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# Thesis Proposal

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Tech Report 4B

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PSUAE

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## Executive Summary

This is a design proposal for Fruanhofer CSE building project. This project is a renovation of an a-hundred-year old historical building. It includes the detail work of the redesign of the lighting depth in four spaces and electrical depth topics. It also explains the two breadth topics on daylighting and architecture.

The lighting depth will consist of the new overall design concept for all the spaces and each space's proposed design solution. The four spaces being redesigned are: lobby, conference room, open office and building façade. The design concept is developed through the company profession which is clean, intelligent and corporative. Detailed criteria can be found in the presentation.

The electrical depth will focus on how to make the lighting system in the building an automatic-controlled system. Different lighting zones will be wired by groups according to the panel board and feeders will be adjusted accordingly. The building will also involve utilizing the solar photovoltaic panel as a source of electricity. So the depth will also entails a design and analysis of how the electrical coordinates with the PV systems.

In the redesign solution, adjusting the interior architectural design is one of the main ideas within the lighting design solution for one of the four spaces. So the two breadths will focus on the interior architecture design and the potential daylighting in that space. The building structure remains the same as it is for over a hundred years. In order to coordinate the lighting design for the open office space, changes in the structure of the architecture will be made. And in this case potential daylighting use in the space will be considered in the redesign of that space.

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## + Building Overview

Fraunhofer CSE building is a renovation of an a-hundred-year-old historical building located in Boston, MA. As a building dedicated in commercializing in clean energy and developing advanced research on building material and sustainable energy. The renovation project is made the building technology showcase that coordinates with other company in the related industry.

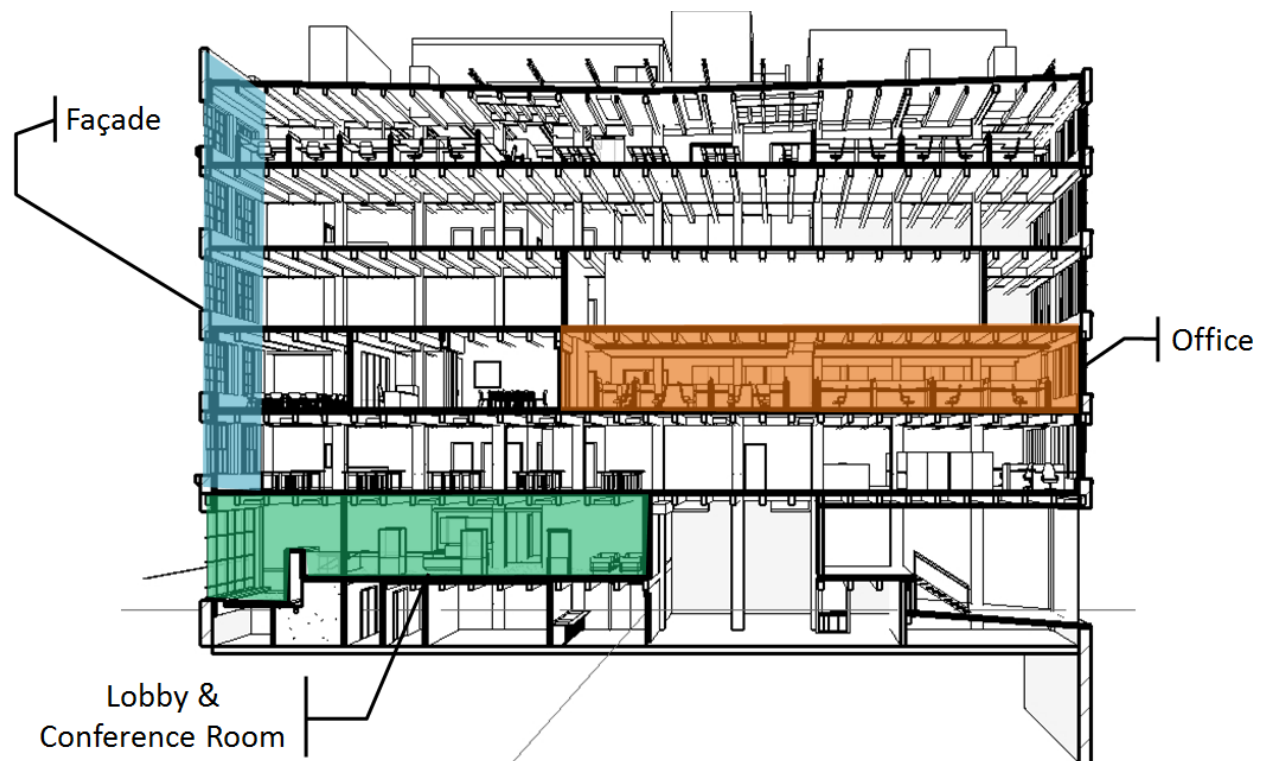
- Building Name: Fraunhofer CSE Project <http://cse.fraunhofer.org/>
- Location: 5 Channel Center Street, Boston, MA
- Occupancy Type: Offices and research laboratories (Group B) and conference room (Group A-3)
- Size: 42150SF
- Number of Stories above Grade: 6
- Project Teams:
  - Owner: Fraunhofer USA
  - General Contractor/Construction Manager: Gilbane Building Co. [www.gilbaneco.com](http://www.gilbaneco.com)
  - Architects: DiMella Shaffer [www.dimellashaffer.com](http://www.dimellashaffer.com)
  - Structural Engineer: McNamara/Salvia, Inc. [www.mcsal.com](http://www.mcsal.com)
  - MEP/FP/Tel Data Engineer: BR+A Consulting Engineers [www.brplusa.com](http://www.brplusa.com)
  - Lighting Consultant: Lam Partners [www.lampartners.com](http://www.lampartners.com)
  - Plumbing/HVAC Services: Northeastern Mechanical [www.northeasternmech.com](http://www.northeasternmech.com)
  - Civil Engineer: VHB, Inc. [www.vhb.com](http://www.vhb.com)
  - Geotechnical Engineer: Haley & Aldrich, Inc. [www.haleyaldrich.com](http://www.haleyaldrich.com)
- Dates of Construction: Jan 2012— Apr 2013
- Actual Cost Information: Not clear
  - This renovation project is designed for Fraunhofer Building Technology Show Case (<http://cse.fraunhofer.org/5cc/>). For this specialness of the project, almost all the products and materials are donated by manufacturers. Therefore cost is hard to be estimated.
- Project Delivery Method: Base building—Tenant Fit-Up

For an overview of the current building system introduction, please visit:

## + Lighting Depth

The lighting design will focus on the redesign of the four spaces chosen in the building:

- Lobby
- Conference Room
- Open Office
- Façade



The design concept is extracted from the company profession that they want to advertise to the public and the related industry about clean energy, intelligent building system and collaborative research on sustainable material. From there I concentrate the main design ideas to be clean, intelligent and collaborative. From those ideas, the design of four spaces will mainly contains linear or simple line lighting patterns that will create a modern and technological look in the spaces like those typical appearances in the sci-fi movies. The lighting will create layers in the space to help emphasize the architectural features in this classical style building so to collaborate the modern and classic style together.

## Lutron Presentation Feedback

### Lee Waldron

- How to light the step lighting in the lobby staircase
- Lobby lighting criteria might be too low especially for the reception area and the pendant above the reception desk may be too dim for that work plane
- Take care of LPD in the space
- Pendant mounting height needs to be adjusted
- Ceiling surface lights instead of pendant in the office will make room feel bigger
- Question about whether there is space for pendant light in the office with low ceiling
- Be careful with where the light is coming from in the rendering
- Consideration of dark sky for the exterior lighting
- Implement more sustainable design for the façade

### Kari Nystrom

- Background introduction in the presentation is too long
- Bad selection for the fixture for the cove light effect in the lobby
- Grazing source location not clear in the lobby
- Power density might be too high
- Keep energy compliance in mind in design
- Pendant might be in the way for video playing in the conference room
- Probably not enough illuminance on the faces in the conference room
- How to deal with pendant in the way of exhibition when open up the space in the first floor of showcase usage
- Check LPD for conference room
- How to mount the linear light on the beams

## Lobby

As the gateway of the company, lobby plays an important part of representing a company's image. With this thought in mind, of all the designs for the four spaces, lobby has the most sophisticated design and it contains the most features to showcase the design concepts. The lobby is on the first and connecting the lower level vestibule with two sections of short length staircases with a landing in between. The upper level lobby is the reception area. There are multiple layers created in the lobby and the layers helps defining the shape of the space. Linear lighting fixtures that highlight the columns to the beams are the main feature of the space. Those linear white lights make the space has a feeling like in the sci-fi

movies. Warm colored indirect light from in between the beams are used to add up the layers above the exposed ceiling structures. The light hide beneath the stairs helps define the transition areas and leading people into the space. The logo wall by the landing next to the stairs is combines with light fixtures and helps emphasizing that the company's profession is about technology.

### **Conference Room**

The conference room, which is next to the lobby, has a more task driven lighting design. Pendant lights will be considered to place above the working plane providing illuminance for writing and reading as well as vertical illuminance on the faces of people sitting around the table. Dimmable glowing ceiling panels will be a potential solution for the general ambient lighting and helps the space to be flexible in different uses. In this space, it is important to achieve all the task goals while having all the different fixtures coordinate flexibly.

### **Open Office (3<sup>rd</sup> floor)**

The goal for the office lighting design is to improve the working environment and truly promote the technology supported lighting design. Different types of lighting features and clean-line lighting elements coordinates smoothly together helps redefine the space. The open office is a small narrow space with very low ceiling level and exposed HVAC system. The lighting design for this condition is aimed to help creating a spacious feeling and make people who work in there will be able to enjoy the working experience for the company. The proposed design for this space is to open up the ceiling in the center bay to the upper floor (which is current vacant and under design process for future use). With this change, it expends to a much larger volume and it provides the space much larger room for creative lighting design. The opened-up space has a more classical proportioned architecture characteristic. The lighting will help celebrate this architectural feature while create a high-end modern office look. Refreshing and spacious feeling will be the main concept of the design in the office with simple line lighting fixtures. Indirect lighting together with washing or grazing method will help define the space, as well as create layers so that all features collaborate together for the whole image of the look.

With the help of increasing the ceiling height, more day-lighting will be coordinated within the lighting design. Day-lighting simulation will be made for this space and helps emphasize the greener energy use in the building.

## Façade

The building façade is well proportioned with classical revival detailing on the cornices. So the design is conducted in the simple way to celebrate those features. The washing light will be placed above the three cornices and light up the wall above it. As a result there should be three portion of the wall are washed with warm flood light. The light trespass to the surrounding and dark sky criteria should be taken in to consideration in order to perform a sustainable lighting solution to match the company's goal to promote sustainable energy and building materials.

## Tasks and Tools

Schematic Design: mainly conducted by photoshop with the help of hand sketches. Altered designs will be performed with suggestions from the professionals.

Design Development: Lighting fixture selection, 3D modeling with AutoCAD, rendering with AGi32 and 3DSmax

Lighting Analysis: calculations will be performed with AGi32, potential daylighting simulation calculation and analysis with Daysim

## + Electrical Depth

### Branch Circuit Redesign

The electrical depth involves the redesign of the branch circuits in each space within the building. With the changing of the lighting system, potential changes will include re-sizing the panel boards and feeders. Intelligent lighting system and smart control system will be involved in the changing of electrical system.

### Short Circuit Analysis

Calculations will be conducted to analyze the performance of the circuit and coordinate protection devices that support the single path distribution system.

### Photovoltaic Array



The building will be operated with the solar photovoltaic array due to that is the main research this company conduct. So with many PH research labs actually locate in the building. The building itself will be served with photovoltaic panel as a power source.

### + Structural Breadth

In this breadth proposes to remove the ceiling in the 3<sup>rd</sup> floor office area and open up to 4<sup>th</sup> floor to create a two-story-height atrium space in the open office. The design will create a more modern looking open working space. Structure analysis will be conducted to study the feasibility of this design and the changes needed to be made structurally, such as sizing beams and load diagrams.

### + Interior Design Breadth (?)

Need further changes.

## + Work Schedule

