Old Tarble Renovation and Addition
Engineering 90 Proposal

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Abstract

We intend to fully design the renovations necessary to Old Tarble in order to accomplish the following two objectives: bring the existing structure up to present IBC (International Building Code) and ADA (Americans with Disabilities Act) code, and add a new wing to replace the one that burned down in 1983. The structure will be designed for use as the new special collections library in order to relieve space constraints in McCabe Library. As key components to our project we will generate structural, HVAC, architectural, plumbing and electrical drawings using CAD software and check for compliance with ACI and LRFD codes via hand calculations and MultiFrame software.

Introduction

In talking to Facilities Director Larry Schall, Associate Vice President of Facilities, Stuart Hain, and Head Librarian Peggy Seiden, it became clear that the Old Tarble has been something of a gray space in terms of usage. Before to its partial destruction, it had served as both a library and a student space. Afterwards, it has been variously assigned to studio art and dance.

There have been some tentative proposals for the space, none of which came to fruition. The first idea was to rehabilitate or possibly replace the space with a student center. It was felt that the campus should have a dedicated student center. However, architect Robert Venturi proposed renovating the inside of Clothier Hall instead, and it was this plan that was finally built in 1987. According to Stuart Hain, the use of Old Tarble as a student space has not been revisited seriously since.

A more attractive use for Old Tarble is as an extension of McCabe library. Typically a library is built to accommodate the growth of its collections for up to 25 years. Seeing as that McCabe was built in 1966, the library is quite overdue. In 1998, McCabe Library commissioned a report on needs for extra space within the library. The architectural firm Einhorn Yaffee Prescott concluded that the library would need some 66,500 ft^2 of new space. According to Peggy Seiden, a bookshelf is considered to be full when it has less than 15% of its space open. In some areas of the library, she said, the librarians have begun stacking the books on top of one another. With the influx of computers into the library a decade ago, the space for shelving has been further reduced. While the use of laptops has alleviated some of that need for computing space, other needs are growing. A recent trend is that students are doing more collaborative work in the library, a use for which the library was never really built for. There are no conference rooms, or quiet meeting spaces available for students.

To be sure, the cost of a renovation to McCabe would be extremely expensive. Certain details of the current building are very eccentric – the floor that supports the Friends and Peace Collections towards the front entrance of the library is actually supported by the bookshelves beneath it. Ripping up such a structure and strengthening it for compact shelving would be prohibitively expensive.

A modern solution for increasing storage space is the use of basements with industrial-scale ceilings and oversized compact shelving. However, this solution is hard to implement at the McCabe site. It was suggested by the architects that the new basement could be sunk into the side of the hill. Because of the fairly shallow bedrock present there, however, this idea was not feasible.

A somewhat more temporary solution than a complete renovation of McCabe or an addition is the use of the Old Tarble space as an extension, a secondary library. Peggy Seiden briefly played around with the idea of moving Special Collections and the Treasury Room out to a secondary structure, proposing a bridge between McCabe and Old Tarble. The new structure would potentially hold special collections, conference rooms for collaborative student work, media production areas, and some office space. It is this idea that we found the most need for.

It must be stressed that the Old Tarble renovation is not meant to be a new library. Like Stanford University's Auxiliary Library (Planning Academic and Research Library Buildings, 44), the renovation is meant to alleviate the space needs of McCabe Library without building an entirely new library. The Special Collections includes both the Friends Historical Library and Peace Collections, and currently occupies a footprint of roughly 5300 ft^2. The Treasury Room occupies roughly 900 ft^2. If we project a two percent growth per year in the size of these collections, (Planning, 18) and 15 years between the time the library extension is built and a replacement for McCabe is begun, the collection will grow to 8300 ft^2, space that will need to be built in to the Tarble renovation. At a cost of $210 per square foot for the new addition and $195 per square foot of renovation, the projected cost of the project is $3.6 million

This project fulfills the E90 requirements as well as the ABET criteria. The E90 requirements are that students pursue projects that integrate materials from the courses they have taken and demonstrate their competence in math, science, engineering and the liberal arts. This project will require that we call upon that which we have learned in virtually all of our civil engineering classes. We will use our knowledge from E6 and

E59 in the design of connections and structural members. We will also have to call upon our knowledge of structural theory and design, which we learned from E60 and E62. Finally, in foundation design, we will use what we learned from E61. Our project further satisfies the ABET criteria because we will have to deal with social, economic and health and safety considerations in pursuing our project.

Design & Codes

According to Larry Schall, there is an existing foundation at the site which was left over from the original wing. In order to minimize the amount of geotechnical and foundation work, we will investigate reusing the old foundation. We will be characterizing the strength of this foundation by examining the original blueprints to estimate the loads that the foundation was designed for. As another possibility, we may use geotechnical reports from the New Dorm as an estimate of soil conditions in the Old Tarble site.

The new wing will be designed in accordance with the 2000 International Building Code, while the existing will also be subject to the 2000 Existing Building Code. Both sections of the building will be subject to the International Plumbing code, as well as Title 34 of the Pennsylvania Code. The following codes were deemed relevant to the proposed expansion of McCabe library and would also be relevant to our project:

International Building Code 2000

- Chapter 3- Use and Occupancy Classification

- Chapter 4- Special Detailed Requirements Based on Use and Occupancy
- Chapter 5- General Building Heights and Areas
- Chapter 6- Types of Construction
- Chapter 7- Fire-Resistance-Rated Construction
- Chapter 8- Interior Finishes
- Chapter 9- Fire Protection Systems
- Chapter 10- Means of Egress
- Chapter 11- Accessibility
- Chapter 34- Existing Structures

International Plumbing Code

- Chapter 1- Administration
- Chapter 4- Fixtures, Faucets and Fixture Fittings

Pennsylvania Code Title 34. Labor and Industry Fire & Panic Regulations

- Chapter 50- General Requirements – Buildings
- Chapter 54- Group B Educational
- Chapter 60- Universal Accessibility Standards

Technical Discussion

The building will be a rigid steel frame with concrete slab flooring and metal decking. Many of the design constraints are dictated not by current needs, but with potential usage in mind. The storage needs of libraries are continually changing, and it is

a good idea to build a structure with semi-modular bays with an eye towards future expansion.

All floors must hold a minimum live load of 150 psf for those sections that support the special collections. The number of cores for the building should be minimized, as permanent cores tend to hinder additions and future demolitions. A single permanent core area surrounding elevator, stairs, and other utilities should be enough to provide circulation and what minor shear bracing that might be needed. The minimum live load will be doubled to 300 psf for the 1200 ft^2 of flooring that supports the treasury room. This increased load is attributed to the use of movable shelving in this particular section. Floor heights will be largely dependent on existing floor heights in old Tarble, with a minimum floor height of 8 ft, 4 in. (Planning, 20.)

The HVAC systems for the treasury room will be as highly specialized as the floor system, as special care has to be taken towards preserving some of the rare books in this collection, which are sensitive to humidity and temperature changes. The environmental requirements for other sections of the building will be less stringent and defined as a separate zone, with conditions typical of most library environments. Power and signal services, closets and distribution systems should be flexible as well. (Planning, 21.)

Realistic Design Constraints

This project is subject to tight restrictions on time, money and space. Time is perhaps the most critical constraint since an immovable deadline for project presentations

exists on May 2nd. The feasibility of the project with respect to this time constraint is borne in mind throughout this proposal. See the "project plan" for further explanation of how this design constraint has been dealt with.

Money constrains the project in two ways: first, a lack of it will prevent us from utilizing many potential resources that could help us with design work; and second, it must be considered in designing an economically viable option for relocation of the special collections library. If money did not have to be considered, we would enroll in AutoCAD courses during winter break. Instead, we are proposing to purchase only what we need: some AutoCAD textbooks and materials for a 3-dimensional model. We will be borrowing a copy of the International Building Codes from Daniel Honig. The second monetary constraint is considered by designing the building with a steel frame. This is further discussed in the "Technical Discussion" section.

The area of land to be built on is limited by the surrounding structures, walkways and embankments since any of these would be costly to obstacles to demolish and relocate. Fortunately, the amount of space required for the special collections library is not significant enough to make this constraint a large problem. In fact, this constraint was considered and solved by deciding to use the Old Tarble space for special collections rather than some other purpose.

This project is further constrained by the need to supply the building with utilities as well as the necessity that none of the existing lines that feed other buildings are disturbed. Presently, old Tarble is a hub for steam distribution utilities that will need to be relocated.

Most importantly, our project must satisfy the demands of our client, College Librarian Peggy Seiden, as determined by the 15 year projected needs assuming two percent growth per year. The existing building has approximately 7300 square feet of space on three floors. The first floor will be used as a reading area lined with special collections in locked display cases. The basement will contain the mechanical room, offices and bathrooms while the top floor will contain a small computing space that overlooks the reading area below. The first floor of the new wing will fill approximately 6300 square feet of space, while the second floor will fill approximately 4000 square feet. The first floor will have special areas for the treasury room, microfilm viewing and bathrooms, but will mostly be taken up by shelving for special collections. Likewise, the second floor will mostly be used for peace collections.

Project Plan

CPM Activities

A: Determining interest in project via meetings with Faculty & Staff- 1 week

B: Preliminary foundation characterization- 2 months

i. Obtaining blueprints - 2 months float

ii. Analysis - 3 weeks

iii. Subsurface exploration – 3 days

C: Building codes-

i. Obtain building codes - 1 week

ii. Get familiar with applicable codes – 1 month

D. Learn CAD/Multiframe – 1 month

i. Obtain CAD package/ Multiframe – 1 week

ii. Obtain tutorial books – 1 week

iii. Learn software – 3 weeks

E: Aesthetic Design – 2 weeks

i. Usage/ needs for building -1 week

ii. Programmatic needs (square footage) – 1 week

F: Rehabilitation of old wing- 6 weeks

i. Examine existing structure – 1 weeks

ii. Design changes to building to comply with code – 5 weeks

G: Structural Design – 8 weeks for all tasks

i. Steel detailing

a. input into CAD

b. hand calculations/ multiframe

c. (re)evaluate design

ii. Concrete

a. mix design

b. reinforcement

H: Nonstructural Design- 4 weeks for all tasks

i. HVAC

ii. Electrical

a. Lighting

b. Phones

c. Ethernet

iii. Plumbing

iv. Drainage

v. Foundation

I. Prepare report and presentation – 2 weeks

i. Type report- 6 days

ii. Prepare Powerpoint- 2 days

iii. Rehearse Presentation- 5 days

iv. Present- 1 day

Division of Labor

Since we are both interested in learning about all aspects of a design project, there will be significant overlap between our functions and responsibilities. However, the major breakdown of work is predicted to be as follows:

Kirk Ellison will be primarily responsible for structural design and analysis by hand and with Multiframe. He will also perform cost estimation of the final design.

Steve Huang will be responsible for the majority of the architectural work. He will design the building in conjunction with Kirk, but will be primarily responsible for drafting with AutoCAD and eventual creation of a three-dimensional model of the structure.

Both of us will be responsible for the foundation design, conceptual design to meet the clients' needs. We will also be equally responsible for ensuring that all relevant building codes are considered and fulfilled.

Project Qualifications

We are both concentrating on civil engineering as majors at Swarthmore College. We have taken or are taking the civil offerings, including Mechanics of Solids, Geotechnical Engineering, and both Structural Theory and Design I and II. In addition, Kirk Ellison worked for construction management company J.J. Henri Company, and took Civil Engineering Management in New Zealand. Steve Huang has taken an summer architecture course at Harvard. We have been talking to Daniel M. Honig '72, of Structures Consulting Engineers who first suggested the project and has offered his time in helping us. Professor Siddiqui is advising.

Project Costs

Because this is primarily a design exercise, the actual costs of the project will be spent mainly on textbooks. There is little or no fabrication involved, and what building materials we do need are for building a scale model of the structure. The total costs are outlined below:

AutoCAD textbooks- $120

Model building materials- $60

Photocopies and bindings for final report- $20

Total - $200

References

E90: Senior Design Proposal for Garage (1996)

Conversation with Stuart Hain from Facilities Management

Conversation with Peggy Seiden, College Librarian

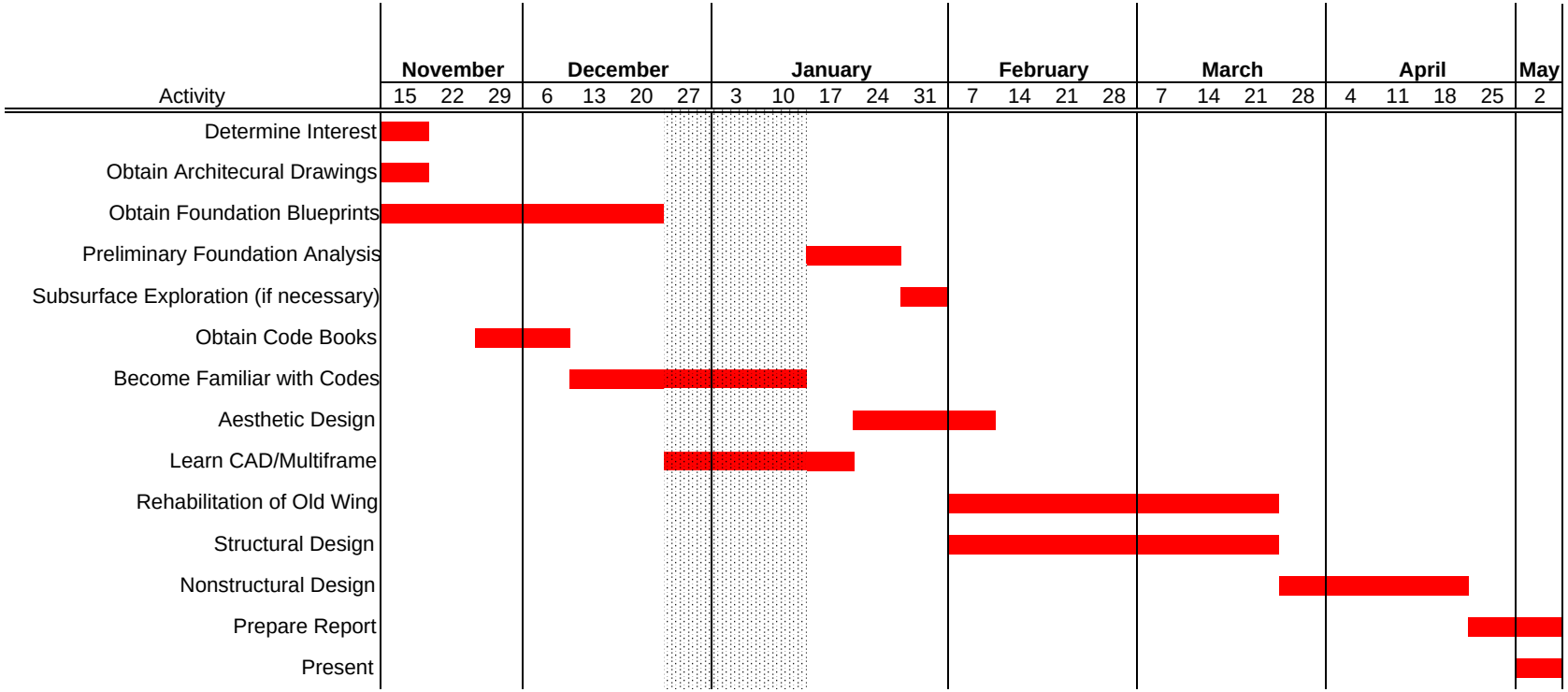
Conversation with Larry Schall, Vice President for Administration

Conversation with Daniel Honig, P.E.

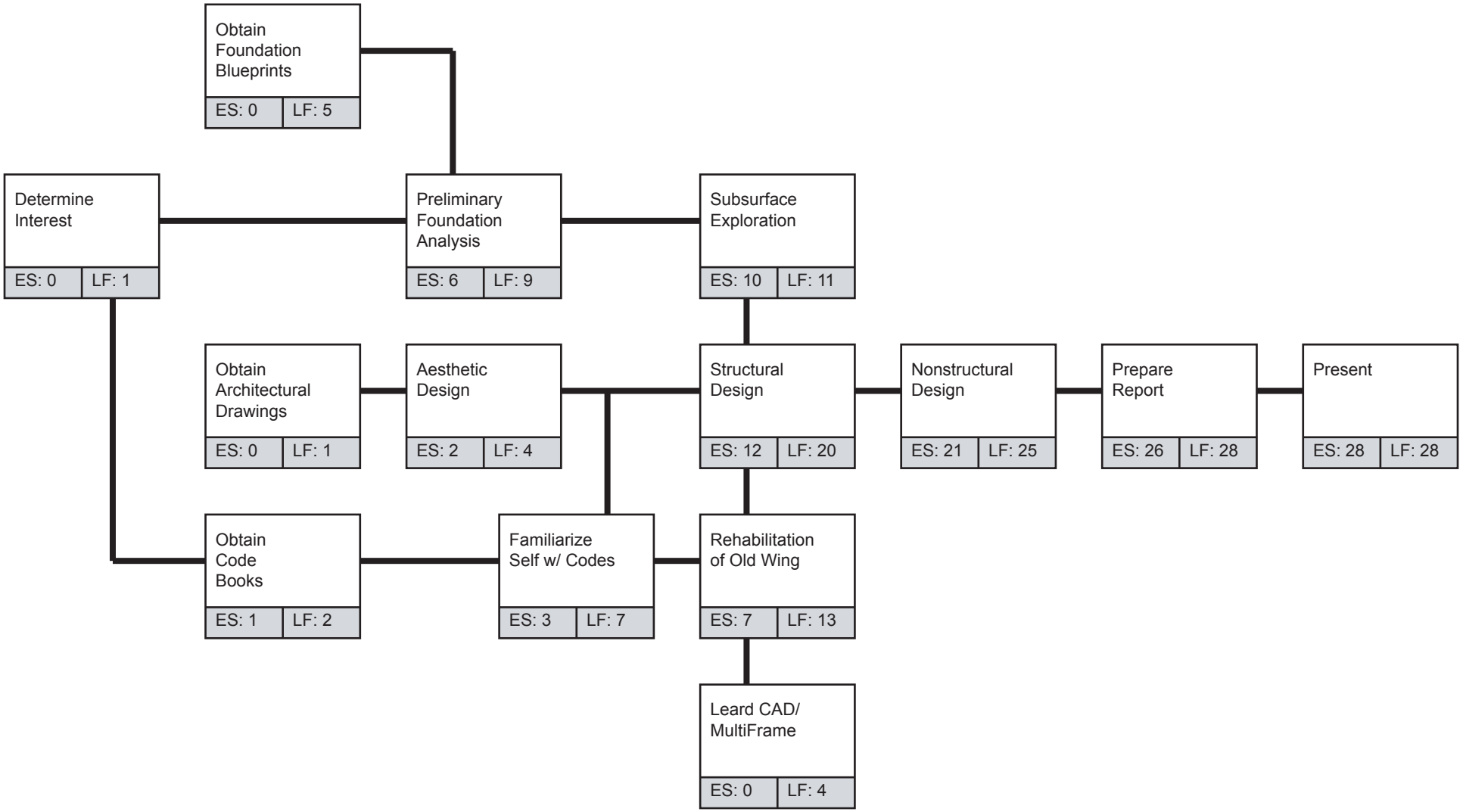
Leighton, Philip D. and David C. Weber. *Planning Academic and Research Library Buildings, 3rd Edition.* Chicago: American Library Association, 1999.

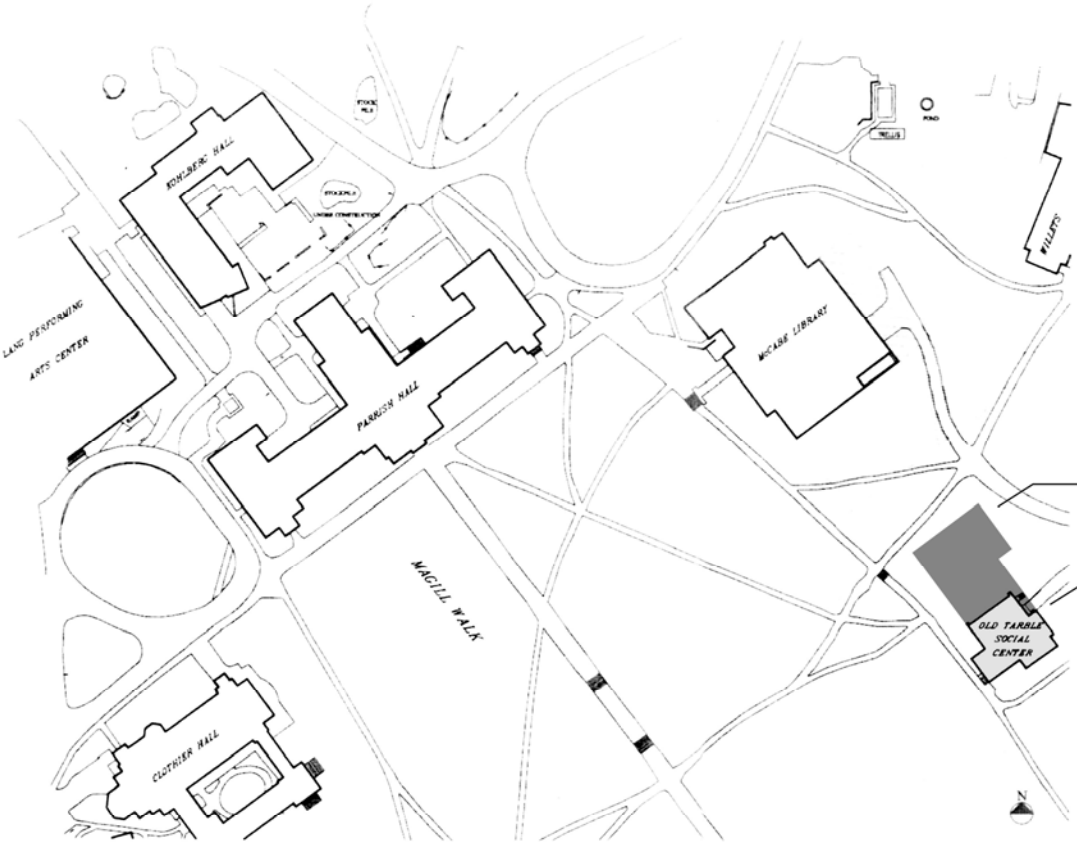
Swarthmore College Library Study, Einhorn Yaffee Prescott, Architecture & Engineering, P.C.

Appendix A: Gantt Chart



Appendix B: Critical Path





Site Plan for Tarble Renovation

Scale 1" = 100'

Proposed New Wing
6300 ft² for first floor
4000 ft² for second floor

Existing Building
3000 ft² for first floor
3000 ft² for second floor