16-Feb
23-Feb
2-Mar
9-Mar
16-Mar
23-Mar
30-Mar
6-Apr
13-Apr
20-Apr
27-Apr
4-May
Prepare all 3D models for 3DS Max
DD - Exterior Walkway
DD - Lobby/Atrium
DD -Auditorium
Daylighting Analysis of Project Labs and Lobby/Atrium
DD - Project Labs
Set up Report and Presentation Graphical Layouts
Start Branch Circuit Analysis
Start Short Circuit Study
Lighting Renders
Work on Documenting Lighting, Daylighting, and Electrical
Finish Electrical Depth
Mechanical Breadth
Structural Breadth
Develop Completed Report
Create Final Presentation and practice
Odds and Ends Fixing things up for Report
INTERIM
SPRING BREAK
FINAL
PRESENTATIONS
THESIS
PRESENTATIONS
MAY 8
Legend
Depth | Lighting
Depth | Electrical
Mechanical Breadth
Structural Breadth
MAE Work | Daylighting Analysis
General Course Maintainance
Milestone Activity Descriptions
Milestone 1 | 30% Lighting, 0% Electrical, 0% Daylighting, 0% Mechanical , 0% Structural, 20% Report
Milestone 2 | 70% Lighting, 0% Electrical, 100% Daylighting, 0% Mechanical , 0% Structural, 20% Report
Milestone 3 | 100% Lighting, 67% Electrical, 100% Daylighting, 0% Mechanical , 0% Structural, 50% Report
Milestone 4 | 100% Lighting, 100% Electrical, 100% Daylighting, 100% Mechanical, 100% Structural, 90% Report