



## Thesis Proposal

# Capital One Lecture Hall Addition





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## Executive Summary

The Capital One Lecture Hall stands as an excellent project in which the use of value engineering played a key role in what will be a successful outcome. During the value engineering process, good communication between the General Contractor and design teams facilitated advantageous analyses. Contrary to this statement, there were also instances where goals of the associated parties were not understood and messages lost in the mix. Some of these jumbled suggestions include alternatives for a structural steel catwalk, removing boilers in the cluttered mechanical rooms, and utilizing shoring techniques during foundation work.

Core research for this project will be an evaluation of the interaction between DAVIS Construction and the design teams. As communication increases between project teams during value engineering, partnering can be critical in order to achieve agreed upon ideas. The lack of interest and knowledge of goals outside of ones own company can lead to value engineering disaster. Exposing these assumptions and recommending appropriate partnering exercises is a must.

When analyzing the structural steel element of the Lecture Hall's catwalk, it seems as though the system may be quite over-designed, not to mention expensive. Hundreds of thousands of dollars will be put into the catwalk alone, providing an alternate system with appropriate load calculations would save the project a lot of money.

The technical analysis of the congested mechanical rooms in the basement leads one to wonder the possibilities of removing two large boilers. Evaluating the constructability and usage of new systems, including brief cost estimates, seems quite beneficial.

A final area of study will include actions to be considered in the even that the Owner, Capital One, wants building completion to occur a significant amount of time earlier than previously agreed upon. One suggestion in particular is the use of sheeting and shoring during foundation work, allowing adjacent sections to begin while previous ones have yet to finish. After evaluating the foundation sequencing and the schedule savings, a brief cost analysis shall be performed to justify an increased work load.



## **Investigation #1 – Partnering for Value Engineering**

### **Problem:**

In every construction project, the interaction of project teams can make or break a successful outcome. After further thought and discussion of issues raised during the PACE Roundtable, there seems to be a lack of attention towards discussing issues of project teams when not directly involved with your own. Could this be because of a lack of available time, interest or what? This detached perception of design teams may be widespread through the construction industry. The only way to develop these relations and communication between teams is to expose problems at the root and suggest improvements.

As projects and the teams working on them get larger, open communication and integrity seem to be put on the “back-burner.” If design teams and contractors do not accept each other as working for the same cause, many problems may arise during preconstruction and construction phases. Due to the increased flow of communication between project teams during value engineering, it is imperative to have team building and partnering exercises put in place.

Like many jobs, the Capital One Lecture Hall experienced a phase of redesigning building systems and searching for acceptable alternate materials to be implemented. The value engineering process seemed to progress rather smoothly. Analyzing this process on different jobs, with diverse project teams, will expose the needs for partnering and bring about particular exercises used to facilitate partnering.

### **Audience and Benefiting Groups:**

Although the main emphasis of this research will be in relating design teams with general contractors and construction managers, owners shall also benefit in knowing how their players interact. By increasing partnering relationships, the goals and needs of whoever is involved shall be considered.

Construction projects change in duration and team members from job to job. The only way to overcome differences in team objectives and motivating factors is increase trust and open communication. Exercising team building activities between contractors and design teams may not only improve project costs, but also improve coordination and decrease schedule durations. In hopes of collected relevant data, a preliminary survey has been included.



**Methodology:**

The survey to follow will be a preliminary method in which to analyze the type of atmosphere generated between project teams and gain additional information into the process of value engineering.

**Partnering for Value Engineering**

*Company:* \_\_\_\_\_ *Name (optional):* \_\_\_\_\_  
*Years in Industry:* \_\_\_\_\_ *Current Project Type:* \_\_\_\_\_  
*Position:* \_\_\_\_\_ *Email (optional):* \_\_\_\_\_

*The first section of the questionnaire consists of 6 short answer questions related to Value Engineering and similar activities. Please respond to each question that may apply to your current project. Additional comments to increase understanding of the answers may be added at the conclusion of this survey. If value engineering or other activities to add value to your project were not performed, you may omit this part.*

1. What was the approximate date of release of the 50%, 75%, and 100% Construction Documents?
2. When was value engineering first considered as an option?
3. Do you feel that the timing of the VE process was appropriate for your given project? If not, why and how could it be improved?
4. Was the objective of value engineering to cut project costs, to reach a lower, more desirable price?



5. Was the objective of value engineering to add value to the project?
  
  
  
  
  
  
  
  
  
  
6. How were the Owner's needs considered prior to and during the value engineering process?

***The second section of the questionnaire consists of 9 positive statements to which you are requested to indicate how much you strongly agree (5) or strongly disagree (1). Please rate the accompanying statements to indicate how you feel in relation to the other project teams on your current job.***

1. I feel I am working in a trusting environment: \_\_\_\_
2. I feel I am working in a positive atmosphere and being respected: \_\_\_\_
3. I feel that good communication is being maintained: \_\_\_\_
4. I feel that working relationships are honest and upheld with integrity: \_\_\_\_
5. I feel that I am working in a team, with no exclusions: \_\_\_\_
6. When disputes arise, I feel that they are being resolved in a timely manner: \_\_\_\_
7. I feel that disputes are being resolved considering the needs of everyone: \_\_\_\_
8. I feel that every party is contributing to the overall goal of the Contract: \_\_\_\_
9. I feel that every party is working to minimize waste from design and construction: \_\_\_\_

***The final section of the questionnaire consists of 2 short answer questions related to Value Engineering. Please respond to each question that may apply to your current project.***

1. What are the attributes of successful VE processes versus ones that are not?
  
  
  
  
  
  
  
  
  
  
2. What is success for your project team?



## Investigation #2 – Steel Catwalk Redesign

### Problem:

As currently designed, the catwalk included within the auditorium consists of large steel members. This system is quite expensive due to the ever increasing market price of steel and contributes to a large portion of the subcontractor's scope of work. If it is possible, propose an alternate structural system for the steel catwalk. As shown in the accompanying picture, the catwalk will be fastened to the steel trusses being put in place.

### Research and Methodology:

To begin this investigation, it will be important to consider all of the possible equipment and live loads on the catwalk during any given conference. Once all of these calculations have been figured, research for an alternate system is needed. Conversing with the structural engineer and possibly a theatrical system consultant will provide a basis to find interchangeable structural systems.

The next step in the catwalk analysis would be to review original cost estimates and schedule durations. As long as alternate systems provide a monetary and schedule savings, more technical investigations can be made. Once a schedule reduction and added value has been proven, its constructability must be checked. Reviewing the dead and live loads previously mentioned, including factors of safety, will round out the investigation for alternate catwalk systems.



Figure 1. Placement of Steel Trusse

### Analyses:

The construction management topics to follow will provide a brief list of things that may need to be considered during the steel catwalk investigation.

### Value Engineering –

- Material costs
- Labor costs
- Equipment rental



**Constructability Review –**

- Dead and live loads
- Shear and moment analyses
- Connection details
- Stage equipment hook-ups

**Schedule Reduction –**

- Lead times
- Construction productivity
- Trade coordination





### **Investigation #3 – Deletion of Boilers**

#### **Problem:**

With DAVIS' Interim GMP being greater than what was desired by Capital One and a lack of available space within the basement floor plan, an alternate mechanical system seems imperative. Besides the three air handling units, two boilers were designed in an additional congested mechanical room. Having two separate mechanical rooms and additional pieces of equipment did not seem cost or space effective. In order to conserve space and decrease the overall mechanical scope of work, removing the boilers and all associated piping would have numerous benefits.

#### **Research and Methodology:**

Before any proposals can be made, it would be important to speak with the mechanical engineer (KTA Group) about the feasibility of such a change. In order to receive a basis of which to compare an alternate mechanical system to, it will be necessary to fully understand the purpose of the boilers. The next step in this study is to evaluate each systems advantages and disadvantages in a lecture hall such as this, in addition to other efficiency and energy consumption numbers.

Once all of the preliminary thesis investigation areas have been considered, an analysis of the mechanical systems is required. Like before, comparing material and labor costs would be the first step. If alternate suggested systems are more expensive, there wouldn't be a need to extend an analysis for constructability. Next, it would be important to check whether load requirements within the atrium and auditorium can be met. An investigation of the alternate HVAC system concerning cost savings and constructability will be the main focus of this redesign.

#### **Analyses:**

The construction management topics to follow will provide a brief list of things that may need to be considered during the steel catwalk investigation.

#### **Value Engineering –**

- Equipment costs
- Material costs
- Labor costs



**Constructability Review –**

- Air conditioning and heating loads
- Piping and ductwork reduction
- System comparisons for lecture hall

**Schedule Reduction –**

- Equipment lead times
- Less equipment to install
- Less trade coordination



## **Investigation #4 – Foundation Sequencing**

### **Problem:**

A few months into the project, after the basement excavation was complete and cast-in-place walls were in progress, Capital One brought up the idea of finishing construction two months earlier than previously agreed upon. By doing a time and cost analysis, DAVIS would have been able to determine if applying a shoring system and re-sequencing foundation work was feasible.

### **Research and Methodology:**

This investigation relies primarily on suggestions made by the general contractor and other subcontractors on how to best manage a construction schedule acceleration of two months. Some of these construction methods may include using sheeting and shoring into the excavation and foundation phase of the Lecture Hall. Examining the sequence of work will also give the General Contractor a better idea of how to coordinate concrete pours if this had been an option. By using soil retention methods, footings for the auditorium and lobby spaces could be completed earlier, instead of waiting for the completion of the basement and backfilling. Other types of sequencing and trade coordination outside of overtime work and increasing crew sizes are a possibility.

The use of a 4-D model can be utilized to help visualization of the work and comparing the schedule differences.



**Analyses:**

The construction management topics to follow will provide a brief list of things that may need to be considered during the steel catwalk investigation.

**Value Engineering –**

- Schedule acceleration cost comparison
- Overtime cost
- Increasing crew sizes
- Shorter duration for equipment rental

**Constructability Review –**

- Coordination of trades
- Construction method alternatives
- Proper shoring systems

**Schedule Reduction –**

- Sequencing activities
- Activity duration changes
- 4-D model representation

**Weight Matrix**

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Partnering in VE	25%	x	x	x	25%
Steel Catwalk	5%	5%	10%	5%	25%
Boilers	5%	5%	10%	5%	25%
Construction Methods	5%	5%	5%	10%	25%
Total	40%	15%	25%	20%	100%