



TECHNICAL ASSIGNMENT #3: Alternative Methods and Research

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Aloft & Element Hotels at Arundel Mills

Hanover, Maryland

December 3, 2007



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3.1 Executive Summary

The following technical report discusses critical issues facing the construction industry today, as well as, an additional issue that will be carefully researched and examined in the coming months. The following report also discusses several problematic features of the Aloft & Element Hotel Project at Arundel Mills that could potentially be improved. From these problematic features, two topics were chosen which will be the focus of an extensive analysis during the next semester of study. A weight matrix then explains where time will be allocated during the next semester with respect to the one critical issue facing the industry today and the two chosen problematic features of the Aloft and Element Project.

Three critical issues facing the industry today were discussed at the annual PACE roundtable event at The Pennsylvania State University. These issues include prefabrication, building information modeling, and labor/management shortages. These topics are summarized in the report below. Aside from the issues discussed at the PACE Roundtable event, another prevalent issue in the industry is poor quality of construction documents. This issue will be researched in the coming months. The goal of the research and steps that will be followed are outlined in this technical report.

Several features of the Aloft and Element Hotel Project at Arundel Mills that could potentially be improved have been identified and include: using PTAC units in lieu of the specified forced air system, using precast concrete for the parking structure in lieu of cast in place concrete, prefabricating bathrooms for the guestroom units, and creating uniformity among the footing types of the structures. From this list, using PTAC units in lieu of the specified forced air system, and prefabricating guest bathrooms have been chosen to be areas of focus of intense analysis. A weight matrix then continues on to outline where time will be spent during the next semester of study.

3.2 Critical Industry Issues

On October 24, 2007 members of the construction industry came together at the annual PACE Roundtable event to discuss important issues that are prevalent in the industry today. The three topics discussed at the event are summarized below.

Topic I: Prefabrication

The benefits of prefabrication are obvious to construction teams; however, owners and designers associate prefabrication with negative implications. Many owners link prefabrication with poor quality. These owners often relate the poor quality of prefabricated homes with prefabricated building components. In addition, designers often see prefabrication as a hindrance to their design freedom and convey this to owners as an inability to customize the building. To combat these preconceived notions of owners and designers, it was suggested in this PACE session to refer to prefabrication as “off-site assembly.” Along with changing the widely used term, it was suggested that construction industry members begin to educate owners about the positive implications of prefabrication. Such positive implications include schedule acceleration, and even a better quality building than the owner would receive if components were constructed on site. Prefabrication often results in better quality, particularly with mechanical systems and fabrication of ductwork. The increase in quality is because the ductwork is fabricated in a controlled environment, often eliminating air leaks. Also, such a prefabrication process can result in LEED points, not only because of more efficient mechanical systems, but because waste is often minimized in a factory environment. Industry members must continue to promote the positive impacts of prefabricating to enable building owners to contribute in prefabrication processes early and often.

Topic II: Building Information Modeling

The session regarding Building Information Modeling (BIM) delved into issues facing the industry concerning BIM. First, panelists confronted the definition of BIM itself. Surprisingly, many members of the construction industry do not understand the meaning of BIM, which in turn causes industry members to be blind to many of the benefits. In this session, panelists did discuss the benefits that many are blind to, such as visualization of construction sequencing, clash detection, and even marketing.

For the construction industry members whom are aware of the benefits to BIM, there are often challenges that must be overcome to initiate a BIM model. Many industry members are employees of small companies and often do not have the manpower or resources to get involved in a BIM model. Often time’s owners are ignorant to the benefits of bimming and refuse to allocate dollar values for such a computer model. Also, because it is often difficult to relate the benefits of a BIM model to a savings in the form of a dollar amount, many project team members are reluctant to take part in modeling a project.

From the view of a design firm, a BIM model is often extremely involved and is seen as extra effort and work that is in excess of the necessary amount. Presumably, designers with this mentality are reluctant to participate in bimming.

For project teams across the board, including owners, designers, and contractors, there is also another nagging issue that is preventing BIM from becoming an industry standard. As BIM became more prevalent, many computer software designers have attempted to invent programs that will be used across the industry. The result is several computer programs that are incompatible with one another. Because there is no one program that has been accepted as a standard, designers and contractors need to be educated in every available software program to be able to be able to utilize all BIM models effectively.

The benefits of BIM are obvious to educated industry members. Because of reasons stated above, designers are often hesitant to partake in a BIM model; therefore, promoting the use of BIM is becoming the responsibility of the construction team. Construction team members are now forced to educate owners about the benefits of BIM and encourage them to require designers to complete a BIM model.

Topic III: Labor / Management Shortages

Construction tradesmen are becoming increasingly scarce and have placed a strain on the construction industry. At an early age, students and children are sent the false message that a construction worker is a person that is uneducated and an underachiever. In the classroom and by friends and relatives, children are told that the life of a trade worker is a life of misery. Long hours and the physical demand on their body have current trade workers urging young people to pursue alternate careers. In reality, a construction worker is becoming more and more of a worthwhile profession that ultimately leads to a comfortable life. Trade workers pay and benefits have positively increased at an incredible rate to lure newcomers to the profession and to maintain the current workforce. Despite this reality, labor is at a shortage and immigrants are now filling the void that has been created. This development in the workforce is presenting a challenge of itself to the industry since many trade workers speak a foreign language, most notably Spanish. Management personal are finding it increasingly difficult to communicate with the workers on site and are finding it necessary to become bilingual. Despite the challenges facing the workforce, panelists at the PACE roundtable could not offer many solutions to the problems other than, it is becoming necessary to learn the Spanish language and it is also becoming necessary to change the negative mentality of young people toward the construction industry.

3.3 Critical Issues Research Method

Problem Statement

As the construction industry grows and buildings become more complex, architects and design engineers are often assigned more and more responsibility. The result is often poor construction documents that frequently hinder the construction process and affect the quality of a finished building.

Research Goal

Throughout the next few months of research, I look forward to develop an understanding of the impact of poor construction documents and the root causes of such documents. During previous internships, I acquired insight into the consequences of poor construction documents both during preconstruction and construction phases. It is my goal to first look at the effects on the construction team, the owner, and ultimately the quality of the finished building. Once I have examined the consequences of subpar documents, I intend to examine the overall root causes of poor construction documents. It is my intent to propose a solution to owners and design firms in order to prevent poor documents to be issued at the outset. I also would like to outline preventative measures that contractors and construction managers can utilize to minimize the effects of poor documents.

Research Steps

1. Define the term “poor construction documents”
2. Survey contractors and construction managers and develop an understanding of how often they deal with poor construction documents.
3. Survey contractors and construction managers to develop a list of the major consequences of poor construction documents.
4. Survey owners to add to the list of consequences.
5. Develop a list of preventative measures that can be taken by the owner, contractors, and construction managers to avoid negative outcomes caused by poor documents.
6. Tactfully survey design firms and develop a list of root causes of poor construction documents.
7. Visit design firms to gain insight on how they function and analyze the causes of poor construction documents during the visits.
8. Develop a list of measures that may be taken by designers to prevent poor construction documents from being issued.

Sample Survey to Contractors / Owners

In the last year, how many (if any) projects that you have actively participated in had poor construction documents? How many projects have you actively participated in the last year?

In the last 2 years, how many (if any) projects that you have actively participated in had poor construction documents? How many projects have you actively participated in the last 2 years?

In the last 5 years, about how many (if any) projects that you have actively participated in had poor construction documents? About how many projects have you actively participated in the last 5 years?

In the last 10 years, about how many (if any) projects that you actively participated in had poor construction documents? About how many projects have you actively participated in the last 10 years?

Would you say the quality of construction documents that are being issued have increased, decreased, or experienced no change in quality over the past 5 years? Over the past 10 years?

Please list below the negative impacts that you have experienced (as many as possible) due to poor construction documents.

What measures have you implemented (if any) to combat the negative impacts of poor construction documents?

Please list any measures that you feel could be implemented by general contractors/construction managers to combat the negative impacts of poor construction documents?

Please list any measures (if any) that you feel could be implemented by general contractors/construction managers to prevent poor construction documents from being issued?

Please list any measures that you feel could be implemented by owners to prevent poor construction documents from being issued?

Sample Survey to Design Firms

In the last year, how many (if any) projects have you been accused of issuing poor construction documents for, by a source outside of a design firm? How many projects have you issued construction documents for in the last year?

In the last 2 years, how many (if any) projects have you been accused of issuing poor construction documents for, by a source outside of a design firm? How many projects have you issued construction documents for in the last 2 years?

In the last 5 years, about how many (if any) projects have you been accused of issuing poor construction documents for, by a source outside of a design firm? About how many projects have you issued construction documents for in the last 5 years?

In the last 10 years, about how many (if any) projects have you been accused of issuing poor construction documents for, by a source outside of a design firm? About how many projects have you issued construction documents for in the last 10 years?

Would you say the quality of construction documents that are you are issuing have increased, decreased, or experienced no change in quality over the past 5 years? Over the past 10 years?

What measures have you or your firm implemented (if any) to ensure that poor construction documents are never issued?

Please list any measures that you would recommend designers and/or their teams implement to prevent poor construction documents from being issued.

Please list any measures that you would recommend owners implement to prevent poor construction documents from being issued.

3.4 Problem Identification

Below is a list of several problematic features of the Aloft & Element hotel project. The listed items will be analyzed and eventually narrowed down to desired thesis proposal topics.

Forced Air vs. PTAC Units

- For the mechanical systems for the Aloft and Element Buildings, each guestroom of the hotels will be fitted with a fan coil unit (FCU) which gives each guest the ability to control the temperature of their room separately. The air is forced through the spaces of the buildings by three air handling units (AHU's) located on the roof of each hotel. Package Terminal Air Conditioner (PTAC) units may alleviate some of the strain on the budget of the project.
- An in depth analysis will take a look at the required PTAC unit for a typical hotel room and the changes in the structural system of the building, particularly at the roof, which is where the air handling units have been placed in the construction drawings. The analysis will also delve into changes on the cost, schedule, and constructability of using the PTAC units in lieu of the specified system.

Cast in Place vs. Precast

- The onsite parking structure of the Aloft & Element Hotel Project at Arundel Mills utilizes cast in place concrete to make up the structure. Typically precast concrete parking structures are cheaper and also quicker to construct. An analysis will examine the advantages and disadvantages of using precast in lieu of cast in place concrete.

Prefabricate Bathrooms

- With just under 300 total guestrooms on the project, prefabricating the majority of the bathrooms for the guestroom units may save valuable schedule time to the project, which could ultimately allow the hotels to open sooner and begin to generate revenue at an earlier date. An analysis of this topic would examine the time that could potentially be saved on the schedule, as well as, some of the negative impacts associated with prefabrication. Negative impacts such as increased crane size and shipping issues would be addressed in this analysis.

Uniform Footing Type

- The footings for the Aloft & Element structures vary greatly in size and type. Adjusting the footings to be uniform in type could potentially save time and money on the project. An analysis in this technical area would examine the impacts on the project's schedule and budget. The effects to the structural system and layout of the building may also be examined.

3.5 Technical Analysis Methods

Below are two areas of analysis that have been chosen from the Problem Identification Section above. The topics are listed, along with the research methods that will be employed to complete a total analysis of the impacts to the design and construction of the building.

Forced air vs. PTAC units

The mechanical system of the Aloft & Element buildings utilizes a forced air system with FCU's in each guestroom that enables each guest to control the temperature of their room separately. While the designed system may be quiet and aesthetically pleasing for the guests, the cost of AHU's and duct runs is a significant cost that may be reduced by implementing the use of PTAC units in each guestroom. The construction manager at risk for the project, Whiting-Turner, has recently recognized this, and proposed the idea of using PTAC units in lieu of the designed system.

An analysis will size the PTAC unit required for a typical guestroom based on the heating and cooling load needed. Since using PTAC units will significantly reduce the load on the AHU's, the number and size of AHU's will be carefully examined. The analysis will also take a look at the effect on the structural system of the building since AHU's may be eliminated, which ultimately will reduce dead load on the building's roof.

Implementing the used of PTAC units will have a significant impact on the budget of the project, therefore this area of impact will be carefully examined. The construction sequencing of the building and schedule, as well as crane sizing and other construction issues will also be affected by using PTAC units; consequently, these areas of impact will be carefully investigated also.

Prefabrication of Guest Bathrooms

Being that the owner of the Aloft & Element Hotels at Arundel Mills had originally hoped for a 12-month schedule, ways of accelerating the schedule of the project continue to be atop the minds of the construction team. Prefabricating repetitive guest bathroom units may be one way to accelerate the schedule of the project, which would ultimately allow the hotels to generate revenue for the owner at an earlier date.

Aside from the impact to the schedule, the cost of assembling bathroom units off site would carry significant cost implications to the project. Changes to the logistics to the site, including crane size and type, would also occur. For the reasons previously stated, the effects to the budget and construction site logistics would be identified and studied.

3.6 Weight Matrix

Below is a weight matrix outlining where time will be allocated during the next semester of research.

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Poor Construction Documents	34%				34%
Forced Air vs. PTAC Units	5%	10%	8%	10%	33%
Prefabrication of Guest Bathrooms	5%	8%	10%	10%	33%
Total	44%	18%	18%	20%	100%