

# **AIRPORT TERMINAL EXPANSION - EASTERN UNITED STATES**

PAUL YINGLING AE SENIOR THESIS 2009



## **Executive Summary**

This portion of the technical assignment will identify areas of the project that are possible topics for research, alternative methods, value engineering, and schedule compression. The first part of the paper the paper will focus on some items the project team suggested for further research. With twenty-two high insight some of the items could have been changed; however, some items' alternatives would not be plausible. The second section of the paper will focus on problem identification and further research topics for the final proposal in the spring.

Constructability challenges, schedule acceleration scenarios, and value engineering topics are all common research issues. The constructability challenges will focus on escalators, government regulations, and temporary corridors for the general public. Schedule acceleration typically comes down to the associated cost which will be discussed and possible scenarios where the schedule could have decreased with no added cost. Value engineering topics will explore alternate building material and construction methods to lower cost.

Problem identification for the project will be discussed through sustainability, panelized construction, temporary pedestrian rerouting, and steel laydown accommodations. From these topics research options will be expressed in the final portion of the paper which includes a proposed Interdisciplinary Document Coordination (IDC). This is a service offered by the CM Agency to possibly resolve many of the issues presented in the Problem Identification portion of the paper.

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This angle differential was again discovered on the opposite side of the building, due to the symmetrical nature of the architecture. To resolve the issue the bearing plate on top of the W30x132 was skewed by two inches along its length for the escalator beam to fit properly.

Another challenge with respect to the elevator installation was the already occupied third floor. The escalators go from the ground floor to the second floor and are in close proximity of the emergency egresses for the building. With limited space to install the escalators, temporary 2<sup>nd</sup> floor partitions had to be removed and relocated. Also, the 3<sup>rd</sup> floor emergency egress paths had to be modified on a daily basis. The reason for this is that the ground floor has to have immediate street access. So if the emergency stairwell is changed the temporary walls (fencing on the ground floor) also need to be relocated. A minor detail, yet important aspect, was to move the temporary signage in the case that people on the occupied 3<sup>rd</sup> floor needed to find the fire egress.

## *Department of Aviation Regulations*

After the events of September 11<sup>th</sup> construction at airports became much stricter. The steel erection on site needed to be done at night and the lifts were not to occur within 500' of the tip of an airplane wing. Therefore, if there was a plane too close to the steel erection the on-site manager would have to decide how critical the work was in the area. Upon that determination, work was either halted or the owner of the plane was contacted and asked to move it away to a more secure location. The same requirement was followed if there was any burning in the area; however, the distance requirement is 250'. After the events of the Shoe Boomer the regulation for gaps in fencing was reduced from 4 inches to 3 inches. Consequently, a person was assigned the unenviable task of walking the site ensuring that this requirement from the DOA was met.

One recent issue arose when the stone veneer was being installed on the exterior of the building. Federal Law prohibits anything being placed within in five feet of the fence perimeter. Therefore when the masons were attempting to install the stone within the five foot zone the project team had to decide whether or not to disassemble the scaffolding ever day and reassemble it the following work day or ask permission to move the perimeter fencing. The site team decided to request the perimeter fencing be moved to allow the stone masons not have to assemble scaffolding each morning.





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## *Temporary Corridors*

The owner requested that customers would not have to exit the terminals while the new connector building was being constructed. This not only affected the schedule but also the design. The previous connector building was constructed from cast in place concrete columns. To accommodate customer travel a temporary enclosure was built on top of the existing columns. The schedule was affected, due to the fact that there were limited night shutdowns of the bridge to erect steel.

The phasing drawings include three temporary corridors. Throughout the placement of the concrete in these phases temporary corridors were erected and demolished to accommodate the public traffic between terminals. This obstacle of being unable to reroute pedestrian traffic around the perimeter added cost and delay. The cost aspect was both material and more importantly labor, due to the fact that the work was required to be done at night which involved overtime for supervisors.



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## Schedule Acceleration

The original contract documents slated the opening of the building for the winter holiday traffic in December. However, after the documents were signed off the ownership decided that it would be better to have the building open for Thanksgiving travelers. As in most cases, the ability to accelerate a schedule comes down to how much the owner is willing to pay and whether or not the labor force in the area is great enough. The location of the project, in a larger city, prohibited the sustainable labor pool to accommodate the requested schedule acceleration. Also, many contractors prefer to use laborers that they have dealt with in the past and are established as efficient workers. There was concern by the contractors that they would not be able to obtain productive union workers from the Hall.

The Critical Path in order for the promised opening was to have the Check Point open in time for the holiday traffic to be permitted in the airport terminal. This Check Point on the 2<sup>nd</sup> floor was compromised by a push for the 3<sup>rd</sup> floor offices to be completed prior to the completion of the 2<sup>nd</sup> floor. In order to have the available space on the 3<sup>rd</sup> floor much of the extraneous material was moved to the 2<sup>nd</sup> floor. Unfortunately, the 2<sup>nd</sup> floor interior design drawing called for terrazzo which goes down in multiple layers over a period of days. To possibly value engineer and accelerate the schedule it was suggested to eliminate the terrazzo and install carpet tile. This suggestion was rejected by the owner and architect because the carpet would not match the rest of the airport complex.

A more common Critical Path item for most construction projects was to have the building weather tight as soon as possible. During the erection of the curtain wall where the curvature of the façade steps back by ten feet on either end the mullions of the glass were intended to line up, but did not due to design issues. This design issue prevented the building from being enclosed while the steel had to be reordered and fabricated to allow the glazing to match the outer portion of the façade.



Steel Tubing





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The ability to keep the building weather tight was a continuing concern as the project moved forward and floors were being turned over. The summer humidity prevented ceiling tile and furniture to be moved onto the 3<sup>rd</sup> floor. The project team attempted to overcome these obstacles by monitoring the temporary measures in place and making sure that after work had been completed in those areas the provisional measures were put back in place.

## **Value Engineering Topics**

With a project cost of \$185 million and the vital security components there is little that could be value engineered out of the building. Also, since the financing for the facility was through tax payers cost was not overlooked, but a minor concern for the owner. The three areas that were discussed before the start project were: roofing material; carpet instead of terrazzo; and ceiling tile modifications. The roofing material was originally supposed to be EPDM w/ HYPALON. The suggested and accepted value engineering material was Paradiene 30 by Siplast. The cost saving was approximately \$500,000 which is small to the total cost of the project (0.03%). Another minor cost reduction idea was to replace the designed terrazzo with carpet tile. Carpet tile was rejected by the owner and architect to maintain the grand appearance of the building's entrance. Also, the Hunter Douglas Techstyle 4x4 acoustical ceiling tile was a possible reduction in cost. The tile is fabric and difficult to install, but the architect decided not to switch to a standard 2x2 ACT system.



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## Problem Identification

### *Sustainability*

Today's energy crisis has accelerated the push toward green sources of energy. Also, with the big three automakers decline in profitability and foreign car manufacturers focus on fuel efficient cars, economic analysts believe that green is the way to go to jump start the economy as computers did in the late 80s and early 90s.

At the airport there is an attempt to make the 3<sup>rd</sup> floor LEED certified. However, this decision was made after the design was complete. The problems associated with this were long lead times for the finishes and added cost. Manufactures are increasing providing sustainability information on their websites to accommodate contractors to meet the sustainability requirements of their submittals.

### *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 incorrect. The time constraint of the 3<sup>rd</sup> 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

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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.

## *Temporary 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. The onsite superintendants were required to monitor and report on these findings daily. The design considered the 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.



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## *Steel Laydown*

Combined with pedestrian traffic traveling directly through an active construction site, steel laydown and erection was problematic. Fortunately, the airport has remote parking lots for short haul of the steel. The ideal situation, onsite, was not possible. Early in the project they were able to use the site access road for steel laydown which effectively shut the site down to other trades.





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## Technical Analysis Methods

### *Interdisciplinary Document Coordination*

Gilbane offers the service of preconstruction document review call 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 A. This service is offered to client at cost in the hope that final costs will be lowered. 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.

### *Value Engineering*

The idea behind value engineering is to reduce cost and maintain the same scope, quality, and aesthetics. Examples mentioned before did not meet the architect's approval; this however, does not mean that the ideas would have reduced the quality. The areas that can be researched further would be; foundations, structural frame, exterior walls, and vertical transportation. The systems that could be evaluated for value engineering are; inter layouts, electrical power generation and distribution, and mechanical systems. The means and methods to research this topic would be to review the drawings and estimate to see what items could be substituted or eliminated from the original design.

### *Sustainability*

The portion of analysis will evaluate what has already been done to make the building more energy efficient and explore innovative techniques to expand on the efficiency of the building. A possible area of research would be considering the shell of the building and modify it to a dual façade. The second would be to reevaluate the mechanical systems and possibly locate deficiencies. A method for this research would be to contact the commissioning agencies and discover where the main focuses of problems are located. There most likely will be plenty of deficiencies, however, due to the nature of the building redundant systems will be left in place and not modified.



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## *Panelized Construction*

This analysis will focus on the possibility of expediting construction, submittals, and cost savings. The panelized system could possibly be a faster system to erect. With the building enclosure being a critical path item this analysis would be important for future projects. The only drawback that might make this option unfeasible would be the site congestion and the ability to find space for a crane. The submittal process could be more exact as the Problem Identification portion of this paper has already explained. The basic principle would be that the contract documents require a complete sample, and with the panelized system there would be no ambiguity about what needs to be submitted. Also, fewer mock-ups would be required and pressure tests on the curtain wall would be reduced to where the seams of the panels connect.

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**Appendix A**

**Introduction to Interdisciplinary Document Control**

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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.