Thesis Proposal

FDA Building One – White Oak, MD

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Thesis proposal serves as an opportunity to explore possible areas of redesign and their impact. For FDA Building One, an extensive solar study will be performed. Also the structural redesign to meet current seismic codes and progressive structural collapse will be investigated. Last, the redesign of the connector link to provide additional open office work space and its impact on the current systems will be assessed.

Executive Summary:

The objective of this proposal is to summarize the information gathered from previous Technical Reports, explore possible areas of depth and breadth study and formulate a look-ahead schedule for the spring semester. Currently FDA Building One uses three air handling units to serve perimeter offices, security pavilion and the core ventilation needs, providing minimum outside air requirements to all zones. The building is hooked up to a central utility plant that provides electricity, chilled/hot water to coils of the air handling units and fan coil units in perimeter offices as well as steam to the domestic hot water exchangers. An energy model was created to evaluate the energy usage of the building. Some potential areas of redevelopment have arisen over the course of studies this semester.

First potential area of redesign will focus on a solar study for the building. The roughly 25,000 SF of roof could provide ample space to install photovoltaic collectors. Energy could be used within the building or redistributed to surrounding buildings. This equates to saving of tax dollars; or at least tax dollars put to better use. A thorough financial feasibility study will be key in implementation.

Another area of redevelopment will be to revisit the engineers' approach of keeping the structural core intact from when the building was originally constructed in the 1940's. Although not looking to take away from the historic preservation aspect of the building, the advancement of building technologies on the structural front gives rise to exploring structural innovation viz. progressive structural collapse techniques.

The final area of redevelopment will be to explore the multi-story connector from Building One to the Central Shared Unit situated behind it. This connector is currently being used as an atrium space with footbridges connecting the two building. Multiple tenant fit out options will be investigated to keep consistency with the rest of the building's design, in addition to impact on other facets of the building in terms of mechanical, electrical or structural.

Building Overview:

FDA Building One is the seventh White Oak structure completed as part of the FDA's consolidation project on the White Oak, MD campus. GSA oversaw the renovation of the 102,000 square foot, four-story historic Building One - originally the headquarters of the Naval Surface Warfare Center for 52 years - to accommodate portions of the FDA's Office of the Commissioner and related executive functions.

Flanked by two office buildings, Building One creates a formal entry forecourt. The building integrates 148 offices, nine conference rooms and several workstations and shared business areas and connects to the campus' first Central Shared Use space with access through the first floor lobby.
The building was the first on the FDA Campus to receive LEED Gold certification.

The design of the building is entirely historic preservation with a few modern touches to the façade. Special considerations were taken into account in order to compliment the design of the existing buildings as well as match the architectural materials that were selected for the original campus facade. The historical considerations of this building played a large role in the building material selection as well as the façade and glazing design

Mechanical System Overview:

FDA Building One receives conditioned supply air from three air handling units (AHU's). The first of the AHU's (OAHU-1) is strictly providing 100% outside air to the peripheral office spaces, the AHU supplying the security pavilion and VAV boxes serviced in part by the third AHU; sized at 5,300 CFM with an energy recovery wheel. The AHU servicing the security pavilion (AHU-2) is provided at constant volume, sized at approximately 7,300 CFM with reheat. The AHU servicing conference rooms and interior areas (AHU-1) through VAV and CAV boxes as well as Dual Duct Air Terminal Units, sized at 19,000 CFM with pre-heat. Two-pipe fan coil units (FCU's) are used in both the electrical closets and telecommunications closets, as well as around the perimeter in private offices.

The building is a part of the larger campus which is serviced by a Central Utility Plant containing a co-generation plant, chillers, boilers, cooling towers, etc. This is in part of an energy saving strategy, in conjunction with reliability concerns, to provide the entire campus with electricity, heating and air conditioning. The utility plant will be able to monitor loads amongst the various buildings and size up or down the supply of utilities based on the demand loads. In this manner, the utility plant itself can function with utmost efficiency, allow for redundancy and extreme load scenarios.

Redesign Considerations:

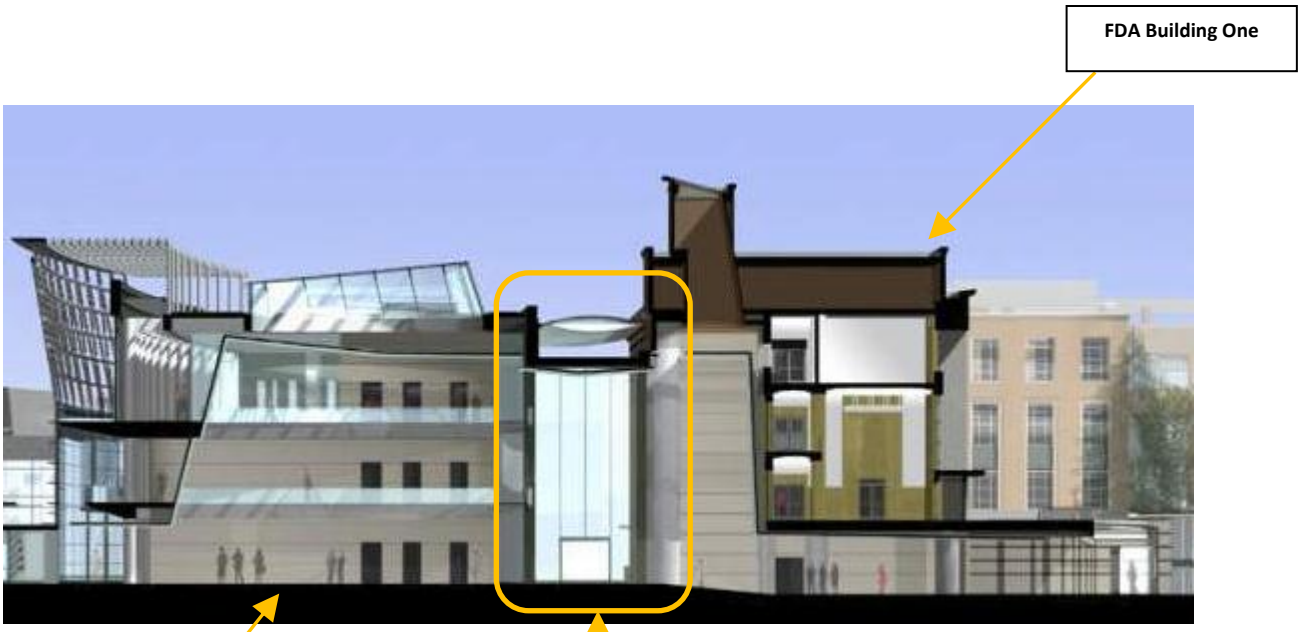
Solar studies of the building will be performed to evaluate the benefits of implementing a photovoltaic collection system on the roof of the building. The roof has an area of 25,000 SF to work with, which is a substantial area that is not being constructively utilized. The energy generated from the photovoltaic panels can be used toward the building's immediate load. Distribution to surrounding buildings will also be considered in cases of excessive generation. The methods learned in AE 456, Solar Thermal Collection systems and design course will be implemented. The use of Engineering Equation Solver and a step by step guide developed in the course will assist in designing a system to fit the capacity of the building given the climate and location.

Having personal rapport with several photovoltaic installation companies, investigation into innovative products will be critical. The financial feasibility and payback will be explored on a realistic basis, taking into consideration local contractor rates. The cost of electricity in the DC Metro area fully warrants such an investigation.

The electricity generated from the photovoltaic panels will be investigated for various uses in the building. Starting small, photovoltaic use for the domestic hot water will be explored. This would eliminate need for large flat plate heat exchangers on the first floor of the building. Individual instantaneous hot water heaters on the floors of the building can be used on a standalone basis. Further use and distribution of electricity will be explored.

Curiosity in the engineer's decision to stick with the original structural design has been present from the beginning of the thesis process. This is not to cast a shadow of doubt on the integrity of code compliance. In fact, FDA Building One received LEED credit for extensive reuse of core, shell and façade elements. However, the chance to explore a breadth for redesign is not going to go by without exploring this lingering interest. The goal of this redesign aspect will be to explore a redesigned structural system to accommodate progressive collapse as implemented in many other federal facilities. The safety of building occupants is highly critical. The White Oak area experienced an earthquake as recently as July of 2010. Although no extensive damage was reported, minor settling was seen in some buildings. This building was originally constructed in the 1940's and the GSA didn't have stringent facility structural requirements. Through this analysis, potential resulting betterments will be explored. Tools from courses over the past years will be implemented in performing this analysis. Being proficient in STAAD and RISA will be a benefit, but this may only be a starting point. Conferring with structural faculty will be critical.

Lastly, an effort will be made to extract value from the connector link that joins Building One at the entrance of the campus, to the Central Shared Unit, a newly constructed building situated behind Building One. Currently being used as an atrium area, the space requires large volumes of air to be conditioned. The main focus of this area is to showcase the two pedestrian bridges between the buildings. An initial estimate shows that roughly 7,500 of open workspace could be provided on multiple levels. The all glass façade provides enough natural daylight for the area to use, but additional lighting requirements will be investigated. Also enhancements to meet minimum outside air requirements will be assessed. Multiple fit out options for this area will serve as alternatives, eventually providing the best overall use of this space. Having experience in office layouts, from previous internships, will be advantageous. Revit will most likely be used as a tool for analyzing various lay outs and options.



Predictions:

Right off the bat, I'm certainly optimistic of the redesign outcomes. With the building facing southwest, the photovoltaic panels will hopefully be successful. This could be a beneficial appropriation of tax payer funds that are used to operate the facility and campus as a whole. Other buildings on the campus have incorporated some solar harnessing methods or another, which is promising. Redesign of the core structural system will be difficult. Expectantly a demonstration of benefit will be the outcome. As for the connector link fit out, I feel that the building owners would be pleased with additional area to accommodate the growing workforce of the Food & Drug Administration. The mechanical equipment is substantially designed for the existing building, so providing a slightly higher load could even prove beneficial in allowing the equipment to run more efficiently.

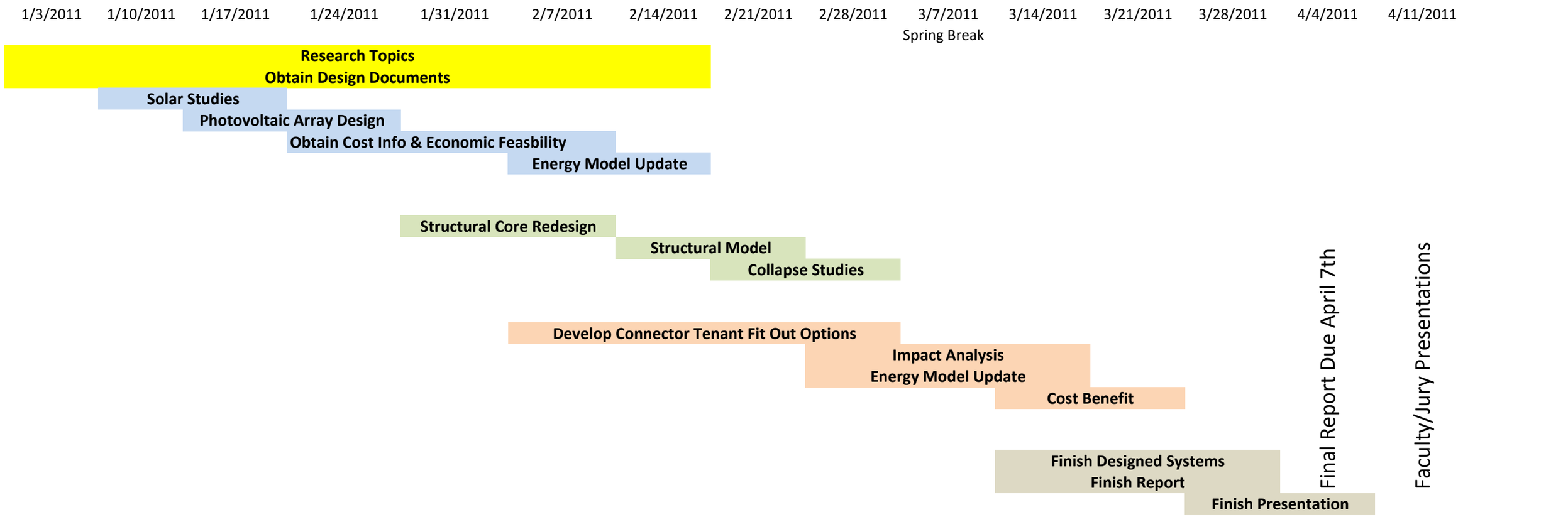
Preliminary Research:

Topics included in this proposal have been a culmination of brainwaves from topics learned throughout Architectural Engineering coursework. My AE advisor contributed as an initial catalyst and I'm thankful for that. Many useful references have been made available for the in-depth study of the proposed topics. These include previous technical reports, graduate dissertations, engineering journal articles and ASHRAE handbooks. A continuous effort will be made to secure design documents from the engineers involved in the project. Short of that, conversations with design team will suffice. As already mentioned, guidance from faculty will be critical and solicited every step of the way

FDA Building One
Spring Thesis Schedule

Milestone 1 1/28/2011
Milestone 2 2/18/2011
Milestone 3 3/4/2011
Milestone 4 3/25/2011

R. Andy Pahwa
Mechanical Option
Advisor: Freihaut/Eplee



Milestones		Deliverable
1	28-Jan	Completed Solar Studies and PV array Design
2	18-Feb	Updated Energy Model, Structural Core Redesign
3	4-Mar	Structural Collapse Studies, Connector Link Tenant Layout
4	25-Mar	Tenant Fitout Cost Benefit & Impact Analysis

References:

-KlingStubbins w/ RTKL. Architectural Construction Documents. Washington, DC

-ASHRAE Handbook of Fundamentals

-White Oak Laboratory Alumni Association: http://www.wolaa.org/historical_preservation.html

-Practicing Mechanical Engineer's LEED expertise

- Solar Engineering of the Thermal Processes by Duffie Beckman

- Heating, Ventilating, and Air Conditioning by McQuiston, Parker, Spitler