

AIRPORT TERMINAL



THESIS PROPOSAL

PREPARED FOR:

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EASTERN
UNITED STATES

CONSTRUCTION MANAGEMENT OPTION

<http://www.engr.psu.edu/ae/thesis/portfolios/2009/pdy103/index.html>

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Executive Summary

This portion of the thesis project identifies areas of analyses to be discussed in the final thesis presentation followed by a brief description of the breadth topics. The analysis portion of the paper defines the problem, or opportunity, supported by the background research that has already been completed. Preliminary investigation has shown that the topics are relative to: critical industry issues, value engineering, and sustainable design.

Analyses that will be proposed in this paper are as follows:

- Interdisciplinary Document Coordination – This is a preconstruction activity that reviews the drawings, as well as, the specifications to locate errors or omissions in an attempt to reduce the amount of RFI's during the construction phase.
- Panelized Construction – This section proposes replacing the stick build façade in the attempt to save time and money on the project.
- Pedestrian Rerouting – Pedestrian rerouting is a common concern, in this instance pedestrians were routed over a temporary elevated corridor that ran directly through the site. Concern for safety and the schedule the proposed elimination of this bridge is evaluated.
- Alternative Glazing – Due to current energy demands, an alternative glazing or dual-façade may be a realistic solution for both cost and end user satisfaction (sound reduction).

The breadth studies will utilize the above analyses and be limited to structural and mechanical. A weight matrix located in Appendix B breaks the analyses into four categories: research, value engineering, constructability review, and schedule reduction. Finally, a timetable is provided for the organization of which the proposed assignment will be completed.

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Analyses

Analysis One – Interdisciplinary Document Coordination

Gilbane offers the service of preconstruction document review called Interdisciplinary Document Control. The mission statement by Gilbane for this service is as follows.

The Document Coordination department will provide multiple types of document analysis by thoroughly understanding and addressing our internal and external Clients' needs through explicitly defined solutions, combining time tested practices with innovative means and methods, in a relentless pursuit of excellence that surpasses our Customers' expectations

The full introduction explanation for this process is offered in Appendix C. This service is offered to the client at cost in hopes that final costs will be lower. At first, this appears to be the same as coordination drawings that are used in every construction project. However, this process goes above and beyond the mechanical portions of the drawings.

This cost saving technique was offered to the owner of the airport but not purchased. A possible review of how many RFI's, change orders, and project delays and a final comparison to overall project cost would be a valuable analysis. The reason to review the possible cost savings after the project is completed could be used in future projects to convince the owner it is in their best interest to purchase this service.

Various techniques of research will include:

- Evaluate how this procedure is implemented
- Locate specific examples (RFI's) that could have been alleviated:
 - Cost Impact?
 - Schedule Impact?
- Compare to other companies similar process
- Speak with CM Agency and discuss

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Analysis Two - Panelized Construction

The stone façade colors were a challenge to gain approval from the architect. After the stone color was eventually approved and while it was being installed the masons noticed that the factory had been delivering two different shades. The second issue involved with the stone façade was that the project team had trouble getting the grout color approved. A possible solution for the confusion of getting the proper stone and grout color would be to use precast panels. By using precast panels the submittal would eliminate the need for a mock up, as well as, a better chance for the manufacturer to maintain consistent colors.

The curtain wall glazing also became an issue with respect to architect approval. The design calls for a racing stripe of etched dots in the glass. When the submittal for the glass was received it was a 12"x12" piece of glass which only showed the etched portion of the glass without the clear stripes on the top and bottom portion, as the full pane of glass was supposed to look. The submittal went through with architect approval and the glass was installed. The architect came to the site for an inspection after the installation of the glass and found it to be unsatisfactory. The time constraint of the 3rd floor opening and the need for the building to be enclosed required the glazers to come in over the weekend and replace all the curtain wall glass. Since the submittal was already approved the argument arose as to who was to pay for the removal and reinstallation of the proper glass which has yet to be resolved. Again, if a panelized submittal was approved and installed time and money could have been saved.

Various techniques of research will include:

- Compare the total costs through
 - Takeoff
 - RS Means
 - Schedule
- Prove there is a comparable manufacturer that meets the specifications
- Identify if the site would accommodate installation
- Speak with individuals currently involved on the project and ask their opinion of the proposed redesign.

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Analysis Three – Pedestrian Rerouting

With the DOA requirement that customers would not be required to exit the building and walk the approximate 300' to the next terminal, the site team had to develop a plan to reroute pedestrian traffic. To accomplish this it was determined that the existing connector bridge would be used until the first temporary corridor was constructed after the steel erection. The problem that developed was that the existing connector bridge was concrete and the design team had to integrate this into the new building. Cracks developed in the existing concrete columns as the building began to be loaded. Onsite superintendants were required to monitor and report on these findings daily. The design considered the



Figure 1: Temporary Connector Bridge Construction

existing concrete columns to be zero force members and found the cracks to not be of structural significance. Combining existing concrete into a steel building, as well as, continually constructing and demolishing temporary corridors began to slow the project. In retrospect an alternate method of rerouting the airport customers around the site instead of straight through the middle of the site and would have accelerated the construction schedule. Also, the existing concrete columns could have been completely demolished and steel erected in place of them.

Various techniques of research will include:

- Speak with a person involved in the preconstruction phase and determine the specific reason that the temporary bridge was necessary, that is, was there a regulation that required indoor accommodations for travelers between terminals.
- Analyze the site and determine alternate means of routing the pedestrians.
 - Cost Impact?
 - Schedule Impact?
- Speak with the owner and determine what regulations, if any, prohibited eliminating the temporary corridor.

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Analysis Four – Alternative Glazing

With the ever rising energy costs in America the need for an efficient building has become a critical industry issue. The concern is that the architectural aesthetics may be compromised with an attempt to create a more energy efficient building. To make the analysis even more complicated the main thermal losses in a building occur at the exterior glazing, which happens to be this building's key feature. With more than half the building's façade consisting of a glass curtain wall this analysis focuses on two possible ways to keep the architectural feature and create a more energy efficient building. The two systems researched are the use of a dual façade and the plausibility of using photovoltaic cells on the south facing portion of the building's façade.

Dual Façade

The idea of dual façade has been around for over a hundred years, but has yet to fully break into the American market. The Europeans have made use of the dual façade technique for some time now with the foremost manufacturer Permasteelisa located in Italy. The basic idea is to have airspace from a few inches to a few feet to insulate the building. Additions to this idea have included shades to control the amount of light entering the building, as well as, louvers on the top and bottom of the façade to allow hotter air to vent through the top of the façade during summer months. There are many other modifications to this technique that will be explored through further research. A current and local example of the use of a dual-façade is at the University of Pennsylvania's Levine Hall. "We realized we could achieve a nearly fully glazed exterior envelope while meeting or exceeding energy code requirements," says Richard Maimon, associate in charge with project architect Kieran Timberlake Associates, Philadelphia. (Gorden 2005)



Figure 2: Levine Hall, Pennsylvania University

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Photovoltaic Cells

The airport already controls the amount of day lighting through the use of screen printed glass. To increase the amount of light that the airport controls would be the use of photovoltaic glass. The concept is that the glass is imbedded with tiny solar cells that can be integrated into the terminals power supply. Unfortunately, the electrical demand of the building is so large that it may shadow the potential benefit of photovoltaic cells. The possible downfall of the efficient aspect may create a unique opportunity for the architectural aesthetics of the building. To this end, an example would be the



Figure 3: GREENPIX

GREENPIX Zero Energy Media Wall in Beijing China. The story behind the building is to represent the willingness of China to follow suit with the rest of the world in becoming more energy savvy. The city is attempting to have all public transportation to have a zero carbon footprint in the coming years and this architectural feature to the building will accent the forward-thinking mentality to all who visit this city. Also, this analysis will further explore the use of a photo-catalytic coating on the glass. Photo-catalytic coatings (titanium dioxide) is used in combination with

ultraviolet light to break down dirt, keeping the glass clean for maximum potential from the photovoltaic cells.

Various techniques of research will include:

- Evaluate how both systems work and to what extent?
 - Advantages
 - Disadvantages
- Evaluate buildings that have implemented these techniques in the past
 - Cost Impact?
 - Schedule Impact?
- Speak with CM Agency and conduct an informal survey. See Appendix C.

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Appendix A: Breadths

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Structural

With a temporary elevated corridor running through the center of the site a congestion issue is presented. The first aspect of this breadth will be to attempt to relocate where the pedestrians can transit between terminals. After the pedestrians have been rerouted there is an opportunity to



completely demolish the existing building (concrete columns). With the absence of existing construction on site the congestion issue will be resolved. There will be a need to replace the existing concrete columns with the structural system of steel that is used in the remainder of the building. Through the installation of new steel, in place of the concrete columns, there will be a more predictable structure for the engineers to evaluate structural submittals. This, hopefully, will alleviate the issues that occurred in the project with cracks appearing in the existing concrete columns as the

building was loaded. Also, there was an issue of the baggage handling conveyers' hangers that exceeded the load bearing capacity of the existing steel. This issue possibly could have had a less expensive solution than what was decided upon, drilling through the existing concrete columns to install plates. Finally, there may be discovered that the project schedule would be overall reduced since the need for erecting and demolishing the three temporary corridors will not be necessary.

Mechanical / Architectural

With current energy situation in the United States the industry is attempting to utilize any efficient building techniques to conserve energy. This breadth will explore how a dual-façade could improve the current energy use by the existing HVAC system. The idea of a dual-façade has been around for years but has many been used in Europe, since the energy costs there have been much higher than the US for years. Also, this portion of the thesis presentation will look at the viability of photovoltaic cells being implemented and determine whether or not the impact is significant enough to support the cost of installation. Unfortunately, it may be concluded that the photovoltaic cells will not be sufficient enough to support the building, which then will lead into the architectural implementation similar to the GREENPIX Zero Energy Media Wall in Beijing China. The architectural aesthetics of the photovoltaic cells combined with LEDs will tell a story of the cities willingness to progress to a more sustainable future in building design.

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Appendix B: Weight Matrix

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Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
IDC	20%	10%	-	-	30%
Panelized Construction	-	10%	10%	-	20%
Pedestrian Rerouting	-	10%	-	10%	20%
Glazing	10%	10%	10%	-	30%
Total	30%	40%	20%	10%	100%

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Appendix C: IDC

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Interdisciplinary Document Coordination (IDC) is a Gilbane offered service designed to address Coordination issues within and between various construction disciplines. At Gilbane, the goal is to provide our Clients a quality project in both process and resulting construct. There are many obstructions to achieving this goal. Gilbane's Clients have identified needless requests for information (RFI's), change orders, and project delays as specific complaints to address. In addition, disharmony among architects, engineers, and contractors must be minimized for individual projects to be successful.

It was determined that significant sources of complaints are change management, job completion, and cost reporting. The construction industry demands projects of increasing complexity, to be designed & constructed in decreasing time frames, with decreasing budgets. The result of these combined factors is project documentation with missing or conflicting information. This is not a denigration of Architects & their consultants. On the contrary, their profession demands continuously original designs requiring supreme effort.

IDC was created to address those Coordination issues. Discrepancies are noted and are reviewed with the design consultants. The final report is made available to Gilbane Operations Personnel. Depending upon Gilbane's role, the report may be used as a reference during construction. In an ideal situation, identified issues are addressed through subsequent issuance of revised construction documents. We recognize, however, that schedule (i.e. fast track or hyper track projects) and delivery methods (i.e. phased construction, early bid packages, etc.) may require the IDC review and dissemination of results be conducted in a manner that meets the project's specific needs.

For this reason, it is extremely critical to understand our internal and external client's expectations. Those expectations require a Document Coordinator to be realistic when assessing review time, available review personnel, budgets, deliverable production, meetings, and time to assist the Project Team by determining if alterations were made to the final contract documents. Finally, the Document Coordinator must be explicit when conveying to our clients what IDC is **not** designed to do, lest the Client is left with the undesired impression that full value for the service has not been achieved.

The IDC review will not identify every conflict. It is not a Constructibility review or Value Engineering session. It is a methodical, systematic examination of construction plan sheets, specifications, sketches, and addenda. The review points out inconsistencies within the body of presented information. It is not a substitute for engineering or architectural review and Gilbane assumes no design liability for the comments generated.

This manual describes the process used for performing an IDC review. It includes descriptions of overlaying plan sheets, conventions used for discrepancy reporting, and specific tasks to perform for each construction discipline. A checklist is included at the rear of this manual. It organizes each review task in summary form and keeps track of completed items. In addition, this manual discusses variables

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to be addressed when assessing IDC review costs, as well as best practices for A/E consideration of IDC observations during transition from design to construction phase.

Keep in mind parts of the review may not apply to all projects and unclear or undefined task descriptions should be identified. It is intended to be as comprehensive as possible. It can and should be tailored for specific sector projects, as well as for the reviewer's examination preferences.

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Appendix D: Possible Survey Questions

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- Was the building ever considered for LEED Certification for New Construction, if so, how many points did the design team believe could be attained?
- Have you ever been involved in a project that included the use or proposed use of photovoltaic cells?
 - If so, why was the idea accepted or rejected?
- Have you ever been involved in a project that included the use or proposed use of a dual façade?
 - If so why was the idea accepted or rejected?
- Do you feel that the city would have been open to the suggested use of either technique, even if the cost was prohibitive?
 - That is, have the building architecturally portray the city's hopes of a more energy efficient future?
- Overall, how do you feel that the façade of the building could become more energy efficient, if any?

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Appendix E: Timetable

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January	Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2	3
	4	5	6	7	8	9	10
	WINTER BREAK						
	11	12	13	14	15	16	17
	ANALYSIS ONE RESEARCH						
18	19	20	21	22	23	24	
ANALYSIS TWO RESEARCH							
25	26	27	28	29	30	31	
ANALYSIS THREE RESEARCH							
2009							

February	Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6	7
	ANALYSIS FOUR RESEARCH						
	8	9	10	11	12	13	14
	CORRESPONDANCE WITH INDUSTRY						
15	16	17	& 18	19	20	21	
MODIFICATIONS TO RESEARCH							
22	23	24	25	26	27	28	
BREADTH ONE							
2009							

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March	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
	1	2	3	4	5	6	7	
	BREADTH ONE							
	8	9	10	11	12	13	14	
	SPRING BREAK CONTINGENCY							
	15	16	17	18	19	20	21	
BREADTH TWO								
22	23	24	25	26	27	28		
29	30	31	PRESENTATION FORMATTING					
2009								

April	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
				1	2	3	4	
	PRESENTATION FORMATTING							
	5	6	7	8	9	10	11	
	EDITING AND FINAL PREPARATIONS							
	12	13	14	15	16	17	18	
THESIS PRESENTATIONS								
19	20	21	22	23	24	25		
26	27	28	29	30				
2009								