Wilkes-Barre/Scranton International Airport
Avoca, Pennsylvania
Thesis Technical Assignment 1
Adam Weis - Construction Management Option
Dr. John Messner – Thesis Advisor

Table of Contents

Adam Weis
Wilkes-Barre Scranton International Airport Avoca, PA
Existing Conditions
10/05/05
Dr. Messner – CM Option

Executive Summary

The Wilkes-Barre/Scranton International Airport provides an excellent example of the complexities of construction. The airport is actually a part of a four-phase contract that includes a parking garage, a shipping garage, an apron/tarmac for around the terminal and the airport itself. To fully explore the complexities of such an undertaking, some other phases of the contract will have to be referenced to bring up critical issues, coordination, and overall budget of the project. Right from the start, the contracting of this airport is a CM agency, allowing Turner construction to advise how to do the construction on site. Turner was notably understaffed for the duration of the project, but the staff present from Turner, with the aid of the engineers from Pasonic Engineering, mangaged the project quite well. A CM agency contract is somewhat new to Turner Construction, taking the fear of "At-Risk" out of the equation and putting them on the sidelines of the project, so to speak.

The overall construction of the building should have progressed much smoother than the actual sequence of events. Various issues over plans and coordination of drawings were a few of the major problems that arose throughout construction.

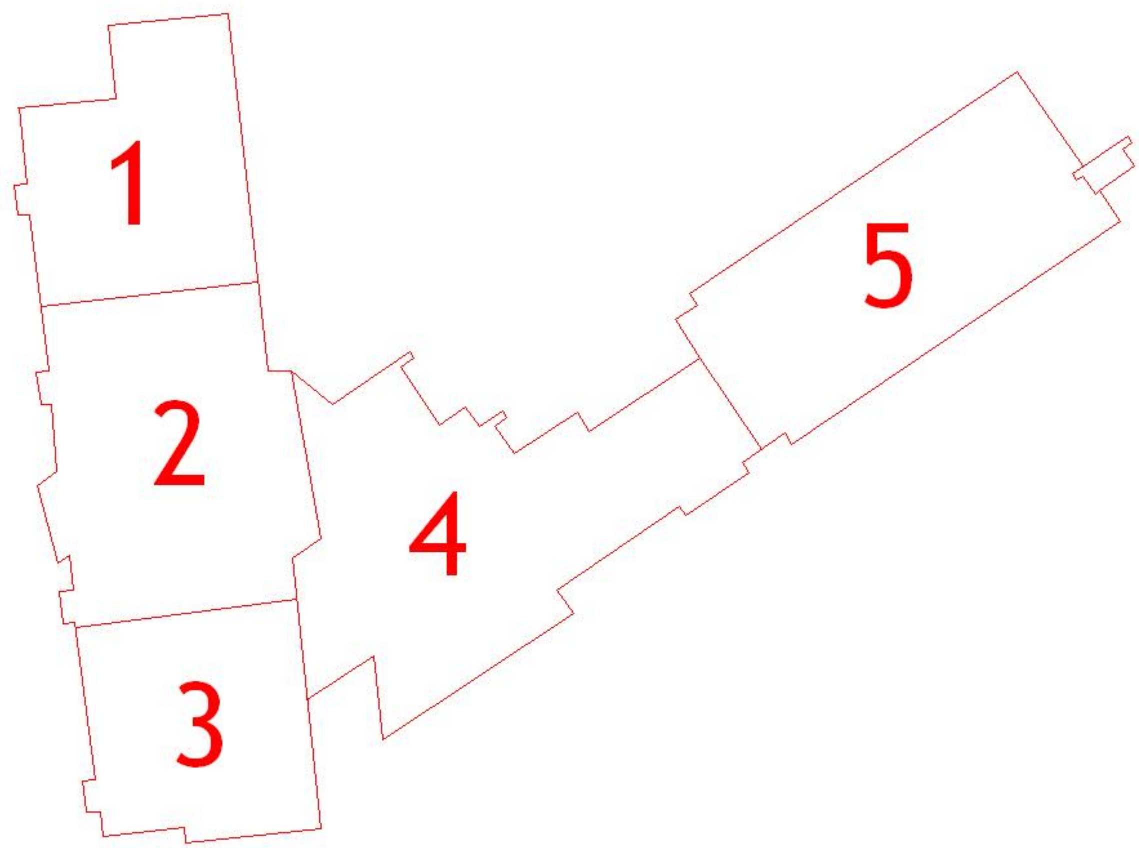
One of the most unique features that lie within the airport is the use of architectural cable trusses to support a high roof spanning the front of the building. This is a marvel in both structural and architectural aspects of construction.

The schedule and estimate of this project are not unlike any other; the fault of its problems lies with the human factor more than anything else. Explaining why there were delays in construction, as well as the flow of change, will affect my thesis research very little. The flow of change orders will actually help my research. This thesis will take a closer look into the pre-construction and startup of the project, using the resultant findings as thesis research.

Project Schedule Summary

The scheduled activities have been lumped into categories, but overall the building is split into five sections. The building is in the shape of a T, and the top of the T is split into three sections, the base of the T in two. Section six is located in the middle-front of section two. Section six is technically one of the first parts of the building to start and one of the last to finish.

The original plan was to work on building the top of the T first, and then continue along with the base. Section one of the T has a basement, so a great deal of excavation had to be done. After the basement excavation of section one was completed, excavation for the rest of the grade-level structures would begin. The phasing of the sublevel with grade-level sections provides a good way to mark specific finishing points and milestones between each section of the building. But these outlines are all theoretical, and the job was completed in an entirely different manner, due to loading of the project and money issues.



Building Systems Summary

Demolition

A surprisingly small amount of demolition was needed to build this project. A small three-room concourse loading dock and its accessories on the end of the existing airport had to be removed. A large amount of concrete apron and bituminous runway/taxiway had to be removed from the site.

Structural Steel Frame

Steel columns are held in place by concrete footers. Tube steel was used in the meditation room because of its intricate shape and design. All beams are moment connected to columns. All supported floor slabs are composite slabs.

Cast-In-Place Concrete

All concrete will be placed by truck and chute on grade and below grade. Second-level concrete placement will be by pump or by crane and bucket. All walls cast in place are reinforced along with any slabs.

Precast Concrete

A majority of the precast concrete is found along the front of the building. Columns supporting the cable trusses are encased in large concrete shells. The knee wall that runs along the front of the building is also precast concrete, supporting the storefront windows. This concrete was supplied by Sun Precast.

Mechanical System

The mechanical system for the airport is composed of twelve rooftop air conditioners; nine variable air volume boxes with hot water reheat coils, two dual-burner 11130 water boilers and two air-cooled condensers. All of the mechanical elements are found on the roof or in the basement of the building. There are three forms of fire protection: wet for interiors, dry for exteriors and an FM-200 rated Clean Agent Extinguishing System found in the server room.

Electrical System

The electrical system within in this building is composed of two 1500KVA Transformers. These transformers convert the electricity coming from 12.5 KVA down to 480/277V. The power is then distributed by two 2000A 277/480V 3 phase Busses. The back-up generator, a 1500KVA Diesel-powered generator, was installed in an earlier phase of the construction project. This generator is wired to the building so that, in case of a power outage at the airport, the building can support all function on its own.

Masonry

A majority of the masonry work in this building is interior. CMU walls are found throughout the building and will act as the support for an enormous sandstone block wall that runs through the entire length of the building. There are architectural CMUs found along the lower level of the building and have a finished face for the exterior. The sandstone wall has a split face at the tunnel entrance and phases to a polished face at the end of the terminal. The blocks are approximately 150 pounds each. The wall is held in place by steel angles bolted to the wall. To keep in alignment, holes are drilled into the top and bottom of the block, and steel pins are inserted for added stability. The finish of the sandstone wall will be caulked and sealed along the joints of where the blocks meet.

Curtain Wall

The curtain wall that encases the building is composed of metal panels and large storefront windows. The metal panels are non-insulated and require fiberglass batting to be installed before the exterior walls are constructed. The panels are attached directly to the frame of the building. The windows are double-glazed and UV-rated. A majority of the southern-facing windows have thin lines painted on them at the factory to prevent any more of the sun's heat from entering the building. General installation of the windows was set in place by workers with suction cup grips. For larger panes weighing over 250 pounds, a crane was used to set them in their frames.

Support of Excavation

Most of the drainage from the site will be tied into existing drainage pipes. A large detention basin will be located on the west side of the site to retain much of the sediment runoff that may accumulate from construction of the new apron.

Project Cost Evaluation

The Wilkes-Barre/Scranton International Airport's construction costs totaled $29,717,200. While reviewing the estimate and finding the square-foot cost of the project to be $224, many observations could easily be made. Much of the work is high-end work involving very expensive products. The conveyance systems within the building definitely put a spike in these square-foot costs. The total construction costs of the airport came to $32,436,430 with the cost of the architect, contracts and licenses that were acquired.

The building system estimates were pretty standard in comparison to many other similar projects. Structural steel came to $2,114,800, with a square-foot cost of $16.65. The electrical system, including a security system, came to $4,201,200 with a square-foot cost of $33.08. The added need of a security system did not put too much of a strain on the square-foot cost, as the individual cost of the security system was $3.86/SF. HVAC overall costs came to $2,581,700, with $20.33 as the square-foot cost.

The following D4 estimate was made comparing prices with two airports of approximately 240,000 SF.

The following is an estimate using RSMeans Square Foot Cost 2005. This is a very rough estimate, due to the absence of similar buildings offered for comparison. Buildings used were a bus terminal and an aircraft hangar. To make a good square-foot analysis, the use of many different building types would have to be used, but doing so weakens the overall cohesion of the building to its costs.

Square Foot Estimate			
Task	Amount	Unit Price	Total
Substructure	127000	10.94	$1,389,380
superstructure	127000	17.8	$2,260,600
Exterior Enclosure	127000	9.43	$1,197,610
Roofing	127000	3.27	$415,290
Conveying	127000	4.6	$584,200
Plumbing	127000	2.54	$322,580
HVAC	127000	20.82	$2,644,140
Fire Protection	127000	4.19	$532,130
Electrical	127000	11.92	$1,513,840
Furnishing	127000	5	$635,000
		Total	$11,494,770

The prices were significantly less expensive for the whole airport than for the Wilkes-Barre/Scranton Airport. This is directly related to costs of steel and concrete. The two airports were built in the mid 1990s, just about when prices started to inflate rapidly. Using the RSMeans Square Foot, the estimate was dramatically different due to the amount of detail that was put into the estimate itself. To get a reasonably good estimate, one cannot use only the square footage of a building and assume it is going to be correct, as there are many more factors involved than simply that figure. Many other factors involve the insufficient resources and poor matching between systems of one building to the next. Each building is different, and it would be hard to find a suitable middle-ground among all buildings.

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Local Conditions

Wilkes-Barre and Scranton are in the beginning stages of bringing life back to the Lackawanna Valley in Northeastern Pennsylvania. Most of the construction in the area is basic and generally of a design-bid-build nature. The Wilkes-Barre/Scranton International Airport was designed this way. The site that they are building on couldn't be any better. It's secluded, and there is plenty of space for parking. Construction parking is located just north of the site, and a section of airport apron has been fenced off for construction use. In this area the contractors' trailers can be found, along with supply and material storage as well as a spacious parking lot.

Conveniently located across the valley is the Lackawanna landfill. The site is recycling as much waste steel as possible. The Lackawanna Recycling Center is a very respectable recycling hub; it's so large that train tracks were built to aid in the transportation of recyclable products to be processed. Recycling is a minor part of the plan at the Wilkes-Barre Scranton International Airport.

The conditions of the Wilkes-Barre/Scranton International Airport are quite favorable. The site is located at the top of the Lackawanna valley. Much of the soil is quite porous and drains very well down through the valley. Coal was found in some parts of the excavation of the building as well.

Client Information

The Wilkes-Barre/Scranton International Airport is owned by the Bi-County Board of Trustees. This board is composed of Luzerne and Lackawanna counties, found in the northeastern part of Pennsylvania. This part of the state is very well known for mining and has had a very strong economy in the past due to the coal jobs. But as time went on, coal mining became more and more dangerous or declined in popularity, so the area started to decline. Today the mayor of Wilkes-Barre has a plan to rejuvenate what is commonly known as the Lackawanna Valley. Part of this plan is to make Wilkes-Barre and Scranton more alluring to big business; unfortunately, the airport this valley has used for more than 30 years was far past its prime. It had two gates, and people were very displeased with the service of this airport located at the top of the valley in Avoca, PA. The best way to bring business back to the valley would be to make it easier for businessmen and women to get into the valley — hence the airport construction.

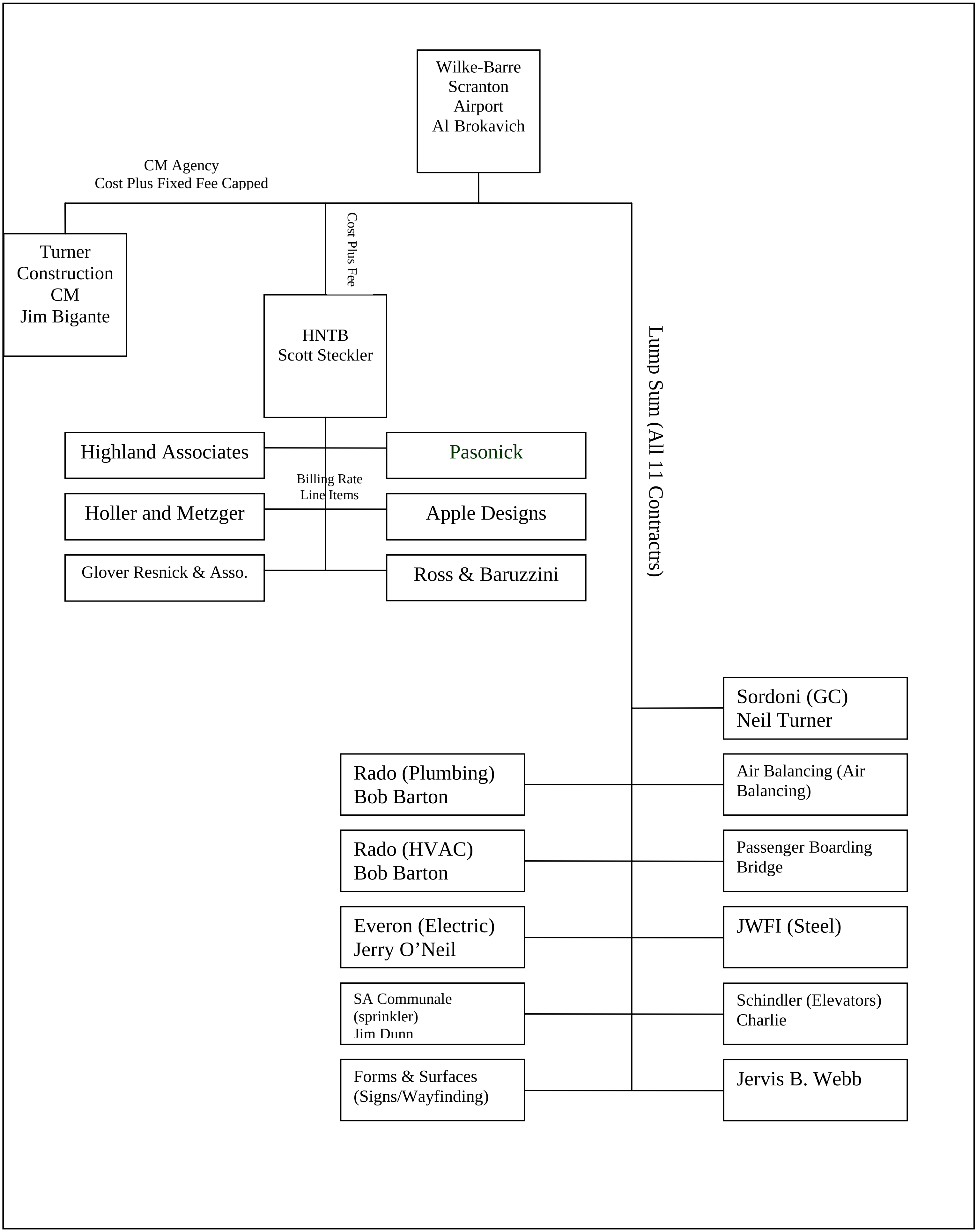
The Bi-County board wanted an entirely new airport, since it would be pointless to renovate the old airport; clearly, a new airport had to be built. The airport could not be as big as the Bi-County Board wanted it to be, because there would be a small market for flight. The airport would be just starting out, and the need for a huge airport would not be critical, but the possibility for expansion is important. The old airport would eventually be torn down after the new airport is put into commission. There were two key players that helped out on the job progress and referred back to the Board.

Money was not a critical issue with the board either. A large amount of the money that went into this airport came from the FAA. The quality of this building is very impressive: large architectural trusses clad in wood, a stone wall running the entire length of the building, large open spaces found throughout the building, and the airport being part of a four-phase contract definitely shows the seriousness put into the project. There were some delays that came up during the project over various items, but nothing entirely critical that would hold up the overall completion of the project. This brings up the schedule of this project. The schedule is mildly important; there was a large delay in construction during the erection of the steel that set the project off-schedule for many months. Many vocal change orders were made that confused many of the workers, and the schedule had to be reworked many times to keep the final completion date. The standard of safety throughout the job site was based on what the GC and CM would consider safe, assuming that the GC and CM would reinforce the safety issues.

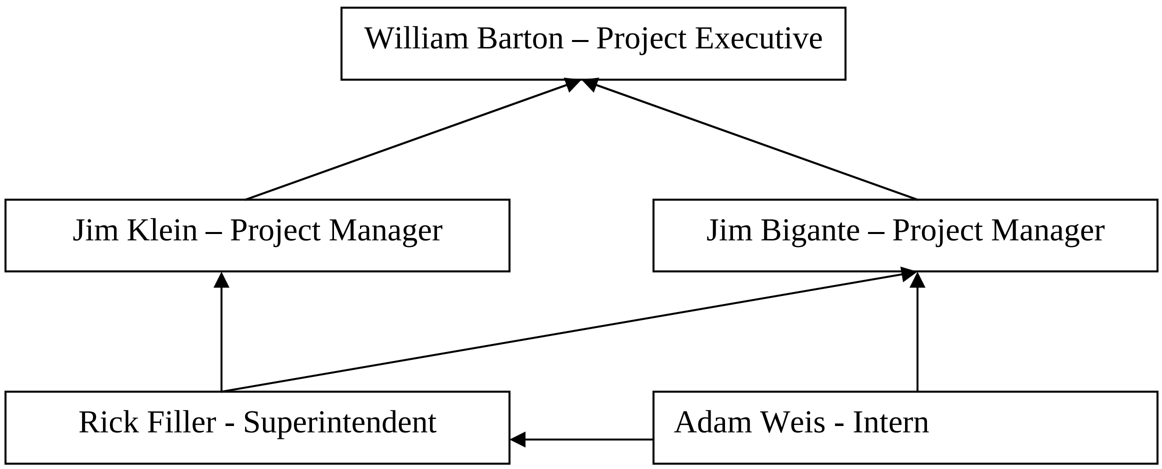
The sequencing of the building was very difficult. Phase A of the project was to make a new parking deck; this parking deck would have a walkway below grade that connects to the new building. A tunnel entrance was designed to accompany the passengers coming from the garage and entering the airport. What makes this difficult is that there will be a road that runs along side the front of the building to drop off and pick up people; the tunnel entrance would have to go under the road. Another major issue in sequencing is aligning the construction of the building with the construction of the new apron surrounding the terminal of the building.

Project Delivery System

The Wilkes-Barre/Scranton International Airport was a CM Agency contract. This delivery method was chosen because it saved the airport money and many of the people on the board were quite knowledgeable about construction. But Turner was hired as more of a consultant, because the airport did not know enough about construction to make this a multiple prime job.


Wilke-Barre
Scranton
Airport
Al Brokavich
CM Agency
Cost Plus Fixed Fee Capped
Turner
Construction
CM
Jim Bigante
Cost Plus Fee
HNTB
Scott Steckler
Lump Sum (All 11 Contractrs)
Highland Associates
Pasonick
Billing Rate
Line Items
Holler and Metzger
Apple Designs
Glover Resnick & Asso.
Ross & Baruzzini
Sordoni (GC)
Neil Turner
Rado (Plumbing)
Bob Barton
Air Balancing (Air
Balancing)
Rado (HVAC)
Bob Barton
Passenger Boarding
Bridge
Everon (Electric)
Jerry O'Neil
JWFI (Steel)
SA Communale
(sprinkler)
Jim Dunn
Schindler (Elevators)
Charlie
Forms & Surfaces
(Signs/Wayfinding)
Jervis B. Webb

Staffing Plan for Turner Construction



The staffing for Turner Construction at the Wilkes-Barre/Scranton International Airport is quite small compared to many other jobs. This is mainly because the contract held between the airport and Turner is for that of a CM agency. However, the need for extra personnel on this job was clearly evident. A secretary was needed, as well an extra superintendent or field engineer — both of which would have proven useful.

Jim Klein was in charge of the long-term issues of the project, as in what would happen in the following two months and how it would happen. Jim Bigante was more of a day-to-day manager, processing RFIs and DCs. Rick Filler was called in late spring to help with some of the critical phases of the building, dealing with interiors as well as his expertise on the fourth phase of the project, the airport apron. Rick Filler was in the field and dealt with issues on the spot and was more in touch with the workers. Adam Weis was hired for the summer as an intern and was put to work on writing smaller RFIs and evaluating DCs for the ten weeks he was there.