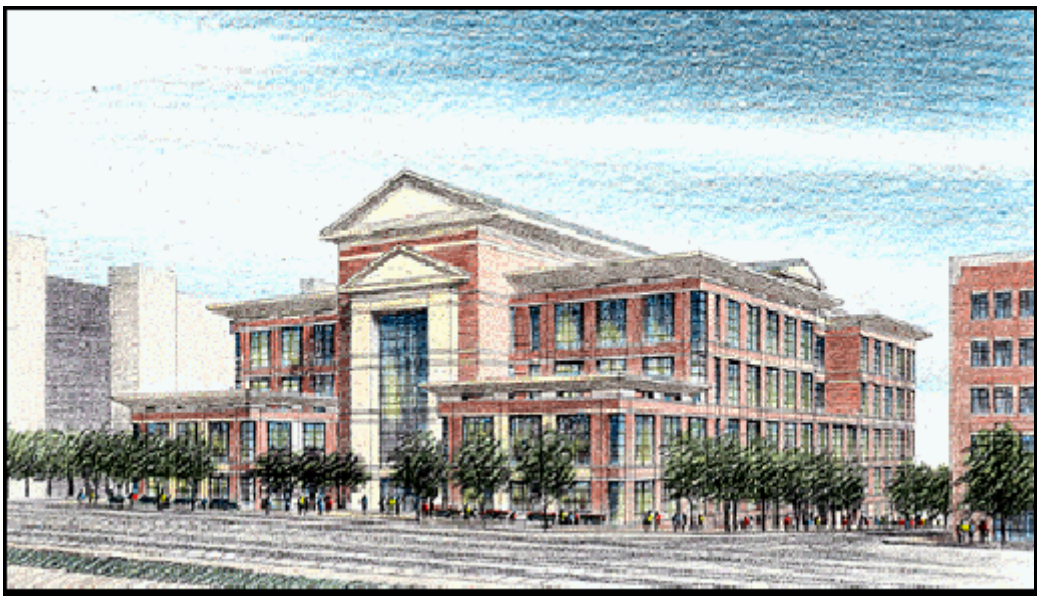
Project Number: GFS-0703

Close-Out Project

At

Worcester Trial Courthouse



A Major Qualifying Project
Submitted to the faculty of
Worcester Polytechnic Institute
In partial fulfillment of the requirements for the
Degree of Bachelor of Science

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Abstract

This project reviews and evaluates Gilbane Building Company's close-out procedures for the Worcester Trial Courthouse. The methods and processes used by Gilbane to conduct close-out were examined. These methods include: Close-out matrices, Rolling Completion List, and Prolog. The project goals were accomplished in collaboration with accountants, engineers, and superintendents. As a result, improvements have been proposed to the Gilbane close-out system. Additionally, an alternative foundation method was designed and evaluated in terms of feasibility. This method is concrete mat foundation.

Acknowledgments

Special thanks to Mr. William F. Kearney Jr. and the Gilbane Construction Company who proposed and sponsored the main portion of the project. We also thank Mrs. Monica Snow, Lauren Egan, and Dan Manescu for taking time out of their busy schedules and guiding us through the project. Last but not least, Professor Salazar for helping us whenever we needed and Professor Tahar El-Korchi for his valuable input to our capstone design.

Capstone Design Experience

Our capstone design investigated the possibility of constructing the Worcester Trial Courthouse using a mat foundation. This idea was proposed because the adjacent AT&T building was constructed with a mat foundation in the 1970s. The comparison was conducted to determine whether the current method was economically and structurally a viable choice based on similar soil conditions.

The original deep foundations method used in the Worcester Trial Courthouse was the pile and cap foundation systems. This method of foundation systems is used when the soil strata on the surface does not satisfy the required structural integrity to withstand the weight of the building. Therefore, the weight of the building must be carried to deeper stronger soil layers. The existing Pressure Injected Foundations method (PIFs) used in the courthouse was studied, and the analysis comprising of the structural design, cost review, productivity analysis, and labor intensity was reviewed for comparison of our alternate foundation design.

An alternative method of deep foundations- a concrete mat- which is a shallow foundation, was proposed for design. The design methods included soil analysis including bearing capacity of the soil and total settlement, total bearing loads of the building, and the weight of the building and the foundation. An analysis was done on both construction methods in order to determine the difference between PIF foundations and concrete mats in terms of cost, schedule, and labor. The results of our report show that the pile foundation method was the better choice over the mat foundation method.

The following "realistic constraints" set forth by the ASCE Commentary: Economic, Sustainability, Environmental and Manufacturability were satisfied in our capstone design of foundations.

From an economic perspective, our design report provides an angle worth of investigating. Our alternative foundation design is slightly more expensive due to additional material costs, and saves approximately one month of construction in comparison with the current PIF method.

Theoretically, the proposed mat foundation should prove to be more stable under seismic loads. Although, PIFs can be flushed with ground level to make the foundation less susceptible to earthquake forces, short columns can still be pushed

over and longer piles may fracture under tremendous bending moments. Structures with mat foundations “damp” vibrations to an extent, making them more sustainable compared to PIF foundations. Mats are also monolithic, making them impenetrable under wet soil conditions.

Our design report also investigates the soil conditions and takes into account soil improvement procedures including deep excavation and disposal of contaminated soil. It also accommodates the issue of backfilling with fresh, environmental-friendly, well graded gravel. This in turn prevents harmful elements from causing health hazards.

The idea of our alternative foundation design follows a creative and well researched contemporary method outlined in a number of reputable and widely used design books. It is an innovative yet achievable approach used widely; making our foundation design’s manufacturability very feasible.

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1.0 Introduction

A new courthouse was needed for the Worcester area, as the pervious one, built in 1989, was dilapidated, congested with court cases piling up, and outdated. The Division of Capital Asset Management decided that the city needed a new courthouse to serve the high demand of public litigation. The prospective courthouse will alleviate such problems and provide the judiciary faculty with more space to conduct their business. It will increase access to state-of-the-art modern technology providing a more pleasant and comfortable environment for all who make use of the courthouse. The new Worcester Trial Courthouse is a $180 million project. It will have 427,000 square feet of space and is being built in downtown Worcester with Gilbane Building Co. as Construction Managers (CM). The ground breaking for the project was held on the 25th of June, 2004. Today, the project is over two years into the construction phase and there are approximately two months to the completion date.

The Construction of the Worcester Trial Courthouse was the first state funded project delivered under the CM-at-risk system in Massachusetts. Prior to the construction reform of 2004, which allowed this delivery system to be used by the state in public projects, the Architect/Engineer, were legally required to have all the plans completed before construction started. The traditional approach, also known as design-bid-build, delayed the starting of construction for many projects including the Worcester Trial Courthouse, which has been delayed several times before. Lack of adequate financing for such large projects made these projects extremely difficult to commence in the first place.

The Division of Capital Asset Management (DCAM) chose the CM at Risk method to construct the Courthouse, where Project Managers are extensively involved and greatly exposed to the risks of quality, costs and schedule.

Today, the construction of the Worcester Trial Courthouse is progressing according to schedule. The project has entered a crucial phase, Close-out. Close-out is essentially the final stage of construction and it is identified as the paper work and administrative tasks that construction management firms are required to perform before handing the project to the owner. Just like any purchase one makes and expects the product to be what he or she pays for, similarly, a project must be in compliance with the

set of specifications in its entirety. Close-out includes procedures such as final inspection, clean-up, punch lists, and lien releases. These procedures are carried out and every detail is inspected thoroughly. Ultimately, this ensures the project is completed meticulously and according to the architects and the owner's standards.

Our MQP group, in collaboration with Gilbane Building Co., proposed to investigate and analyze the current processes and policies that Gilbane applies in conducting their close-out. This permitted the group to gain a close-out perspective from a construction management point of view. This type of construction management analysis was made possible by regular visits to the Worcester Trial Courthouse, weekly meetings with the staff responsible for close-out, and various methods of data collection.

As an important part of our major qualifying project, the group conducted an extensive design analysis on deep foundation alternatives. The current method of foundations used in the WTC, Pressure Injected Footings or PIFs, was thoroughly analyzed and evaluated. Subsequently, we proposed an alternative method of foundations, a Concrete Mat that would replace the existing PIF method. The two methods were compared in terms of cost, schedule and quality.

2.0 Background

2.1 Worcester Trial Courthouse

The project of our focus was the Worcester Trial Courthouse. A courthouse is one of the main structures in a city. The city of Worcester was in serious need of a new courthouse given that the previous one was very crowded and the structure was quickly deteriorating. The new courthouse, located in the heart of Worcester on Main Street, will be a majestic building and an architectural landmark for the city. Once completed, it will be the biggest courthouse in the state of Massachusetts. The new project was designed by the prestigious Shepley Bullfinch Richardson and Abbot Architects from Boston, Ma. It will include a district, housing, county juvenile, superior, and family courts. The courthouse will have public, restricted, and secured areas in a total of 427,000 square footage of a steel structure. It will also include underground parking and private entrances for the judges. The Worcester Trail Courthouse began construction in June 2004 and was scheduled to be completed by July 2007. The total cost including design of the structure is $180 million dollars.

2.2 DCAM – Division of Capital Asset Management

The Division of Capital Asset Management (DCAM) is responsible for development of new projects, property management, facilities maintenance, and supervision of construction of public buildings for the state of Massachusetts. DCAM does about 10% to 20% new building constructions and 80% to 90% building renovations for the state. It has used the traditional Design-Bid-Build contracts exclusively for many years. DCAM, as the 'owner' and financer of the Worcester Trial Courthouse, had chosen the Fast Track system under the new by-law of the Construction Reform to build the courthouse. Fast tracking a project allows the actual site work to begin before the design of the building is completed. It saves money on project overhead by cutting down the number of days needed for the completion of a project. By hiring construction managers, DCAM is effectively partnering with the construction company in order to deliver high quality projects that could incur lots of changes. According to Monica Snow, by fast

tracking the project, DCAM ultimately saved about a year worth of time and money. It is worth noting that a problem with the fast tracking system is that it results in many open changes as the project progresses because of the uncertainty in the scope of work.

2.3 Gilbane Building Company

After debating between a number of esteemed construction management firms, DCAM chose Gilbane Building Company as construction managers. Gilbane was chosen for their respected reputation to perform management tasks under budget and within the timeframe; with no compromise on the quality of the project. Gilbane's growing reputation as a very efficient and highly rated CM firm alongside their renowned attention for technical aspects of construction made DCAM select Gilbane for this challenging project. A very important sign of Gilbane's success on this project is their selection in 2006 to be construction managers on Plymouth Courthouse, another judicial building owned by DCAM.

Gilbane Building Company was founded in 1873 in Providence, RI as a family-owned carpentry and general contracting firm and remains a family-owned, privately-held company. Over the years, Gilbane has developed a rich history based on performance and a tradition of exceptional people leaving clients satisfied with the quality of work, hence building a solid reputation. Operating nation-wide, Gilbane has consistently been ranked among the top five construction management firms and is the 10^{th} largest building contractor in the United States according to ENR. Gilbane is in compliance with OSHA (Occupational Safety and Health Administration) regulations and has an outstanding EMR of 0.35. Gilbane is a seven-time winner of the prestigious award in all of construction management – The Associated General Contractors of America "Build America Award." Today it has more than 25 offices in the United States, generating annual revenue of nearly $2.5 billion.

Gilbane Building Company has an extensive project portfolio in Massachusetts and in the Worcester area. Some of these projects include hospitals, financial institutions, and university buildings. The following list includes some of Gilbane's most recent projects in the New England area:

• Fleet Boston Financial Reconfiguration Project, Boston, MA

• Concord Hospital Payson Center for Cancer Care, Concord, MA
• Life Sciences Building, Providence, Brown University, RI
• New WPI Residence Building, Worcester, MA
• Ambulatory Wing and Renovations, Cambridge Hospital, Cambridge, MA
• Rhode Island State Training School Juvenile Correction Facility, Providence, RI
• T.F. Green Airport Bruce Sundlun Terminal, R.I. Airport Corporation, Warwick, RI
• Bartlett Center, WPI, Worcester, MA
• Verizon Wireless Arena, Verizon Wireless Arena, Manchester, NH

Tishman Construction Company, from Boston Massachusetts, was selected as the owner representative acting as an agent for DCAM to monitor the work of Gilbane.

2.4 Construction Management (CM) at Risk

"Project Management is the art and science of coordinating people, equipment, materials, money, and schedules to complete a specified project on time and within budget"[1]

Project management is a combination of organizational, leadership, and problem-solving skills that a person or organization must posses in order to deliver a successful project. There are many types of delivery systems that can be used to carry out a project such as Design-Bid-Build, Construction Management, and Design-Build. The desired method of construction is usually chosen prior to the start of a project in order to satisfy the owner's needs and project objectives. A relatively new method in public construction in Massachusetts is the Construction Management at Risk (CM @ Risk). This method was just approved by the state in 2003 under the Construction Reform.

The CM contract is a four-party approach involving the owner, designer, CM firm (here Gilbane), and the sub-contractors. The CM @ Risk approach involves the CM company in the design and construction phase extensively; thereby they are exposed to risks of quality, cost, and schedule. This method essentially endorses the concept of Guaranteed Maximum Price (GMP). The CM firm must control the cost of the project to remain under the GMP and would be financially liable if the cost of the project exceeds that amount. The advantage of this method is that total project time is reduced; this is

[1] Oberlender, Project Management for Engineers and Construction. 2000

achieved by allowing the use of fast-tracking techniques. The owner benefits from early construction input from the CM firm in the design phase. Also, the contract conditions are softer, in terms of liquidated damages and time constraints. Changes and change orders are easy to process and cost less which results in business-friendly environment.

2.5 Close-out

Construction management involves a number of steps that have to be processed before the project is finished. These steps include engineering study, final design, construction contractors, construction, and close-out, etc. Completing a project does not only comprise of the construction phase, there are other phases necessary to carry out a project. Contractually, construction management firms are required to perform paperwork and other type of administrative tasks before handing the project to the owner. That process is identified as close-out.

Furthermore, the close-out process for a construction project is the final stage before handing the project to the owner. The process includes the following items:

- Final Inspection (Certificate of Substantial Completion)
- Punch List
- Certificate of Occupancy
- Guarantee/Warranty
- Clean-up
- Lien Releases
- As-Build Drawings
- Disposition of Project File
- Call Backs
- Disposition of Project File
- Keys
- Attic Stock
- Owner's Manual

The final inspection is completed when the CM requests the owner's representative to visit the site in order to check the final work of the project. This is done after the project manager checks all the punch list items, which is a "to-do" list of items, still left after majority of work has been completed, and ensures that all the work has been completed. Upon the acceptance of work, a Certificate of Substantial Completion is issued by the CM and approved by the owner. The Certificate of Occupancy is issued after that by the state/city hall approving the building. At this point, the project can be used for its intended purposes and only minor items remain to be finished. The guarantee period is usually one year after completion of construction. The CM also submits guarantee/warranties for all equipment, machines and work done by subcontractors. The owner can request a lien release or a payment bond indicating that all subcontractors and laborers have been paid. A Lien is a hold on property for the benefit of someone whose work improves the property. [2]

Another important part of close-out is the delivery of attic stock and keys from the subcontractors to the owners. This can be a lengthy process depending on the size of the project. Attic stock includes but is not limited to: gypsum boards, tiles, carpet, etc.
The CM is also required to hand over record files and as-built drawings, prepared by all the subcontractors on the work they completed, to the owner at the end of the project.

Close-out involves engineers, accountants, project managers, and the primary owner. It is a lengthy and important process in the construction management industry. Close-out is often a time consuming process where nobody wants to take responsibility, thus, the CM must insure that there is a responsible party for each of the items involved in the close-out phase of the job. Good construction managers ensure that the close-out process starts as soon as project work commences, making sure that the subcontractors and all parties involved in the project close-out when they finish their work.

[2] Oberlender, Project Management for Engineers and Construction. 2000

3.0 Close-out

The Worcester Trial courthouse, as mentioned before, is $180 million dollar DCAM project with 42 bid packages and 18 subcontractors. It is the first project to be built by DCAM under construction management at risk. DCAM is very cautious about the delivery of the building and watches over Gilbane with a "microscope". The project is also built by the fast-track method which leaves a lot of unknowns until a very late stage of the project. These factors presented a set of challenges for the engineers working on the courthouse throughout the life of project. The close-out process at the Worcester Trial Courthouse was one of those challenges, given the size of the project and the fact that the engineering staff consists of mainly junior engineers with little or no close-out experience on previous Gilbane projects.

3.1 Gilbane Close-Out Procedures

We begin this chapter by addressing the current methods and processes used by Gilbane to conduct their close-out. We observe the project team and their roles in the process, the methods and information technology used by Gilbane, and the subcontractors.

3.1.1 Gilbane's Contractual Responsibilities

A good Construction Management firm must be responsible and efficient throughout the life of the project. The responsibilities of Gilbane started right after they won the bid to manage the project. In the case of the courthouse, the subcontractors were pre-selected by DCAM through their own bidding process, where filed sub bids are chosen as mandated by the construction law in Massachusetts. During pre-construction, Gilbane met with all the subcontractors to finalize the contracts as defined in the specifications. Then in the construction phase, Gilbane was responsible for handling the subcontractors so that the work was done in a safe and coordinated fashion. They also had to keep DCAM and Tishman updated throughout the life of the project. Before the CM Company is relieved of its responsibilities, the project must be closed-out before it is handed it over to the owner.

The close-out process is when the builder or CM delivers the project to the owner. The close-out deliverables that the CM must submit to the owner are defined in the close-out procedures. A close-out section is typically found in the general requirements, which is division 1 of the specifications.

Contractually, the close-out is a two step process. First, Gilbane closes out with all the subcontractors. In this process, Gilbane has to make sure they have completed all the work that was required from the contract. Depending on the contract, the deliverables of the subcontractor, other than the performance of the work, include but are not limited to attic stock, special warranties, and keys. Although, the majority of the items will be given to the owner, Gilbane has full responsibility for collecting them. In the case of the courthouse project, DCAM also requires that Gilbane produce a list of items that must be completed after substantial completion, a punch list. A matrix is also created to keep track of all the items and submittals required by the subcontractors. The matrix is for Gilbane internal control only and is not required by the owner.

Gilbane's contract with DCAM can be closed only after the subcontractor can be closed-out. A detail of all the requirements can be found in Appendix III. DCAM, with the help of Tishman, inspect the site and all the submittals and give the final acceptance. (Specs 01700, paragraph 1.5). A sample of the paragraph is:

"2.1 Submit Final Contract Value & Payment Request

2.2 Submit certified copy of Designers final inspection list of items."

This process also requires turning over of the keys and giving the owner staff training on running and maintaining the facility.

According to the operations manual of Gilbane, their goal is to completely close-out all projects within ninety (90) days after the last staff member leaves the site. An efficient close-out process directly reflects a good construction management practices firm because it shows the accuracy of their planning and scheduling.

Project Team and Responsibilities

The following figure represents the current personnel organizational structure of the Worcester Trial Courthouse. It is followed by a description of each staff member and their respective role in the close-out process.

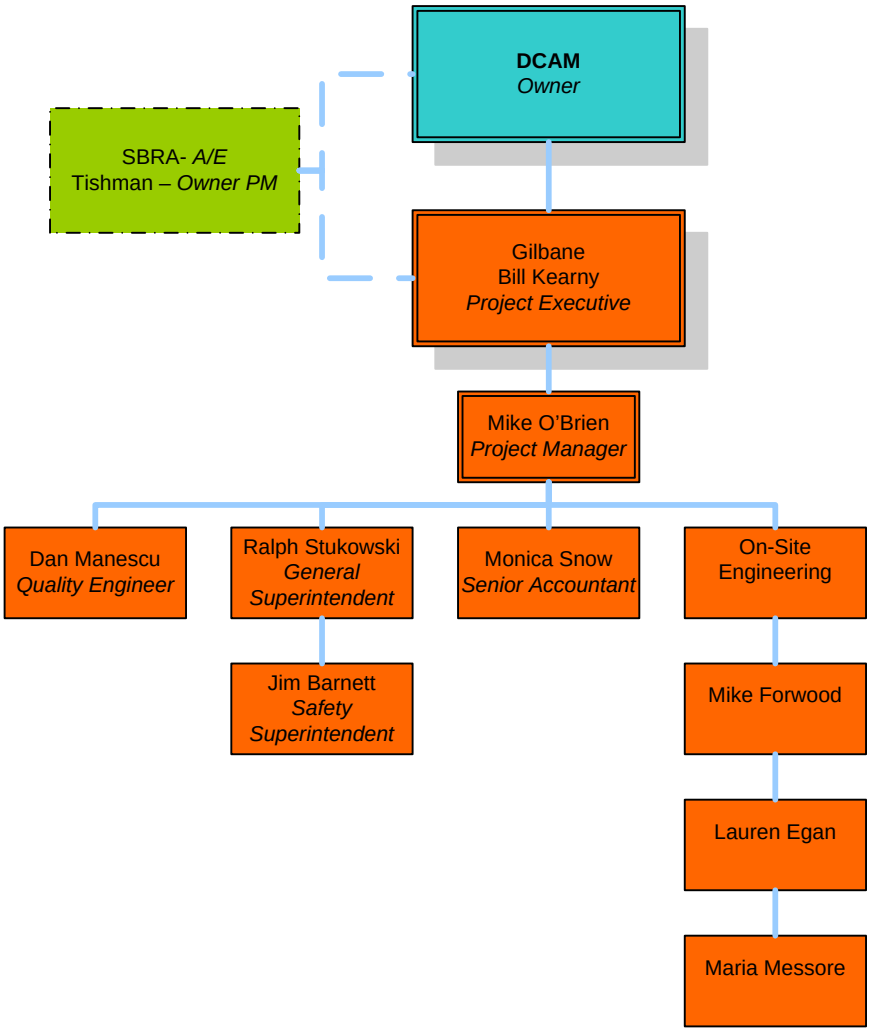

Figure 1 – Worcester Courthouse Team Structure

William Kearney Jr., - Project Executive

The project executive oversees all the activities on the project. He usually oversees three to four different projects depending on their size and status. William Kearny is the head man that deals with the owner as the representative from Gilbane in terms of financial and general services. In terms of close-out, the project executive is responsible for all the actions of the accountant, engineer, and the superintendent. He is

responsible to make sure that the team is working towards close-out early in the project and that all close-out items are completed on time.

Michael O'Brien – Project Manager

The project engineer makes sure the work gets done and the project stays on the track in terms of schedule and cost. Mr. O'Brien is in charge of all the superintendents and engineers. The project manager is the driving force for the completion of the project but not necessary a big player in terms of close-out. His main responsibility is to do the final sign off of the papers after the accountant, QA/QC, superintendent, and engineer have ensured that all items are ready to be closed.

Monica Snow – Senior Accountant

Monica is responsible for all the financial aspects of the project. Monica is also the project leader in when it comes to close-out. She is responsible for making sure the necessary items are received so the subcontractor can be closed out with his final payment. Senior Accountant is the final person to leave the project, sometimes long after all the construction is complete. Monica is usually responsible for three to four projects at a time and she is the driving force behind the whole close-out process. One of her responsibilities is issuing close-out letters; look below.

Dan Manescu – Quality and Safety engineer

Quality Assurance / Quality Control engineer is responsible for making sure the conditions of the project site are safe and quality is on par with specifications. The QA/QC handles all the state and city inspectors and getting all the necessary permits for construction. Dan is mainly responsible for issuing and updating the rolling completion list and punch list items.

Michael Forwood – Senior Engineer,
Lauren Egan & Maria Messore – Engineers

The engineers are responsible for all the technical aspects of the project. The engineers also perform field tests to ensure that all the construction is built for the

necessary strength. They manage all the open changes and submittals in Prolog. They are responsible for making sure all the submittal items are entered into Prolog for each subcontractor according to the specifications. The engineer also makes sure that all required close-out items are submitted by each subcontractor.

3.1.2 Current Structure of the Close-Out process

Throughout this MQP project, we were able to understand the process currently employed by Gilbane to conduct close-out. This was accomplished by weekly interaction with the project staff. The following is a review of Gilbane's methods and processes.

A. Kick off Meeting

Close-out starts early in the life of a project, even before construction. At the beginning of the project, two main things are done at Gilbane to set a main close-out plan to carry throughout the project. A general close-out meeting is set during pre construction to outline the close-out process. The project engineers are assigned different tasks related to close-out. One of the outcomes of this meeting is a general matrix that includes all the items related to close-out (Refer to Figure 5). Also, The Specs are checked and items related to close-out are registered in Prolog.

B. Prolog

Prolog Manager provides complete construction project management control by automating all aspects of the construction lifecycle, from project design to close-out., Prolog Manager has become the AEC industry standard for construction companies with more than $100 million in construction volume.

Prolog has the capability to perform the following:

- Submittal Register
- Reports
- Meeting Minutes
- Punch list and Rolling Completion List (RCL)
- Close-Out Register
- Information Storage

Prolog software has a very secure interface. The level of access can be set for each user according to his/her involvement to the project. For example, the subcontractor will have access only to view the rolling completion list and required submittals but will have no access to edit any entries. However, the project engineer has access to all entries and also has editing capabilities. Figure 2 is a screen shot of the project website related to the Worcester Trail Courthouse project.

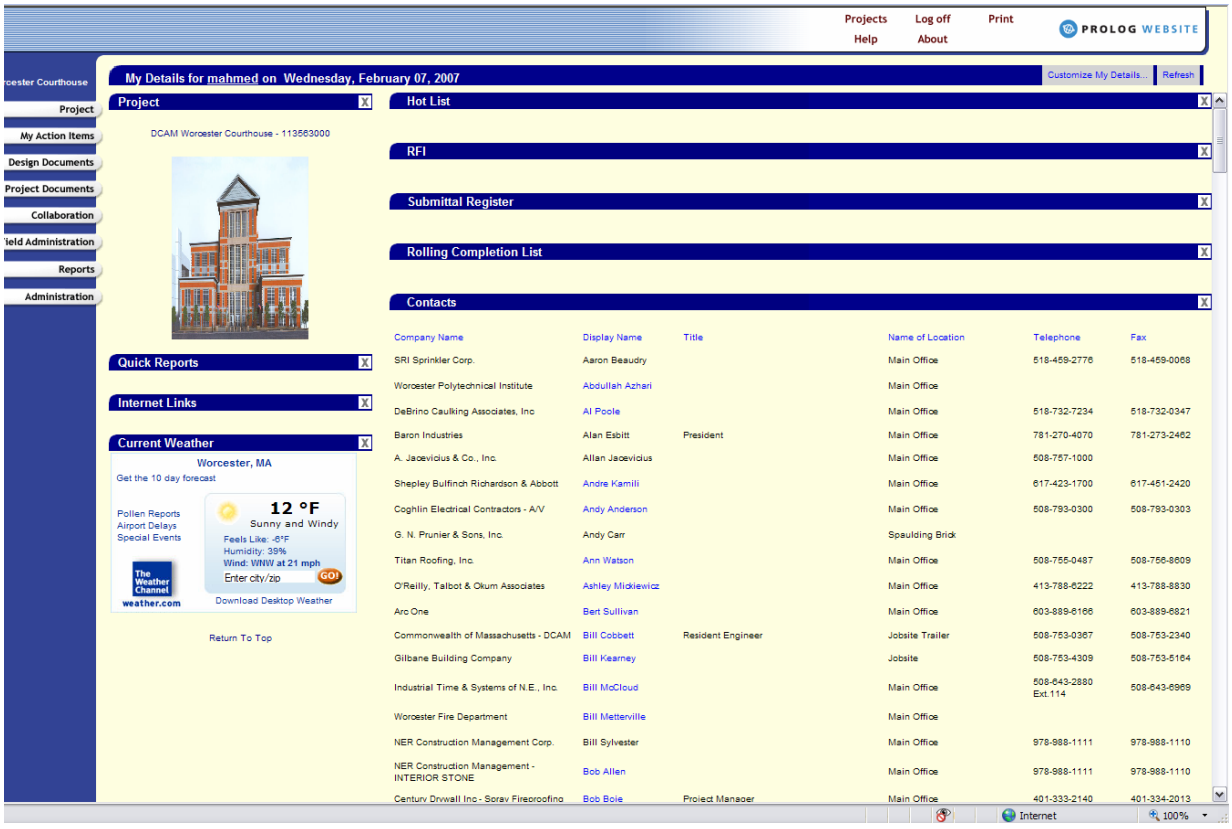

Figure 2 – Home Screen of WTC Prolog page

The Prolog software is a very powerful document management program. It acts as File Exchange site where one party can upload files such as AutoCAD drawings and the contractor can download from another remote location. Having the information readily available saves a lot of time and money compared to the conventional hard paper process of retrieving information. The software is also used to help with the communication between many different parties such as owner, Gilbane and subcontractors.

Prolog has built-in close-out functions where close-out items and submittals can be registered, organized and tracked. However, the submittal register function and RCL are the ones currently used for close-out use by Gilbane. The reason for that according to Monica Snow is that the close-out function in Prolog is relatively new and there are no formal instructions or training required by the Gilbane manual on that issue.

C. Specifications – submittals and close-out specifications

The specification chapters are an essential part of a construction project in terms of paper work and processes. Architects produce these chapters alongside the construction drawings to tailor a project according to the owner's needs and vision. The specs are heavily used in the early stages of a project to obtain important information and detail on how to set up the construction process and close-out, along with other important aspects. The specs are divided into different bid packages and then each bid package is awarded to a subcontractor with some subs performing multiple bid packages. The submittals in the specs are sorted out at the beginning of the project by the engineers depending on the bid package and for close-out. For our project purposes we divided submittals into two main categories: (See figure 4)

1. General submittals: shop drawings, samples, open changes, etc.
2. Close-Out submittals: Warranties, guaranties, attic stock, O&M manuals, etc.

Prolog was used throughout the life of the project to register submittals. The following is a list of these submittals. (See figure 3)

- Required items
- Open items
- Open packages
- Closed packages

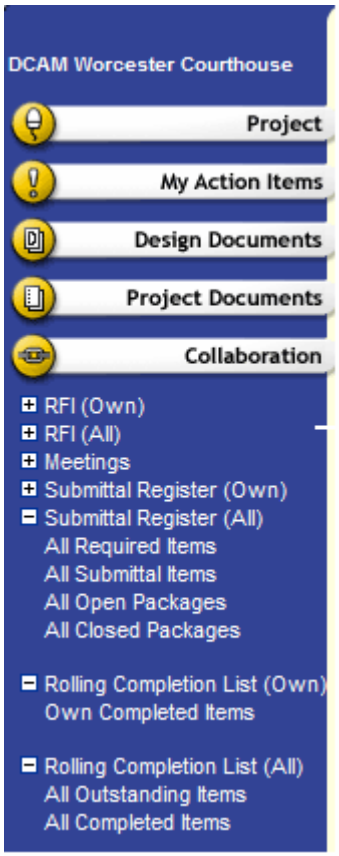

Figure 3 - Submittal Registrar in Prolog

The list of submittals for each bid package comes directly from the specifications. In the beginning stages of the project, the engineering department goes through the specifications and inserts all the required submittals in Prolog as open-submittals. Submittals which occur from changes on the field are filed under required items and open packages. Open register items when the project starts. As the project progresses, some of the entries need to be updated or deleted/modified because they are not required by the subs. This is because the text in the specifications is carbon copied or cut and pasted from other projects with changing only the major differences for the new project.

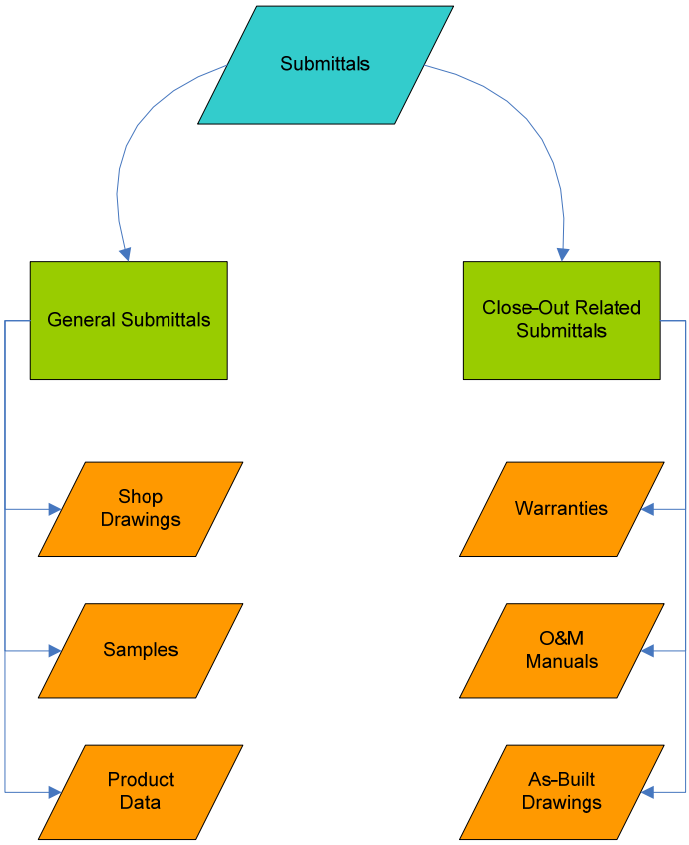

Figure 4 – Submittals Process

D. Close-Out Matrices

Gilbane uses spread sheet matrices heavily in close-out for organizational purposes. Each matrix is setup for a specified goal, some are major close-out matrices that are needed to check out all close-out items and others are related to certain bid packages or RCL. There are four of them listed here.

I. Bid package Close-Out Matrices

This is the first step in organizing the information required for closing out subcontractors. This matrix includes all the specific items from the general conditions and specifications as of the subcontractor's bid packages that are relevant to close-out. This matrix is created by site engineers and the items are registered as required submittals. In the big picture, this matrix is on the bottom of the "food chain" because it includes information specific to each bid package at a time, in total there must be 42 matrices like this one for this project. The information related to close-out is such as: warranties, guarantees, attic stock, keys, as-built drawings, etc. We developed close-out matrices for about 18 bid packages; Gilbane requested that the focus to be on Mechanical, Electrical, Plumbing (MEP) and Finishes (Chapter 9, 15 and 16 of the specs). An example of the matrix can be seen in Figure 5. The entire matrix can be found in the Appendix IV.

	CONTRACTOR	Bid Package	Spec Section	Sub Section	Para-graph	Description
Site improvements/Utilities	Marois	02A	02870	3.30	A.	After completing site and street furnishing installation, inspect components. Remove spots, dirt and debris. Repair damaged finishes to match original finish or replace component.
	Marois	02A				
	Marois	02A				
Concrete foundations & Structural slab	F. Harvey	03A				
Concrete slabs	Handford/Harvey LLC	03B				
Masonry & Architectural Pa	GN Prunier		04200	3.26	D.	
Structural steel	Beauce Atlas		05120	1.06	H.	
Water & Damp proofing	NER	07B				
Spray Fireproofing	Century		07810	1.1	B.	Special Warranty: Submit a written warranty, Executed by Contractor and cosigned by Installer, agreeing to repair or replace sprayed fire-resistaive materials that fail within the specified warranty period (2 Years)
Foundation Waterproofing	Debrino	07E				
Drywall	Century Drywall	09A	10100	1.3	E.	Product Certificates
			10100	1.4	A.	Installer Qualifications for maintanence work
			10100	1.5	A	General Warranty
			10100	1.5	B.	Porcelain Enamel Makerboard Warranty
			9841	1.4	C	Product Certificates
			9841	1.4	F	Maintenance Data
			9841	1.8	A	General Warranty (2 years)
			9841	1.9	A	Extra Materials
			9841	3.3	C	Cleaning
			9841	3.4	A	Provide final protection and maintain condititons in a manner acceptable to manufactorer and installer that ensure acoustical wall panels are without damage or deteioration at time of Substantial Completion
			9841	3.4	B	Replace panels that cannot be cleaned and repaited in a manner approved by Architect before time of Substantial Completion
Ceramic Tile	West Flooring	09B	9310	1.7	E.	Product Certificates
			9310	1.8	A	Installer Qualifications for maintanence work
			9310	1.11	A	Extra Materials

Figure 5 – Matrix: Lists item required from the Specifications

It is important to note that much of the close-out information in the specifications is not clearly stated and is hard to find thus making these matrices time consuming to construct. However, these matrices are very necessary for close-out because they serve as a base for the process.

II. Subcontractor Close-out Status

This matrix is used by the accountant to see the status on all the general requirements of the subcontractors. It includes billing information, final approval, final papers, etc. The main goal of this matrix is to help the accountant organize the vast

Subcontractor	Contract No	Billing Instr. Issued	Final Papers Issued	General Guarantee	General Release	Consent Of Surety	Bond Incr. Rider
America Sport Floors	18990	5/29/02	07/16/04	09/23/04	09/23/04	09/23/04	N/A
AMSCo Inc	17302		07/16/04				
Associated Concrete Coatings	18746	4/5/02	07/16/04	06/28/04	09/09/04	09/09/04	N/A
Bloom South Flooring	19056	5/29/02	07/16/04	04/29/05	04/29/05		
Boston Showcase	19901	8/9/02	07/16/04	9/14/04	9/14/04	9/14/04	9/14/04
Brochu Inc., LA	21583	12/12/02	07/16/04	8/26/04	8/26/04	8/26/04	8/26/04
CB Seating	19897	8/9/02	07/16/04	12/02/04	12/02/04	01/25/05	01/25/05
Control Technologies	18273		07/16/04	10/25/04	10/25/04	11/01/04	11/01/04
CPI Int'l	18794	4/5/02	02/04/04	03/24/04	03/09/04	03/19/04	N/A
D'Agostino Assoc	18135		05/24/04	06/17/04	09/09/04	06/17/04	09/03/04

Figure 6 - Example of Subcontractor Matrix

amount of information. This is one of the key matrices because the accountant is the last person to leave any job site and must make sure everything is completed. Refer to Close-Out Matrix in the Appendix IV.

III. Main Close-Out Matrix

This is the main close-out matrix and is the one submitted to the Project Manager and the owner once close-out is completed – here Bill Kearny and DCAM respectively. Input into this matrix comes from all the different departments: engineers, accountant,

ECT CLOSE OUT LOG

BID PACKAGE	CONTRACTOR AWARDED	GBC Contract #	Complete By	General Guarantee
Site Preparation/Utilities	Marois Brothers, Inc.	29142		
Site Improvements/Landscaping	Francis Harvey & Sons, Inc.	38057		
Pressure Injected Footings	G. Donaldson Construction Co., Inc.	29209		
Concrete Foundations & Structural Slab	Francis Harvey & Sons, Inc.	29211		
Concrete Slabs	Harvey/Hanford JV	34016		
Masonry & Architectural Precast	G. Prunier & Sons	31119		
Structural Steel	Beace Atlas	29989		
Miscellaneous & Ornamental Metals	Berlin Steel	33174		
Millwork	Beaubois	35360		
Roofing	Titan Roofing	32219		
Waterproofing & Dampproofing	NER Construction	32217		

Figure 7 – Sample Insert section of the Main close-out Matrix

superintendent, and project managers. It is in the top of the "food chain" because all close-out information regarding each and every bid package is condensed into this main matrix. One of the main uses of this matrix is to monitor the effectiveness and progress of close-out and to see what percent of the project is complete and how much work is remaining. The main matrix is created when the construction begins finishing phase. Refer to Close-Out Matrix 4 in the Appendix IV.

Remarks

- There is no clear responsible party from the engineers or the superintendents for checking off the completed items, thus causing confusion and frustration in the assignment of tasks.

- A lot of information from the Subcontractor Close-out Status matrix is included in this main matrix.

E. Rolling Completion List (RCL) and Punch List

As the construction phase is progressing and each subcontractor is completing his work, a number of construction items/deliverables do not satisfy the CM standards as specified by the owner/architect. These items are compiled together in a number of lists that are called Punch list and the rolling completion lists.

RCL is a list of items that need to be completed for all open or change items. The list is called by that name because of its constantly developing and updating nature. On the Worcester Trial Courthouse Dan Manescu, the QA/QC on the project creates the list and registers it on Prolog. The list gets checked by all the superintendents and the project engineers. The punch list is created after construction effectively ends on the project from the remaining items that had not been addressed in the RCL. All the items on RCL and Punch List need to be completed in order to completely close-out a subcontractor. Figure 8 is photo shot of an RCL. It includes the subcontractor, bid package, Description of the item and schedule completion date.

#	Responsible Contact	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Scheduled Completion Date	Punchlist Classification
35	Fred Collins - 03A	53	Building					Ground level exposed concrete casing columns to get smooth finish on the visible sides.	6/27/2005	Dan Manescu - GBCO	7/25/2005	
36	Fred Collins - 03A	37	Building		Floor 1			Rebar at the side of the window openings. On the Foundation Wall on the sides of each opening in the masonry wall instead of #5 rebar Harvey will install one #6 at 4" each side and one #6 at 8" each side. The #5 rebars on each side of the openings will be replaced by #6 rebars. Replaced by SER instructions. Work completed and accepted. Item closed.	4/6/2005	Dan Manescu - GBCO	4/15/2005	
46	John Harvey - 03A	196	Building		Floor 2		South	The sidewalk section between the main sidewalk and stair #6 door is sloping towards the stair #6 door. The slope of that sidewalk section has to be corrected per approved drawings and specs.		Dan Manescu - GBCO	12/20/2006	
47	John Harvey - 03A	185	Building		Floor 2		South	Missing boxout for handrail at stairs #8 and 9 at 3rd floor		Dan Manescu - GBCO	10/31/2006	
48	John Harvey - 03A	41						Concrete finish in areas with a 6" toping - 1st deck S-E corner		Dan Manescu - GBCO		
49	John Harvey - 03A	31	Building		Floor 1		East	Incompleted ground floor shower depressions. See RFI #510 - attached procedures.		Dan Manescu - GBCO		

Figure 8 – Example of RCL

F. Close-Out Letters

Close-out letters are letters issued by Gilbane to the subcontractors (accountant- Monica Snow) late in the project to notify the subs of the status of their packages and the remaining items needed for close-out.

Close-out letters are a very important part in the process because they focus the subcontractor's attention to the outstanding items on their part to complete their close-out. Close-out letters are issued per each package and they include: Punch list items, submittals, open change requests, waiver of lien and, accounting documents. A close-out letter sample can be found in Appendix III. Close-out letters are issued to subcontractors who have completed a substantial portion of their scope- usually over 90%.

3.2 Close-Out Contributions

The best way to learn and understand a subject is to fully engage and in the whole process behind it. Our MQP group worked closely and was involved with everyone in the Gilbane WTC office. Our work consisted of providing the site team with assistance and information needed for close-out.

Weekly Meetings:

We met with Monica Snow regularly to discuss the status of the project, close-out and current procedures. Monica was an excellent guide throughout, and demonstrated how Gilbane conducts their close-out. In these weekly meetings all different departments of Gilbane made an attendance, from accounting to engineers. The site staff was heavily involved in construction-related activities thus dedicating most of their efforts and time towards that goal. Our group helped keep their focus on close-out by attending regular close-out meeting that kept the process in the back of their radar. Site Engineers attended the meeting in order to provide input from a different perspective on close-out. All the minutes of the meetings can be found in Appendix I.

The Gilbane team requested that our team to acquire a full experience in the close-out process so we were assigned the following close-out related tasks:

Specifications

The task was to go through the specifications for a few bid packages and find out all the related close-out items and submittals. We then inserted them into the bid package matrix. The items we found were submittals of warranties, as-built drawings, and attic stock. The followings are an example of the packages in the matrix:

- 02A
- 02B
- 16A

The matrix we created was used in the close-out letters sent to the subcontractors. The full matrix can be found in Appendix IV.

RCL and Punch list

By February 2007, there ware 9 bid packages over 90% completed and it was the right time to send out close-out letters to the subcontractors responsible for those packages. After a meeting with Monica Snow it was decided to have those letters sent as soon as possible so we were assigned to extract RCL items from Prolog intended for the packages that needed to be closed out. We then went through the list with Mr. Manescu and we gained an understanding of the size and scope of the remaining work to be completed.

Owner and subcontractor meetings

Attended meetings to observe what goes on between the owner/Architect and Gilbane. Change orders and construction schedules were the main topics of discussion in the meetings. A lot of attention was addressed to change orders, which significantly affect the cost and time it would take to complete the project. Refer to Appendix I for a full copy of the meeting minutes.

Site visits

Site visits with Dan Manescu, the QA/QC for Gilbane, were conducted to see how the Gilbane handles the open items. After a RCL list was generated from Prolog, we went through the courthouse, to see items which the subcontractors had forgotten. Figure 9 is an example of two uncompleted items which have been added to the rolling completion list. The first one is where grout between the stucco has been not fully filled at the bottom. The second is at the railing where the cement is not fully filled to the top.

Figure 9 – Example of RCL Items

Another example can be seen in figure 10 where the original design did not take into account the furniture. The electrical switch will require an open-change, which means that it will result in open submittals for plans and specifications. The project is in the finals stages of construction but small changes still arise since it is a fast-tracked project.

Figure 10 - Example of Required Change Order

A site tour with a superintended from Gilbane, Jim Barnett, was done to see how subcontractors are handled in terms of close-out and the safety precautions taken on the job site. The detail of the tour can be found in Appendix I. Tour.

3.3 Observations

The main purpose of this academic project management assignment is to observe and examine the current processes that are being utilized as part of the delivery system of a construction management company, Gilbane. Our involvement in close-out (from September 2006- March 2007) started early in the process where only one close-out letter had been sent out for a nearly completed package. By means of our weekly meetings with the Gilbane staff and owing to the amount of knowledge that they offered to share with us we were able to document our observations about close-out in this chapter.

The close-out process is outlined at the beginning of the project and each member is responsible for a certain part. Close-out is not discussed or no real work or effort is put towards close-out from the engineers until the later stages of the project. On the other hand the senior accountant on the project, who is also responsible for three to four other projects, is the one person who keeps pushing to go forward with close-out. That does not happen very efficiently because of the heavy involvement with other projects as well.

The project staffing is below the number needed to accomplish the project requirements and specifications to meet Gilbane's standards. This means that engineers who are responsible to attend to close-out are often busy with field activities. Also, this project team has no senior engineer who usually coordinates close-out. The reasoning behind this is the shortage of personnel at that moment of time. According to Mrs. Snow, Gilbane had won a number of new projects in the last two years which caused this shortage of staffing.

After meeting with Gilbane project team, it was understood that there is low communication between different project members in regard to the close-out process. Currently, there are several layers of organization of the process. The close-out is broken down to different categories and tasks which accountants, engineers, and superintendents are individually assigned to accomplish. Each level of organization starts with specific data, according to the responsible party, and then develops into a broader and more general matrix. Thus, the close-out information and detail starts at a very specific level of the organization and as it moves up, details are summarized into main close-out items. See figure below.

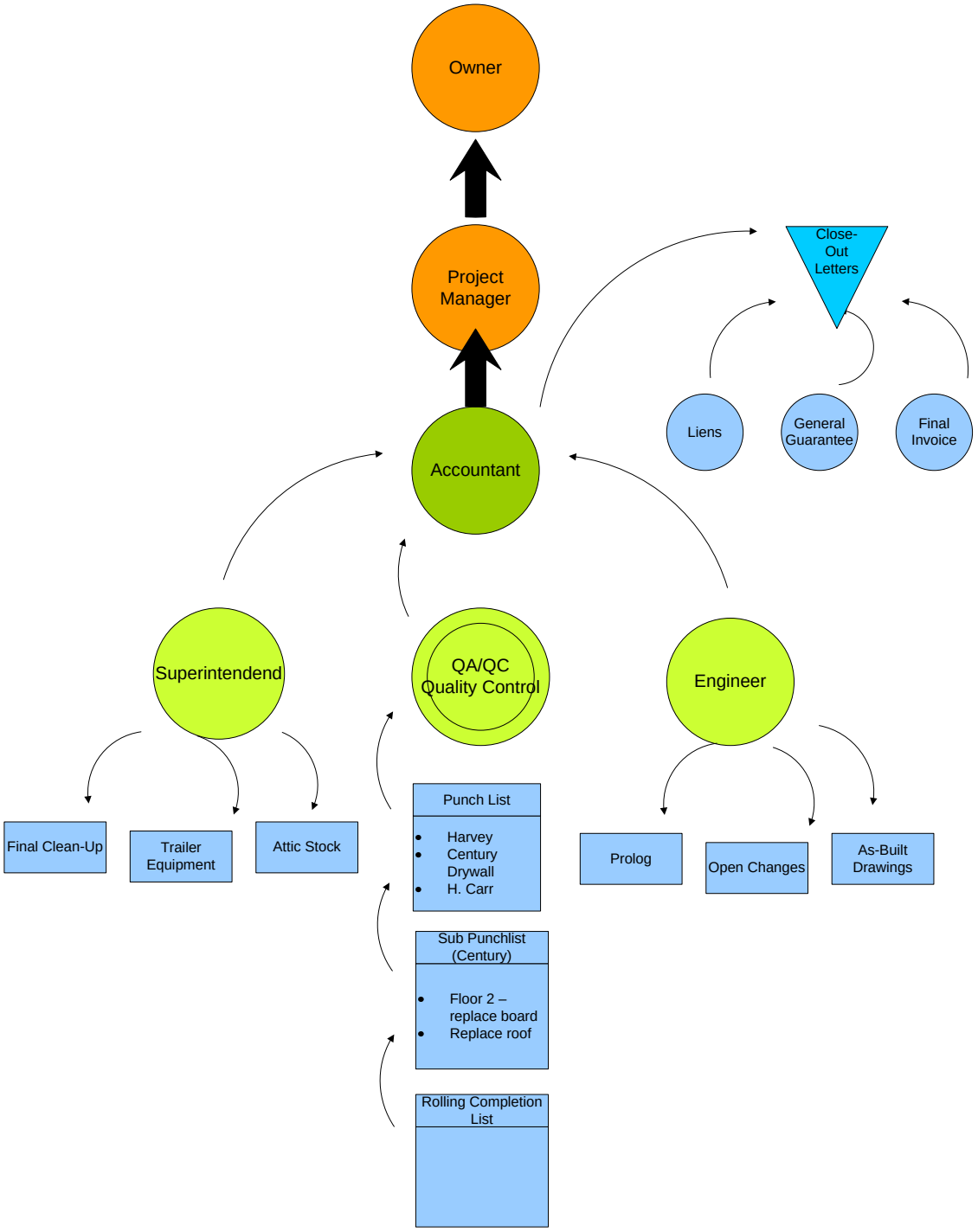

Figure 11 – Organization and Responsibilities in Close-out

The Graph describes how close-out responsibilities are divided between the different project members working on the Worcester Trial Courthouse. The three main departments responsible for the close-items are: the Accountant, the Engineer and the Superintendent. The quality engineer is responsible mainly for the punch list and rolling

completion list items. The RCL is a very important part of close-out because it is a way of checking the uncompleted items and the items that need to be fixed. The accountant is the main player in the close-out process. The accountant's direct responsibilities include the following: General Guarantee, Release of Liens, Final Invoice, Final Subs/Suppliers waiver, sales tax certification. The accountant is also responsible mainly for putting the entire close-out items that are done by the superintendent and the engineer together and issuing 'close-out letters'.

A good example that illustrates the current organization is the punch-list and rolling completion list. The rolling completion list is created by the quality engineer after he inspects the completed work done by a subcontractor. It includes items that are not done properly or items that need to be replaced or fixed. As the project progresses, the rolling completion list becomes a subcontractor-specific punch list which identifies items that need to be addressed by a specific subcontractor. A general punch-list is also created that includes every subcontractor on the project and that is presented to the project manager who in turns presents to the owner as part of close-out.

It was understood that close-out was first estimated to be completed 90 days after June 15th, September 2007– the date of completion of the project- However, according to Monica Snow and Mike Forwood, the close-out is now estimated to be completed in December 2007 or beyond that. This will result in Gilbane having to incur over $200,000 a month of job overhead cost if the delays do not get approved by DCAM.

We observed that the communication between the different parties involved in the process is low. A project team meeting is held at the beginning of the project where close-out is discussed and the responsibilities are outlined. Each team member seems to know what their close-out responsibilities are and when to do them; without having formal communication with other members of the project. Eventually this causes considerable close-out delays. The team members are not motivated/ready to start the close-out process because they are busy with constructions activities.

Another major problem that was observed is the lack of experience on behalf of the site engineers in the close-out process. On this 150 million dollar project, only the accountant had previous experience with Gilbane's close-out processes. Even after three years on the project, many of the staff members did not have a clear understanding of

contractual responsibility that Gilbane had with the subcontractors and the owner. The project executive and project manager's direct involvement in close-out is very limited. The accountant is the team leader when it comes to close-out with both the project executive and manager delegating close-out work to the accountant. For example, when Monica Snow felt that the close-out process was lacking, she 'red flagged' the Gilbane home office informing them of the close-out delay and not the project executive or manager directly.

The other issue that we think is important and not addressed is the utilization of Prolog in the close-out process. Prolog has a close-out section but it is not used. Instead, the Gilbane team only uses submittals sections for the rolling completion list (punch-list).

Subcontractors are responsible for sending all close-out items to Gilbane. A lot can depend on them because once they leave the project it is very hard to get them back to work on it or submit the required close-out items. For example, Bartlett Center is still not 100% closed out after 1 year of completion with 1 package still pending (open). So it is essential to start the process of closing them out before they finish all of their work. Even though Gilbane retains a small portion of the subs money -that is usually not released until the package is closed-out- subcontractors often get new contracts that will earn them more money once they move their staff onto the new project.

Change orders had a direct effect on close-out. It was observed that change orders affected project delivery, cost and eventually close-out. This type of delay was entirely out of Gilbane's hands. The Worcester Trial Courthouse is a fast-tracked project where there are unknowns and contingences, as the project neared completion, the unknowns started to clear and a very large number of change orders were generated by the owner. The vast amount of change orders causes the engineers to be extremely busy with field work. Hence, they do not dedicate enough time or attention towards close-out.

Change orders take a lot of time to process and complete from the time a request is filed until it is approved and then completed. In a 'normal' project this takes an average of 20 days. However, on this particular project change orders take at least 2 months and that goes up to 6 months in some cases. According to Dan Manescu and based on some findings from Prolog, this project has over 1000 change orders. This is due to the nature of the project- DCAM and CM @ Risk. Change orders on the courthouse had

significantly affected the schedule. Although original contract documents stated that the building must be closed-out within 90 days of substantial completion, which is June 15 2007. The estimated date for Gilbane to close-out the entire project had been moved from September 2007 to December 2007.

4.0 Alternative Design of Foundation

4.1 Introduction

Our capstone design investigates and analyzes the use of two types of foundations, the existing PIF foundation method and the proposed mat foundation method, under similar soil conditions. These are two different types of foundations, the PIF foundation being a deep foundation whereas the mat, a form of spread-footing, is a shallow foundation. This chapter outlines differences between the two methods, how they were investigated according to schedule, labor and cost, and how the results of our analysis illustrate which method was a smarter choice.

Deep foundations

Deep foundations are foundations for structures and/or other heavy loads that circumvent weak or compressible soil layers to provide adequate support for the structures or loads mentioned above. There are multiple different types of deep foundations:

- Piles
- Drilled shafts
- Caissons
- Piers
- Earth stabilized columns.

Shallow foundations

A shallow foundation is a type of foundation that does not penetrate the ground surface as much as a deep foundation. These foundations are most preferable for smaller structures, but are used for bigger structures with larger loads as well. The common forms of shallow foundations are spread-footing and mat foundation. These types of foundations consists of a ‘mat’ or layer of concrete which extend below the frost line and transfer the weight from walls and columns to the bearing soil or bedrock. Mat foundations are considered when a great amount of load needs to be supported under poor

soil conditions or because the labor intensiveness of deep foundations proves to be inefficient and expensive.

The following sections explain mat foundations, the circumstances where they are used and different types of mats with a brief description of the two methods about how they are designed and what variables affect their design.

Mat Foundations

The foundations of the Worcester Trial Courthouse were built using a deep foundation system known as Pressure Injected Footings (PIF). In this study, the design of a mat foundation and its feasibility are considered as an alternative shallow foundation. Mats are a form of shallow foundation, where a mat is essentially a very large spread footing that encompasses the entire footprint of the structure. They are also known as raft foundations and are always made of reinforced concrete.

Mat design foundations are considered under the following conditions:

- The structural loads of high extremities, or under poor soil conditions, are circumstances when large spread footings should be considered.
- Unpredictable soil conditions lead to excessive differential settlements, where the soil is not evenly distributed making judgments based on soil settlement difficult. The structural continuity and flexural strength of a mat will bridge over these irregularities.
- The structural loads are not uniform causing excessive differential settlements.
- The lateral loads are not uniformly distributed through the structure and thus may cause differential horizontal movements in the spread footings or pile caps. The continuity of a mat will resist such movements.
- The uplift loads are larger than spread footings can accommodate. The greater weight and continuity of a mat may provide sufficient resistance.
- The bottom of the structure is located below the groundwater table, so waterproofing is an important concern. The mats are monolithic and easy to waterproof.
- The weight prevents the mat from hydrostatic uplift forces from the groundwater.

- The bedrock, or as in the case of the WTC the glacial till, is very deep; boring piles in such cases may stretch the 'injecting process' over a long period of time, making it more expensive. With a mat, some of the soil can be excavated the differential can be automatically achieved, saving time and labor costs.

In the case of the WTC many of the conditions aforementioned were present. The soil conditions were far from ideal; the alluvial deposits were to be disposed and further excavation had to be performed for decontamination procedures to be put into effect. The glacial outwash was sloped at an incline, shallow in some areas and deeper up to 20 feet in other areas, making the soil settle in a non-uniform method.

The placement of the proposed mat foundation with respect to the water table was not a problem as the water table was at a sufficient depth beneath the mat foundation. The frost line issue was also eliminated as the mat foundation was assumed to be provided with sufficient water-proofing admixtures and measures taken to avoid frost lenses in the concrete. In comparison with the PIF method, the mat would also be easier to water-proof.

4.2 Different Types of Mat design foundations

There are two basic types of mat designs: Rigid and Non-Rigid. The rigid method assumes there are no flexural deflections in the mat, so the distribution of soil-bearing-

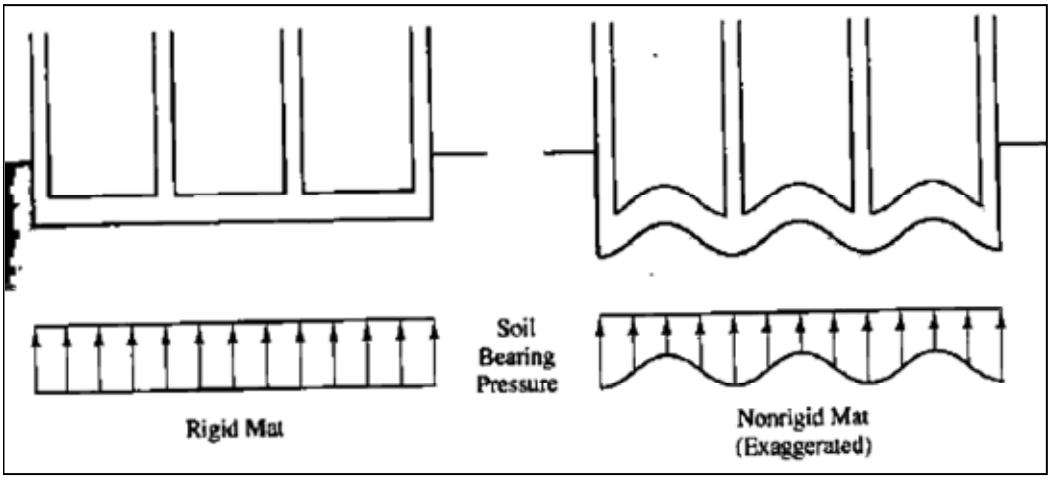

Figure 12 – Rigid Mat vs. Non-rigid Mat

pressure is considered to be uniformly distributed under the building. In contrast, the

pressure distribution in the non-rigid mat is non-uniform around the soil. This is illustrated in Fig 12.

Rigid Methods

This is the simplest approach to structural design of mats. Also known as the conventional method of static equilibrium, this method assumes that the mat is much more rigid than the underlying solids, which means any distortions in the mat are too small and will not significantly impact the distribution of the bearing pressure. The magnitude and distribution of the bearing pressure depends on the applied loads and weight of the mat. This is either uniform across the bottom of the mat or varies linearly across it.

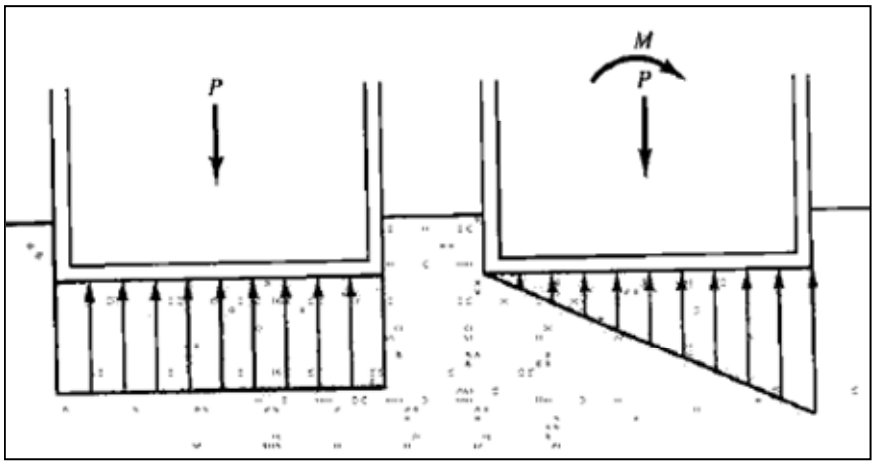

Figure 13 – Different types of loading interactions

This distribution makes it easy to compute the flexural stresses and deflections in the mat, and for analytical purpose the mat becomes an inverted and simply loaded two way slab. Hence, all the shears, moments, and deflections can be easily computed using the understanding of structural mechanics. But, since the width-to-height ratio is greater than those in slabs, the assumption of rigidity is no longer valid. Some portions of the mat may sag where there are greater loads and the redistribution of bearing pressure is not taken into account. Shear, moments and deformation estimates are not reliable.

Non-Rigid Methods

These methods produce more accurate values of mat deformations and stresses compared to rigid methods, even though they are more difficult to implement as soil-structure interaction understanding is required and analysis is not as simple. There are many types of non-rigid designs for a mat foundation; these are namely: Winkler Method, Coupled Method, Pseudo-Coupled Method, and Multiple Parameter Method. Out of these the Sub-Grade Reaction Method and the Finite Element Method are used extensively, which are briefly described as follows for understanding purposes:

Coefficient of Sub grade Reaction

This method of describing bearing pressure is called a soil-structure interaction analysis because the bearing pressure depends on the mat deformations, and the mat deformations depend on the bearing pressure. Non-rigid methods must take into account that both the soil and the foundation have deformation characteristics which may be linear or non-linear. The deformation characteristics of the soil are quantified in the coefficient of sub-grade reaction, or k_s. Fig 14 shows how k_s form the basis of the "bed of springs" analogy.

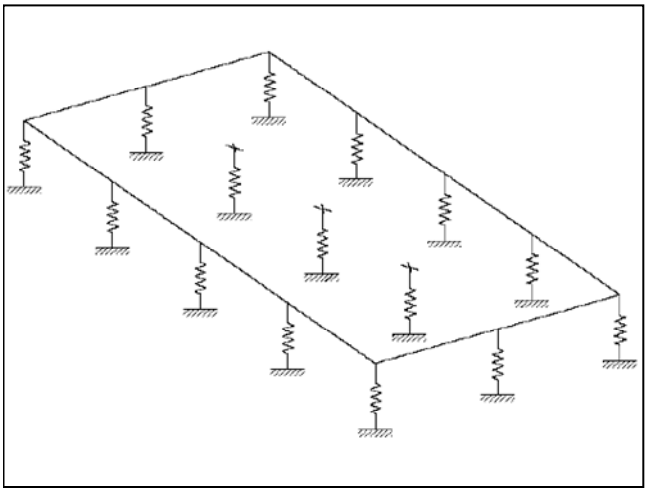

Figure 14 – Bed of springs

This method uses a simple concept: The sum of these springs must equal the applied structural loads plus the weight of the mat, as illustrated by the following equation:

$$\sum P + W_f - u_D = \int qdA = \int \delta \, k_s \, dA$$

$$k_s = \frac{q}{\delta}$$

Where:

k_s = Coefficient of sub-grade reaction

$\sum P$ = sum of structural loads acting on the mat

W_f = weight of the mat

u_D = pore water pressure along the base of the mat

q = bearing water pressure between mat and soil

A = mat-soil contact area

δ = settlement at a point on the mat

Finite Element Method

This method is an alternative method to the one-dimensional spring system (which makes the system simple to perform structural analysis). It models the mat, soil and superstructure in a three dimensional way. This method divides the soil into a network of small elements, each with defined engineering properties and each connected to the adjacent elements in a specified way. In theory, it should be the most accurate method as it divides the proposed area the foundation is spread over into a "pixel" like format. The structural and gravitational loads are then applied and the elements are stressed and deformed accordingly.

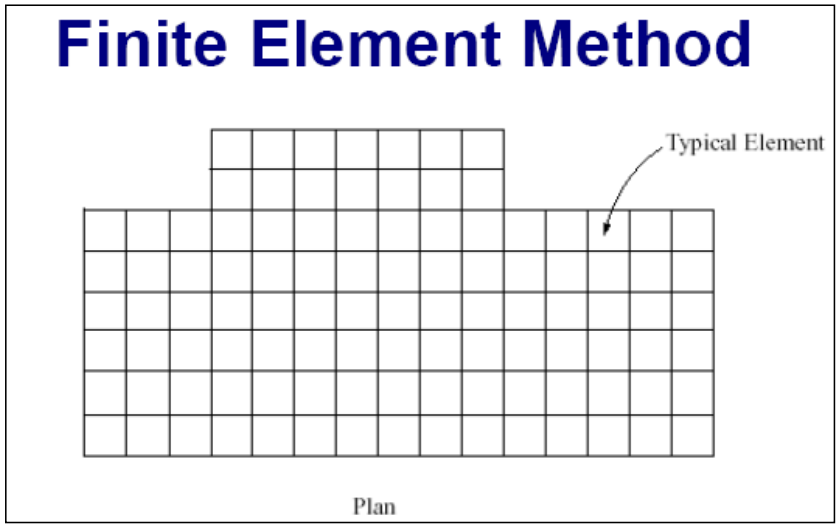

Figure 15 – Plan view of Finite Element Method

Fig 15 shows an example of a plan view where a site may be separated into tiny "pixels" for analyses of a unit area of land allowing independent reactions due to highly variable soils (meaning different soil bearing capacities).

4.3 Structural Design

Designing shallow foundations has its advantages and disadvantages. It may be affordable by cost and simple in regard to construction procedure, but it has settlement issues and the foundation is subjected to pullout, torsion and moment. The mat foundation consists of concrete not does not require intensive labor expertise, but it limits the capacity of the soil structure.

The structural design requires two types of analyses: Strength and serviceability.[3] Before we can design the mat and make a decision about which method to use, we must look into a several factors as follows:

Soil Report:

The foundation engineering report for the proposed Worcester Trial Court House, Worcester, Massachusetts was conducted and prepared by McPhail Associates, Inc. The soil analysis was conducted on April 19th, 2002 and submitted to SBRA, the architect. To explore the possibilities of our alternative foundation design we made use of this report to calculate the bearing capacity of the soil. The soil report can be found in Appendix VIII.

The soil analysis site was bounded by Thomas Street to the north, Commercial Street to the east, Central Street to the south and Main Street to the west with dimensions of 240 by 340 feet in Downtown Worcester. Boring samples were taken every five feet (12 soil borings, 4 observation wells) on locations based on a 20-scale site plan using hollow stem augers (3-1/4-inch diameter) and wet rotary boring drilling techniques.

Fig 16 on the following page shows a cross-sectional profile of the earth as bore holes are made to investigate the depths of different soil strata at different depths. Fig 17 shows a plan view of the exploratory bore holes made on site. It can be clearly seen that the glacial till at the WTC site was not uniform, varying at depths of 25 to 30 feet at the commercial street end and to very shallow depths near the Main Street end.

[3] Foundation Design by Coduto

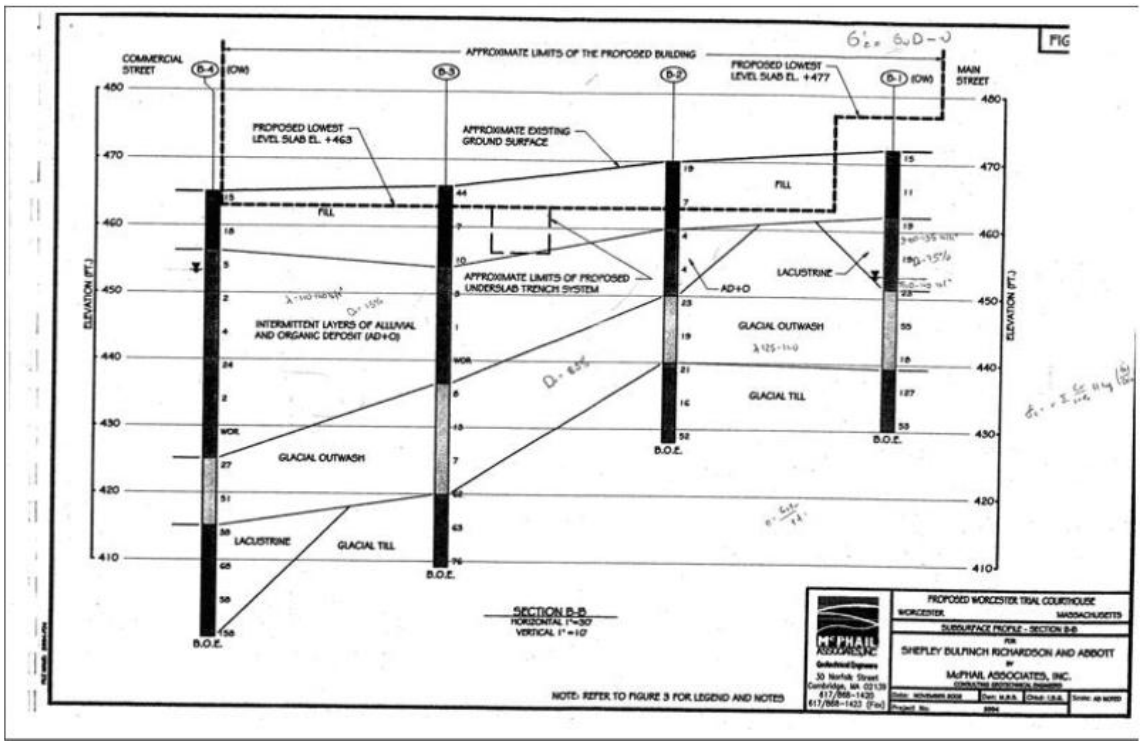

Figure 16 – Cross-Sectional Profile of Bore Holes

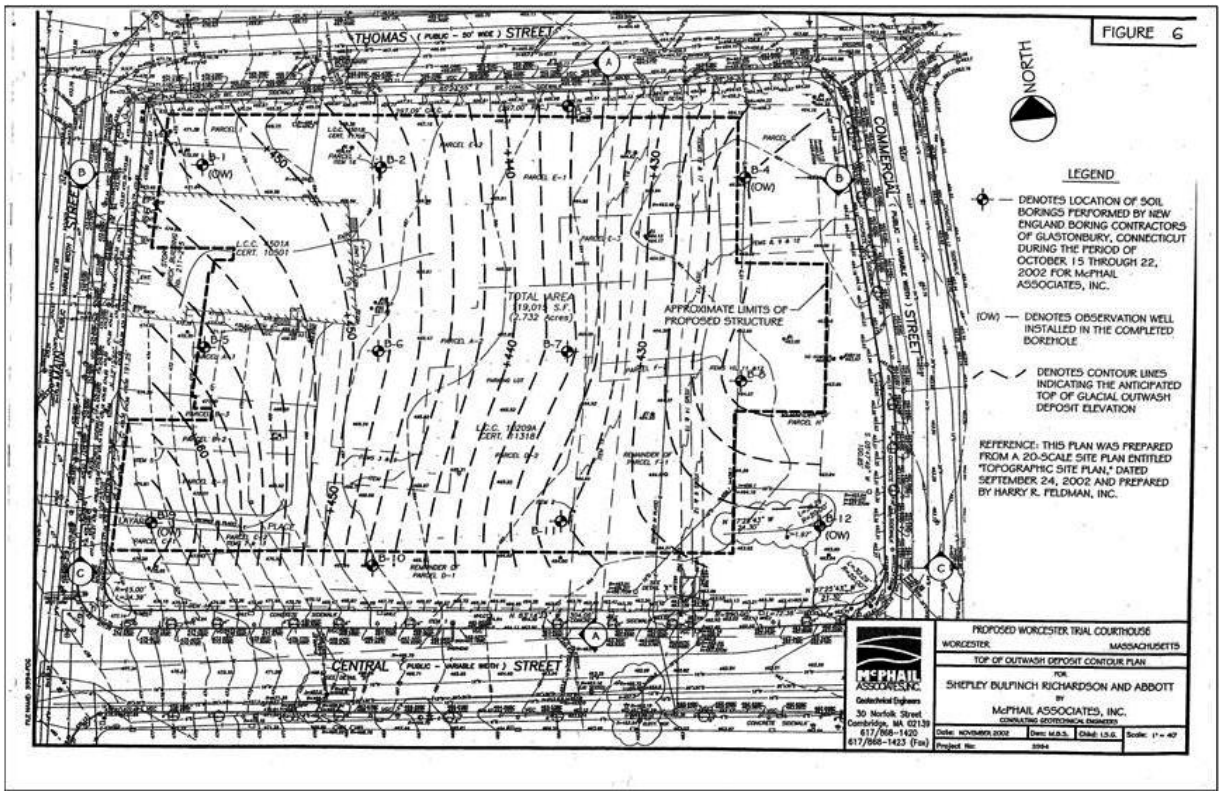

Figure 17 - Side Profile

The soil was determined to consist of different layers of soil with different properties. The following was discovered about the soil:

Table 1 – Soil Types at WTC

Soil Type	Depth	Description
Granular fill	Proposed structure underlain with a layer 9 – 18feet thick.	Dark brown well-graded mixture of silt, sand and gravel containing various amounts of brick, ash, and cinders.
Alluvial fine sand and silt	Underlying the granular fill to depths of 15 to 40 feet from ground surface.	Fine sand and silt, and organic deposits from the Blackstone river. Soft dark brown loose to compact silt and peat with occasional fine sand lenses.
Glacial outwash	Underlying the Alluvial fine sand and silt	Compact to dense, brown to gray, consisting of sand and gravel with a trace to some silt.
Glacial till	30 to 60.5 feet below the existing ground surface	Dense, gray to brown glacial till deposit. Consists of a well-graded mixture of silt, sand and gravel with cobles and boulders and is generally underlain by the bedrock surface.
Bedrock	From 45 to 80 feet below the ground surface	Very hard, fresh to slightly weathered, sound to extremely fractured granite.
Groundwater	Elevation +454.7 to +453.3, at depths of 9.1 to 21.5 feet below the ground surface	

The boreholes, made to depths ranging from 36 – 80 feet (glacial till) and observation wells with well tips at 20 feet intervals enabled soil samples to be taken, which were then tested in the lab. By conducting sieve analysis tests, different grain size distributions were obtained. For the given soil conditions after laboratory testing, McPhail Associates, Inc. recommended that PIFs be used, bearing in the outwash deposit. For heavily loaded columns 120-ton design PIFs and for structurally supported lowest level slab 50-tons per unit were recommended (near the main street area, where the

glacial till is at a higher elevation, the depths being closer to the ground surface. The grain-size distribution charts can be found in Appendix VIII Soil Report.

To effectively design the mat foundation, the differential settlement was taken into account, which is the difference in settlement between two points on a single foundation. Excessive differential settlement is troublesome because it distorts the structure and thus introduces serviceability problems, for example, under clayey soil conditions, a structure will start to sink to sub-surface elevations; the front door would be inaccessible.

Differential settlements may be caused by several factors. The most important ones that concern our case are:

- Variations in the soil profile: this occurs when part of the structure is underlain by stiff natural soil, or glacial till, and part by a loose, un-compacted fill. Such a type of soil may cause the structure to excessive differential settlement due to the different compressibility of these soil types.
- Design controlled by bearing capacity: In some foundations, the design is controlled by the bearing capacity and not by settlement, so even the design settlement may be less than that of other foundations in the same structure.

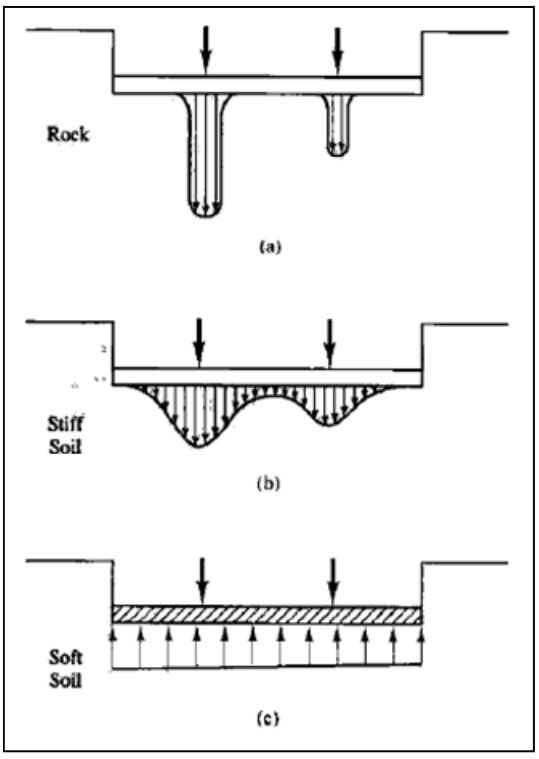

Figure 18 – Different types of Soil Reactions

It must be noted that the mat will react differently under different soil conditions. Fig 18 illustrates how it may react under conditions of (a) Rock, (b) Stiff Soil, and (c) Soft Soil:

This makes the rigidity of the mat foundation vital and an important influence on the impact the foundation makes on the soil. Another advantage with using our alternative to foundation design is that using the mat foundation provides sufficient rigidity.

In this study, the differential settlement issue has been ignored as the impact is very small; the weight of the mat itself helps in the settlement of the soil. Ideal conditions are assumed.

Loading capacity of the Mat

The determination of the design load for the alternative mat foundation design was quite simple. The PIF report was obtained from Gilbane's Prolog website as shown in Table 2, contains the number of PIFs with their respective design load capacities as indicated in the table below. Each PIF is designed to carry loads with safety factors enforced on them, supporting a certain percentage of the building dead and live loads, some with higher capacity (120-ton) to carry loads due to longer length (30 – 50 feet) or intermediate capacity (50-ton) shorter lengths.

Table 2 – Number of PIFS at WTC

AREA	PIFs in Place	PIFs Poured	Remaining to Pour per Area Installed	% Complete
1	353	345	8	98%
2	343	310	33	90%
3	25	16	9	64%
4	116	114	2	98%
Grand Total	**837**	**785**	**52**	**94%**

To calculate the total capacity of the mat foundation, instead of revisiting the structural drawings to calculate the loads, and therefore weight of the entire building on the mat foundation, we worked backwards using the total capacity of all the PIFs.

Using this method, we summed the total tonnage capacity for higher and lower capacity PIFs, calculating the total tonnage capacity of all the PIFs combined, and assigned that very value to the mat design. We achieved this by listing a total of 837 PIFs on MS excel, each with a 120-ton, and summing the total number in order to calculate the total capacity of 100,440 tons. A copy of the excel file can be found in Appendix VIII.

After the loading capacity of the mat had been determined, many other factors had to be looked into such as bearing pressure and determining the settlement of the

foundation due to the combined weight of the structure and the concrete mat foundation. Assuming a rigid foundation, the bearing capacity, settlement and the stress distributions beneath the foundation had to be determined.

Bearing Pressure

The bearing pressure is the relationship between the mat foundation and the soil it interacts with. This is the contact force per unit area along the bottom of the foundations. The distribution of the bearing pressure may or may not be even distributed; in our case it is evenly distributed, apart from the main street area, where spread-footings are used for supporting the slabs.

If the soil distribution is erratic and prone to excessive differential elements, the structural continuity and flexural strength of a mat will bridge over them. If the structural loads are variable, again, the rigidity of the mat will absorb these irregularities, as mats are more flexible than spread-footings. . The mat, after waterproofing treatment, is considered to be monolithic, allowing the mat to resist hydrostatic uplift forces from the groundwater.

Bearing pressure is calculated by using the formula

$$q = \frac{P + W_f}{A} - u_D$$

Where:

q = bearing pressure

P = vertical column load

W_f = Weight of foundation + Weight of soil above foundation

A = base area of foundation

u_D = Pore water pressure under foundation

The following steps are followed in the determining the total settlement:

- Total Settlement values will be calculated using the 'bed of springs' method after which the shears, moments and deformation in the mat can be computed.
- General Methodology includes drilling exploratory borings at the site of the proposed foundations and obtaining undisturbed samples of the soil strata.

- Perform consolidation tests and divide the soil beneath the foundation into layers. Compute σ_{z0}' at the midpoint of each layer.
- Using the simplified method, calculate the $\Delta\sigma_z$ at the midpoint of each layer.
- Compute σ_{zf}' at the midpoint of each layer.
- Categorize soil in either consolidated soils ($\sigma_{z0}' \approx \sigma_c'$), over-consolidated soils – Case I ($\sigma_{zf}' < \sigma_c'$) or over-consolidated soils – Case II ($\sigma_{z0}' < \sigma_c' < \sigma_{zf}'$), and calculate δ_c for each layer then sum.
- Calculate the distortion settlement using: $\delta_d = \frac{(q - \sigma_{zD}')B}{E_u} \times I_1 I_2$
- Compute the settlement using: $\delta = \delta_d + \psi\delta_c$

4.4 Design Procedure

The dimensions of the mat in plan view were taken to be 240' x 260'. This area was determined due to the inclination in elevation of the Glacial Outwash from Commercial Street to Main Street; the area where the elevation of the outwash was high enough was laid out with shallow spread-footings. The thickness of the mat foundation was determined by using the calculation methods documented in the book from *Reinforced Concrete Design: Mechanics and Design*[4] and *Foundation Design*

The factored loads were computed to be 3220 psf, applying a net load of 1288 kips on each column of dimensions 36" with a tributary area of 20' x 20'. Fig 19 on the following page clearly illustrates how this was done. This value includes all safety factors; the factored loads were deduced by backtracking PIF design capacities used by Gilbane with the PIF method in effect. The number of columns was determined by making a 12 x 13 column grid as observed from the structural drawings over the 240' x 260' square foot area. The factored net soil pressure was calculated as 3.22 ksf and the thickness of the mat foundation was determined to be approximately 3 feet. The spreadsheet with the calculations can be found in Appendix VIII as Mat Design.

[4] Page 805, example 16-2

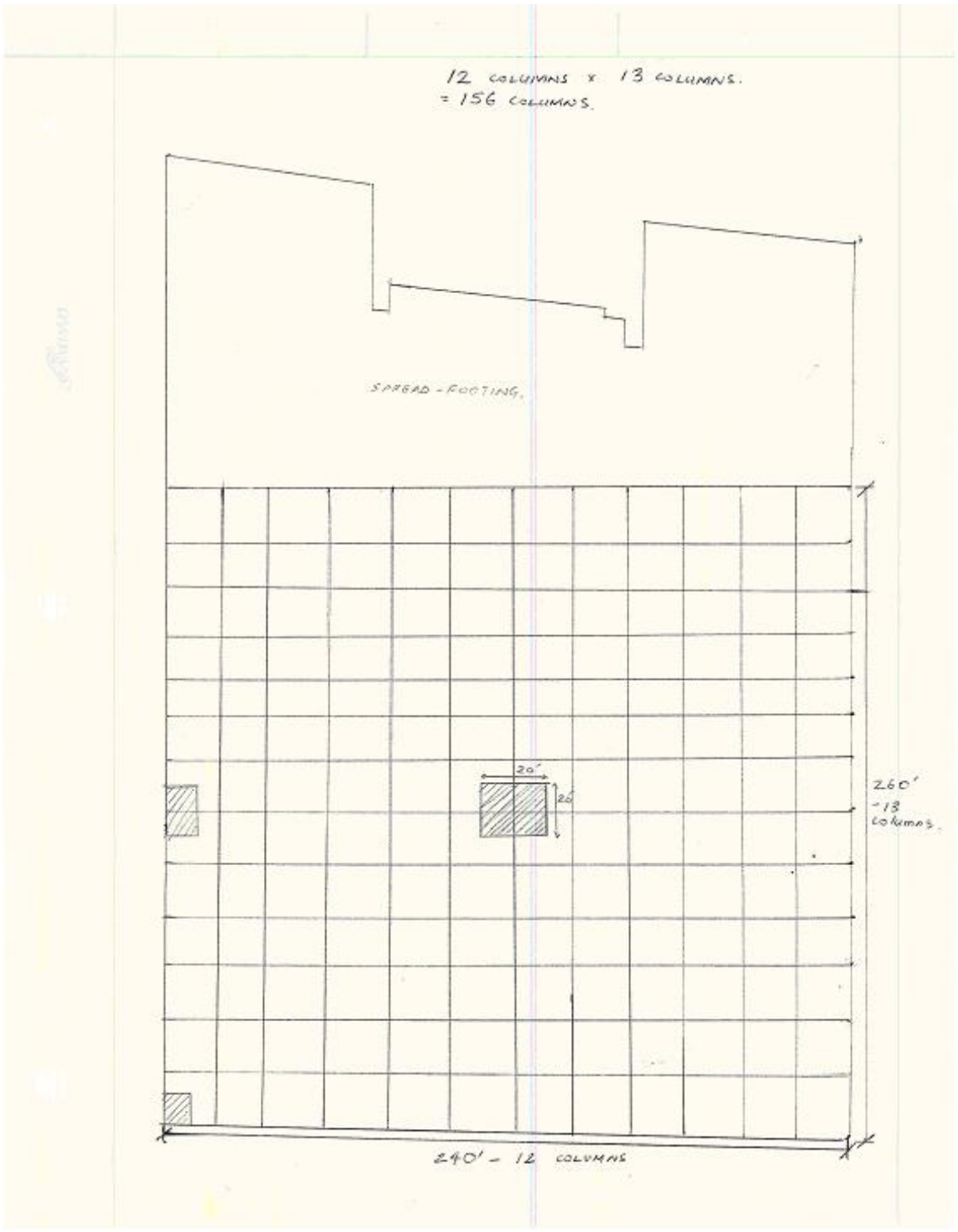

Figure 19 - Plan View

The thickness was tested for two-way shear; our smallest $ØV_c$ value of 3363.76 kips was greater than the V_n value of 1250.4 kips, satisfying our two-way shear capacity.

The mat was also checked for one-way shear and once again our $\emptyset V_c$ value of 828.16 kips satisfied the required V_n value of 225.4 kips.

The flexural reinforcement for the mat was designed as follows: the moment was computed and the A_s value we computed was 9.28 in^2; The minimum A_s was checked with reference to the ACI sections 10.5.3 and 7.12.2, and determined to be 27.99 in^2 and 11 no. 8 were tried at a maximum spacing of 18" and a greater A_s value was 10.27 in^2 was chosen and 13 no. 8 bars were used instead.

Check the development: Using table 8-1 from MacGregor, two cases were laid out using equations below for the development lengths. For no. 7 and larger bars the following two formulas were used:

$$l_d = \frac{f_y \alpha \beta \lambda}{25\sqrt{f'_c}} d_b$$

Case 1

$$l_d = \frac{3 f_y \alpha \beta \lambda}{40\sqrt{f'_c}} d_b$$

Case 2

Case 1 was used for clear spacing of bars being developed not less than d_b and Case II was used for $2d_b$. With these equations it was determined that with an A_s value of 9.28, 13 no. 8 bars with uncoated reinforcement should be used.

The bearing pressure of the soil was calculated assuming pore pressure to be zero as the water table was underneath the mat foundation elevation by a sufficient amount, and the pressure 'q' was calculated to be 2395 lb/ft^2.

From *Coduto's* excel files, we used the settlement analysis for shallow foundations interactive file to determine the net settlement using the "classical method". The net settlement we obtained was 8", resulting in 1541 cubic yards of additional fill required.

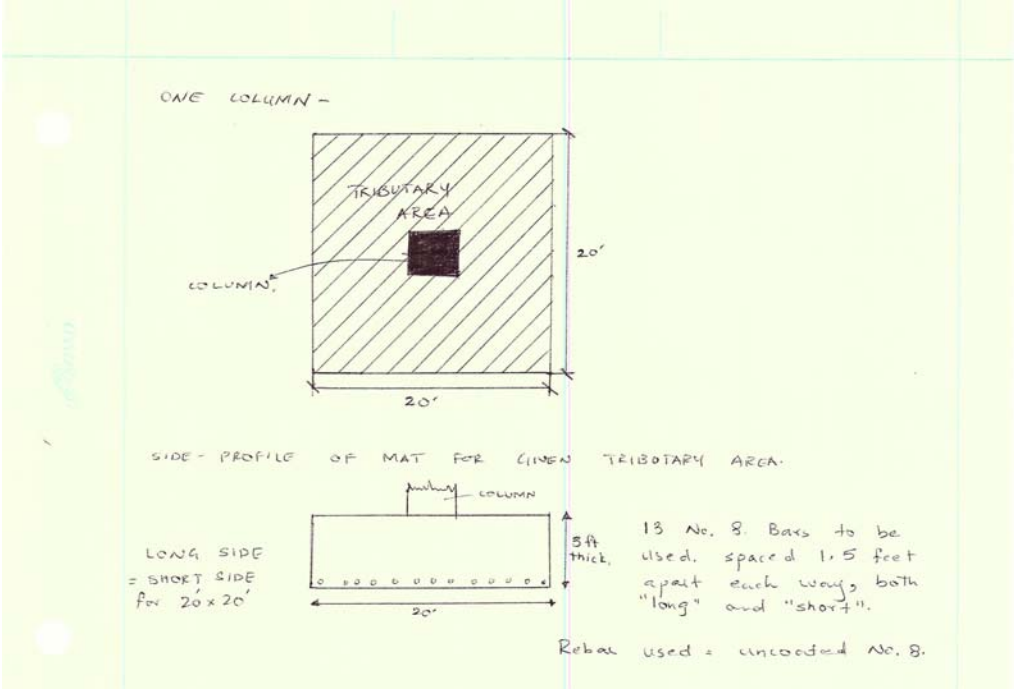

Figure 20 - Cross-section of Mat Foundation 20 x 20

The mat foundation passes by a large margin, so the soil within ranges of 130 lb/ft^3 was chosen. We selected Well Graded (WG) or Silty Gravel (SG). The soil was chosen such that after excavating the poor soil, the fill after compaction would have an 'N' value > 20. Our N_{60} values = 25, σ'_z value = 1597.6 and our Ø ≈ 29 degrees and c' was assumed to be reserved.

We used Coduto's Bearing Capacity of shallow foundation software (excel file) to determine qult and qa values for both the Terzaghi and Vesic methods as shown in our results, giving us allowable column loads of P = 2,619 k for the Terzaghi method, and P = 2,719 k for the Vesic method, meaning that our 1,288 k loads were within range. Our gamma values were computed as 128 lb/ft^3 when our D_w = 10 ft using a factor of safety F = 3. All the details of our calculations can be found in Appendix VII.

4.5 Design Analysis

After completing the design of the alternative mat foundation for the WTC it is important to analyze the components to assess the feasibility and constructability of the method. For our project purposes, a comparison between the PIF method and the Mat method was conducted in terms of cost, schedule, and quality.

4.5.1 Cost

The cost of the Mat foundation was found by researching material costs and summing up the following; all prices inclusive of labor and equipment costs:

- The cost of the process of replacing the contaminated soil with a soil that has better bearing capacity and consistency.
- Well Graded gravel at $22/cubic yard
- Concrete at $81/cubic yard
- Steel Reinforcement- $1075 per ton.
- Formwork - $8.7/ SFCA @ 3000 SF for walls.

A summary of all effective costs can be summarized in the following table:

Table 3 - Cost Summary Analysis

		PIF	Mat
Exacavation	Used in both Current and Capstone Design methods. Hence, ignored.	N/A	N/A
Fill		$755,445	$1,107,986
Compaction	Factor 1.15	None	$166,198
Concrete	F'c = 3000 psi		$561,600
Reinforcement	81120' of No. 8 Bars		$116,417
Forms	3000 SFCA		$26,100
Labor		Specialized	Only Need Concrete Labors
Time	After excavation and compaction	3 month	2 month
Overhead	The project overhead cost is $200,000. The PIF method still proves to be more expensive.	-	-

[5]

The excavation costs in either case were assumed to be the same, as it was mandatory for decontamination of the soil, hence these costs were ignored. The amount

[5] RSMeans – 62nd Edition, 2004.

of fill was calculated keeping in mind the fact that the poor alluvial deposits ranged to a depth up to 20 feet at one end, while it remained shallow at the other.

The volume of the trapezoidal void was calculated and the amount of fill (130 pcf, WG silty gravel) was multiplied by a compaction factor. The settlement was calculated using *Coduto's* settlement analysis interactive excel file, and an additional volume of sand with a compaction factor was added to ensure that the mat foundation along with the entire building does not settle any further.

Once the thickness of the mat foundation was calculated as outlined in our design procedure, the volume of concrete of relevant capacity required could be determined. The mat was designed to be of dimensions 240' x 260' x 3', totaling to a volume of 6933.3 cubic yards. The mat was also designed to be reinforced with uncoated No. 8 rebar, which also meant that formwork would be required. The dimensions of the mat were taken into account and the square footage of formwork and linear footage of rebar was calculated to be 3000 SFCA and 81120 LF respectively.

For all the material required, prices were thoroughly researched by calling up respective professional companies for quotes, researched online. The *RSMeans, Building Construction Cost Data* book proved to be a reliable source, and was used to estimate the total cost for our proposed foundation design.

The cost of the PIF method as mentioned before was obtained by summing up the sums of the bid packages that involve foundation work. For Gilbane's confidential purposes the detailed breakdown of the cost analysis has not been disclosed, although the total sum of the cost of the project is available. The total cost of both methods was found to be close. Deep foundation cost as a bid package was $1,617,800. The total cost of the mat foundations was estimated to be $1,987,000.

4.5.2 Scheduling

PIF Schedule:

Table 4 – PIF Schedule

Count of PIF #	
DATE	Total
7/23/2004	4
7/27/2004	9
7/28/2004	13
7/29/2004	12
7/30/2004	14
7/31/2004	11
8/2/2004	14
8/3/2004	12
8/4/2004	13
8/5/2004	7
8/6/2004	21
8/7/2004	15
8/9/2004	22
8/10/2004	18
8/11/2004	19
8/12/2004	19
8/13/2004	23
8/14/2004	12
8/16/2004	13
8/17/2004	15
8/18/2004	19
8/19/2004	19
8/20/2004	17
8/21/2004	13
8/23/2004	17
8/24/2004	10
8/25/2004	16
8/26/2004	13
8/27/2004	17
8/28/2004	6
8/30/2004	16
8/31/2004	22
9/1/2004	16
9/2/2004	14
9/3/2004	15
9/7/2004	13
9/8/2004	18
9/9/2004	6
9/10/2004	16
9/11/2004	19
9/13/2004	26
9/14/2004	29
9/15/2004	24
9/16/2004	28
9/17/2004	10
9/20/2004	9
9/21/2004	8
9/22/2004	8
9/23/2004	11
9/27/2004	8
9/28/2004	3
9/29/2004	8
9/30/2004	7
10/1/2004	8
10/4/2004	12
10/5/2004	13
10/6/2004	13
10/7/2004	17
10/9/2004	7
Grand Total	**837**

The PIF schedule was obtained directly from the Prolog website, courtesy of Gilbane Building Company. A wide range of PIF relevant data was made available to us including matrices regarding Actual PIF Count, PIF by Area, Obstructions, As-Built Variances, PIF by location, etc. According to this data, the first PIF was poured on 7/23/2004, and continued all through 10/9/2004 as shown in the adjacent table 4.

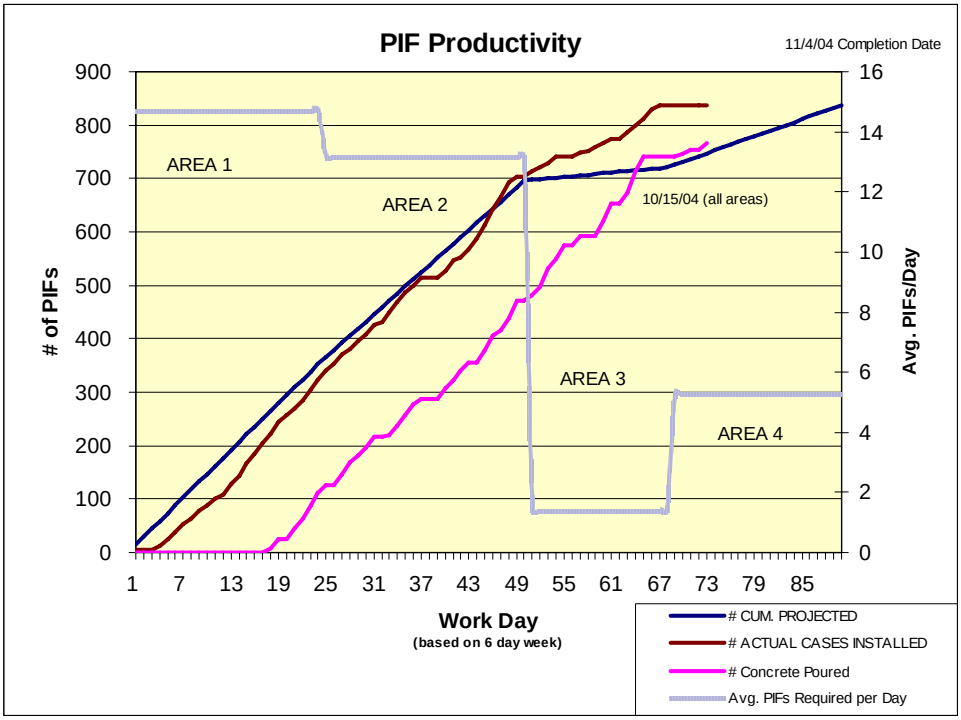

Figure 21 – PIF Productivity

Figure 21 shows the PIF Productivity by number of PIFs, by Work Days and Average PIFs per day. The total time it took to construction the pile foundation come to three months. Pile foundations are more labor intensive since different types of specialization is needed: carpenters, steel erectors, heavy equipment

operators, constant and careful engineering testing.

Mat Foundation

For purposes of comparing scheduling of the PIF method with that of the mat foundation, we made appropriate labor productivity calculations as outlined *Cost Analysis*.

Labor productivity is the output per worker or worker-hour. We assumed 9 hour work days, 5 days a week at a labor productivity constant of 0.4 for continuous footings. This rate pertains to the scope of work involved in formwork, concrete and reinforcement works, where the cost of labor obtained from *RSMeans* per unit volume of concrete, per unit area of formwork and per unit weight (ton) of reinforcement. Labor and material cost for each can be found under the "Cost" section.

A total of 7000 cubic yards were multiplied by the productivity constant to get the number of hours required by one worker. For a crew of 10 workers and one foreman, the task would achievable in 31 days.

After the reinforced steel structure of the foundation has been completed and the concrete is poured, it will take 28 days for the mix to cure and achieve maximum strength. These two tasks combined would take approximately two months for completion, a month less than it was required of the pile foundation.

The project overhead cost $200,000 per month for the PIF method. Even though the mat foundation construction can be completed in approximately two months,

4.5.3 Quality

Pile foundation quality was found to be structurally sound because of the certainty of its structural behavior. PIFs go all the way to the glacier till and the load is well distributed over whole area. Piles are more commonly used to support large structures even though mat foundation is easier to construct in most cases.

Pile foundation requires substantial testing on the field and on paper. The size of each pif has to be analyzed with the way it interacts with the soil. Then the pifs have to be analyzed as a group so they do not negatively affect each other. But pile foundation is a better choice when the soil has a really low bearing capacity or is very variable.

On the other hand, the strength of Mat foundation depends largely on the soil which it is laid upon. The only problem on this project is that the soil is not adequate enough to handle the mat foundation. To accommodate the foundation, sandy gravel had to be filled and compacted on the site. The amount of soil improvement which is necessary on this project makes it more practical to go with pile foundation.

5.0 Conclusion and Recommendations

5.1 Close-Out Recommendations

After having the opportunity to observe in detail Gilbane's close-out process in this project, we propose the following recommendations to make the close-out process more efficient and organized. We must understand that Gilbane constructed the Worcester Trial courthouse with a fast track method, and therefore in terms of close-out this resulted in a more time constrained and demanding environment.. The fast track method leaves room for numerous uncertainties and consequently affects the amount of change orders and submittals, influencing the close-out process. From our analysis, we conclude that the close-out process would be much easier and quicker if the construction took place with the design-bid-built manner. Nevertheless, the fast track method saves time and money and hence becomes better choice of construction in this type of project.

Before the start of construction, the written specifications should have an explicit section about the close-out in each chapter. The engineer should look over the specifications for items that they need to insert into the matrix. It would make it easier if at the end of every chapter, there was a section listing all the close-out items. This has to be done in coordination with the CM since the A/E (who writes the specifications) does not necessarily have this type of knowledge and experience. The only problem about this is that majority of architects do not actually write new specifications but rather copy and paste them from previous documents to save on time and effort.

Throughout the construction phase, a close-out meeting should be held at least once a month to remind all personnel regarding the process. This is different from the weekly meetings that we were involved in as mentioned in the chapter 'our contributions'. When the project is close to substantial completion, a meeting should be held every two weeks. The close-out, like all other aspects in construction, is a team effort that requires everyone to be on the same page. Gilbane tends to transfer their engineers and accountants around different projects throughout the region, thus close-out meetings can keep everyone updated regarding the process and in the same mind frame. For example, for the Worcester courthouse, Gilbane relocated a senior engineer to

another project. He was in charge of keeping the team aware of the need to start processing close-out items. Once he was moved to a different project, the close-out void that was created was extremely visible. We conclude that frequent meetings would be a good reminder to senior personnel and an information session for new personnel.

Another major aspect that can make the close-out process much easier is the use of the Prolog software. Currently, Gilbane uses Prolog for RCLs and submittals. However, it has the potential to incorporate more items such as matrices. The significance of Prolog is that it can track the items completed within the project. It was observed that any site engineer can update items on Prolog that were submitted by subcontractors. However, only one member of the project team is aware of its completion. With the use of Prolog, each project member can acknowledge the completed and submitted items. The accountant will not need to fully depend on the various people involved in the process to complete the close-out letters if all the information is readily available in the software. Prolog will also be a great assistance to the accountant when he or she is the only person left on the job and all the engineers and superintendents have moved on to other projects.

Last but not least, we recommend staffing two or more members with previous experience in Gilbane's close-out procedures full-time on a new project. Monica, the accountant, is the only person that had this previous experience, consequently becoming the driving force to start the close-out for such a high magnitude project.

5.2 Design Conclusion

After analyzing both deep and shallow foundations, we concluded that Pile foundation was the better choice. Even though in terms of cost, Mat foundation can save approximately $200,000 in actual cost and over $200,000 in project overhead. But the soil improvement for decontamination alone was over 4 million dollars. To have compacted soil with good bearing capacity would easily add another million dollars with a soil price at 25 dollars per cubic yard.

Mat foundation would realistically save only one month because of the curing process which the concrete takes to reach full bearing capacity. It is also very difficult to maintain the full strength of concrete for the time it takes to pour the 7000 cubic yards.

Special Admixtures must be applied to the concrete so that it can cure after all the concrete has been set which in turn will greatly higher the price and the time.

The major excavation required to get better soil will also be a health and safety issue because the soil is known to be contaminated – according to the soil report. Excavation can be a problem because over 50,000 cubic yards of soil is required to be excavated for a mat foundation. Thus, the opportunity cost, health and safety issues make the Pile foundation a better choice. We conclude that it was the smarter choice by SBRA and DCAM.

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Appendix I. Meeting Minutes

Project Close-out MQP Team Meeting

Wednesday September 13, 2006, 11:00AM

Location: Gilbane Courthouse site-office

Participants: MQP Students: Abdullah Azhari
Muneer Ahmed
Mustansir Jivanjee
Other(s): Mrs. Monica Snow (Gilbane Senior Accountant), Prof. Salazar (Advisor)

Summarized Minutes

Meeting Items:

1. Met with Mrs. Monica Snow – Senior Accountant for Gilbane, Worcester Courthouse Project.
2. Briefed on the Worcester Courthouse Project, history, FAQ, current progress - $148 million for construction, 42 subcontractors, 28 months into construction, deadline is September 2007, project CM at risk, subs and GMP bought out 90%
3. Defined Close-out as process of handing over the building, training the owner, return attic stock, handing over warranties, guarantees, etc.
4. Issues regarding close-out discussed: close-out relevant items difficult to sort out as there is too much documentation to sort through, role of prolog in close-out, etc.
5. Scope of MQP Close-out vaguely defined.
6. Next meeting with Mrs. Monica Snow scheduled for September 19, 2006.

Project Close-out MQP Team Meeting

Tuesday September 19, 2006

Location: Gilbane Courthouse site-office

Participants: MQP Students: Abdullah Azhari
Muneer Ahmed
Mustansir Jivanjee
Other(s): Mrs. Monica Snow (Gilbane Senior Accountant)

Summarized Minutes

Meeting Items:

7. Go through specs to get close-out info for 12 subcontractor activities.
8. Create subcontractor specific spread sheet including division, job accomplished.
9. Create "Master-list" that combines both previously mentioned items.
10. Create owner's manual that includes: guarantees, warranties, operation training, O & M, and as-built drawings.
11. Accountant and project engineer close-out roles: Punch-list items and change orders.
12. Capstone design: contact Ralph Stawuski, Lauren Eagan.
13. Documents to receive from Monica: Full Specs, close-out documents for previous projects, security clearance for Prolog.
14. Contact and coordinate with Monica through e-mail until next meeting: Wednesday, October 11, 2006.

Project Close-out MQP Team Meeting

Thursday October 12, 2006, 11:00AM

Location: Gilbane Courthouse site-office

Participants: MQP Students: Abdullah Azhari
Muneer Ahmed
Mustansir Jivanjee
Other(s): Mrs. Monica Snow (Gilbane Senior Accountant)

Summarized Minutes

Meeting Items:

15. Met with Engineer Maria Messore (finishing packages engineer)
16. Met with Neil Banner; helped us go through the specifications and instructed us on how to sort out close-out items from the rest efficiently.
17. Discussed time of schedule for tour of the site (to be scheduled with Monica/Jim Barnett – Safety & Area Super).
18. Attained contact list of engineers along with scope of engineering assigned to them and their email addresses. (Lauren Egan – Mechanical packages, Mike Forwood – Misc. bid packages, Mike O'Brien - PM)
19. Discussed meeting time with Ralph; Best time to meet between 4:45 – 5:15 or lunch time.
20. Subcontractor list to be sent to us by Monica.
21. Meetings with Gilbane & subcontractors – Tuesdays, 10:00 AM
    Gilbane & owners - Wednesdays, 10:00 AM
    Schedule with Monica.
22. Contact and coordinate with Monica through e-mail and set next meeting.

Project Close-out MQP Team Meeting

Thursday November 1, 9:00AM

Location: Gilbane Courthouse site-office

Participants: MQP Students: Abdullah Azhari
Muneer Ahmed
Mustansir Jivanjee
Gilbane: Mrs. Lauren Egan
Mr. Dan Manescu

Summarized Minutes

Meeting Items:

- Main Close-out items
    - As-built/record drawings
    - Warranty

Information about the process can be found in Prolog under Meeting minutes. A lot of the information is sorted out and discussed in the pre-construction meetings

- Pre-construction meeting
    - Introducing players and their requirements
    - Accountants meet and inform subs to what they need to fill in and submit
- Rolling completion list → GC/Sub Punch List → Owner/GC Punch List
    - Excel and Prolog are both used to track the dates the last item for that sub has been completed
    - Projected expected to be closed out by mid-June
- Discussed the spread footing and pile camps with Lauren Egan
    - Spread footing was used on some parts of the foundation
    - Got PIF plans and specifications
    - Special Soil disposal (urban Area) $20/ton to $40/ton
    - Average elevation 460
- Scheduled Project tour with James C. Barnett for Thursday 12.30am to 2am

Worcester Trial Courthouse

Site Visits with Jim Barnett

11/2

The first day we meet for about an hour and a half and we were given a general tour of the courthouse. We did a quick walkthrough of all the floors from the basement to the penthouse. The most amazing part of the building was the cantilever staircases in the middle of the lobby. The foundation of the building is what made the structure possible. We also observed the finish work being done at different stages of the construction. The finish work is progressing from top down in the majority of the cases.

11/10

On the second day of our tour, we spent sometime studying the structural and foundation drawings in the Office. It is noted that each PFI is designed to have a loading capacity of a 150 tons and the site was designed with 182 PFI. On the Main Street side of the building, a large amount of spread footing was used because the glacier tilt was so close to the finish grade. While in the building, we visited the HVAC room which was located in the penthouse. We also got to walk on the roof and observed how detailed the building was designed since it included massive safety ties for exterior window cleaning personal.

Questions:

Does the AT&T building next door done have a mat foundation? If so, is it because the loading capacity is a lot lower or because the glacier tilts was more prominent in the ground?

Project Close-out MQP Team Meeting

Thursday November 15th, 10:00AM – 1:30PM

Location: Gilbane Courthouse site-office

Event: Owner – Gilbane meeting

Participants: MQP Students:	Muneer Ahmed			
	Mustansir Jivanjee			
Primary attendees:	Gilbane	DCAM	BR+A	
	AOTC	Trishman	SBRA	

Summarized Minutes

Meeting Items:

- After meeting with Mrs. Monica snow at 9:00am, we attended the Owner – Gilbane meeting addressing the main issues in the past week.
- Copy of SBRA (by Geoffrey Barter) meeting minutes enclosed – it gives a brief review of the meeting comments providing the latest 4-week schedule for work dated since October.
- Main Issues addressed were Structural Steel, Underground Electrical/Site Improvements, Masonry, Mill Work and HVAC.
- Close-out items checked off on list; problems sorted out and misconceptions cleared up.
- Furniture mobilization scheduled for 19th December, 2006.
- RFI Summary log enclosed – Lists Outstanding RFIs (Team meeting)
- Submittal Package enclosed – Lists Summary of logs indicating Description of submittal, sent date, due date, number of days exceeded and the action taken.

Worcester Trial Courthouse

Close-out Project Meeting Minutes

Wednesday November 15, 2006

Time: 9AM

Abdullah Azhari

Mustansir Jivanjee

Muneer Ahmed

Advisor: Monica Snow

- The project is 71% complete
    - Subs at various stages of completion
    - ONLY 1 sub is completely closed
    - Monica has sent a warning to the home office in Providence because of the lag of the close-out process
- When sub is greater than 90% complete → closeout and open changes
    - Open changes can take anywhere from a few days to 6 weeks to a year depending the sub and the contractors ability to get it done
- Our new focus will be: Open changes and Rolling completion list
    - Open Changes → Engineers
    - Rolling Completion List → Dan Manescu (or any super)
    - Meet w/ Dan → walk in the field and find out what we are looking for specifically from pro-log. Sections of the building need final inspection like the exterior location
- 1st step:
    - Close out letter
    - Open changes
    - Rolling completion list
        - Prolog – sort by trade
- Monica agrees with some of our observations such as the lack of communication between the Gilbane team members

- Keep a distance and see the whole process from an outside view. A person can not realize all of the problems when he/she is in the middle of the whole mess.

Close-Out Letters

The Worcester Trial Courthouse is reaching a critical stage of its construction as only four months remain for the scheduled date of substantial completion. According to Monica Snow, only one close-out letter has been issued so far and the project seems to be behind of schedule in that sense. Therefore we met with Dan Manesceu, the project quality engineer who is responsible for checking the rolling completion list and the punch list. From that meeting we learned that a number of subcontractors have completed the majority of their work and close-out letters could be sent to them. The following is a list of the subs that substantially have completed their work and are ready to be closed out:

- Beauce Atlas – Steel Elector – Canada
- F Harvey and Sons – Pifs – 99% completed. This sub was assigned different construction packages. Work was completed on some items and other work remains to be done. Not sure if this is the time to send the letter.
- Ferguson Neudorf Glass – Skylights
- Folan Waterproofing – caulking
- Francis Harvey and Sons
- G.N. Prunier & Sons, Inc.
- Marois Brothers
- NER
- Debrino Caulking – 96%

RCL Meeting with Dan Manesceu on Thursday 11/30

- What subs are close to substantial completion and ready to be closed-out?
- How are items on the rolling completion list addressed? Completed?
- What does the close-out letter to the sub consist of?
- Who takes responsibility of the punch list items on the close out letter? Owner/Gilbane?
- How many close-out letters do you project to be completed?
- How can we be involved closely in issuing close-out letter?
- What percentage of the project is complete according to you sir?

Shepley Bulfinch Richardson & Abbott

PROJECT TEAM MEETING MINUTES

Meeting Date:	November 01, 2006	**Date:**	November 14, 2006
Project:	JWO9115 DC1 Expansion to and Renovation of Massachusetts Trial Court Complex Worcester, Massachusetts	SBRA Job No. Subject: Minutes by:	3300 Project Team Meeting No. 103 Geoffrey Barter

PRESENT

Division of Capital Asset			**Administrative Office**		
Management – Owner:	Mr. Charles Willse	No	**of the Trial Court:**	Mr. Michael Hayes	No
DCAM	Mr. Mark Bontempo	Yes	Owner; AOTC	Mr. Paul Antoniewicz	No
	Mr. Bill Cobbett	Yes		Mr. Michael Norman	No
	Ms. Joan Correia	No		Mr. Joe Indrisano	Yes
Gilbane Building Co.			**Tishman Const. Corp.**	Mr. Bob Poitrast	Yes
CM:	Mr. William Kearney	Yes	Owner's Representative	Mr. Dimitri Theodossiou	Yes
	Mr. Michael O'Brien	Yes		Mr. Bob Morelli	Yes
	Ms. Lauren Egan	Yes		Mr. Lee Cleveland	Yes
	Ms. Maria Messore	Yes	**Department of Public Safety**		
	Mr. Michael Forwood	Yes	State Bldg. Inspector:	Mr. Joseph McEvoy	No
SAR			**BR+A**		
P/FP Engineers:	Mr. Tom Curtin	No	M/E Engineer:	Mr. Gene Kofman	Yes
				Mr. Robert S. Rayla	No
Copley Wolff			**Shepley Bulfinch**	Mr. Geoffrey Barter	Yes
Landscape Architect:	Mr. Sean Sanger	No	**Richardson and Abbott**	Mr. Ernest M. Marsh	Yes
			Architect:	Mr. Sid Bowen	No

MEETING RECORD				
		The project team reviewed the items as listed on the meeting agenda. The following is a summary of the discussions: **Bold items indicate new business for that item.** ***Italicized* items indicate notes that have revised the initial statement.**		
SCHEDULE				
General	On-going **11/01/06**	Next schedule update due; 12/04/06 Next schedule review meeting; 12/13/06. @ Field Office. Minus 18 days to overall schedule directly relating to Millwork installation. **Beaubois to establish a schedule to make up the time.** **Schedule will show zero (0) float for finishing**	 **Beaubo**	 **10/19/06**
		New Business		
PROJECT LOOK AHEAD				
General	**11/01/06**	A brief review of the meeting comments is shown below; See the latest 4-week schedule for work dated; October	Eric Record	RCL
42.5	**11/01/06**	**Masonry/Pre-cast: Interior cmu tooth in elev doors November. Precast install Complete; precast repair review required. Curbs @ the penthouse an issue. Bench and topping slab have cracks. GBC to investigate.**	**Record**	after
42.6	**11/01/06**	**Curtain Wall: Install Alucabond @ side atrium; Gap on cap to be reviewed Louver installation is on-going. Bullet frames being installed**	**Record**	
42.7	**11/01/06**	**Roofing: Cornice work is on-going; NE started; BUR 5th fl to start 10/30/06. Roof using new cap sheet material showing signs of blistering.**	**Record**	
48.1	**11/01/06**	**Metal studwork: Installing studs and soffits 2nd NW complete, 1st floor atrium walls next couple of weeks. Atrium wall signoff pending. Last in-wall inspection completed**	**Record** Complete	

high bats staging.

Hobra.

Item	Updated	Description	Action	Due Date
49.1	11/01/06	MEP: PH piping ongoing, Ductwork complete, AHU and equipment installation is on-going. Boilers started. Penthouse piping on-going. Perimeter radiant and VAV heat to be up and running.	Record	
50.1	11/01/06	Elevators: 1, 2, 3, 4, 5, 6, 7, 8, 10&11 started, 13 cab built and will be running early Nov. 14 install is on-going. Inspection week of the 13th. Hoisting platform to stay through Dec. – Door	Record – 11 mechanicams cab 13 done.	
64.1	11/01/06	Miscl. Metal/Stair: Catwalk installation is waiting until other adjacent work is completed; Stair 11 bracing to be reviewed. Door at catwalk to be installed.	Record	
65.1	11/01/06	GWB/Ceiling Grid: Installation is on-going. 4th east taped and painted. 3rd on going. Sloped walls taped, level-5 finish and painted, working down. Stair-1 soffit being framed. 2nd fl S/W and 1st Fl. Atrium. 3rd floor painting	Record → after Thanksgiving.	
74.1	11/01/06	Terrazzo: Ground complete, 4th complete accept bridge. 3rd fl. started	Record	
75.1	11/01/06	Painting: Interior painting is on-going, level 5 finish. Truss started Cells to be painted after hours (fumes).	Record	
76.1	11/01/06	Exterior caulking: Window and control joint installation 85% complete.	Record	
80.1	11/01/06	Woodwork: schedule pending Crtrm work on-going. Above ceiling inspect started. Base & picture rail being installed in judges offices. Millwork panels fabricated WO following approved shop drawings.	Record	
81.1	11/01/06	Ceramic Tile: Installation is on-going.	Record	
83.2	11/01/06	EIFS: complete Nov 1st. Needs to be complete before re-roof can start.	Record	
86.1	11/01/06	Stone: Ground complete; 4th all but soffit. 3rd almost complete. 2nd almost complete. 1st being field measured.	Record	
87.1	11/01/06	Site improvements: Site work Main on-going, Commercial and Thomas sidewalks almost complete. Hoisting platform NE being removed. Hit duct-bank on Central.	Record	
99.1	11/01/06	Staging in the atrium removed. Side next.	Record	
99.2	11/01/06	Roll up doors installed. HM doors and frames on going	Record	
100.1	11/01/06	Light fixtures being installed 1st floor east working Northwest on permanent power.		
101.1	11/01/06	Carpeting this month than System Furniture to start December 15. Project team concerned about construction traffic through the space. GBC will protect installed carpet. Mock-up required prior to installation.		
101.2	11/01/06	Plank ceiling in cells to start, caulking and painting started 10/25/06. Dentention doors and epoxy floors to start end of Nov.		
		New Business		
SAFETY				
	General	Next AIG Inspection on 09/07/06.	TCC	On-going
100.1	09/20/06 11/01/06	Clean-up efforts to address material required to be removed. Central street clean-up efforts to start. Other areas on going.	Record	
		New Business		
GENERAL MINUTES				
85.1	05/10/06 08/2306	DCAM stated that the sub-contractors good standing issue is not resolved. Same; GBC stated that 4 Subs are left to process.	GBC	09/06/06
99.1	09/06/06	~~Change Order Meeting 10/25/06. GBC to distribute hot items.~~	Closed	
101.1	**10/04/06**	**DCAM asked about monitoring second shift. GBC to use full time employee.**	Closed	
		New Business		
PROCUREMENT				
81.1	04/12/06 09/20/06 11/01/06	TCC/DCAM requested final Sub Contact copies from GBC. Same; GBC working on getting the Contract copies distributed. 1 left - Specialties	GBC	On-going

Item	Updated	Description	Action	Due Date
STRUCTURAL STEEL				
66.1	12/21/05 General 05/24/06 09/06/06 **11/01/06**	Foundation and Steel Record and As-built drawings: See previous Meeting Minutes for notes (condensed). Lim to review submittal; SBRA/Lim to review foundation as-built req's. Lim to revise and re-issue drawings for record. Written approval required from Lim for as-built submittal. **GBC submitted drawings do not have comments, mark ups or stamp.** **GBC to address.**	 **GBC**	 **Pending**
96.1	08/02/06 09/06/06 **11/01/06**	GBC will review the out-standing structural change orders w/o 21st. Beaus Atlas CR's have been submitted for review. **Meeting 11/16/06.**	 **Team**	 **11/16/06**
100.2	09/20/06 10/04/06	Stair 8 and 9 detail @ rail to be reviewed. SBRA has suggested that Pourock would be a better finish than the proposal for a stainless steel cover over the shoe. GBC is looking at the possibility not to use a shoe to support the glass and fill the glass rail housing with Pourock.	 **GBC**	
		New Business		
UNDERGROUND ELECTRICAL / SITE IMPROVEMENTS				
77.1	*General* 09/06/06 10/04/06	*See previous meeting minutes for notes (condensed).* Tree tagging to be rescheduled. Date pending All trees to be planted in the Spring Ground cover planting to start in the spring.	 **Closed**	
92.3	06/28/06 **11/01/06**	Can the under ground electric contract be closed? GBC stated that minor issues to be resolved with Ostro Electric prior to closeout. **Same.**	**DCAM** **GBC**	**TBD**
92.4	06/28/06 **11/01/06**	Debrino contract to be closed. **Some elevator pits still require waterproofing.**	**DCAM** **GBC**	**TBD**
98.1	08/23/06 09/06/06 10/04/06 **10/18/06**	GBC needs access bollard RFI answered. Sallyport bollard needs camera, intercom integrated into bollard. 1" conduit through foundation wall to bollard required. SBRA to issue bulletin 194. Coordination required. **Keypad not required on garage bollard.** **Airphone only @ sallyport** **Bollard durability in question. AOTC has requested a concrete filled steel bollard 2'x2'x 54" +/- in height.**	 **pending**	
101.1	10/04/06 **10/18/06**	Catch Basin issues to be resolved. **GBC to update project team on any issues**	 **GBC**	
102.1	10/18/06	Grades at the entrance to be revised. GBC to maintain the proposed grades to comply with code.	 **Record**	
		New Business		
EXTERIOR WALL (MASONRY / EIFS)				
89.1	06/07/06 10/04/06 **10/18/06**	GBC to setup a sample mockup of pre-cast repair. GBC to have Prunier implement repair procedures. **Mock-up has been used for test. Team to review.**	 **Record**	
100.1	9/20/06	Pre-cast mortar cracks an issue. GBC stated that contractor to resolve. **Pre-cast joint fix pending.** **SBRA to review with comments.**	 **SBRA**	
		New Business		
103.1	**11/01/06**	**Curbs missing in the penthouse an issue. GBC stated they did not bid the work. GBC want to use block. SBRA stated that cast-in-place curbs are part of the documents. NER to price lump sum to perform work.**	**GBC**	

Item	Updated	Description	Action	Due Date
ROOF				
92.2	06/28/06 **09/20/06**	Owens Corning letter required. **GBC waiting for formal letter from Garland which addresses the issues**	**GBC**	**09/13/06**
100.1	9/20/06 10/04/06 **10/18/06**	Meeting with Garland and Titan regarding bubbles in the cap sheet. Garland to issue repair procedures and materials as a submittal prior to implementation of the work. **GBC waiting for complete submittal from Garland/ Titan.**	**GBC**	
102.1	10/18/06 **11/01/06**	DCAM wants to remove the gravel from roofing material @ the cooling tower and generator wells. GBC stated that removing the gravel reduces the UV protection which would reduce the agreed to warranty of 30 years in these areas only. **It was recommended that the gravel remain and maintain the use of walking pads to maintain the 30 year warranty.**	**GBC**	
		New Business		
(HVAC) MECHANICAL				
96.1	08/02/06 08/16/06 08/23/06 09/20/06 10/04/06 **11/01/06**	The cooling tower tank is drawing air to the pumps; BR+A is on-site to run a series of tests with GBC and Sub; GBC would like to by-pass the tank in order to get the system operational by next week; A meeting is scheduled for this afternoon. Temporary by-pass completed; Working on control issues with chiller (system cuts out at near 55 degree outside air temp); Meeting scheduled for September 6th to discuss the final system requirements. GBC issued an update (See attached Penthouse AC System update 8/23/06). BR+A to discuss repair procedures with the team 10/04/06 BR+A discussed the system requirements with the team. A draft of A flow diagram for HVAC chilled water and condenser was distributed. A follow-up meeting will be held to discuss the final recommendations. BR+A has not received any other feed back to their proposal. Any work in this area would not start until mid December. **BR+A to submit final bulletin. With sequence of operations to include electrical.**	**BR+A**	
98.1	08/23/06 **09/06/06**	11/01/06 is target date for heat start-up **GBC stated it was on target**	**Record**	
99.1	09/06/06 10/04/06 **11/01/06**	Radiant heating in garage pending. Heat from fin tube heating should be adequate for temp heat. The hot water loop to be started 10/18/06 and rediant heating in Garage being implemented. **Unit heaters being installed.**	**Record**	
99.2	09/06/06 09/20/06 **10/18/06**	AOTC has requested a maintenance plan for all equipment used while in construction. GBC to investigate plan GBC/ KMD to issue a plan. AOTC requested to have AOTC personal work with KMD foreman to review system. **GBC to issue draft to AOTC**	**GBC**	**Pending**
		New Business		
ELECTRICAL/ AV				
95.1	07/26/06 **09/20/06**	GBC to review stair requirements at the emergency generator. **Same.**	**GBC**	**Pending**
99.1	09/06/06 **10/18/06**	AV – Crestron coordination meeting required between AOTC, Coughlin and manufacturer. GBC to set up meeting Crestron screen design and programming being worked on.	**Record**	
102.1	10/18/06	2-Light fixtures in stair 6 need to be moved to the wall. ~~GBC to advice. See RFI~~	**Closed**	
		New Business		

Item	Updated	Description	Action	Due Date
FIRE PROTECTION				
97.1	08/16/06 09/06/06 10/04/06 **11/01/06**	DCAM asked for review of sprinkler pipe in wall at the clerestory windows. SBRA issued bulletin 192KMD to provide grill. Century to install. KMD to provide pricing. **Vents only were pipes exist. 1' x2' x 1" wide**	**GBC**	
		New Business		
SPRAY FIREPROOFING				
		None.		
		New Business		
PLUMBING				
		None.		
		New Business		
ELEVATOR				
95.1	07/26/06 09/20/06 **11/01/06**	GBC to get frame add-on sketch from Sub for review/approval. Otis to submit sketch for ground floor elevator frame cap. **See RFI.**	**GBC**	
100.1	10/18/06 **11/01/06**	Service elevator cab 13 installation on going. Will be operational early **Nov.** Temp fire alarm required. **Inspection week of 11/13/06**	**GBC**	
102.1	10/18/06 **11/01/06**	Card reader at the 2nd floor elevator door entry required. ~~See bulletin 200~~	**Closed**	
		New Business		
CURTAINWALL				
		New Business		
MILLWORK				
98.1	08/23/06 **10/18/06** **11/01/06**	GBC requested sketch of side atria windows. **GBC and SBRA discussing.** **SBRA to provide sketch and bulletin.**	**Record**	
98.2	08/23/06 **11/01/06**	GBC needs DCAM to approve CSO desk and pew/bench change. **Stay with solid wood at end of bench.**	**Record**	
99.1	09/06/06 10/18/06 **11/01/06**	GBC stated that the X-ray table and Side Atrium shop drawings are due. X-ray table being submitted is on wheels. DCAM/ AOTC want's prefab tables instead of custom. SBRA to issue bulletin stating" Remove millwork tables and provide manufacturer for prefabricated tables. **SBRA submitted bulletin 202 rejecting millwork tables for X-Ray**	**Record**	
100.2	9/20/06	Humidity monitoring report to be distributed weekly	**Record**	
102.1	10/18/06 **11/01/06**	SBRA consultant Woody Vaughn stated: Exposed drywall behind panel reveals to be painted. Wall panels in courtroom 4-15 not being installed correctly. Field joints in the miter joints in Courtroom 2-6 Spectator Rail are not tight and show excessive caulking. Shims at platforms at each vertical member. Particleboard should not be used. Adjustable shelves behind bench do not have edge bands front and back as shown on SKA 148B. **Vaughn/ SBRA submitted Vaughn field report.** **GBC to address report.** **The corner joint on millwork being installed w/a blocking to support panel.**	**GBC**	
		New Business		
103.1	**11/01/06**	**CCR inspected AV under platform.**		

Item	Updated	Description	Action	Due Date
MISCELLANEOUS METALS				
73.1	02/08/06 02/15/06 04/26/06 09/20/06 **10/18/06**	TCC: Wants the seismic bracing plan/mark-up submitted to John L/Lim for review (per John L. request); GBC to provide. Berlin to provide sketch. A final as-built will be issued and reviewed; Record. Same; DPS wants a copy of the final as-built submitted to DPS. **A few are missing but being installed.**	**GBC**	**On-going**
94.2	07/19/06 08/02/06 08/16/06 **09/20/06**	GBC to write RFI on catwalk thermal break. GBC to issue confirming RFI; SBRA to review insulation option. SBRA gave GBC direction in RFI response; GBC to price the 2-options. **Same.**	**GBC**	**09/06/06**
		New Business		
FINISHES				
98.1	08/23/06 10/04/06 10/18/06	GBC, SBRA and Sub to review terrazzo layout and color discrepancies. Apparently there is additional cost with the negotiated change and redistribution of terrazzo. GBC is negotiating with the sub with regard to this additional cost. CCA being issued.	**Closed**	
98.2	09/20/06 10/04/06 10/18/06	TCC requested a review of stone protection; GBC to review. GBC wants to ban lifts in finished areas. Lift restrictions being instituted by GBC	**Closed**	
102.1	10/18/06	Terrazzo edge condition at stone wall and glass rail on the 4th floor to be reviewed. The terrazzo is not tight against the wall leaving a gap and some rough patches. **GBC to address concerns**	**GBC**	
102.2	10/18/06	2nd floor stone being installed without approved shop drawings	**Record**	
102.3	10/18/06 **11/01/06**	A few Electric Room doors need to swing out so as not to interfere with equipment in room. **See RFI. Knockdown frames to be used.**	**Record**	
102.4	10/18/06	Hardware/ Security changes to be addressed in a bulletin 200	**Closed**	
		New Business		
FURNITURE/EQUIPMENT				
75.1 - A	03/01/06 **09/06/06**	AOTC, GBC and DCAM to setup a meeting to discuss equipment procurement. **DCAM and AOTC met on Monday; On-going meeting's to be scheduled.**	**DCAM AOTC**	**TBD**
99.2	09/06/06 **9/20/06**	GBC to provide furniture installation schedule. **System furniture installation to start December**	**Record**	
100.1	9/20/06	GBC to schedule the installation systematic shelving rail. Shot blast of slab, prep and pouring of topping slab by end of month.	GBC	Pending
		New Business		
DESIGN				
90.1	06/14/06 06/28/06 07/26/06 08/02/06 10/04/06 **11/01/06**	Lady of Justice location still under review. Bulletin for lighting and location sketches required. Same; DCAM, SBRA and AOTC to review after meeting. Location determined at lobby vestibule; SBRA to issue Bulletin. Meeting with Historical Society. 10/25/06 **SBRA details pending.**	**SBRA**	
94.1	07/19/06 **10/18/06**	TCC asked SBRA/Lim to check main stair if it will need counterweights for vibration; SBRA stated wait for stone to be placed and staging removed. **Same.**	**LIM CT**	**TBD**
		New Business		

Item	Updated	Description	Action	Due Date
MISCELLANIOUS				
84.1	05/03/06 General **11/01/06**	Keying: GBC requested DCAM schedule keying meeting with AOTC. See previous meeting minutes for notes (condensed). **Next meeting is 9/26/06 @ 10:00am.** **Date pending**	**GBC**	
85.1	05/10/06 General **08/23/06**	SBRA to issue Bulletin to delete the dock-lift. See previous meeting minutes for notes (condensed). **Same; DCAM and AOTC are reviewing dock-lift alternates.**	**DCAM** **AOTC**	**Hold**
85.2	05/10/06 General **08/23/06**	AOTC request; CCR to address repeater with AOTC. See previous meeting minutes for notes (condensed). **CCR/SBRA to issue Bulletin for hardware change.**	**CCR**	**09/06/06**
		New Business		
FIELD REPORT				
	General	Review after meeting; See Field Report.	ALL	On-going
QA / QC				
	General	Separate weekly GBC meeting; See QA/QC list.	ALL	On-going
CHANGE ORDERS				
	General	Separate review meetings are scheduled.	ALL	On-going
SUBMITTALS				
	General	See Submittal log; reviewed at end of this meeting.	ALL	On-going
RFI's				
	General	See RFI log; reviewed at end of this meeting.	ALL	On-going
NEXT PROJECT MEETING				
		Next job meeting is scheduled for Wednesday, **November 14, 2006**, at 10:00 a.m.		

Note: Any comments or concerns regarding the statements made in this document should be provided within 48 hours of issuing. Meeting minutes become record after the weekly project team meeting.

Appendix II. Our Initial MQP Proposal

Abdullah Azhari **September 21, 2006**
Muneer Ahmed
Mustansir Jivanjee

Worcester Trial Courthouse MQP Proposal

Introduction:

Construction management (CM) is one of the relatively new methods used in the construction industry for managing multi-million dollar projects. Big construction companies, such as Gilbane, provide construction management as their primary service. The Worcester trial courthouse is one example of a CM project. It is the first project in Massachusetts built by the division of Capital Asset Management, under the Construction Management at Risk contracting method. The courthouse approximated cost at the end of construction is $170 million. The project has been under construction for over two years, and nine months remain for completion. The close-out process is one of the remaining tasks in order to deliver the project to the owner.

Close-out Process:

In general, the close-out process for any project is the final stage of construction before handing the project to the owner. The process includes the following main points:

- Final Inspection (Certificate of Substantial Completion)
- Guarantee/Warranty
- Clean-up
- Punch List
- Lien Releases
- As-Build Drawings
- Disposition of Project File
- Call Backs

The final inspection is done when the contractor requests the owner's representative to visit the site in order to check the final work of the project. This is done after the project

manager checks all the punch list items and ensures that all the work has been completed. Upon the acceptance of work, a Certificate of Substantial Completion is issued and approved by the owner. At this point, the project can be used for its purposes and only minor items remain to be finished. The contractor is required to guarantee all materials, equipments, and work done on the project. The guarantee period is usually one year after completion of construction. The contractor also submits guarantee/warranty for all equipment, machines and work done by subcontractors. The owner can request a lien release or a bond indicating that all subcontractors and laborers have been paid. The contractor is required to hand over record files and as-built drawings to the owner at the end of the project.

Close out involves engineers, accountants, project managers, and primarily owners. It is a long and important process in the construction management industry. Nobody at a construction site wants to take that responsibility and the project manager often delegates the work to others. Good construction managers ensure that the process starts as soon as project work commences, making sure that the subcontractors and all parties involved in the project close-out when they finish their work.

Academic Objective

At this point in time Gilbane is starting the close-out process for the Worcester Trial Courthouse. For that they depend on the inputs generated by the project documents, but primarily on what has been programmed into the Prolog systems. It is not clear that the Work Breakdown Structure (WBS) used to track information through the Prolog system will clearly serve the purpose to organize the information for the close-out process from the accounting point of view.

Our main focus in this project is to study the close-out process from a construction management perspective. In order to accomplish that, we are going to examine the current process/policy that Gilbane applies in conducting close-outs. At a meeting with Ms. Monica Snow, a senior accountant of the courthouse project, the following was discussed:

- The Cost Account Coding System between the Accounting and Project Management software may not be fully compatible. A lot of info regarding close-out may not be not readily accessible or user friendly to readily support the Close-Out process.
- Close-out must start as soon as a project begins.
- There seems to be a large amount of partially unorganized close-out information and it is stored in different databases.

The close-out process could be complicated and time consuming process at the current organizational level. There may be room for improvement and that is the core of our MQP project: to develop a systematic process that organizes the close-out and makes it more efficient. We propose the following steps in order to kick off our project:

1. Find out how Gilbane currently conducts their close-out project (Their policy/procedures).
2. Get familiar with project management software (prolog/timberline/primavera)
3. Examine the status of the close-out process on the courthouse project.
4. Propose and if necessary develop a more efficient method for conducting the close-out process.

Our project starts September 2006 and goes through March 2007. In order to accomplish our project scope we will visit the site regularly and will collaborate with the Mrs. Monica Snow and other project management members namely Mr. Bill Kearney, Mr. Michael O'Bryan and Mr. Ralph. In order to complete our academic objectives we will be advised by project management faculty Professor Guillermo Salazar.

Capstone Design

In addition to the proposed MQP academic objective, our project will review the current design of the deep-foundations used in the courthouse. We will design and propose an

alternative method of foundations. Our study will compare and evaluate each method in terms of quality, cost, labor intensity and schedule.

Appendix III. Gilbane close-out documents

1. Close-Out Plan

GILBANE

CLOSEOUT PLAN

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
A. OWNER/GBCO - DELIVERABLES			
1. SUBSTANTIAL COMPLETION (Spec. 01700, paragraph 1.4)			
1.1 Advise DCAM of pending Insurance Changeover Requirements			
1.2 Submit Specific Warranties, Workmanship Bonds, Maintenance Agreements, Final Certifications and similar documents			
1.2.1 Warranties	Review and approve attached list	TEAM	
1.2.2 Workmanship Bonds	Need More Info	SBRA/DCAM	
1.2.3 Maintenance Agreements			
1.2.4 Final Certificates			
1.2.5 Similar Documents	Need More Info	SBRA/DCAM	
1.3 Obtain & Submit Releases for DCAM unrestricted Access to services and utilities			
1.3.1 Occupancy Permits	Need List	SBRA/DCAM	
1.3.2 Operating Certificates	Need List	SBRA/DCAM	
1.3.3 Similar Releases	Need List	SBRA/DCAM	
1.4 Submit Record Documents			
1.4.1 Record Drawings	Need more specific info: s/b included in Tech Specs	SBRA/DCAM	
1.4.2 O&M Manuals	Need more specific info: s/b included in Tech Specs	SBRA/DCAM	
1.4.3 Final Project Photographs			
1.4.4 Damage or Settlement Surveys			
1.4.5 Similar Final Record Information			
1.5 Deliver: tools, spare parts, extra stock and similar items	Need List: s/b included in Tech Specs	SBRA/DCAM	
1.6 Changeover to permanent locks and deliver to Owner			
1.7 Complete start-up testing of systems and instructions of DCAM's and AOTC's operation and maintenance personnel			
1.7.1 Discontinue and remove temp facilities, mock-ups, construction tools and similar elements.			
1.8 Complete Final Clean-up (Specification 01700 paragraph 1.7)			
1.8.1 Provide Final Cleaning per Section 01700 paragraph 3.1			
Final Clean: Employ professional cleaners for final clean as outlined in 3.1.B.1			
Pest Control: Licensed exterminator to provide final inspection and extermination of pests			
Removal of Protection: Remove temporary protection and facilities			
Compliance: comply with regulationsand safety standards for cleaning. Extra materials become DCAM's property, to be disposed of as directed by DCAM.			

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
1.8.2 Remove waste materials, rubbish, tools, equipment, machinery, etc.. And clean all sight-exposed surfaces			
1.8.3 Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials on site exposed surfaces			
1.8.4 Wash and polish mirrors			
All new and/or existing glass and plastic surfaces thru building shall be cleaned/washed by Qualified Window Cleaners			
1.8.5 Repair, patch and touchup marred surfaces to specified finish, to match adjacent surfaces			
1.8.6 Polish glossy surfaces to clear shine			
1.8.7 Ventilation Systems: clean permanent filters and replace disposable filters (if operated during construction) and clean ducts, blowers and coils if units were operated without filters during construction			
1.8.8 Prior to Final Completion: CM and DCAM to conduct inspection of sight exposed, interior and exterior surfaces, and all work areas to verify clean and acceptable to DCAM			
1.8.9 Broom Clean exterior paved surfaces and rake clean grounds.			
1.9 Touch-up, repair and restore marred and exposed finishes			
1.10 Submit subcontractor releases of liens, showing no outstanding claims			
1.11 Submit request for Final Inspection			
2. FINAL ACCEPTANCE (Specification 01700, paragraph 1.5)			
2.1 Submit Final Contract Value & Payment Request with releases and supporting documentation (not previously submitted)			
2.1.1 Includes Insurance Certificates			
2.1.2 Submit updated Final Statement, accounting for final additional changes to the Contract Sum.			
2.1.3 Include Subcontractor Releases			
2.2 Submit certified copy of Designers final inspection list of items. List shall state completion status of items.			
2.2.1 Obtain owner and architect signature and acceptance on Final Punch List (Rolling Completion List)			
2.3 Final Meter readings for utilities, a measured record of stored fuel and similar data as of Substantial Completion			
2.4 Submit consent of surety to final payment			
2.5 Submit final liquidated damages settlement statement			
2.6 Submit evidence of final, continuing insurance coverage complying with insurance requirements			
3. RECORD DOCUMENTS SUBMITTALS (Specification 01700, paragraph 1.6 and Specification 01720)			

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
3.1 Record Documents Includes:	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
3.1.1 Marked up set of Contract Drawings			
3.1.2 Marked up set of Shop Drawings			
3.1.3 Newly Prepared Drawings			
3.1.4 Marked up copies of Specifications, addenda and change orders			
3.1.5 Marked up Product Data submittals			
3.1.6 Record Samples			
3.1.7 Field records for variable and concealed conditions			
3.1.8 Record information on work that is recorded only schematically			
3.2 Record Drawings:	Format? Electronic?	SBRA/DCAM	
3.2.1 Marked up set of contract drawings showing as-built conditions. Submit to A/E for approval at substantial completion.	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
3.2.2 Submit full set of corrected (wash-off mylar) transparencies of Mechanical and Electrical Contract and Shop Drawings.			
3.3 Record Specifications			
3.3.1 Marked up set of contract specifications showing as-built conditions. Submit to A/E for approval at substantial completion.	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
In each specification section where products, materials or units of equipment are specified, mark copy with name, model of product furnished, manufacturer, installer, supplier			
3.4 Record Product Data	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
3.4.1 Maintain 3 copies of product data submittal			
3.5 Record Samples	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
3.5.1 Submit required samples as determined by A/E, and DCAM personnel prior to substantial completion			
3.6 Maintenance Manuals	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
3.6.1 3 copies in 3-ring binders, indexed and tabbed and will include:			
a. Emergency instructions			
b. Spare Parts List			
c. Copies of Specific Warranties			
d. Wiring Diagrams			

		INFO REQUIRED	RESPONSIBILITY	COMPLETED
	e. Recommended maintenance procedures and turn-around times			
	f. Inspection and System Test Procedures			
	g. Copies of applicable shop drawings and product data			
	h. List of required maintenance materials and services			
	i. Names and addresses of sources of maintenance materials			
	j. Maintenance drawings and diagrams			
	k. Precautions against improper maintenance and exposure			
3.7	Miscellaneous Record Submittals	Need List of Spec Sections…s/b included in Technical Specs.	SBRA/DCAM	
a.	Field records on excavations and foundations	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
b.	Field records on underground construction	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
c.	Survey showing locations/elevations of underground lines	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
d.	Invert elevations of drainage piping			
e.	Survey showing building lines and levels			
f.	Authorized measurements using unit prices and allowances	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
g.	Records of Plant Treatment	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
h.	Ambient and substrate condition tests	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
i.	Certifications received in lieu of labels on bulk products	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
j.	Batch mixing and bulk delivery records	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
k.	Testing and qualifications of tradesmen	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
l.	Documented qualification of installation firms	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
m.	Load and performance testing	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
n.	Inspections and certifications by governing authorities	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
o.	Leakage and water-penetration tests	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
p.	Fire resistance and flame spread tests results	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	
q.	Final inspection and correction procedures	Need Specific info….s/b included in Tech Specs	SBRA/DCAM	

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
r. Submit NFPA sections: 13, 13A, 14, 14A, 20, 70 & 101 standards			
4. CLOSEOUT REQUIREMENTS & SUBMITTALS (Specification 01700, paragraph 1.9)			
4.1 Submit written certification			
3.1.1 Inspected for compliance with Contract Documents and has satidfied Department of Public Safety			
3.1.2 Equipment and Systems have been tested in presence of Designer and are operational and satisfactory			
3.1.3 Project is complete and ready for Final Inspection			
4.2 Arrange for Department of Public Safety final inspection and secure the signed Certificate of Inspection for Use and Occupancy from DPS			
5. BUILDING SYSTEMS CHECK AND COMMISSIONING (Specifcation 01700, Paragraph 1.10 and Specification 01810)			
5.1 Commissioning Plan and implementation			
6. GUARANTEES AND WARRANTIES (Specification 01700, Paragraph 1.11 and Specification 01710)			
6.1 Submit written warranties to the Designer during the shop drawing phase and prior to Substantial completion.			
6.1.1 See warranty list	Review and approve Warranty List	Team	
6.1.2 Separately bind warranties and bonds in 3 sets of 3-ring binders			
7. DCAM OPERATING AND MAINTENANCE REQUIREMENTS (Specification 01700, Paragraph 1.12)	Same as Item #3?....s/b included in Tech Specs	SBRA/DCAM	
7.1 At least 30 days prior to Final Acceptance, the CM shall deliver to The User Agency via the Designer, indexed files containing: O&M Manuals, shop drawings and other data as follows:	Same as Item #3?....s/b included in Tech Specs	SBRA/DCAM	
7.1.1 O&M Manuals and Maintenance Instructions for all systems			
7.1.2 Summary of inventory of all major mehcanical and electrical equipment provided in electronic format and shall include: Equipment type, description, manufacturer, model number, serial number and room location.			
7.1.3 Catalog Data Sheets (include performance curves, rating data and parts list)			
7.1.4 Catalog sheets, maintenance manuals and approved shop drawings of all mechanical and electrical equipment controls and fixtures with all details clearly indicated including lamp sizes.			
7.1.5 Names, addresses and phone numbers of repair and service companies for each major systems installed			
7.2 Instructions of Owner's Personnel (Specification 01700, Paragraph 1.13)	Same as Item #3?....s/b included in Tech Specs	SBRA/DCAM	

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
7.2.1 For each installer of operating equipment: Provide competent instructors or manufacturer's representatives, to give full instruction in the care, adjustment and operation of the systems and equipment to the maintenance personnel			
Instruction shall be conducted in a classroom environment, supplemented with hands-on demonstrations of the equipment and systems in situ, and shall be provided prior to Substantial Completion			
7.2.2 Provide detailed review of the following items or as such as may be applied to each item or system			
Location of O&M Manuals, Record Documents, Spare Parts and Materials, Tools, Lubricants, Fuels, Identification Systems, Control and Control Sequences, Hazards, Cleaning, Warranties, bonds, maintenance agreements and other continuing commitments			
7.2.3 Provide procedure demonstration of the following items or as such as may be applied to each item or system			
Start-up, shutdown, emergency operations, seasonal changeover, noise and vibration adjustments, safety procedures, economy and efficiency adjustments, effective energy utilization and reprogramming controls.			
7.2.4 Operating demonstration and instruction shall include fully operational modes of all equipment and shall extend over a many days as necessary to complete instruction over all operational modes.			
7.2.5 Complete Instruction and Demonstration to be repeated at 11 months after Substantial Completion			

B. TYPICAL SUBCONTRACTOR CLOSEOUT REQUIREMENTS

1. Work items remaining?			
1.1 Un-corrected and/or open punch list?			
1.2 Other open issues / problems?			
2. As-Builts received? (Specification Section 01720)			
2.1 Define Requirements			
2.2 Include in Submittal List			
2.3 Review at Monthly Requisition			
2.4 Collect and Review at Completion			
2.5 Get A/E Approval			
2.6 Turnover to Owner			
3. Attic stock and special tools received and turned over?			
3.1 Review Specification Requirement			
3.2 Include in Submittal List			
3.3 Discussion with Owner about QTY of Attic Stock			
3.3.1 Discussion with Owner about QTY of Attic Stock - Reconfirm			
3.4 Collect Attic Stock and Turnover to Owner			
4. Time and materials tickets reconciled?			
5. Embedded allowances reconciled?			
5.1 Establish and updated Allowance Tracking in JDE			

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
5.2 Establish final dollar amount with contractor			
5.3 If Owner allowance, obtain final change order (add/deduct)			
5.4 Issue amendment for Contractor			
6. Claims and disputed backcharges?			
7. Other open changes?			
8. All outstanding amendments issued?			
9. Final payment documents sent? (see final payment checklist)			
10. Final payment documents returned?			
11. Consent of surety received?			
12 Waivers / warranties / guarantees?			
12.1 Trade Contractor Warranty Contact List			
13. Execute final payment checklist?			
14. Final billing received and processed?			
15. Trade contractor evaluation form completed?			
C. GBCO INTERNAL ADMINISTRATION ITEMS			
1. Reconciliation of cost vs. billings to owner item.			
2. Prepare and distribute final cost report.			
3. Prepare and distribute Final Project Data Report.			
4. Lessons learned meetings / report.			
4.1 Daily Input into Lessons Learned Application			
4.2 Discuss with Team LL Meeting and Schedule Meeting			
4.3 Collect Team Info/Print Log from LL Application			
4.4 LL Meeting with established agenda and issue notes			
4.5 Update LL Application based on meeting minutes			
5. Establish support services close-out budget (after site demobilization)			
6. Obtain final bond premium invoice.			
7. Purchase order de-commitments.			
8. Reconcile and close petty cash.			
9. Reconcile physical inventory of equipment and assets with inventory			
10. Transfer or sell GBCo general conditions equipment.			

GILBANE

CLOSEOUT PLAN

	INFO REQUIRED	RESPONSIBILITY	COMPLETED
11. Pack, log, and send project records to storage.			
11.1 Send records per Records Retention Policy			
11.2 Copy all electronic documentation to disk per Records Retention Policy			
11.3 Archive Prolog Files with EIS			
12. Close out Post Office box and arrange for mail forwarding.			
13. Terminate / remove construction services (fence, toilets, etc.)			
14. Terminate trailer (field office) utilities and services.			
14.1 Landlord - Inspect and Final Lease Payment accepted			
14.2 Terminate phone service.			
15. Remove trailers / field office / mock-ups .			
16. Close out City Permits (street closing permits….streets are acceptable)			
17. Notify corporate & region of project demobilization.			

REMARKS / added items			

3. Close-Letter

December 13, 2006

Marois Bros. Inc.
965 Millbury Street
Worcester,Massachusetts, 01607

RE: **Worcester Trial Courthouse**
Gilbane Job #3563

Subject: **Closeout**

To Whom It May Concern:

To close out this project, all work must be accepted, final contract sum agreed to, and all necessary documentation completed. To this end, the following/attached is a comprehensive list of open items. Please review and complete all items as soon as possible; in this way, we can work together to get final payments out promptly.

Punch list: List is attached.

Submittals: List is attached.

Open Change Requests: List is attached (**).

Accounting documents: The following documents must be submitted:

1. Final Contract Paperwork (copy attached)
2. All amendments executed and returned to the jobsite
3. "FINAL" sub-subcontractor and supplier waivers
4. Consent of Surety to Final Payment
5. M/WBE Affidavit (if applicable – copy attached)

Please do not hesitate to call regarding questions/issues with any items. For further issues with punchlist, call Dan Manescu; submittals or changes, call Mike Forwood, Lauren Egan or Maria Messore (**Please notify this office immediately if you have any open CR's that are NOT on the attached list); accounting issues, call Monica Snow. To schedule work, call Ralph Stukowski.

Thank you in advance for your prompt response to all items.

Sincerely,

GILBANE

Michael O'Brien
Senior Project Manager

Enclosures

cc: Reading File, File

FINAL CONTRACT PAPERWORK

Date _____

State Of _____

County of _____.
To all whom it may concern

Job 113563000
V# 39715
C# 29142

_____ of City of _____ County of _____,
and State of _____, being duly sworn, deposes and says that he is the _____ (title) of the **Marois Brothers** hereinafter called the Contractor; and being duly authorized makes this statement its behalf; that the Contractor in the performance of a certain contract dated _____ and all change orders thereto with DCAM (Owner) for the **Site Preparation/Utilities** (Work), Gilbane Building Company Job No. 113563000. **Worcester Trial Courthouse** in the City of **Worcester**, County of Worcester, State of **Massachusetts.**

FINAL CONTRACTOR'S SWORN STATEMENT

Contractor furnished labor or materials or both, (either by itself or by others under agreement with contractor), supervision of construction or alteration, and/or otherwise in connection with the site development and/or the erection and construction of a certain building or buildings, structures and installations situated on the property, that the following are the names of every person, firm or corporation furnishing material to, and of every unpaid laborer of and of every Subcontractor for, said Contractor in connection with said contract, and that the amounts due or to become due to such Subcontractors, persons, firms, corporations, laborers and others, for work done and materials furnished to the date of _____ are fully and correctly set forth opposite their names respectively; and that all other statements herein contained are true and correct.

SUBCONTRACTS

Name	Total Net Amount of Subcontract	Total Net Amount Earned to Date	Total Paid	Amount Included in This Application

MATERIALS

Name	Purchase Price of Material Furnished	Paid	Balance

LABOR

Name	Amount Due

Gilbane

Supplier's Waiver Of Lien
(Final)

I, the undersigned, being duly authorized Agent Officer of the Company stated below, do hereby affirm that all bills against ***Marois Bros. Inc.*** *for materials, services etc... delivered to said Company at the site of Gilbane Building Company's project,* ***Worcester Trial Court,*** *located at,* ***Worcester, MA*** *have been fully satisfied through period ending _____ and our right of lien is hereby waived.*

Paid in Full $_____ Dated this _____day of _____20___

_____
Company Name

_____
Signature

_____
Print or Type Name and Title

Contract No. 29142 Supplier No. 39715

Minority Business Enterprise Participation Affidavit

Gilbane Building Company - Construction Manager

For Period Ending:

Cost Code:		**Affidavit No:**	
Trade Contractor:		**Base Contract Amount:**	
Approved Contract Amendments:		**Adjusted Contract Value:**	
MBE Base Contract Commitment:		**MBE Base Contract Percentage:**	%

Actual MBE Contract Awards

Firm Name	Contractor (C) Supplier (S)	Classification MBE/WBE	Contract Amount	Payments
		TOTALS		

TOTAL MBE COMMITMENT: _____

ADJUSTED CONTRACT VALUE: _____

% MBE PARTICIPATION ACHIEVED: _____ %

NOTARIZED AND SIGNED BY OFFICER: _____

DATE: _____

Order Number . 00029142 Site Preparation / Utilities Marois Brothers Incorporated

Job/SubJob Cost Code	Rec Type Cost Typ	Job Name Cost Description	Date	Amd No	Lin ID	Cr No CR Desc	Original Contract	Amendment Amount	Contract Amount	Billed	Open	Retained
113563000	OS	Worcester Trial Court Complex	07/02/04	000	001		2,900,000.00		2,900,000.00	2,842,547.50	57,452.50	92,608.86
10202200	4115	Site Prep/Utilities										
113563000	OS	Worcester Trial Court Complex	10/21/04	001	001	4						
10202200	4115	Site Prep/Utilities				RFI#13- added MWell abandonment						
113563000	OS	Worcester Trial Court Complex	10/21/04	001	002	15		36,600.00	36,600.00	36,600.00		
10202201	4115	Site Prep Changes				Mass Highway Stock pile prep						
113563000	OS	Worcester Trial Court Complex	11/09/04	002	001	10		76,974.78	76,974.78	76,974.78		
10202201	4115	Site Prep Changes				Added Equipment for slab demo						
113563000	OS	Worcester Trial Court Complex	11/30/04	003	001	30		24,000.00	24,000.00	24,000.00		
10202201	4115	Site Prep Changes				Remove Fuel storage Tank						
113563000	OS	Worcester Trial Court Complex	01/17/05	004	001	540		17,000.00-	17,000.00-	10,200.00-	6,800.00-	
10202201	4115	Site Prep Changes				EB Slope chng from 1:1 to 2:1						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	001	1						
10202201	4115	Site Prep Changes				Bull#4- Issue PAM Plan						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	002	3		13,314.75	13,314.75	13,314.75		
10202201	4115	Site Prep Changes				Bul#1 Lead in Soil Abatement						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	003	7						
10202201	4115	Site Prep Changes				Bull#3 - Addendum #2						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	004	8						
10202201	4115	Site Prep Changes				Bull#5 - Addendum #3						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	005	70		4,990.61	4,990.61	4,990.61		249.55
10202201	4115	Site Prep Changes				R&D of Paint Reg & Soil						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	006	190		9,832.84	9,832.84	9,832.84		
10202201	4115	Site Prep Changes				Obst. Removal CR#10 over Run						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	007	240						
10202201	4115	Site Prep Changes				Bull#13-4in Fnd Sleeve Moistur						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	008	250						
10202201	4115	Site Prep Changes				UG-Plum changes for F-Capr						
113563000	OS	Worcester Trial Court Complex	01/20/05	005	009	5016		15,802.35-	15,802.35-	15,802.35-		
10202201	4115	Site Prep Changes				02A-R&D of 50K sf concrete slb						
113563000	OS	Worcester Trial Court Complex	02/07/05	006	001	130		2,245.52	2,245.52	2,245.52		
10202201	4115	Site Prep Changes				Add PIF's&Caps@16" 6.9,H.3/14						
113563000	OS	Worcester Trial Court Complex	03/09/05	007	001	10		7,628.00	7,628.00	7,628.00		
10202201	4115	Site Prep Changes				Pile change @ Wood Piles						
113563000	OS	Worcester Trial Court Complex	03/09/05	007	002	200		46,531.00	46,531.00	46,531.00		
10202201	4115	Site Prep Changes				Sprd Ftgs @ Elev #8&12 & #5&9						
113563000	OS	Worcester Trial Court Complex	03/09/05	007	003	210		18,460.14	18,460.14	18,460.14		
10202201	4115	Site Prep Changes				Premium Time w/CR #5070						
113563000	OS	Worcester Trial Court Complex	03/09/05	007	004	5070		30,000.00-	30,000.00-	30,000.00-		
10202201	4115	Site Prep Changes				02A-2,000 LF dewatering trench						
113563000	OS	Worcester Trial Court Complex	04/19/05	008	001	520		1,467.74	1,467.74	1,467.74		
10202201	4115	Site Prep Changes				Perim Fdn Drain chg to Schd 40						
113563000	OS	Worcester Trial Court Complex	05/10/05	009	001	310		5,802.97	5,802.97	5,802.97		
10202201	4115	Site Prep Changes				Demo Existing Elevator Piston						
113563000	OS	Worcester Trial Court Complex	05/12/05	010	001	170		24,972.09	24,972.09	24,972.09		
10202201	4115	Site Prep Changes				Contaminated Soil @ J-9						
113563000	OS	Worcester Trial Court Complex	05/12/05	010	002	410		1,250.00	1,250.00	1,250.00		
10202201	4115	Site Prep Changes				Bull #23-SKA-26: Perim Drain						
113563000	OS	Worcester Trial Court Complex	05/12/05	010	003	550		2,054.28	2,054.28	2,054.28		
10202201	4115	Site Prep Changes				Dewatering 1/6/05 - 1/31/05						
113563000	OS	Worcester Trial Court Complex	06/07/05	011	001	420		2,677.32	2,677.32	2,677.32		
10202201	4115	Site Prep Changes				RFI#62-added manhole SE Corner						
113563000	OS	Worcester Trial Court Complex	06/07/05	011	002	480		5,611.50	5,611.50	5,611.50		
10202201	4115	Site Prep Changes				SKS-105:sprd ftg @ EtoF-4 line						
113563000	OS	Worcester Trial Court Complex	06/07/05	011	003	890		5,050.90	5,050.00	5,050.00		
10202201	4115	Site Prep Changes				Added work for TIF Obstruction						
113563000	OS	Worcester Trial Court Complex	08/26/05	012	001	17		885.00	885.00	885.00		
10202201	4115	Site Prep Changes				Pile chnge @ Wood Piles-SKS-46						
113563000	OS	Worcester Trial Court Complex	08/26/05	012	002	5040		12,219.70	12,219.70	12,219.70		
10202201	4115	Site Prep Changes				02A- $10K Temp Earthen Ramps						
113563000	OS	Worcester Trial Court Complex	09/20/05	013	001	551		5,967.71	5,967.71	5,967.71		
10202201	4115	Site Prep Changes				Dewatering 2-1-05 to 4-05-05						
113563000	OS	Worcester Trial Complex	10/05/05	014	001	551		5,967.71-	5,967.71-	5,967.71-		
10202201	4115	Site Prep Changes				Dewatering 2-1-05 to 4-05-05						

Order Number . 03029142 Site Preparation / Utilities Marois Brothers Incorporated

Job/SubJob Cost Code	Rec Type Cost Typ	Job Name Cost Description	Date	Amd No	Lin ID	Cr No CR Desc	Original Contract	Amendment Amount	Contract Amount	Billed	Open	Retained
113563000	OS	Worcester Trial Court Complex	10/05/05	014	002	551		5,967.71	5,967.71	5,967.71		
11919000	4115	Outstanding Changes				Dewatering 9-1- 5 to 4-05-06						
113563000	OS	Worcester Trial Court Complex	10/19/05	015	001	180		18,148.20	18,148.20	18,148.20		1,819.24
10202201	4115	Site Prep Changes				Add Spread Footings SW corner						
113563000	OS	Worcester Trial Court Complex	01/17/06	016	001	230		675.00	675.00	400.00	275.00	
10202201	4115	Site Prep Changes				Bull#8- Added Dark Fiber Tele						
113563000	OS	Worcester Trial Court Complex	02/07/06	017	001	160		9,479.87	9,479.87	9,479.87		
10202201	4115	Site Prep Changes				Work to expose Unknown Waterlin						
113563000	OS	Worcester Trial Court Complex	02/21/06	018	001	9000		1,785.04	1,785.04	1,785.04		
10202201	4115	Site Prep Changes				Marois CM directed OT						
113563000	OS	Worcester Trial Court Complex	03/29/06	019	001	1540		4,703.67	4,703.67	4,703.67		
11919000	4115	Outstanding Changes				Premium Time To Prep Subgrade.						
113563000	OS	Worcester Trial Court Complex	03/29/06	019	002	2100		19,180.45	19,180.45	19,180.45		
11919000	4115	Outstanding Changes				Added Work Sanastrm SE Corner						
113563000	OS	Worcester Trial Court Complex	04/10/06	020	001	81		8,810.00	8,810.00	8,810.00		
11919000	4115	Outstanding Changes				Ramp Removal						
113563000	OS	Worcester Trial Court Complex	05/11/06	021	001	101		19,995.76	19,995.76	19,995.76		
11919000	4115	Outstanding Changes				Add cost earth shoring on Main						
113563000	OS	Worcester Trial Court Complex	05/11/06	021	002	1500		2,677.32	2,677.32		2,677.32	
11919000	4115	Outstanding Changes				RFI#518-Added DMH and work						
113563000	OS	Worcester Trial Court Complex	05/11/06	021	003	1550		2,726.65	2,726.65		2,726.65	
11919000	4115	Outstanding Changes				Hand Excavate @ Switchgear						
113563000	OS	Worcester Trial Court Complex	05/11/06	021	004	2360		20,004.24	20,004.24	20,004.24		
11919000	4115	Outstanding Changes				Added Soil Disposal Marois						
113563000	OS	Worcester Trial Court Complex	05/11/06	022	001	1500		2,677.32-	2,677.32-		2,677.32-	
10202201	4115	Site Prep Changes				RFI#518-Added DMH and work						
113563000	OS	Worcester Trial Court Complex	05/11/06	022	002	1500		2,677.32	2,677.32		2,677.32	
11919000	4115	Outstanding Changes				RFI#518-Added DMH and work						
113563000	OS	Worcester Trial Court Complex	05/11/06	022	003	1550		2,726.65-	2,726.65-		2,726.65-	
10202201	4115	Site Prep Changes				Hand Excavate @ Switchgear						
113563000	OS	Worcester Trial Court Complex	05/11/06	022	004	1550		2,726.65	2,726.65		2,726.65	
11919000	4115	Outstanding Changes				Hand Excavate @ Switchgear						
113563000	OS	Worcester Trial Court Complex	09/15/06	023	001	9646		10,815.00-	10,815.00-		10,815.00-	
10202201	4115	Site Prep Changes				Replace City Light Fixtures						
113563000	OS	Worcester Trial Court Complex	10/02/06	024	001	5060		7,775.75-	7,775.75-		7,775.75-	
10202201	4115	Site Prep Changes				@2A-25 test pits						
Totals For: Marois Brothers Incorporated							2,900,000.00	335,329.05	3,235,329.05	3,197,588.33	37,740.72	94,677.65

Pending Changes		CR No. Sts	Cost Description	Original Estimate	Contractor Quoted	Contractor Final	Original Contract	Pending Changes	Total Pending	Quote Due	Quote Recvd
113563000	OS	6	80	6,413.00	.00	.00		6,413.00	6,413.00		
10202201	4115	See CR#81			Erection Crane Access						
113563000	OS	6	360	.00	.00	.00		.00	.00	12/10/04	
10202201	4115	Site Prep Changes			SKS-56: Combine P2/P3 Caps						
113563000	OS	8	2210	.00	.00	.00		.00	.00	10/04/05	
10202201	4115	Site Prep Changes			Bull#95-Rev 15" Drain South						
113563000	OS	3	2270	2,000.00	.00	.00		2,000.00	2,000.00	03/21/06	
10202201	4115	Site Prep Changes			Bull 98-Civil-Hoop Pkg&Rel CB						
113563000	OS	5	5000	.00	.00	.00		.00	.00		
10202200	4115	Site Prep/Utilities			@2A-R&D 5000cy rocks/stone fnd						
113563000	OS	6	5010	.00	.00	.00		.00	.00		
10202200	4115	Site Prep/Utilities			@2A-R&D of 50K sf concrete slb						
113563000	OS	3	5020	7,500.00-	.00	.00		7,500.00-	7,500.00-		
10202201	4115	Site Prep Changes			@2A- 500sy of temp bituminous						
113563000	OS	2	5030	.00	.00	.00		.00	.00		
10202200	4115	Site Prep/Utilities			@2A- $10K R&D Asbestos in Soil						
113563000	OS	3	5030	10,000.00-	.00	.00		10,000.00-	10,000.00-		
10202201	4115	Site Prep Changes			@2A- $10K R&D Asbestos in Soil						

Order Number . 00029142 Site Preparation / Utilities Marois Brothers Incorporated

Pending Changes		CR No. Sts Cost Description	Original Estimate	Contractor Quoted	Contractor Final	Original Contract	Pending Changes	Total Pending	Quote Due	Quote Recvd
113563000	OS	6 5040	12,219.70	.00	.00		12,219.70	12,219.70		
10202200	4115	Site Prep/Utilities		02A- $10K Temp Earthen Ramps						
113563000	OS	6 5070	.00	.00	.00		.00	.00		
10202200	4115	Site Prep/Utilities		02A-2,000 LF dewatering trench						
113563000	OS	2 8038	1,000.00	.00	.00		1,000.00	1,000.00		
10202201	4115	Site Prep Changes		BC GNF Cleanup for Silos						
113563000	OS	2 8050	5,001.60-	.00	.00		5,001.00-	5,001.00-		
10202201	4115	Site Prep Changes		BC Marois Damages NW Site Imp						
113563000	OS	2 9008	2,699.96	2,702.00	.00		2,702.00	2,702.00		
10202201	4115	Site Prep Changes		Marois Extend Pollution						
113563000	OS	2 9017	1,500.00	1,500.00	.00		1,500.00	1,500.00		
10202201	4115	Site Prep Changes		Marois Street Permit Bond						
113563000	OS	2 9021	.00	6,169.17	5,473.65		5,473.65	5,473.65		
10202201	4115	Site Prep Changes		cut to backfill N fndn wall						
113563000	OS	2 9047	3,000.00	.00	.00		3,000.00	3,000.00		
10202201	4115	Site Prep Changes		Marois excavate for grnd grid						
Total Pending Changes:			6,231.70	10,371.17	5,473.65		11,807.35	11,807.35		
Total Projected:						2,900,000.00	347,136.40	3,247,136.40		

#	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Responsible Contact	Scheduled Completion Date	Punchlist Classification
63	00195	Building		Floor 2		South	Marois completed underground overdue work and they removed and damaged the curbs and sidewalk installed by Harvey at NW corner of the building. This issue needs to be addressed as soon as possible.		Dan Manescu - GBCO	Joe May - 02A	12/20/2006	
64	00012	Site					Drawing CD-100 requires to cut and cap gas line at Main St. Wait for confirmation letter. (FALL TIME)	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
65	00014	Site					Remove MEC Aluminum lights: (1) located on Main Street and (1) located on Comercial Street. Completed but Mass Electric still tracing circuts to shut off power at the locations~~Item closed~~	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
66	00015	Site					Remove overhead sign and deliver to the proper authorityr. - Sign was removed and submitted to the Highway Department. Item closed.	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
67	00016	Site					Remove & Dispose old existing light poles. Item closed.	11/30/2004	MATSKI	Joe May - 02A	3/31/2005	
68	00017	Site					Cable TV Box on Thomas Street Remove the Cable TV Box on Thomas Street coordinate with Cable Company. See ADD #1 - SKC-1 dated 5/22/04. Cable TV Box not to be moved anymore by Gilbane ~~Item closed~~	11/30/2004	MATSKI	Joe May - 02A	3/31/2005	RCL
69	00059	Building					Non-conforming crushed stone The crushed stone MHD M2.01.4 3/4" off-site borrowed from Worcester Sand & Gravel is not in conformance with the specs. This crushed stone will be used at a different location and the approved one will be delivered on site. The approved stone is delivered on site. ~~Item closed~~.	6/27/2005	Dan Manescu - GBCO	Joe May - 02A	7/11/2005	

#	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Responsible Contact	Scheduled Completion Date	Punchlist Classification
70	00071	Building		Floor 1		North	Missing Fabric Filter - The fabric filter on both sides of the sleeve in the foundation wall line A/7-8 is missing. Marois Brothers will install it after the crane departure. - The fabric fiter (Morafi Paper) was installed. Pictures were sent today to DCAM, SBRA, Tishman. - Also, per approved procedures the fabric fiter (Morafi Paper) will be installed at the interior end of the sleeve. - Work completed and accepted. ~~Item closed~~.	8/18/2005	Dan Manescu - GBCO	Joe May - 02A		
71	00064	Building				South	Crushed Stone backfilling - UTS report regarding the crushed stone used as a backfilling material at the south wall section around the drainage pipe between lines A/6-8 states that is not conforming to the spec. - Item in review by Gilbane and Marois Brothers. - Marois will reveal the stone layer around the drainage pipe for determining the type of stone used. - Per UTS report the stone used is not accepted. Marois will replace it with approved stone. - Work completed and accepted. ~~Item closed~~	6/27/2005	Dan Manescu - GBCO	Joe May - 02A	7/11/2005	
73	00108						Exposed foundation waterproofing to be checked and repaired on lines A/2-8; 1R and M		Dan Manescu - GBCO	Joe May - 02A		

ISSUING COMPANY / Description	Rec'd On	Issued On	Sch'd Comp	Actual Comp	Value	Closed
Gilbane Building Company						
KMD Mechanical Corp. - Plumbing						
RCL ITEM						
In courtroom 2-9 the electrical boxes to be installed correctly, and 3rd floor North corridor side missing electrical boxes for controls.		10/2/2006		10/24/2006	0	No
Item Notes: Yankee Technology to complete the following work: - Courtroom 2-9 the electrical boxes to be installed correctly. - 3rd floor North corridor side missing electrical boxes for controls.						
KMD Mechanical Corp.- HVAC						
RCL ITEM						
00083 **Location:**						
VAV Cover Access for servicing the VAV boxes					0	No
Item Notes: Access blocked by: Sprinkler pipes; Sanitary pipes; HVAC Duct; Wall studs, etc. - Yesterday 11/15/05 KMD started working at the VAV boxes covers. - As of today 11/30/05 two locatios fixed by KMD/HVAC. - As of today 1/11/06 more locations identified. List and pictures distributed to contractors. - Locations identified with contractors. Work started and is ongoing. - As of today 05/30/06, work completed on the East half of the building. Work ongoing at the west side of the building. - The list with fixing instructions for the first floor was given to the subs. Work ongoing. - The list with fixing instructions for the ground floor was given to the subs. Work ongoing. - Last Thursday 9/14 4th floor East and West was inspected by Gilbane and BR+A - Work ongoing based on the list submitted after latest inspection.						
00161 **Location: Building - Floor 2 - South**						
VAV box too low at stair #3 5th floor.		5/16/2006	6/16/2006		0	No
Item Notes: - KMD to relocate the VAV box. See bulletin #101 instructions. Work to be scheduled.						
00180 **Location: Building - Floor 2 - South**						
Access steps for the cooling tower.		10/2/2006	10/24/2006		0	No
Item Notes: Access steps for the cooling tower to be provided and installed by KMD.						
Marois Brothers, Inc.						
RCL ITEM						

ISSUING COMPANY / Description	Rec'd On	Issued On	Sch'd Comp	Actual Comp	Value	Closed
Gilbane Building Company						
Marois Brothers, Inc.						
RCL ITEM						
00108 **Location:**						
Exposed foundation waterproofing to be checked and repaired on lines A/2-8; 1R and M					0	No
Item Notes: - Exposed foundation waterproofing to be checked and repaired on lines A/2-8; 1R and M. Also drainage board and rigid insulation to be completed. - Work will be completed after removing the staging at the west elevation. - Work started the first week of September and is ongoing all around the building. A sign off drawing was distributed to DCAM and SBRA. - Work is ongoing. Daily inspections are performed and areas are signed off on the record drawing. - As of today 10/3/06 the east, north and west elevations are complete and signed off. Work to be scheduled for the south elevation in coordination with Harvey and Coghlin. - As of today 11/14/2006 the area on line A between lines 1R-2R and 6-17 was inspected and approved.						
00195 **Location:** **Building - Floor 2 - South**						
Marois completed underground overdue work and they removed and damaged the curbs and sidewalk installed by Harvey at NW corner of the building. This issue needs to be addressed as soon as possible.		12/20/2006	12/20/2006		0	No
Item Notes: Marois completed underground overdue work and they removed and damaged the curbs and sidewalk installed by Harvey at NW corner of the building. This issue needs to be addressed as soon as possible.						
Otis Elevator						
RCL ITEM						
00141 **Location:** **Building**						
Two precast panels were chipped by an Otis forklift operator on 2/15/06. See attached picture.		1/18/2006	2/1/2006		0	No
Item Notes: Two precast panels were chipped by an Otis forklift operator on 2/15/06. See attachment. - As of today the work is completed and is to be reviwed.						
00202 **Location:** **Building - Floor 5**						
At ground floor @ public elevators 1,2,3 and 4 the elevator door jamb doesn't align with the stone veneer.	12/12/2006		12/18/2006		0	No
Item Notes: At ground floor @ public elevators 1,2,3 and 4 the elevator door jamb doesn't align with the stone veneer. Otis to submit fix proposal. - As of today 12/12/06 fix proposal was submitted and approved with RFI# 1093. Construction adhesive to be submitted for approval. Work is to be scheduled.						

3.0 Operations Manual: Project Close-Out

OPERATIONS MANUAL
CONSTRUCTION

Gilbane

CLOSE-OUT

PROJECT CLOSE-OUT Top

All projects are to be closed out in a timely and efficient manner. It is the intent of Gilbane to close out its projects by the dates specified for achieving project completion stated in the Owner contract. It is also the goal of Gilbane to completely close out all projects within ninety (90) days after the last staff member leaves the site.

The project closeout is one of the most important phases during a project's life for establishing Gilbane's reputation. The better we are at closing out a project the better an Owner will remember us.

The close out of a project starts at the beginning of the project and continues through the life of the project. Satisfactory close out of the project is an ongoing process that must be well planned and carefully tracked through project completion.

The Project Executive is responsible for closing out a project. A closeout schedule must be prepared during the final quarter of the construction process, detailing:

- Remaining construction activities
- Outstanding change order work
- Rolling Completion List and Punch List completion
- Construction demobilization
- Gilbane staff demobilization

- Trade contract closing activities
- Archival functions
- Gilbane Owner contract closing activities

The Project Staff must process all paperwork on a current basis during the course of the project in order to achieve the close out goal. The processing of change estimates, backcharges, change orders, amendments, etc., cannot be allowed to accumulate during the progress of the work. Special attention must be given to expediting and completing rolling completion list and punch list items.

If a project cannot be completely closed out within the time period allotted for doing so, the Project Executive will identify the specific items causing the delay, document the reasons why Gilbane will not be able to complete them and create a schedule for completion. The Project Executive will then develop a comprehensive management plan, including cost and Gilbane staffing requirements, for completing these items in as expeditious a manner as possible. The Project Executive shall inform the Regional Operations Manager of the plan's intent and review any contractual impacts with the Owner.

PROJECT CLOSE-OUT CHECKLIST Top

Initial Activities:

- Establish close-out plan and schedule early in the project
- Conduct project close-out progress meeting(s) with the Owner and trade contractors to review close-out requirements
- Assign close-out duties
- Send out accounting requirements and close-out documents package to the trade contractors
- Prepare Project Data Report
- Complete trade contractor evaluation forms
- Advise insurance carrier/surety of job status
- Assemble final Lessons Learned, review, meet to update and enter final data and close any open items in database
- Personnel reassignment/evaluations
- Ensure Owner reference is good
- Ensure delivery of and obtain completed final client survey forms from the

Owner and Architect/Engineer

Resolve all remaining changes and cost-related items:

- Settle all outstanding changes/claims with the Owner
- Settle all outstanding changes with all trade contractors /vendors
- Settle outstanding backcharges with all trade contractors
- Settle outstanding claims with all trade contractors
- Process final amendments to trade contracts
- Verify that all projected costs for close out are included in the final estimate to complete.
- Prepare and distribute final Cost Report

Rolling Completion List (RCL) and Punch List:

- Maintain established RCL tracking system
- Compile, distribute, and review RCL and punch lists
  - List incomplete work with anticipated completion dates
  - List outstanding materials needed to complete work with anticipated delivery dates
  - Compile Gilbane's own final RCL prior to the punch list
  - Obtain punch lists from Owner, Architect/Engineers, and building operation/maintenance people
  - Issue consolidated punch list to the affected trade contractors for completion
  - Review punch list items with all interested parties on a regular basis to review progress
- Complete or correct all punch list items expeditiously
- Obtain Owner and Architect sign-off of punch list items if required

Final Accounting Requirements:

- Making final payments to Trade Contractors: (see Trade Contractor Final Payment Checklist in the Appendix to this manual.)
  - Obtain consent of surety to make a Trade Contractor final payment prior

to payment

- Obtain all waivers of lien from the trade contractors with copies of their trade subcontractors' waivers attached.
- Obtain final payment applications from trade contractors
- Reconcile trade contractors final payment
- Collect all final payment documentation
- Submit trade contractors final payment application to the Owner for their information and concurrence
- Process final payments to trade contractor

- Final Owner Requisition:
  - Purchase order de-commitment
  - Reconcile job cost to Owner Requisition
  - Obtain final Bond Premium Invoice (if applicable)
  - Reconcile project savings with Owner
  - Send final requisition to the Owner
  - Obtain final payment from Owner
  - Reconcile and close all project cash accounts and petty cash
  - Reconcile physical inventory of equipment and assets with inventory listing and arrange for disposal in accordance with the requirements of the Gilbane/Owner contract.

Final deliverables:

- Obtain operations and maintenance manuals
- Obtain specified warranties and certificates along with each warranty start date and length of warranty
- Turnover as-built drawings where required
- Obtain special warranties and certificates
- Document all deliverables turned over to the Owner with a letter of transmittal signed by who received the items for the Owner.

Contractor Close-Out

Contractor : Beauce-Atlas Inc

Contract No. 113563000-29989

Supplier No. 59942

	Engineering	**Date**	**GBCo Initials**
1	O&M Manuals (# ____ sets)	_____	_____
2	As-Builts (# _____ Sepia, # _____ Bluelines)	_____	_____
3	Special Guarantees	_____	_____
4	Manufacturer Guarantees/Warrantees	_____	_____
5	Backcharges Settled	_____	_____
6	C.R.'s Settled, C.O.'s Signed	_____	_____
7	Contact Listing To Owner For Warranty Work	_____	_____
8	Claims Settled	_____	_____
9	Owners Final Acceptance Of Work	_____	_____
10	A/E Certificate Of Final Completion	_____	_____
11	Final Release Amendment Issued/Signed/Filed	_____	_____

_____

Project Engineer

	Field	**Date**	**Initials**
1	Gilbane Punchlist Complete	_____	_____
2	Owner/Architect Punchlist Complete	_____	_____
3	Certificate & Permits	_____	_____
4	Attic Stock Turned Over/ Signed Off	_____	_____
5	Field Work Complete	_____	_____

_____

Superintendent

	Accounting	**Date**	**GBCo Initials**
1	General Release & Waiver Of Lien	_____	_____
2	General Guarantee	_____	_____
3	Consent Of Surety To Release Of Final Payment	_____	_____
4	Suppliers Waivers	_____	_____
5	MBE/WBE/DBE Settled	_____	_____
6	Final Sworn Statement	_____	_____
7	Bond Rider Increase	_____	_____

_____

Project Accountant

Project Manager

Contract Ready To Close-out

_____

Project Manager

- Schedule equipment demonstrations for Owner personnel, if in Owner contract, video tape, otherwise recommend Owner video tape
- Perform training for Owner required by specifications, if in Owner contract, video tape, otherwise recommend Owner video tape
- Turnover specified attic stock, keys, spare parts, etc. to Owner
- Turn over to Owner equipment and materials purchased for the project

Inspections:

- Final inspection walk down of trade contractor's contract work
  - Gilbane
  - Owner
  - Architect
  - Effected Trade Contractor
- Final inspections by municipal authorities:
  - Plumbing
  - Electrical
  - Structural
  - Building
  - Environmental
  - Fire Marshall
  - Elevator
  - Zoning
- Assemble copies of all final inspections made during the life of the project and turn over to the Owner

Occupancy:

- Obtain certificate of occupancy
- Obtain certificate of compliance
- Obtain certificate of substantial completion from Architect

- Obtain release of Governmental Jurisdiction bonds

Gilbane Site Demobilization:

- Demobilize project office
- Demobilize construction office/trailers
- Remove all construction equipment
- Terminate temporary utilities: electricity, water, phone, gas
- Transfer utility bills to Owner's name
- Transfer or sell Gilbane general conditions equipment as the Owner contract requires
- Forward mail to regional office
- Send records to storage in accordance with Records Retention in Operations Manual – General
- Notify Corporate of project demobilization
- Leave the site clean and orderly with no unfinished work that can negatively impact Gilbane
- Do a final inspection of the project office site and project with the Owner before leaving to make sure they are satisfied.

PROJECT DATA REPORT (Mandatory For All Projects) Top

The Project Data Report is required to be submitted at the start of a project as the "Initial Report" and at the conclusion as the "Final Report". The initial report includes general project information and forms the basis of the final report. Both reports are submitted using the approved Project Data Report form. The initial report is submitted within two weeks of the start of on-site construction. The final report submitted when construction is 95% complete. The report is not complete until the supplemental information indicated on the form is added.

The Project Data Report is an essential tool to provide the Company with a summarization of all pertinent data concerning a project that is extremely difficult to obtain after closeout. The Corporate and Regional Offices use the data for the development of historical references. The Project Data Report form is available in the Appendix to this manual.

As a source document it contains:

- Usage of the project
- Project Management Type

- Contract Amount
- Summary Description of the project
- Scope of services
- Cost Variance
- Project directory – Owner, Architect, Engineers and Consultants
- Gilbane staffing and durations on project
- Building details
- Number of changes handled on project
- Number of RFI's handled on project
- Project specific Quality Plan
- List of significant successes and/or error prevention resulting from the project quality plan process
- Cost data summary
- Initial and Final cost reports with variance explanation
- Number of claims on project and number of claims remaining open
- Description of building systems
- As-built schedule summary
- Initial and final schedules with variance explanation
- Actual MBE/WBE percentage achieved on project
- Project's average SCORE safety rating.
- Number and list of Quality activities on project
- Guarantees and warranties
- Trade contractors, major Trade Subcontractors and major suppliers
- Lessons learned (see QIC 010 Lessons Learned Documentation)
- Project photographs.

Distribution of the initial and final report includes at least three copies: one for the project permanent record, one copy to the Regional Operations Manager and one copy to Corporate Quality Manager.

OPERATIONS AND MAINTENANCE MANUALS Top

The Owner/Gilbane contract documents and the project's specifications will define the amount of materials that will be included in the Operations and Maintenance Manuals. The project staff is responsible for accumulating the required data and assembling the manual(s) for submission to the Owner.

The standard Operations and Maintenance Manual shall be assembled as specified in the project documents and at a minimum be in three ring binders and include:

- Table of Contents - the project specifications should be used, subject to Owner approval, as the numbering index guide for arranging and identifying items in the manual.

- Guarantee Periods - a listing of all guarantees, the company supplying the guarantee, start dates for the guarantees, duration of the guarantee and contact person with business and emergency telephone numbers.

- For each section of the specifications, provide the trade contractor, major trade subcontractor, supplier, installer, etc., who performed the work with their contact names and business telephone numbers.

- Also, list the specific manufacturer name, equipment name and nomenclature, model number, style, color, details, etc., for each specification section which were approved to be used and installed.

- Provide documentation and manufacturer's recommended preventive maintenance schedules for mechanical and electrical work where there are operating machinery, controls, gear, etc., that requires frequent inspection, servicing, and maintenance.

- Provide manufacturer and supplier data for structural and architectural items by specification, indicating if they are standard, special order, or custom items. Specific information is essential on items, such as hardware, painting, ceiling tile, wall fabrics, carpets and floor tile that are involved in any future "alterations" the Owner may want to perform. Include instructions on how the products should be cleaned or otherwise maintained.

All approved samples, color charts, product data, etc. shall be turned over to the Owner.

The Operations and Maintenance Manuals should be completed, and at least conditionally approved, at the time of "start up" activity. Gilbane staff and Owner's personnel should use them jointly during the start up period. During this time they can be checked, revised, and supplemented, if required, in order to produce a final completed and approved document to the Owner at the time of acceptance.

O&M manual format shall be as specified. If no format is required, the trade contractor should be required to submit a complete format for approval by Gilbane, the Engineer and the Owner

OWNER'S TRAINING Top

Prior to turning over the operation of any system of a building to the Owner, the Owner's operations and maintenance personnel shall be trained in the proper operation and maintenance procedures and requirements for the system. Approved O & M Manuals covering the equipment subject to training should be submitted to the Owner prior to the time of the training. Owner training should be provided before or be part of the trade contractors' demonstration that the equipment installed operates as intended.

It is advisable to have the designers of the system present during these training sessions to explain the design intent and unique characteristics of the system.

Proper training and understanding of intended system operation, proper method of operation, and required maintenance procedures can help minimize the number of call-backs to the project after the Owner assumes operations.

Training should be scheduled and the trade contractor's agenda be distributed in advance of training to give sufficient review, preparation and comment time.

The project staff shall assure that all training is conducted, maintain records of when the training is conducted and the attendees at the training sessions. Ensure that the record documents at the end of every session that the Owner was satisfied with the training and had no open questions or issues.

FOLLOW-UP AFTER PROJECT COMPLETION Top

The Project Executive is responsible for responding to any request received from the Owner during the guarantee or warranty period.

The Project Executive or other employee designated by the Regional Operations Manager shall visit completed projects prior to the expiration of the one-year warranty period, or for a time as required in the Owner contract or by local laws or regulations, to ensure that all guarantee and warranty obligations have been satisfied.

If extended guarantees or warranties have been provided to the Owner, periodic follow up visits shall be scheduled to ensure proper maintenance and operating procedures are being followed for the product/system covered by the extended guarantee or warranty. If during a follow up visit, a product/system covered by an extended guarantee or warranty is noted to be defective, the Project Executive shall take such actions as are necessary to protect Gilbane's interests and to satisfy contractual obligations to the Owner.

The Regional Operations Manager shall be notified of any such defects and the actions proposed by the Project Executive.

Appendix IV. Matrices

1. Example of Sub Matrix

Gilbane

Nashua High School South
Nashua, NH
Job No. 112660500

Subcontractor Close-Out Status

As Of:
04/24/07

Subcontractor	Contract No	Billing Instr. Issued	Final Papers Issued	General Guarantee	General Release	Consent Of Surety	Bond Incr. Rider	Suppliers Waivers	Final Sworn Statement	DBE/WBE Docs	OCIP Notice of Work Completion	OCIP Final Audit	Close-Out Checklist	Final Approval	Final Amendment	Billed 100%
America Sport Floors	18990	5/29/02	07/16/04	09/23/04	09/23/04	09/23/04	N/A	09/23/04	09/23/04	N/A	09/23/04		11-16 Mich	11/30/04	Amd#5 6/25/04	
AMSCo Inc	17302		07/16/04							N/A					Amd#75 4/12/05	APR
Associated Concrete Coatings	18746	4/5/02	07/16/04	06/28/04	09/09/04	09/09/04	N/A	09/09/04	09/09/04	N/A	9/1/04		11-16 Mich	11/30/04	Amd#11 8/11	**NOV**
Bloom South Flooring	19056	5/29/02	07/16/04	04/29/05	04/29/05			04/29/05	04/29/05	N/A					Amd#31 12/16	
Boston Showcase	19901	8/9/02	07/16/04	9/14/04	9/14/04	9/14/04	9/14/04	9/14/04	9/14/04	N/A	9/14/04			1/26/05	Amd#8 12/7	DEC
Brochu Inc., LA	21583	12/12/02	07/16/04	8/26/04	8/26/04	8/26/04	8/26/04	8/26/04	8/26/04	N/A	8/26/04		12/20/04	1/5/05	Amd 3 10/19	**NOV**
CB Seating	19897	8/9/02	07/16/04	12/02/04	12/02/04	01/25/05	01/25/05	12/02/04	12/02/04	N/A	8/1/04		02/09/05	02/14/05	Amd 4 10/19	**NOV**
Control Technologies	18273		07/16/04	10/25/04	10/25/04	11/01/04	11/01/04	N/A	10/25/04	N/A			3-14 Mich		Amd#26 12/2	APR
CPI Int'l	18794	4/5/02	02/04/04	03/24/04	03/09/04	03/19/04	N/A	04/26/04	03/09/04	N/A	3/24/04	N/A	07/06/04	09/24/04	Amd #2 2/4	
D'Agostino Assoc	18135		05/24/04	06/17/04	09/09/04	06/17/04	09/03/04	09/03/04	09/03/04	N/A	9/3/04		12/20/04	01/05/05	Amd 040 8/31	
Dailey, AP	19925	8/9/02	07/16/04	11/29/04	11/29/04	01/21/05	01/21/05	11/29/04	11/29/04	N/A	8/11/04		02/04/05	02/08/05	Amd #11	
Dec-Tam Corp	19060	5/29/02	02/24/04	07/06/04	07/06/04	07/06/04	07/06/04	11/29/04	11/29/04	$829,476	N/A	N/A	01/01/05	01/26/05	Amd 10/4/04	**NOV**
Delta Roofing	18258		06/02/04	12/13/04	09/14/04	12/22/04	12/22/04	12/22/04	12/22/04	N/A	11/16/04		01/12/05	01/17/05	Amd#45 12/7	**NOV**
Fimbel Paunet Corp	18792	4/5/02	07/16/04	11/05/04	11/05/04	11/05/04	11/05/04	11/05/04	11/05/04	N/A	11/05/04		11/16/04	11/30/04	Amd 10/4/04	
Griffin Electric	18129		07/16/04	12/22/04	06/07/05	06/07/05	06/07/05	06/07/05	06/07/05	N/A					06/17/05	07/05/05
HCI	18066		07/16/04	08/13/04	09/21/04	08/13/04	09/21/04	09/21/04	09/21/04	N/A	N/A	N/A	2-4 Mich		Amd#36 4/11/05	APR
Highland Seating	19956	8/9/02	02/04/04	06/21/04	06/21/04	02/12/04	N/A	N/A	06/21/04	N/A	N/A	N/A	06/22/04	7/30/04	Amd #5 2/4	
Interstate Concrete	18257		07/16/04	10/04/04	10/04/04	11/16/04	11/16/04	11/16/04	11/16/04	N/A	11/16/04		11-16 Mich		Amd 41	**NOV**
K&K Acoustical	19295	8/9/02	07/16/04	02/09/05	02/09/05	01/21/05	01/21/05	02/07/05	02/09/05	N/A			4-22 Jim		Amd #16	
Kel-Rick Const	18275		07/16/04	11/05/04	11/05/04	01/31/05	01/31/05	03/03/05	03/03/05	N/A			03/14/05	03/29/05	Amd #79	JAN
King Painting	18989	5/29/02	07/16/04							N/A	9/1/04				Amd #34 3/15	APR
Kreative II	19931	8/9/02	07/16/04	02/14/05	02/14/05	N/A	N/A	02/14/05	02/14/05	N/A	7/29/04		02/23/05	03/03/05	07/26/04	JAN
Krueger Int'l	19930	8/9/02	07/16/04	11/16/04	11/16/04	12/01/04	11/16/04		11/16/04	N/A	N/A	N/A	01/04/05	02/08/05	Amd 1 10/19	
Mas Con Corp	17630		02/24/04	11/30/04	11/30/04	11/30/04	11/30/04	11/30/04	11/30/04	N/A	11/30/04		12/20/04	01/05/05	Amd 015 8/31	
Material Handling Sales	18984	5/29/02	05/24/04	01/05/05	01/12/05	01/12/05	01/12/05	01/05/05	01/05/05	N/A	N/A	N/A	1-12 Mich		Amd #7	DEC
MD Wallboard	18274		04/15/03	07/02/03	07/02/03	07/02/03	07/02/03	07/02/03	07/02/03	07/02/03	10/13/03		07/02/03	10/24/03	08/28/03	
Merrimack Building Supply	20669	10/7/02	07/16/04	12/30/04	12/30/04	02/28/05	02/28/05	12/30/04	12/30/04	N/A	7/21/04		02/04/05	02/08/05	Amd#4 12/7	DEC
Merrimack Tile	19054	5/29/02	07/16/04		04/18/05	02/10/05	02/10/05		02/10/05	N/A					Amd#22 12/7	JAN
New Hampshire Steel	18739	4/5/02	07/16/04	12/17/04	12/17/04	12/17/04	12/17/04	12/17/04	12/17/04	N/A	N/A	N/A	12/31/04	01/17/05	Amd 31	DEC
Northeast Interior Systems	19900	8/9/02	07/16/04	03/14/05	03/14/05	01/05/05	01/05/05	04/22/05	12/30/04	N/A	9/1/04		3-14 Mich		Amd #15	DEC
Northern Peabody	17993		07/16/04	03/25/05	03/25/05	03/25/05	03/25/05	03/25/05	03/25/05	N/A					Amd #60	07/05/05
Northern Plasterwork	18807	4/5/02	02/24/04	08/31/04	08/31/04	08/31/04	08/31/04	08/31/04	08/31/04	N/A	8/31/04		10/26/04	11/15/04	Amd 009 8/31	
Novel Iron Works	17498		02/24/04	03/18/04	03/18/04	03/18/04	03/18/04	08/04/04	08/04/04	N/A	3/19/04	x	10/19/04	11/15/04	08/04/04	
Polyvision Corp	20331	10/7/02	05/24/04	11/05/04	11/02/04	11/02/04	11/02/04	11/17/04	11/02/04	N/A	11/02/04		12/20/04	01/05/05	Amd #9	**NOV**
Porter Athletic	19698	8/9/02	05/18/04	08/04/04	08/04/04	08/04/04	08/04/04	08/04/04	08/04/04	N/A	8/4/04		02/04/05	02/08/05	08/31/04	
R&R Window	18729	4/5/02	07/16/04	08/31/04	09/17/04	08/31/04	09/09/04	09/17/04	09/17/04	$51,138	8/26/04		11/29/04	11/30/04	Amd #28	
Sign Shoppe	21981	3/20/03	07/16/04							$62,635					Amd #4	07/05/05
Stanley Elevator	19899	8/9/02	07/16/04	09/09/04	09/09/04	09/09/04	N/A	09/09/04	09/09/04	N/A	8/26/04		11-15 Mich	12/30/05	Amd#1 10/4	
TriState Flag Inc	20662	10/7/02	07/16/04	09/21/04	09/21/04	N/A	N/A	N/A	N/A	N/A	9/21/04		12/16/04	01/05/05	Amd #1	
Tri-State Sprinkler	18252		07/16/04	12/30/04	12/30/04	01/30/05	01/31/05	12/30/04	12/30/04	N/A	12/30/04		02/14/05	03/03/05	Amd #19 12/2	DEC
Walker Specialties	20304	10/7/02	02/04/04	03/24/04	03/24/04	03/24/04	03/24/04	03/24/04	03/24/04	N/A	3/24/04	N/A	04/16/04	04/30/04	04/09/04	
Walsh Hannon Gladwin	20672	10/7/02	07/16/04	10/28/04	10/28/04	10/28/04	10/28/04	10/28/04	10/28/04	N/A	10/28/05		11/29/04	01/05/05	Amd#7	
Youngblood	18067		07/16/04	01/05/05	01/05/05	01/05/05	01/05/05	01/05/05	01/05/05	N/A	01/05/05		02/23/05	02/24/05	Amd#40	DEC

	= Received and/or Done
N/A	**= Not Applicable**

$981,053

2. Main matrix: close-out matrix: Job #3563

DCAM
WORCESTER COURT HOUSE
GILBANE # 3653

	= Information Needed
X	= Received/Completed
	= See Corresponding Sheet
	= Not Applicable

PROJECT CLOSE OUT LOG

					ACCOUNTING								ENGINEERING								SUPERINTENDENT				PM/PX
BP NO.	BID PACKAGE	CONTRACTOR AWARDED	GBC Contract #	Complete By	General Guarantee	General Release Of Liens & Waiver	Consent of Surety	Final Sworn Statement	Final Subs/Suppliers Waivers	MBE/WBE Paperwork	Sales Tax Certification	Final Invoice	Final CR Issued	Closeout of Allowances	As-Built/Record Drawings	Guarantees/Warranties	O & M Manuals	Owner Training Rec'd	A/E Final Certification	Owner Acceptance	Punchlist Complete	Final Clean-up Accepted	Attic Stock Received	Trailers/Equip. Removed from Site	Contractor Evaluation
02A	Site Preparation/Utilities	Marois Brothers, Inc.	29142																						
02B	Site Improvements/Landscaping	Francis Harvey & Sons, Inc.	38057																						
02C	Pressure Injected Footings	G. Donaldson Construction Co., Inc.	29209																						
03A	Concrete Foundations & Structural Slab	Francis Harvey & Sons, Inc.	29211																						
03B	Concrete Slabs	Harvey/Hanford JV	34016																						
04A	Masonry & Architectural Precast	G. Prunier & Sons	31119																						
05A	Structural Steel	Beace Atlas	29989																						
05B	Miscellaneous & Ornamental Metals	Berlin Steel	33174																						
06A	Millwork	Beaubois	35360																						
07A	Roofing	Titan Roofing	32219																						
07B	Waterproofing & Dampproofing	NER Construction	32217																						
07C	Spray Fireproofing	Century Drywall	32354																						
07D	Joint Sealants	Folan Construction	32215																						
07E	Foundation Waterproofing	DeBrino Caulking Associates, Inc	29609																						
08A	Special Doors	Baron Industries	34331																						
08B	Glass & Glazing	Modern Glass	36889																						
08C	Doors, Frames, & Hardware (furnish only)	Arc One (HCI/ACME)	33423																						
08D	Curtain Wall/Metal Panel	Ferguson-Neudorf	31730																						
09A	Drywall	Century Drywall	33190																						
09B	Ceramic Tile	West Flooring	33614																						
09C	Acoustical Ceilings	H. Carr & Sons	33613																						
09D	Interior Stone	NER Construction	33352																						
09E	Resilient Flooring	Kasseli & Morse	33615																						
09F	Epoxy Flooring	Mackenzie Painting	34585																						
09G	Carpet	Allegheney Contract Flooring	34325																						
09H	Painting and Wallcoverings	Century Drywall	36383																						
09J	Terrazzo	Joseph Cohn & Sons	36407																						
10A	Access Flooring	Longden	37293																						
10B	Signage	Sunshine Signs	38617																						
10C	Specialties																								
11A	Parking Equipment	Industrial Time & Systems	37289																						
11B	Detention Equipment	KNE Corporation	36901																						
14A	Elevators	Otis Elevators	32537																						
15A	Fire Protection	SRI Fire Sprinkler	31645																						
15B	Plumbing	KMD Mechanical	31639																						
15C	HVAC	KMD Mechanical	31633																						
15D	Underground Plumbing	KMD Mechanical	29600																						
16A	Electrical	Coghlin Electric	31790																						
16B	Underground Electrical	Ostrow Electric Company	29839																						
17A	A/V Equipment	Coghlin Electric	37553																						
17B	Furniture	Haworth	38625																						

3. Courthouse Template

	CONTRACTOR	Bid Package	Spec Section	Sub Section	Para-graph	Description	Quantity	Required Duration	Attic Stock	Keys/ Special Tools	Gaurantee	Warranty	O & M Manual	As-Builts	Training
Site improvements/Utilities	Marois	02A	02870	3.30	A.	After completing site and street furnishing installation, inspect components. Remove spots, dirt and debris. Repair damaged finishes to match original finish or replace component.									
	Marois	02A													
	Marois	02A													
Concrete foundations & Structural slab	F. Harvey	03A													
Concrete slabs	Handford/Harvey LLC	03B													
Masonry & Architectural Pa	GN Prunier		04200	3.26	D.										
Structural steel	Beauce Atlas		05120	1.06	H.										
Water & Damp proofing	NER	07B													
Spray Fireproofing	Century		07810	1.1	B.	Special Warranty: Submit a written warranty, Executed by Contractor and cosigned by Installer, agreeing to repair or replace sprayed fire-resistaive materials that fail within the specified warranty period (2 Years)									
Foundation Waterproofing	Debrino	07E													
	Ferguson Neudorf	08D													
Drywall	Century Drywall	09A													
Ceramic Tile	West Flooring	09B													
Acoustical Ceilings	H. Carr & Sons	09C													
Interior Stone	NER Construction	09D													
Resilient Flooring	Kasseli & Morse	09E													
Epoxy Flooring	Mackenzie Painting	09F													
Carpet	Allegheney Contract Flooring	09G													
Painting and Wall covering	Century Drywall	09H													
Terrazzo	Joseph Cohn & Sons	09J													
Fire Protection	SRI Fire Sprinkler	15A	15300	1.07	C.	At completion of work prepare a complete set of record drawings on Autocad 2000, showing all systems as actuallly installed.									
	SRI Fire Sprinkler	15A	15300	1.08	A-F	O&M									
	SRI Fire Sprinkler	15A	15300	3.14	E.	1. Upon completeion of the work, all equipment shall be thoroughly cleaned, polished and left in first class condiotoin for final acceptance									
	SRI Fire Sprinkler	15A	15300	3.18	A-E	Acceptance Tests									
Plumbing	KMD Mechanical	15B	15400	1.06	A-J	Guarantee and 24 Hour Service									
	KMD Mechanical	15B	15400	1.07	A-G	Record Drawings									
	KMD Mechanical	15B	15400	3.03	B.	Cleaning and Adjusting: 1. At the completion of the work, all parts of the installtion shall be thoroughly cleaned . All equipment, pipe, valves and fittings shall be cleaned of grease, metal cutting, sludge which may have accumulated by operation of the system for testing.									
HVAC	KMD Mechanical	15C	15501	1.7	B.	All Warranties Shall begin on the date of Substanial Completion of the entire project or DCAM's acceptance of the workmanship and/or material covered by the warranty, whichever is later. If no specfic period is spceifed period is specifed, the warranty shall extend for a minimum of 365 days.									
	KMD Mechanical	15C	15501	1.7	G.	HVAC Subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the General Requirements.									
	KMD Mechanical	15C	15501	3.8	A.	When all HVAC work on the project has been completed as indiciated on the drawings and specified herein and is ready for final inspection, such an inspection shall be made. At this time, the HVAC contractor for the work under this contract shall demonstrate that the requirements of these specifications ahve been met to the Designer's satisfaction									
	KMD Mechanical	15C	15501	2.49	B.										
Underground Plumbing	KMD Mechanical	15D													
Electrical	Coghlin Electric	16A	16010	3.6	A	Raceways and Junction Boxes: Raceways and junction boxes shall be blown out, dried and capped for future use.									

	Coghlin Electric	16A	16010	3.6	B.	During construction, cap conduits so as to prevent the entrance of sand and dirt.										
	Coghlin Electric	16A	16010	1.11	J	All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this contract.										
	Coghlin Electric	16A	16010	3.7	A	Final Inspection: A. When all electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the contract documents, the electrical subcontractor, for the work under this contract, shall demonstrate that the requirements of these specifications have been met to the architect's satisfaction.										
Electrical	Coghlin Electric	16A	16010	1.6	B.	All warranties shall begin on the date of substantial completion of the entire project or DCAM's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty periods. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.										
	Coghlin Electric	16A	16010	1.6	G.	Electrical subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the general requirements.										
	Coghlin Electric	16A	16010	1.15	A	Correction of work: A. The electrical subcontractor shall promptly correct all work provided under his contract and rejected by the designer as defective or as failing to conform to the contract document, whether observed before or after completion of work, and whether or not fabricated, installed or completed.										
	Coghlin Electric	16A	16010	1.17	A	Touch-up painting: The electrical subcontractor for the work under his contract shall refinish and restore to the original condition all equipment which have sustained damage to the manufacturer's prime and finish coats of paint and/or enamel during the course of construction, regardless of the source of damage.										
	Coghlin Electric	16A	16010	1.18	A - D	O & M										
	Coghlin Electric	16A	16010	1.21	A - I	Submit project Record Documents										
	Coghlin Electric	16A	16010	3.5	F	All equipment, whether part of the electrical subcontractor's contract or not, which must be cleaned due to the electrical subcontractor's work, shall be cleaned by the electrical subcontractor to the satisfaction of the designer.										
Electrical	Coghlin Electric	16A	16010	3.6	A	When all electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made.										
	Coghlin Electric	16A	16065	1.8	A	Submit project Record Documents										
	Coghlin Electric	16A	16116	1.5	A	In addition to the specific guarantee requirements of the general conditions, the contractor shall obtain, in the owner's name, the standard written manufacturer's guarantee of all materials furnished under this section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the contractor may have by law or other provisions of the contract documents.										
Electrical	Coghlin Electric	16A	16225	1.7	A, 4	Written statement of warranty										
	Coghlin Electric	16A	16225	3.5	I	Maunfacturer shall provide copies of test reports upon request.										
	Coghlin Electric	16A	16225	3.6	A - C	The Electrical Subcontractor shall provide a training session for DCAM's representatives for a normal workday at a jobsite location determined by DCAM										
	Coghlin Electric	16A	16225	3.7	A - C	O & M Documents shall be submitted										
	Coghlin Electric	16A	16260	3.5	A. & B	Manufacturer's Certification (provide 3 copies of manufacturer's representative's certification before final payment is made.										
	Coghlin Electric	16A	16260	3.6	A-C	Electrical Subcontractor shall provide a training session for DCAM reprsentative										
	Coghlin Electric	16A	16410	1.11	A.	Closeout Submittals and O&M Manuals 1. Final as-built drawing 2. Operatoin and maintenance manuals for items listed above. 3. Wiring diagrams. 4. Certified production test reports. 5.Installation information 6. Seismic certification and equipment anchorage details.										

	Coghlin Electric	16A	16410	3.6	A-C	Manufacturer's Certification (provide 3 copies of manufacturer's representative's certification before final payment is made.)										
	Coghlin Electric	16A	16410	3.7	A-C	Electrical Subcontractor shall provide a training session for DCAM reprsentative										
	Coghlin Electric	16A	16500	2.4	A.	Lighting fixture finishes shall be selected by the Designer. The Designer shall select finishes and indicate the color selections on the shop drawing submittals.										
	Coghlin Electric	16A	16570	1.8	A.	The manufacturer shall provide a full two-year limited warranty on all equipment supplied. The warranty shall cover 100% of the parts and manufacturers labor costs required over the first two-yers, which are directly attributable to the manufacturer.										
	Coghlin Electric	16A	16570	1.1	B.	The Manufacturer must make available new replacement parts for a minimum preiod of ten years from the final date of commissioning.										
	Coghlin Electric	16A	16725	1.8	B.	After completion of the installation, a traine technician empolyed by the system supplier shall demonstrate the system to the satisfaction of DCAM's representative and shall make all additional adjustment to the system operation as required by DCAM's representative as a result of this demonstration.										
	Coghlin Electric	16A	16725	3.8	A	A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. It should be given to personnel responsible for operating the system and representatives of the Boston Fire Department										
Electrical	Coghlin Electric	16A	16740	1.06	A - B	As-built drawings shall be submitted										
	Coghlin Electric	16A	16740	2.02	A	The contractor shall guarantee at the time of the bid that all category 6 cabling and components meet or exceed proposed specifications (including installation) of TIA/EIA-568A 569										
	Coghlin Electric	16A	16740	2.07	A - 1,2,3,4	The Manufacturer 25 year extended product warranty and application assurance for this SCS shall be provided to DCAM										
	Coghlin Electric	16A	16780	1.06	A	Submit As-Built Drawings two weeks prior to the cutover										
	Coghlin Electric	16A	16780	2.01	B.	The contractor shall furnish the manufactureres guarantee and all extended warranties.										
	Coghlin Electric	16A	16780	2.07	A.	The contractor shall provide a one year warranty of the installed system against defects in material and workmanship.										
	Coghlin Electric	16A	16780	5.02	A.	The contractor shall furnish the documentation of last calibration in the form of a certificate and all test results as part of the "As-Built" package										
	Coghlin Electric	16A	16780	5.02	B.	The contractor shall furnish 2 copies of complete cablind shedule, operating manuals and user guide for each system, complete with record drawings										
	Coghlin Electric	16A	16780	5.02	D	The contractor will clean all equipment and work areas of this scope.										
	Coghlin Electric	16A	16800	1.05	C - E	Submit As-Built Drawings, O & M Manuals and other relevant documents										
	Coghlin Electric	16A	16800	1.12	A - C	Warranty systems in writing against defects in material and workmanship for one year after system acceptance										
	Coghlin Electric	16A	16800	3.04	A - G	Operational training must be provided as specified										
	Coghlin Electric	16A	16260	1.6	E.	Electrical Subcontractor shall furnish, before the final payment is made, a written guarantee covering the above requirements										
Underground Electrical	Ostrow Electric Company	16B														

	Coghlin Electric	16A	16010	3.6	B.	During construction, cap conduits so as to prevent the entrance of sand and dirt.
	Coghlin Electric	16A	16010	1.11	J	All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this contract.
	Coghlin Electric	16A	16010	3.7	A	Final Inspection: A. When all electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the contract documents, the electrical subcontractor, for the work under this contract, shall demonstrate that the requirements of these specifications have been met to the architect's satisfaction.
Electrical	Coghlin Electric	16A	16010	1.6	B.	All warranties shall begin on the date of substantial completion of the entire project or DCAM's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty periods. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.
	Coghlin Electric	16A	16010	1.6	G.	Electrical subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the general requirements.
	Coghlin Electric	16A	16010	1.15	A	Correction of work: A. The electrical subcontractor shall promptly correct all work provided under his contract and rejected by the designer as defective or as failing to conform to the contract document, whether observed before or after completion of work, and whether or not fabricated, installed or completed.
	Coghlin Electric	16A	16010	1.17	A	Touch-up painting: The electrical subcontractor for the work under his contract shall refinish and restore to the original condition all equipment which have sustained damage to the manufacturer's prime and finish coats of paint and/or enamel during the course of construction, regardless of the source of damage.
	Coghlin Electric	16A	16010	1.18	A - D	O & M
	Coghlin Electric	16A	16010	1.21	A - I	Submit project Record Documents
	Coghlin Electric	16A	16010	3.5	F	All equipment, whether part of the electrical subcontractor's contract or not, which must be cleaned due to the electrical subcontractor's work, shall be cleaned by the electrical subcontractor to the satisfaction of the designer.
Electrical	Coghlin Electric	16A	16010	3.6	A	When all electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made.
	Coghlin Electric	16A	16010	1.8	A	Submit project Record Documents
	Coghlin Electric	16A	16065	1.5	A	In addition to the specific guarantee requirements of the general conditions, the contractor shall obtain, in the owner's name, the standard written manufacturer's guarantee of all materials furnished under this section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the contractor may have by law or other provisions of the contract documents.
Electrical	Coghlin Electric	16A	16116	1.7	A, 4	Written statement of warranty
	Coghlin Electric	16A	16225	3.5	I	Maunfacturer shall provide copies of test reports upon request.
	Coghlin Electric	16A	16225	3.6	A - C	The Electrical Subcontractor shall provide a training session for DCAM's representatives for a normal workday at a jobsite location determined by DCAM
	Coghlin Electric	16A	16225	3.7	A - C	O & M Documents shall be submitted
	Coghlin Electric	16A	16225	3.5	A. & B	Manufacturer's Certification (provide 3 copies of manufacturer's representative's certification before final payment is made.
	Coghlin Electric	16A	16260	3.6	A-C	Electrical Subcontractor shall provide a training session for DCAM reprsentative
	Coghlin Electric	16A	16260	1.11	A.	Closeout Submittals and O&M Manuals 1. Final as-built drawing 2. Operatoin and maintenance manuals for items listed above. 3. Wiring

						diagrams. 4. Certified production test reports. 5.Installation information 6. Seismic certification and equipment anchorage details.
	Coghlin Electric	16A	16410	3.6	A-C	Manufacturer's Certification (provide 3 copies of manufacturer's representative's certification before final payment is made.)
	Coghlin Electric	16A	16410	3.7	A-C	Electrical Subcontractor shall provide a training session for DCAM reprsentative
	Coghlin Electric	16A	16410	2.4	A.	Lighting fixture finishes shall be selected by the Designer. The Designer shall select finishes and indicate the color selections on the shop drawing submittals.
	Coghlin Electric	16A	16500	1.8	A.	The manufacturer shall provide a full two-year limited warranty on all equipment supplied. The warranty shall cover 100% of the parts and manufacturers labor costs required over the first two-yers, which are directly attributable to the manufacturer.
	Coghlin Electric	16A	16570	1.1	B.	The Manufacturer must make available new replacement parts for a minimum preiod of ten years from the final date of commissioning.
	Coghlin Electric	16A	16570	1.8	B.	After completion of the installation, a traine technician empolyed by the system supplier shall demonstrate the system to the satisfaction of DCAM's representative and shall make all additional adjustment to the system operation as required by DCAM's representative as a result of this demonstration.
	Coghlin Electric	16A	16725	3.8	A	A training session shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. It should be given to personnel responsible for operating the system and representatives of the Boston Fire Department
Electrical	Coghlin Electric	16A	16725	1.06	A - B	As-built drawings shall be submitted
	Coghlin Electric	16A	16740	2.02	A	The contractor shall guarantee at the time of the bid that all category 6 cabling and components meet or exceed proposed specifications (including installation) of TIA/EIA-568A 569
	Coghlin Electric	16A	16740	2.07	A - 1,2,3,4	The Manufacturer 25 year extended product warranty and application assurance for this SCS shall be provided to DCAM
	Coghlin Electric	16A	16740	1.06	A	Submit As-Built Drawings two weeks prior to the cutover
	Coghlin Electric	16A	16780	2.01	B.	The contractor shall furnish the manufactureres guarantee and all extended warranties.
	Coghlin Electric	16A	16780	2.07	A.	The contractor shall provide a one year warranty of the installed system against defects in material and workmanship.
	Coghlin Electric	16A	16780	5.02	A.	The contractor shall furnish the documentation of last calibration in the form of a certificate and all test results as part of the "As-Built" package
	Coghlin Electric	16A	16780	5.02	B.	The contractor shall furnish 2 copies of complete cablind shedule, operating manuals and user guide for each system, complete with record drawings
	Coghlin Electric	16A	16780	5.02	D	The contractor will clean all equipment and work areas of this scope.
	Coghlin Electric	16A	16780	1.05	C - E	Submit As-Built Drawings, O & M Manuals and other relevant documents
	Coghlin Electric	16A	16800	1.12	A - C	Warranty systems in writing against defects in material and workmanship for one year after system acceptance
	Coghlin Electric	16A	16800	3.04	A - G	Operational training must be provided as specified
	Coghlin Electric	16A	16800	1.6	E.	Electrical Subcontractor shall furnish, before the final payment is made, a written guarantee covering the above requirements
			16260			
Underground Electrical	Ostrow Electric Company	16B				

Appendix V. Submittals List

1. Submittal Open Items

Submittals Register - All Open Packages

#	Package Number (1st Part)	Package Number (2nd Part)	**REV**	**DESCRIPTION**	Is Closed	Importance	Trade	General Notes	Reviewer Notes	Author Company	Author Contact	Author Ref Number	Bid Package Number
1	2	11190	1	DE/Detention Equipment/Security Screen & Shelf at Prisoner-Attorney Interview Rooms (G210A, G210B & G210C) Product Data and Shop Drawings	No	Urgent	Detention Equipment			KNE Corporation (11B)	Victor Conklin - 11B		
2	9	12510	0	Electrical Components for Systems Furniture	No		Office Furniture			Spaceworks (17B)	Tabitha Joy - 17B		
3	14	5500	2	MM/Metal Fab./Revised Interior Pipe Bollards Shop Drawing and Finish Color Chart & Product Data	No	Urgent	Miscellaneous & Ornamental Metals (05B) - 05500			Berlin Steel Construction Co. (05B)	Stephen Seymour - 05B		05B
4	1	5700	2	MM/Orna.Metals/Revised Main Atrium (West) - Ornamental Railing System Shop Drawings	No	Urgent	Misc. & Ornamental Metal (05B) - 05700			Berlin Steel Construction Co. (05B)	Stephen Seymour - 05B		
5	2	5700	2	MM/Orna.Metals/Revised Main Atrium (East) and Stair No. 1 - Ornamental Railing System Shop Drawings	No	Urgent	Misc. & Ornamental Metal (05B) - 05700			Berlin Steel Construction Co. (05B)	Stephen Seymour - 05B		
6	3	5700	2	MM/Orna.Metals/Revised Side Atriums (North & South) and Stair Nos. 8 & 9 - Ornamental Railing System Shop Drawings	No	Urgent	Misc. & Ornamental Metal (05B) - 05700			Berlin Steel Construction Co. (05B)	Stephen Seymour - 05B		
7	14	5500	3	MM/Metal Fab./Revised OH Door Frames Shop Drawing	No	Urgent	Miscellaneous & Ornamental Metals (05B) - 05500	submittal returned 12/8/05. Interior pipe bollards was incorrectly reviewed by SBRA. Notified SBRA awaiting their response. MTF.		Berlin Steel Construction Co. (05B)	Stephen Seymour - 05B		
8	18	3450	0	Exterior Precast Architectural Concrete Piece Schedule & Piece Shop Drawings for East & West Pediments (Beton)	No	Urgent	Masonry	Drawing submitted by Beton/GNP on 8/25/05 were in French and were Rejected by GBCo		G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		04A

9	12	3450	3	Exterior Precast Concrete Mix Designs - Water Absorption Test Results	No	High	Masonry	Information regarding need of cylinder data phoned to GNP 4/27/05. Awaiting data for resubmission. Per SBRA Cylinder strength approved for mix. Still need to submit water absorption test data for complete approval of mix. Informed Steve Prunier (GNP) 5/31/05.(MF) Submission on Mix Design Completed 6/14/05.(MF)	Resubmit per spec 03450 2.4E (Jeffery Leupold)	G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		
10	22	4200	2	Masonry/Masonry Reinforcing Steel Drawings For Exterior Elevations - Level 2 to Level Mech. Level	No	Urgent	Masonry			G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		
11	17	3450	0	Exterior Precast Architectural Concrete Piece Schedule & Piece Shop Drawings	No	Urgent	Masonry			G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		04A
12	21	4200	1	Masonry/Masonry Reinforcing Steel Drawings For Exterior Elevations - Ground to Level 2	No	High	Masonry			G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		04A
13	25	4200	3	Masonry/Revised Masonry Reinforcing Steel Drawings For Exterior Elevations - Mech. Level	No	High	Masonry			G. N. Prunier & Sons, Inc. (04A)	Steve Prunier - 04A		

14	1	7261	6	WP/A-V Barrier/Sheet Rubberized Asphalt Barrier (SRAB) And Auxiliary Materials Product Data & Shop Drawings	No	Urgent	Waterproofing & Dampproofing (07B)	Submittal 0001-07261-00 was withdrawn by NER. They changed the material from Blueskin to Perma-Barrier. Resubmitted as part of this submittal. Details WP2, WP3, WP4, WP6B, WP7A, WP7B & WP8 in this package were revised prior to return of this submittal. The revisions were based on a meeting with SBRA on 5/4/05. These items were in submittal 0001-07261-04. Only detail WP9C will require resubmission. (MF)		NER Construction Management Corp. (07B)	STECOO		07B
15	9	2781	0	Site Imp/Site Stonework/Granite Dimensional Site Stone & Landscape Curbing (Inboard Granite Curbing & Planters) Finish Texture Verification Sample	No	Urgent	Site Stonework (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		02B
16	3	2780	1	Site Imp/Unit Pavers/Detectable Warning Unit Paver Color Samples	No	Urgent	Unit Pavers (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		02B
17	1	2951	2	Site Imp/Landscape Work/Landscaping Mulch Sample	No	Urgent	Landscape Work (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		
18	1	2218	3	Site Imp/Lndscpe Grading/Imported Topsoil Sample (Source: Agresource, inc.)	No	Urgent	Landscaping Grading (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		
19	1	2810	2	Site Imp/Irrigation Sys/Revised Sprinklers Product Data and Additional Irrigation System Components Product Data	No	Urgent	Irrigation System (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		

20	7	10431	1	Site Imp/Signage/No Parking, Drop Off and Handicapped Site Street Signs Shop Drawings & Product Data	No	Normal	Site Imp/Signage (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		
21	3	2951	1	Site Imp/Landscape Work/Landscaping Cround Cover Fertilizer Product Data	No	Urgent	Landscape Work (02B)			F. Harvey & Sons, Inc. (02B)	Sean Nelligan - 02B		
22	1	10100	1	GWB/Visual Display Boards/Revised Claridge Markerboards Product Data & Shop Drawings	No		Visual Display Boards (09A)			Century Drywall Inc - Drywall (09A)	Ryan Simons - 09A		09A
23	40	6400	0	Millwork/Removable Jury Platform Hardware	No	Urgent	Architectural Woodwork (06A)			Beaubois (06A)	Pierre Faucher - 06A	#406-27	06A
24	15	14211	1	Detainee Cab Drawings	No		Traction Elevators			Otis Elevator (14A)	Peter Ratigan - 14A		
25	55	5120	1	Structural Steel blocks 25,29,33,34	No	Urgent	Structural Steel	Status was given 2/16/07. hard copies received 2/18/05.		Beauce Atlas (05A)	Martin Savoie - 05A		
26	88	5120	0	Structural Steel Piece Record DWGs Zones 1,2,3,4,5	No	Urgent	Structural Steel			Beauce Atlas (05A)	Martin Savoie - 05A		
27	95	5120	0	see attacked list of Record Piece Dwgs. blocks 1@48	No		Structural Steel			Beauce Atlas (05A)	Martin Savoie - 05A		
28	99	5120	0	Structural Steel Record Drawings	No		Structural Steel			Beauce Atlas (05A)	Martin Savoie - 05A		
29	5	9400	0	TERRAZZO- Mock Up	No		Terrazzo			Joseph Cohn Company (09J)	Lou Monico - 09J		
30	2	7162	1	Crystalline Waterproofing - Guarantee & Waterproofing Final Approvals	No		Crystalline Waterproofing			DeBrino Caulking Associates, Inc (07E)	Lewis Houghtaling 3rd - 07E		

31	5	8410	1	CW/Alum. Store Fronts/Aluminum Entrances Door Schedule, Shop Drawings and Product Data for Doors Nos. 1225, C3002, C3101, C3403B, C3404B, C3502, CG110 & CG210	No	Urgent	Curtain Wall & Metal Panels (08D) - 08410	3/3/06-MTF (GBCo) - Submittal returned referencing Bulletin #154. Bulletin has not been issued as of this dated. Submittal held open until bulletin is issued. Bulletin No. 154 received 4/19/06 changing the hardware in this submittal. Submittal to be revised and resubmitted.		Ferguson Neudorf Glass, Inc. (08D)	John Neudorf - 08D		
32	1	8800	2	CW/Curtain Wall, Storefront & Skylight Glazing Product Data and Verification Samples	No	Urgent	Glazing	Samples perviously Approved as Noted - Resubmit for Record. These are the record samples.		Ferguson Neudorf Glass, Inc. (08D)	John Neudorf - 08D		
33	4	10200	2	CW/Non-Cutrain Wall Louvres Glazed into Curtain Wall Frames Substitution Request and Shop Drawings	No	Urgent	Curtain Wall & Metal Panels (08D) - 10200			Ferguson Neudorf Glass, Inc. (08D)	John Neudorf - 08D		
34	7	8920	4	CW/Alum.Glazed CW/Revised West Main Entrance Stainless Steel Swing Door Shop Drawings, Hardware Product Data and Hardware Schedule	No	Urgent	Curtain Wall & Metal Panels (08D)			Ferguson Neudorf Glass, Inc. (08D)	John Neudorf - 08D		
35	4	9260	1	Gypsum Board Assemblies-Trim Accessories Samples	No		Gypsum Board Assemblies			Century Drywall Inc - Drywall (09A)	Joel Trojan - 09A		
36	1	9265	1	Gypsum Board Shaft- Wall Assemblies	No		Gypsum Board Shaft-wall Assemblies			Century Drywall Inc - Drywall (09A)	Joel Trojan - 09A		
37	1	10290	1	Bird Control - Fasteners for Metal Cornice	No		Bird Control			Adams Management Group (10C)	Joe Robichaud - 10C		

38	5	15501	1	HVAC - Sheet Metal Duct Standards Record Copy	No		HVAC			KMD Mechanical Corp.- HVAC (15C)	JENVAR		
39	25	15501	2	Registers, Grilles & Diffusers - Types K & L	No		HVAC			KMD Mechanical Corp.- HVAC (15C)	JENVAR		
40	4	15970	0	Thermostat Layout Locations Ground thru 5th floors	No		Automatic Temperature Controls			KMD Mechanical Corp.- HVAC (15C)	JENVAR		
41	4	8800	1	G&G/Glazing/Interior Glass and Glazing Product Data, Glazing Schedule, Test Reports, Certificates & Verification Samples	No	Urgent	Glass and Glazing (08B) - Glazing		Glazing Schedule submitted was rejected by GBCo due to numerous errors and missing items. Also numerous other problems with submitted information. Modern Glass informed and submittal held until proper information received. 6/28/06-MTF-GBCo	Modern Glass & Aluminum, Inc. (08B)	Jeffrey Johnson - 08B		
42	6	10431	1	Signage/Exterior Sign Shop Drawings	No	Urgent	Signs (10B)			Sunshine Sign Company (10B)	Jason Barthe - 10B		

43	8	10431	0	Signage/Signage Samples (M2, M1, A/W, A, Braille Rail & Hardware for Overhead Signs)	No	Urgent	Signs (10B)			Sunshine Sign Company (10B)	Jason Barthe - 10B		10B
44	10	10431	0	Signage/Signage Samples Courtroom Seal	No	Urgent	Signs (10B)			Sunshine Sign Company (10B)	Jason Barthe - 10B		10B
45	24	4200	1	Masonry/3/4" Hooked Anchor at Top of Masonry Wall Seismic Connection Substitution Request, 3/4" Power Stud Product Data &Top of Masonry Wall Seismic Connection Details	No	Urgent	Masonry			G. N. Prunier & Sons, Inc. (04A)	George Prunier - 04A		04A
46	38	6400	1	Millwork/CSO Desks in Main Atrium (#2000, #3000 & #4000) Shop Drawings	No	Urgent	Architectural Woodwork (06A)			Beaubois (06A)	Gaetan Godin - 06A		
47	29	6400	5	Millwork/Revised Judicial Sec Workstation Shop Drawings & Substitution Request	No	Urgent	Architectural Woodwork (06A)			Beaubois (06A)	Gaetan Godin - 06A		
48	36	6400	1	Millwork/Wood Wainscot at South Side Atrium Shop Drawings	No	Urgent	Architectural Woodwork (06A)			Beaubois (06A)	Gaetan Godin - 06A		
49	3	8211	1	Millwork/Wood Doors Sample	No		Flush Wood Door (06A)			Beaubois (06A)	FLOBRO		
50	2	5400	2	Roofing/Cold Formed Metal Framing/Cornice and Cooling Tower & Generator Wells Cold Form Metal Framing Shop Drwaings & Calculations	No	High	Roofing (07A) Cold Formed Metal Framing			Titan Roofing, Inc. (07A)	EDGEB		
51	4	7610	3	Roofing/Metal Roofing Shop Drawings	No	Urgent	Roofing (07A) (07610)			Titan Roofing, Inc. (07A)	EDGEB		
52	3	6100	1	Roofing/Rough Carpentry/CDX Plywood and Kwik-Flex Screw Product Data	No	Urgent	Roofing (07A) - Rough Carpentry			Titan Roofing, Inc. (07A)	EDGEB		
53	1	7900	1	Roofing/Joint Sealant Product Data and Color Chart	No	Urgent	Roofing (07A) - 07900	Submittal held by GBCo. Awaiting narative of use of product from Titan.(MF-5/4/05). Narative recieved 9/14/05.(MF)		Titan Roofing, Inc. (07A)	EDGEB		

54	4	16110	2	Electrical Underground As-builts - East & West	No		Conduits and Raceways	3/25/05: gave copy to Coghlin Electric for coordination 3/28/05: sent to SBRA for review. 4/11/05: SBRA send back not reviewed....did not include GBC review stamp 4/27/05: resent with stamp		Ostrow Electric Company (16B)	David Esteves - 16B		
55	1	15400	1	Underground Plumbing Clean-out Covers	No		Plumbing			KMD Mechanical Corp. - Underground Plumbing (15D)	David Dupre - 15D		
56	6	3300	1	Wall, Pile Cap & Grade beam Rebar Dwgs M-A/5-1 line - R1, R3-R7, R18-R20	No		Cast-in-Place Concrete			Francis Harvey and Sons (03A)	Chris Barbadora - 03A		
57	2	3300	2	Rebar Shop Drawings A-F.3 / 17-6 lines: R2-R7, R12 & R13 & RS2, RS4, RS6 & RS7, SK1&2	No		Cast-in-Place Concrete			Francis Harvey and Sons (03A)	Chris Barbadora - 03A		
58	1	16740	1	Structured Cabling System - Voice Patch Panels	No		Structured Cabling System			Coghlin Electrical Contractors (16A)	Brian Lewis - 16A		
59	5	16410	1	Short Circuit & Protective Device Coordination Study	No		Low-Voltage Distribution			Coghlin Electrical Contractors (16A)	Brian Lewis - 16A		
60	5	9600	0	Interior Stone- Stair 8 and 9 Shop Drawings	No		Flooring			NER Construction Management - INTERIOR STONE (09D)	Bob Dejadon - 09D		

3.0 RFI(s)

Gilbane

RFI Summary Log

Outstanding RFIs (Team Meeting)

DCAM Worcester Courthouse
204 Main StreetWorcester, MA 01608

Project # 113563000
Tel: 508-753-4309 Fax: 508-753-5164

Gilbane Building Company

RFI #	Subject	Author Company	Answer Company	Date Created	Date Resp	Days in Rev	
1048	Bull #143 - Drs @ Vestibule Security clarification	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	9/8/2006		68	
1068	Message Schedule for Sign Types A5 & M6	Sunshine Sign Company	Shepley Bulfinch Richardson & Abbott	9/25/2006		51	
1075	Emergency receptacle feed in tel/data room 3305	Coghlin Electrical Contractors	Shepley Bulfinch Richardson & Abbott	10/4/2006		42	
1076	Wing Wall Depths at Plastic Laminate Countertops	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	10/5/2006	11/3/06	41	Team TO Review
1079	Clarification for Lighting	Tishman Construction Corporation of New England	Shepley Bulfinch Richardson & Abbott	10/10/2006		36	
1088	Atrium Cove light interference with bridge steel	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	10/17/2006		29	
1097	Lobby LCD Monitor Installs	Coghlin Electrical Contractors - A/V	Shepley Bulfinch Richardson & Abbott	10/30/2006		16	
1099	Court Provided 4 Channel Recorder	Coghlin Electrical Contractors - A/V	Shepley Bulfinch Richardson & Abbott	10/30/2006		16	
1103	Communications Details - Fiber Terminations	Coghlin Electrical Contractors - A/V	Shepley Bulfinch Richardson & Abbott	10/31/2006		15	
1104	Restricted Elevator No. 7 Entrance	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/1/2006	11/3/06	14	Need More Info.
1105	Room 2001 Soffit, Ceiling and Floor Plan Dimensions	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/1/2006		14	
1107	Construction Joints on Central Street Sidewalks	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/2/2006		13	
1109	VCT Floor Pattern Design	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/3/2006		12	
1111	NCR-Courtrooms 4-10, 4-13, 4-14, 4-15, 4-17 & 3-9 Wall Panel As-Built Layout	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/6/2006		9	
1112	Mounting Heights & Locations for outlets for vending area - URGENT	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/7/2006		8	
1113	Confirming - Refrigerator Ice makers	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/15/2006		0	
1114	Metal Locker Numbering Sequence	Century Drywall Inc - Drywall	Shepley Bulfinch Richardson & Abbott	11/8/2006		7	
1115	Steel rail system/ stair risers	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/8/2006		7	

Gilbane

RFI Summary Log
Outstanding RFIs (Team Meeting)

RFI #	Subject	Author Company	Answer Company	Date Created	Date Resp	Days in Rev
1117	VCT rom 1221	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/10/2006		5
1118	Postal Codes for Postal Specialties Post Office Boxes	Century Drywall Inc - Drywall	Shepley Bulfinch Richardson & Abbott	11/10/2006		5
1119	Cracking of Mortar Joints between Precast Panels	Gilbane Building Company	Shepley Bulfinch Richardson & Abbott	11/13/2006		2

Total Number of RFIs for this project: 21 Final Totals for this project:

Gilbane

Submittal Packages

Summary Log (Team Meeting)

DCAM Worcester Courthouse
204 Main StreetWorcester, MA 01608

Project # 113563000
Tel: 508-753-4309 Fax: 508-753-5164

Gilbane Building Company

Number-Rev	Description	To Company	Sent	Due	Rec'd	Days +/-	Action
Baron Industries							
0001-11160-00	SD/Low Profile Elevating Dock Product Data	Shepley Bulfinch Richardson & Abbott	7/5/2006	7/19/2006		133	
Beaubois							
0034-06400-1	Millwork/Revised Transaction Counter at Register & Probate Family Services (Rm 2001) & Probation Workstation (Rm 2100) Shop Drawings	Shepley Bulfinch Richardson & Abbott	11/10/2006	11/24/2006		5	
0035-06400-1	Millwork/Judical Conference Rooms (Rooms 3200 & 3600) MDF Joint Samples	Shepley Bulfinch Richardson & Abbott	11/9/2006	11/23/2006		6	
Beauce Atlas							
0099-05120-0	Structural Steel Record Drawings	Shepley Bulfinch Richardson & Abbott	5/16/2006	5/30/2006		183	
Berlin Steel Construction Co.							
0033-05500-00	MM/Metal Fab./Penthouse & Elevator Machine Room Roof Access Ships Ladders (Lapeyre Stairs) Shop Drawings	Shepley Bulfinch Richardson & Abbott	11/3/2006	11/17/2006		12	
Century Drywall - Paint							
0011-09900-0	Exterior Paint Samples	Shepley Bulfinch Richardson & Abbott	11/9/2006	11/23/2006		6	
Century Drywall Inc - Drywall							
0002-12498-1	GWB/Chain and Sprocket Double Roller Shades Overlap at Clerestory Corner Shop Drawing	Shepley Bulfinch Richardson & Abbott	11/10/2006	11/24/2006		5	
0003-08305-00	GWB/Access Doors/Exterior Flush Access Doors for 3rd and 5th Level Soffits at West Elevation	Shepley Bulfinch Richardson & Abbott	11/8/2006	11/22/2006		7	
0005-09260-00	GWB/GWB Assem/Exterior Soffit Board Product Data for 3rd and 5th Level Soffits at West Entrance	Shepley Bulfinch Richardson & Abbott	11/9/2006	11/23/2006		6	
F. Harvey & Sons, Inc.							

Gilbane

Submittal Packages
Summary Log (Team Meeting)

Number-Rev	Description	To Company	Sent	Due	Rec'd	Days +/-	Action
F. Harvey & Sons, Inc.							
0001-02218-00	Site Imp/Lndscpe Grading/Imported Topsoil Sample (Source: Baldarelli Brothers, Inc.)	Shepley Bulfinch Richardson & Abbott	8/22/2006	9/5/2006		85	Rejected
0001-02218-02	Site Imp/Lndscpe Grading/Imported Topsoil Sample (Source: Agresource, inc.)	Shepley Bulfinch Richardson & Abbott	10/13/2006	10/27/2006		33	
0001-02810-01	Site Imp/Irrigation Sys/Revised Sprinklers Product Data and Additional Irrigation System Components Product Data	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0001-02870-02	Site Imp/Site Improvements/Revised Paver Suspended Tree Grates Shop Drawings Shop Drawings	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0002-02870-04	Site Imp/Site Improvements/Revised North Custom Tree Grates & Bronze Area Drain Grates Product Data & Shop Drawings	Shepley Bulfinch Richardson & Abbott	10/27/2006	11/10/2006		19	
0002-02938-00	Site Imp/Sodding/Sodding Installer's Qualification Data	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0003-02951-00	Site Imp/Landscape Work/Landscaping Cround Cover Fertilizer Product Data & Contractor Qualifications	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0003-11152-00	Site Imp/Traffic Controls/Loop Detectors for Central Street Product Data & Certificate of Compliance	Shepley Bulfinch Richardson & Abbott	10/28/2006	11/11/2006		18	
0004-02940-0	Site Imp/Structural Soil/Hydrogel Product Data	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0006-02300-00	Site Imp/Earthwork/Gravel Fill, Crushed Stone & Ordinary Fill Samples	Shepley Bulfinch Richardson & Abbott	8/22/2006	9/5/2006		85	
0006-02300-01	Site Imp/Earthwork/Gravel Fill Retest Sample (Aggregate Industries)	Shepley Bulfinch Richardson & Abbott	8/22/2006	9/5/2006		85	
0006-02781-00	Site Imp/Site Stonework/Granite Dimensional Site Stone & Pavers Shop Drawings	Shepley Bulfinch Richardson & Abbott	10/25/2006	11/8/2006		21	
0007-02300-00	Site Imp/Earthwork/Gravel Fill & Crushed Stone Samples (Alternate Source: Baldarelli Brothers, Inc.)	Shepley Bulfinch Richardson & Abbott	8/22/2006	9/5/2006		85	
0007-02781-00	Site Imp/Site Stonework/Granite Inboard Curb Shop Drawings	Shepley Bulfinch Richardson & Abbott	10/28/2006	11/11/2006		18	
0007-10431-00	Site Imp/Signage/No Parking, Drop Off and Handicapped Site Street Signs Shop Drawings & Product Data	Shepley Bulfinch Richardson & Abbott	11/14/2006	11/28/2006		1	
0008-02300-00	Site Imp/Earthwork/Ordinary Fill Sample (Source: Baldarelli Brothers, Inc.)	Shepley Bulfinch Richardson & Abbott	8/29/2006	9/12/2006		78	
0010-07900-00	Site Imp/Joint Sealers/Sidewalk Joint Sealant Product Data, Color Chart, and Installer Qualifications	Shepley Bulfinch Richardson & Abbott	10/28/2006	11/11/2006		18	
Industrial Time & Systems of N.E., Inc.							
0002-11152-0	Parking Control System - revised Pedestal Post	Shepley Bulfinch Richardson & Abbott	10/4/2006	10/18/2006		42	

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Submittal Packages
Summary Log (Team Meeting)

Number-Rev.	Description	To Company	Sent	Due	Rec'd	Days +/-	Action
KMD Mechanical Corp.- HVAC							
0011-15501-4	HVAC- Fin Tube Radiation - FT-A Grd E/W, 1st, 2nd, 3rd & 4th Floor West & FT-B	BR+A Consulting Engineers, Inc.	11/9/2006	11/23/2006		6	
KNE Corporation							
0001-11192-01	Detention Equip/Revised GAP Control Panel Shop Drawing	Shepley Bulfinch Richardson & Abbott	11/2/2006	11/16/2006		13	
0005-08800-00	DE/Glazing/Assault Resistant Glazing Product Data & Sample	Shepley Bulfinch Richardson & Abbott	11/7/2006	11/21/2006		8	
MacKenzie Industrial Flooring							
0004-09671-0	Resinous Floor- Base Detail	Shepley Bulfinch Richardson & Abbott	11/1/2006	11/15/2006		14	
NER Construction Management - INTERIOR STONE							
0002-09600-4	Interior Stone- Second Floor Shop Drawings	Shepley Bulfinch Richardson & Abbott	11/1/2006	11/15/2006		14	
Spaceworks							
0004-12510-2	Loose Furniture- Wood Color Sample for Courtroom Furniture	Shepley Bulfinch Richardson & Abbott	11/7/2006	11/21/2006		8	
0007-12510-0	Systems Furniture Part 2- Floors 2-4	Shepley Bulfinch Richardson & Abbott	10/31/2006	11/14/2006		15	
Sunshine Sign Company							
0003-10431-00	Signage/Security Desk Directory Shop Drawings	Shepley Bulfinch Richardson & Abbott	9/26/2006	10/10/2006		50	
0005-10431-00	Signage/Additional Signage Program Shop Drawings (Main Directory, ~~AVW, MS & AC Signs~~)	Shepley Bulfinch Richardson & Abbott	10/10/2006	10/24/2006		36	
Titan Roofing, Inc.							
0005-07552-0	Roofing/SBS Roof Modifications Product Data, Material Certification, Assembly Letter, Samples & Shop Drawings	Shepley Bulfinch Richardson & Abbott	11/2/2006	11/16/2006		13	

Number of Submittal Packages in this Project: 37

Appendix VI. RCL

1. Bid Package 02A

#	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Responsible Contact	Scheduled Completion Date	Punchlist Classification
63	00195	Building		Floor 2		South	Marois completed underground overdue work and they removed and damaged the curbs and sidewalk installed by Harvey at NW corner of the building. This issue needs to be addressed as soon as possible.		Dan Manescu - GBCO	Joe May - 02A	12/20/2006	
64	00012	Site					Drawing CD-100 requires to cut and cap gas line at Main St. Wait for confirmation letter. (FALL TIME)	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
65	00014	Site					Remove MEC Aluminum lights: (1) located on Main Street and (1) located on Comercial Street. Completed but Mass Electric still tracing circuts to shut off power at the locations! Item closed.	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
66	00015	Site					Remove overhead sign and deliver to the proper authorityr. - Sign was removed and submitted to the Highway Department. Item closed.	11/30/2004	MATSKI	Joe May - 02A	1/31/2005	RCL
67	00016	Site					Remove & Dispose old existing light poles. Item closed.	11/30/2004	MATSKI	Joe May - 02A	3/31/2005	
68	00017	Site					Cable TV Box on Thomas Street Remove the Cable TV Box on Thomas Street coordinate with Cable Company. See ADD #1 - SKC-1 dated 5/22/04. Cable TV Box not to be moved anymore by Gilbane. Item closed	11/30/2004	MATSKI	Joe May - 02A	3/31/2005	RCL
69	00059	Building					Non-conforming crushed stone The crushed stone MHD M2.01.4 3/4" off-site borrowed from Worcester Sand & Gravel is not in conformance with the specs. This crushed stone will be used at a different location and the approved one will be delivered on site. The approved stone is delivered on site. Item closed.	6/27/2005	Dan Manescu - GBCO	Joe May - 02A	7/11/2005	

70	00071	Building		Floor 1		North	Missing Fabric Filter - The fabric filter on both sides of the sleeve in the foundation wall line A/7-8 is missing. Marois Brothers will instal it after the crane departure. - The fabric fiter (Morafi Paper) was installed. Pictures were sent today to DCAM, SBRA, Tishman. - Also, per approved procedures the fabric fiter (Morafi Paper) will be installed at the interior end of the sleeve. - Work completed and accepted. Item closed.	8/18/2005	Dan Manescu - GBCO	Joe May - 02A		
71	00064	Building				South	Crushed Stone backfilling - UTS report regarding the crushed stone used as a backfilling material at the south wall section around the drainage pipe between lines A/6-8 states that is not conforming to the spec. - Item in review by Gilbane and Marois Brothers. - Marois will reveal the stone layer around the drainage pipe for determining the type of stone used. - Per UTS report the stone used is not accepted. Marois will replace it with approved stone. - Work completed and accepted. Item closed.	6/27/2005	Dan Manescu - GBCO	Joe May - 02A	7/11/2005	
73	00108						Exposed foundation waterproofing to be checked and repaired on lines A/2-8; 1R and M		Dan Manescu - GBCO	Joe May - 02A		

2. Bid Package 03A

#	Responsible Contact	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Scheduled Completion Date	Punchlist Classification
35	Fred Collins - 03A	53	Building					Ground level exposed concrete casing columns to get smooth finish on the visible sides.	6/27/2005	Dan Manescu - GBCO	7/25/2005	
36	Fred Collins - 03A	37	Building		Floor 1			Rebar at the side of the window openings. On the Foundation Wall on the sides of each opening in the masonry wall instead of #5 rebar Harvey will install one #6 at 4" each side and one #6 at 8" each side. The #5 rebars on each side of the openings will be replaced by #6 rebars. Replaced by SER instructions. Work completed and accepted. Item closed.	4/6/2005	Dan Manescu - GBCO	4/15/2005	
46	John Harvey - 03A	196	Building		Floor 2		South	The sidewalk section between the main sidewalk and stair #6 door is sloping towards the stair #6 door. The slope of that sidewalk section has to be corrected per approved drawings and specs.		Dan Manescu - GBCO	12/20/2006	
47	John Harvey - 03A	185	Building		Floor 2		South	Missing boxout for handrail at stairs #8 and 9 at 3rd floor		Dan Manescu - GBCO	10/31/2006	
48	John Harvey - 03A	41						Concrete finish in areas with a 6" toping - 1st deck S-E corner		Dan Manescu - GBCO		
49	John Harvey - 03A	31	Building		Floor 1		East	Incompleted ground floor shower depressions. See RFI #510 - attached procedures.		Dan Manescu - GBCO		
50	John Harvey - 03A	32	Building		Floor 1		East	Incompleted ground floor ramps per drawing BF101B. See RFI #510		Dan Manescu - GBCO	5/31/2006	
51	John Harvey - 03A	40						Extending of the thread on the anchor bolts at H3/14 column.		Mike O'Brien - GBCO		
52	John Harvey - 03A	34	Building		Floor 1		South	Miss placed #6 masonry dowels. The #6 masonry placed 4" from the inside face of the foundation wall when the detail calls for them to be placed 4" from the outside face of the foundation wall. See pictures at L:\Photos\Dowels on the South wall - Central Street. Francis Harvey will fix the issue per SER instructions. As of today 5/18/2005 the #6 dowels are installed to SER satisfaction. The operation is ongoing. As of today 6/8/2005 the operation of installing the #6 dowels per SER instructions is ongoing. As of today 6/15/2005 the operation of installing the #6 dowels per SER instructions is ongoing. The work was completed and accepted. Item closed.	3/27/2005	Dan Manescu - GBCO	4/1/2005	
53	John Harvey - 03A	35	Building		Floor 1		South	ELO CONE The anchor bolts at one column on line 10 are too short. Harvey will use four 5" long ELO CONE replacements. Harvey ordered them and the delivery date will be sometime next week. As of 5/10/2005 the ELO CONE replacements are fabricated and will be replaced next week. As of today 5/18/2005 the ELO CONE replacements are on site and will be replaced per SER instructions. As of today 3 ELO CONE are installed. Work is underway to install the fourth one. SER - John Lok checked and supervised the installation of the ELO CONE. As of today 6/8/2005 the 4th ELO CONE was installed at the column K-10.1. The ELO CONE for the column K-11 will be installed this week per SER instructions. As of today 6/13/2005 the ELO CONE was installed at the column K-11 per SER instructions. Item closed	3/27/2005	Dan Manescu - GBCO	4/1/2005	
54	John Harvey - 03A	11	Site					Anchor bolts not installed on pile caps on 14 line.	11/22/2004	MATSKI	12/6/2004	Notice to Comply

55	John Harvey - 03A	22	Site	Area 2			North	Exposed rebar during winter. Rebar left exposed during winter weather to be visually inspected for precense of rust/scale prior to placing concrete. Scale/rust should be removed to satisfaction of Structural Engineer. The scale/rust will be removed at the end of july before the installation of the new liquid boot. Rebar checked and accepted. Item closed.	2/9/2005	Mike O'Brien - GBCO	4/1/2005	RCL
56	John Harvey - 03A	23	Site	Area 2			North	Voids at base of foundation wall (both sides) at A line between 7 & 5 lines. - Repair voids at base of foundation wall (both sides) at A line between 7 & 5 lines. - Using non shrink grout @ 7,500 psi, Report by John Lok. The voids were repaired using the specified grout. John Lok report pending. - Repairs completed and inspected by UTS. - Item closed.	2/9/2005	Mike O'Brien - GBCO	4/1/2005	Notice to Comply
57	John Harvey - 03A	26	Building	Area 1	Undergr ound		East	Repair of the Grout under column baseplates The Grout under column baseplates is not solid 8 line east. See Lee Lim's chart for locations of repair. RFI#325 There is concern that the grout under some of the columns, A to M line might have been compromised. A field test to check the integrity of the grout was conducted, there were several members present. Lee Lim has sent a report and F. Harvey has forwarded the repair procedures, advance copy provided and will be forwarded via normal procedures. RFI 0325 has been submitted. F. Harvey has been requested to check grout at areas where columns have not been placed as of yet. 2/22/05 Lee Lim & SBRA to clarify RFI response. Received clarification via RFI 0325, 2/24/2005 Harvey to proceed with corrective work , weather permitting. 3/14/2005 Harvey to start repairs this week, remove leveling plates east of 11 line and UTS will check with Swiss hammer. All Repairs lines 8-17/A-M completed and inspected by UTS, DCAM, Tishman, SER. Impact Test and Sounding Test. See the Walkdown Inspection Report. Item closed	2/18/2005	Mike O'Brien - GBCO	2/21/2005	Notice to Comply
58	John Harvey - 03A	170	Building		Floor 2		South	Weeps missing at lighting poles concrete bases.		Dan Manescu - GBCO	9/29/2006	
59	John Harvey - 03A	57	Building					Missing reglet at joint between structural slab and foundation wall - See RFI 569	6/27/2005	Dan Manescu - GBCO	7/11/2005	
60	John Harvey - 03A	62	Building					Bented rebars at pile caps. - At the pile caps which are in the crawler crane's path the rebars were bented over. - The bented rebars were cut out and the new one will be epoxy in place. - As of today the holes are completed per SER instructions. - Before the new rebars will be epoxy in place the holes will be vacuumed and air pressure cleaned. - Work will start today after the smoke test of the Liquid Boot. - Anchores were installed per approved procedures. Work to be inspected by UTS. - Work completed. Item closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005	

3. Bid Package 04A

#	Responsible Contact	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Scheduled Completion Date	Punchlist Classification
5	Steve Prunier - 04A	182	Building		Floor 2		South	Grind mortar around door frames at 5th floor NE and SW roofs and also at ground floor at top of the widows were calking needs to be applied.		Dan Manescu - GBCO	11/30/2006	
6	Steve Prunier - 04A	91	Building		Floor 3		East	Missing weep holes at the pier by door jamb lines D and H.8/line 14 at the 3rd floor roof		Dan Manescu - GBCO	11/9/2005	
7	Steve Prunier - 04A	102						3 chipped precast panels 4th floor level South elevation line A/14 and ground floor A/12		Dan Manescu - GBCO	1/9/2006	
8	Steve Prunier - 04A	105						Control joints missing @ 3rd and 5th floors N and S elevations.		Dan Manescu - GBCO		
9	Steve Prunier - 04A	00025	Building	Area 1	Underground		East	Verification survey of brick shelf. Done. Item closed	2/15/2005	Mike O'Brien - GBCO	2/28/2005	
10	Steve Prunier - 04A	00049	Building		Floor 2		East	At the second floor line A16 south elevation perimeter CMU blocks, the last CMU block at the first course towards west has the face inside the building cracked. Also, one joint presents lack of mortar. The foreman from G. N. Prunier & Sons, Inc. Mike aknowledged the situation and was planning to replace the CMU block and to complete the joint. Operation is ongoing. Work completed and inspected. Item closed.	6/20/2005	Dan Manescu - GBCO	7/4/2005	
11	Steve Prunier - 04A	00052						Bricks with vertical cracks Several bricks used for the mock-up have complete vertical cracks and some others have multiple cracks. The bricks are unacceptable and all future shipments need to be inspected. Revision of Prunier submittal from the brick manufacturer. Today Wednesday July 6th at 2PM is set up the meeting with Tom Kachoris, President of Spaulding Brick, and George Prunier, of GN Prunier & Sons, to discuss the brick fire crack issue. The issue is settled between the parties. No bricks having cracks longer that the shorter side of a brick will be accepted. Item closed.	6/21/2005	Dan Manescu - GBCO	7/5/2005	
12	Steve Prunier - 04A	00024	Building	Area 1	Underground		East	Verification survey of brick shelf. Done. Item closed.	2/15/2005	Mike O'Brien - GBCO	2/28/2005	
13	Steve Prunier - 04A	00146	Building					At stair #3, 5, 6 and #7 steel tube support pockets into the CMU wall to be filled in.		Dan Manescu - GBCO		
14	Steve Prunier - 04A	00153	Building		Floor 2		South	The door's MO to be increased at the appropriate dimmension.		Dan Manescu - GBCO	5/15/2006	
15	Steve Prunier - 04A	00065	Building		Floor 1		South	Precast corners at zipper window sill A/14 are wrong shape	6/27/2005	Dan Manescu - GBCO	7/11/2005	
16	Steve Prunier - 04A	00078	Building					Stainless Steel precast Anchors too long - Impact on the window air barrier assembly	9/1/2005	Dan Manescu - GBCO	9/6/2005	
17	Steve Prunier - 04A	00080	Building					Stains on the Relieving Angles at South and East Elevation walls	9/9/2005	Dan Manescu - GBCO	9/22/2005	

18	Steve Prunier - 04A	00081	Building					Dry Pack above the CMU wall between the Relieving angles hangers at ground floor North lines 9-17 . - The sequence of soft joints and dry pack above the CMU wall between the Relieving angles hangers at ground floor North lines 9-17 needs to be checked with Prunier. - Prunier will start to install the Dry Pack at the specified locations. - Work completed, inspected and accepted by Tishman-Jack Rossetti. - NER patched the SRAB. Item closed.	9/9/2005	Dan Manescu - GBCO	9/22/2005	
19	Steve Prunier - 04A	00082	Building					Weep holes to be on the stainless steel flashing and not on the mortar bed	9/9/2005	Dan Manescu - GBCO		
20	Steve Prunier - 04A	00167	Building		Floor 2		South	CMU wall corners to be adjusted (rounded) at the ground floor CMU walls including partitionwalls in the deteinee cells.		Dan Manescu - GBCO	7/21/2006	
21	Steve Prunier - 04A	00171	Building		Floor 2		South	Precast block missing at East facade above the gas meter on the side of the ground floor window.		Dan Manescu - GBCO	9/19/2006	
22	Steve Prunier - 04A	00172	Building		Floor 2		South	Mortar cracked at joints between precast panels.		Dan Manescu - GBCO	10/9/2006	
23	Steve Prunier - 04A	00120						Roof deck to be restored at the openings for rigging the pediments. - At east elevation the roof deck to be restored at the openings used for rigging the precast pediments. - Work completed. Item closed.		Dan Manescu - GBCO		
24	Steve Prunier - 04A	00116						Rigid insulation 1" board was installed behind the East elevation precast columns. See RFI#697		Dan Manescu - GBCO		
25	Steve Prunier - 04A	00123	Building		Floor 5		South	Missing CMU joint reinforcement		Dan Manescu - GBCO		
26	Steve Prunier - 04A	00124	Building		Floor 5		South	Seismic clips bolts to be tightened. Shimms to be used.		Dan Manescu - GBCO		
27	Steve Prunier - 04A	00125	Building		Floor 5		South	Precast blocks chipped at the East Pediment Precast top row. Prunier/Beton to submit repair procedure.		Dan Manescu - GBCO		
28	Steve Prunier - 04A	00128	Building		Floor 5		South	Deck Penetrations form FRACO anchors to be filled in with concrete by G.N.Prunier		Dan Manescu - GBCO	1/18/2006	
29	Steve Prunier - 04A	00106	Building				East	Hard joint at the underside of the beams and slabs on the ground floor - see detail S0.7 and A902.		Dan Manescu - GBCO		
30	Steve Prunier - 04A	00136	Building					Bithutene Mastic @ precast anchors impedes installation of air/water barrier system at the window sills		Dan Manescu - GBCO	2/1/2006	
31	Steve Prunier - 04A	00137	Building					The top strip of rigid insulation under the bottom of the precast anchors is missing @ window sills.		Dan Manescu - GBCO	2/1/2006	
32	Steve Prunier - 04A	00144	Building					One precast chipped panel on the South elevation A/9. See attached picture.		Dan Manescu - GBCO	2/1/2006	
33	Steve Prunier - 04A	00109						- Building facade inspection - punch list.		Dan Manescu - GBCO		
34	Steve Prunier - 04A	00110						Insulation missing @ 1st floor M/1R line corner.		Dan Manescu - GBCO		
35	Steve Prunier - 04A	00111						Mortar @ construction joint along M line. Picture and location provided to Prunier (SPRING TIME)		Dan Manescu - GBCO		
36	Steve Prunier - 04A	00112						Mortar splashes at windows sill to be removed by Prunier.		Dan Manescu - GBCO		
37	Steve Prunier - 04A	00107						Brick facade to be washed to remove the eflorescence		Dan Manescu - GBCO		

4. Bid Package 05A

#	Responsible Contact	Number	Building	Wing	Floor	Room Number	Elevation	Description	Inspected Date	Author	Scheduled Completion Date
41	Regis Savard - 05A	156	Building		Floor 2		South	Missing seismic clips		Dan Manescu - GBCO	5/30/2006
42	Regis Savard - 05A	72	Building		Floor 1		South	Slotted holes of the base plate of the C86053(7.5/A) & C86054(7/A) see RFI 579 We had to slot the holes of the base plate of the C86053(7.5/A) & C86054(7/A) because the anchor bolts have been installed in the wrong location. We intend to put some 3/8 4"1/2 x 4"1/2 plate washers welded all around with a 1/4" fillet to cover the slots; please confirm. The proposed fix is acceptable per SER. RFI 579 answered. Work completed and accepted. Item closed.	8/18/2005	Dan Manescu - GBCO	
43	Regis Savard - 05A	73	Building		Floor 5		East	Painting to be done at old seismic clips at the penthouse located in the window opening.	8/18/2005	Dan Manescu - GBCO	
44	Regis Savard - 05A	74	Building		Floor 5		East	Missing Deck Extension at 4th level south line A/9 The deck extension at the 4th level south line A/9 was not on site when the CMU pier was constructed. Now, the fully grouted and reinforced CMU pier is spanning two levels, 3rd an 4th. To anchor the CMU pier to the deck we propose using two seismic clips w/2 anchor bolts as per the attached sketch - see RFI 581. RFI 581 answered. Work completed and accepted. Item closed.	8/18/2005	Dan Manescu - GBCO	
45	Regis Savard - 05A	38	Building		Floor 1		East	Relieving angles touch-up procedure for the relieving angles. - The First Delivery Inspection of the relieving angles revealed that they are many deep scratches on the galvanized painted areas, and bent tabs some of them having cracked welding. Also the connecting bolts are not galvanized as they are required per specs and drawings. Furthermore, the galvanized paint applied on the relieving angles is off color. - As repair, the galvanized paint shall be applied on all the bottom (visible) side of the relieving angles and also on the side edge and 1" under the precast panel. In areas where there are windows, the touch up paint shall go 6" past window. - A representative from Duncan Galvanizing is on site to demonstrate the application of the touch up galvi paint. Today 5/11/2005 the relieving angles are cleaned and prepared for the setting up operation. - Yesterday 5/17/2005 was inspected and approved the benchmark for "The field touch-up procedure for the relieving angles". The benchmark consisted in 5 angles being in successive stages of the procedure: sanded/abraded surface, primer application and colorgalv finish coat application. - Attached is the Benchmark Inspection Form. - The field touch-up procedure is ongoing according to the approved benchmark.	2/27/2005	Dan Manescu - GBCO	4/15/2005
52	Martin Savoie - 05A	00029	Site	Area 1			East	Rough surfaces at the edges to be welded on the cantilever beam having the piece# 9015. The cantilever beam having the piece# 9015 presents rough surfaces at the edges to be welded. The welded ends will be examined by an inspector from UTS on Wednesday 3/02/05 morning for evidence of laminations. inclusions or other discontinuities. The extent to which such defects will be permitted and the extent of repair permitted shall be determined by the inspector and made in accordance with ASTM A6, Paragraph 9. ten pictures of the mentioned beam and of a similar beam were taken and they are in L:\Photos\Cantilever beam welding. The end of the beam was grinded down and UTS inspected and approved. Item closed	2/28/2005	Dan Manescu - GBCO	3/9/2005

53	Martin Savoie - 05A	00030	Building	Area 4	Floor 3		East	Not inspected full penetration welds at the columns C4121(3rd level F/13) & C5111(3rd level H/11) The full penetration welds at the columns C4121(3rd level F/13) & C5111(3rd level H/11) have not been inspected at 100%. They are already erected, so the remaining percentage shall be inspected on site to satisfy the requirement. Submit report with test results. Inspection done by UTS - Report submitted. Item closed	2/8/2005	MATSKI	3/17/2005
54	Martin Savoie - 05A	00079	Building				South	5/16" Bent plate at the top of the ridge beam.	9/7/2005	Dan Manescu - GBCO	
55	Martin Savoie - 05A	00066	Building		Floor 3		South	The skewed right connection flange of the HSS20x12x1/2 at A/3-4 (B91025) - The skewed right connection of the HSS20x12x1/2 at A/3-4 (B91025) connecting to the W21x44 at 3R/A-A.2 (B91028) has been fabricated with the wrong angle. - RFI 0575 answered by Lee Lim's office. Work to be completed. - The work to start next week. - Work completed and checked by UTS. Item Closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005
56	Martin Savoie - 05A	00056	Building					Corner galvanized diagonal missing and cornice frame around the building	6/27/2005	Dan Manescu - GBCO	7/11/2005
57	Martin Savoie - 05A	00058	Building					Adjustable supports for top of CMU wall-Ground Floor + 5th floor/sides of the penthhouse	6/27/2005	Dan Manescu - GBCO	7/11/2005
58	Martin Savoie - 05A	00075	Building		Floor 5		East	Compatibility of the primer and the fireproofing.	8/18/2005	Dan Manescu - GBCO	
59	Martin Savoie - 05A	00060	Building		Floor 1		West	Slotted holes at the Entrance Columns base plates Due to a fabrication error regarding the skew angle of the entrance we have to slot the holes of the base plate of the Entrance Columns C57114(2R.2/F), C57113(2R.2/F.3&F.6) & C57115(2R.2/G) by 1"3/4 to be able to rotate them. We intend to put some 3/8 washers to cover the slots; please confirm. Work completed. Item closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005
60	Martin Savoie - 05A	00061	Building					Burnt rigid insulation at the west wall. When the holes of the base plates at the Entrance Columns C57114(2R.2/F), C57113(2R.2/F.3&F.6) & C57115(2R.2/G) were slotted sparks landed on the west wall's rigid insulation. The rigid insulation area affected will be replaced. Work completed. Item closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005
61	Martin Savoie - 05A	00063	Building		Floor 5		North	Burnt rigid insulation at the west wall. When the holes of the base plates at the Entrance Columns C57114(2R.2/F), C57113(2R.2/F.3&F.6) & C57115(2R.2/G) were slotted sparks landed on the west wall's rigid insulation. The rigid insulation area affected will be replaced. Work completed. Item closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005
62	Martin Savoie - 05A	00114						Two steel columns not installed at penthouse S-W for bringing in AHU 1 and 2		Dan Manescu - GBCO	10/31/2005
63	Martin Savoie - 05A	00101	Building		Floor 3		East	Steel piece FWB 91025 @ stair #4.		Dan Manescu - GBCO	
64	Martin Savoie - 05A	00094	Building		Floor 3		East	Decking over the cornices to completed by Beauce Atlas. See RFI #678		Dan Manescu - GBCO	
65	Martin Savoie - 05A	00095	Building		Floor 3		East	Louvers Steel at Penthouse.		Dan Manescu - GBCO	
66	Martin Savoie - 05A	00096	Building		Floor 3		East	Roof decking panels to be removed and reinstalled after the positioning in place of the AHU's.		Dan Manescu - GBCO	
67	Martin Savoie - 05A	00097	Building		Floor 3		East	Lintel for louver M line North-West.		Dan Manescu - GBCO	
68	Martin Savoie - 05A	00098	Building		Floor 3		East	Galvanized 8"x8" HSS at West elevation to be welded after precast columns - (SPRING TIME)		Dan Manescu - GBCO	
69	Martin Savoie - 05A	00099	Building		Floor 3		East	Seismic clips at CMU zipper windows walls.		Dan Manescu - GBCO	
70	Martin Savoie - 05A	00092	Building		Floor 3		East	Damage at the interior side beam of the gutter North-East elevation.		Dan Manescu - GBCO	

71	Martin Savoie - 05A	00089	Building		Floor 1			Stairs #1, 8 and 9 to be cleaned, primed and painted.		Dan Manescu - GBCO	
72	Martin Savoie - 05A	00090	Building		Floor 1			Main Skylight anchors - see RFI #645 and #619. Due to variations in the alignment in the structural steel ridge beam for the Main Skylight, the south side skylight peak anchor will not reach the skylight frame without placing shims under the anchor. FNG has proposed shimming under the south side peak anchor with 4"X2 1/2"X5/16" Steel Channel 12" Long welded to the structural steel ridge beam at each purlin locations where necessary. Please see the attached FNG sketch SK-11 and the comments by Raymond Wilson & Associates and confirm that this method of shimming is acceptable. - As of today 11/01/05, waiting for answer from SBRA. - As of today 11/16/05 waiting for answer from SBRA. - As of today 11/30/05 waiting for answer from SBRA. - Answer recieved. Work completed per instructions. Item closed.		Dan Manescu - GBCO	
73	Martin Savoie - 05A	00039						Correcting the slotted base plates. Due to a surveying error during the anchor bolt as-built survey by Beaus Atlas, some column base plates were slotted in the fabrication shop which did not require slotting. There are procedures in-place to correct the slotting of the base plates. GBCo. to provide copies of these correction procedures. See RFI 0283 addresses some of the base plates and RFI 0312 will correct others. Approved heavy duty washers will be used under the bolts. 2/8 Slots to be checked today with SBRA. 2/15 Lee Lim to comment on corrective work at each column. 2/22/2005 Still waiting for response from Lee Lim. 3/2/2005 Remedial work sketch received Repair completed according to SER/SBRA sketch and recommendations. Inspection done by UTS, SER, Tishman. Item closed.		Mike O'Brien - GBCO	
74	Martin Savoie - 05A	00033	Building		Floor 1		South	A 325 HEX galvanized bolts at the relieving angles. At the relieving angles all TC bolts will be replaced by galvanized A 325 HEX bolts having the head of the bolt inside of the relieving angles. UTS will use the Skidmore device to calibrate the tool for tightening the bolts. As of today 5/18/2005 the approved galvanized bolts and washers are on site. As of today 6/1/2005 the tools used for tightening the bolts are calibrated. The bolts replacing operation is ongoing. As of today 6/8/2005 the bolts replacing operation is ongoing. As of today 6/15/2005 the bolts replacing operation is ongoing. Item closed.	3/27/2005	Dan Manescu - GBCO	4/1/2005
75	Martin Savoie - 05A	00027	Building		Floor 2			Missplaced Piece number 6027 Piece number 6027 second floor framing on F line between 11 & 12 line, the bent plate was oriented south when it should have been north. Repair completed and tested by UTS. Item closed.	2/15/2005	Jim Barnett GBCO	3/4/2005
76	Martin Savoie - 05A	00028	Site	Area 1			East	Crane over manhole. On the North-East corner of the building (lines M-17), while the crane operated by CRS/Beauce Atlas/Structures Derek was doing maneuvers for attaching the 40Ft extension, it went over a sewer manhole and a telephone manhole, damaging (cracked and popped up) the asphalt around the manholes. - Witnesses at the incident were Ralph Stukowski, Jim Barnett and Dan Manescu. - 3 pictures regarding this incident and this document they are @ L:\Photos\Cran over manholes folder. - Reapair cost will be incurred by Beauce Atlas and Structures Derek. - The manhole will be replaced by Verizon (Bobby Zack) at no charge. - Item Closed.	2/23/2005	Dan Manescu - GBCO	3/9/2005

77	Martin Savoie - 05A	00166	Building		Floor 2		South	Missing seven bolts at stair #9 bridge.		Dan Manescu - GBCO	7/21/2006
78	Martin Savoie - 05A	00054	Building					Construction gap between the ends of the relieving angles to be adjusted in width	6/27/2005	Dan Manescu - GBCO	7/11/2005
79	Martin Savoie - 05A	00055	Building		Floor 1		South	Relieving angle-Rectangular gaps at the end of the angle above ground floor zipper window. - At lines A/14 at the zipper window above the ground floor window the relieving angle above the window is cut short creating two rectangular gaps at its ends. - Beauce Atlas will submit means and methods to correct the issue. - Work completed and accepted. - Item closed.	6/27/2005	Dan Manescu - GBCO	7/11/2005
80	Martin Savoie - 05A	00020	Building	Area 1	Underground		East	Missing shop installed welds on pieces 1112,1114,1117 & 1054. Missing shop installed welds on pieces 1112,1114,1117 & 1054.See RFI#313 for corrective action. Repair completed and inspected by UTS. Item closed.	2/7/2005	Mike O'Brien - GBCO	2/21/2005
81	Martin Savoie - 05A	00115						Landing between 2nd and 3rd elevation at stair #1 is not level. See RFI # 673. Survey by FNG.		Dan Manescu - GBCO	1/9/2006

Appendix VII. Capstone Design Proposal

Introduction:

The Worcester Trial Courthouse facility is currently being built. The existing soil consists of 9 to 18-foot thick deposit of granular fill consisting of a loose to compact dark brown well-graded mixture of silt, sand and gravel containing various amounts of brick, ash, and cinders. Therefore, the bearing capacity of the existing soil is not enough to support the large weight of the proposed building. As such, the foundation for the building has been designed using a Pressure Injected Foundation system. The piles are driven to the point in which they transmit the building loads into the more solid glacier till. A structural slab rests directly on the pile caps with beams horizontal beams connecting the caps together to form a structural element.

Current Method-PIFs:

As a result of the design of this construction method: PIFS, many issues regarding construction cost and schedule arose:

- First of all, the Worcester Trial Courthouse is a Union job; therefore a person can only do the work that belongs to his union even though he is fully capable of doing the work. This results in many trades being on-site at the time of construction and increases the price of the project.
- Another issue is that pile foundations were not issued for the whole building. This was discovered when they were injecting the piles but found that they glacier till was at about 10 feet below the grade. So shallow foundations was used in many different parts of the building.

Proposed Method-Mat Foundation:

For our project, we will design and propose an alternative method of deep foundations with potential lower cost and shorter construction time: Concrete Mat. An evaluation/comparison analysis is to be done on both construction methods in order to

determine the difference between PIF foundations and Concrete Mats in terms of cost, labor intensity, time, and quality.

The design methods are addressed in details in the following section.

1.0 Structural Design:

The structural design of mat foundations must satisfy both the strength and serviceability requirements. Two separate analyses are required:
(1) Evaluate the strength requirements using the factored loads and LRFD design methods using the following equations[6]:

$$U = 1.4D + 1.7L$$
$$U = 0.75(1.4D + 1.4T + 1.7L)$$
$$U = 0.9D + 1.4F$$
$$U = 1.4D + 1.7L + 1.4F$$
$$U = 1.4D + 1.7L + 1.4H$$
$$U = 0.9D + 1.3W$$
$$U = 0.9D + 1.43E$$
$$U = 0.75\ (1.4D + 1.7L + 1.7W)$$
$$U = 0.75\ (1.4D + 1.7L + 1.7E)$$

(2) Evaluate mat deformations using un-factored loads:

$$D$$
$$D + L + F + H + T + (L, \text{ or } S, \text{ or } R)$$
$$D + L + (L, \text{ or } S, \text{ or } R) + (W \text{ or } E)$$
$$D + (W \text{ or } E)$$

These deformations are the result of concentrated loading at the column locations, possible non-uniformities in the mat, and variations in the soil stiffness. In effect, these deformations are the equivalent of differential settlement. Of they are excessive, then the mat must be stiffer by increasing its thickness.

[6] **Foundation Design: Principles and Practices (2nd Edition)** By Donald P. Coduto

We will design the mat foundations using the finite element method. This method is an alternative method to the one-dimensional spring system (which makes the system simple to perform structural analysis), and uses a three dimensional mathematical model of moth the mat, soil and superstructure.

This method divides the soil into a network of small elements, each with defined engineering properties and each connected to the adjacent elements in a specified way. The structural and gravitational loads are then applied and the elements are stressed and deformed accordingly. This provides a much more accurate representation of the mat, and is also an economical design, although it poses some problems. A lot of elements are involved, and very few engineers have access to well-equipped computer resources. Also it is difficult to determine the required soil properties especially at sites where the soils are highly variable.

This method assumes the superstructure is perfectly flexible and offers no resistance to deformations in the mat. The finite element analysis can be extended to include the superstructure, the mat and the underlying soil in a single three-dimensional finite element model.

Total settlement:

- Total Settlement values will be calculated using the 'bed of springs' method after which the shears, moments and deformation in the mat can be computed.
- General Methodology includes drilling exploratory borings at the site of the proposed foundations and obtaining undisturbed samples of the soil strata.
- Perform consolidation tests and divide the soil beneath the foundation into layers. Compute σ_{z0}' at the midpoint of each layer.
- Using the simplified method, calculate the $\Delta\sigma_z$ at the midpoint of each layer.
- Compute σ_{zf}' at the midpoint of each layer.
- Categorize soil in either consolidated soils ($\sigma_{z0}' \approx \sigma_c'$), over-consolidated soils – Case I ($\sigma_{zf}' < \sigma_c'$) or over-consolidated soils – Case II ($\sigma_{z0}' < \sigma_c' < \sigma_{zf}'$), and calculate δ_c for each layer then sum.
- Calculate the distortion settlement using: $\delta_d = \frac{(q - \sigma_{zD}')B}{} \times I_1 I_2$

E_u

- Determine the three-dimensional adjustment coefficient, ψ
- Compute the settlement using: $\delta = \delta_d + \psi\delta_c$

Bearing Capacity

Because of mat's large widths, mat foundations on sand and gravels do not pose any bearing capacity problems. But they are very important in silts and clays, especially when un-drained conditions prevail. It's a good practice to design the mat so that the bearing pressure at all points is less than the allowable bearing capacity.

2.0 Evaluate in terms of quality, time, cost, labor intensity, effort.

First of all, we will create a construction schedule for the mat foundations and by looking at the as-built schedule of the PIF foundations used in the court house, we will be able to compare the time of construction. By examining the labor utilization reports for the current construction method and comparing that to the proposed mat foundation method, we will be able to evaluate in terms of labor intensity and cost.

Another major issue to look at in the construction of deep foundations is the cost. We will generate a detailed cost estimate for the mat foundation and compare that closely to the cost of the bid package of the PIF foundation. By doing research and evaluating the design and construction methods of each of the alternatives and comparing them, we will be able to identify the tradeoffs of each system in terms of quality and effort.

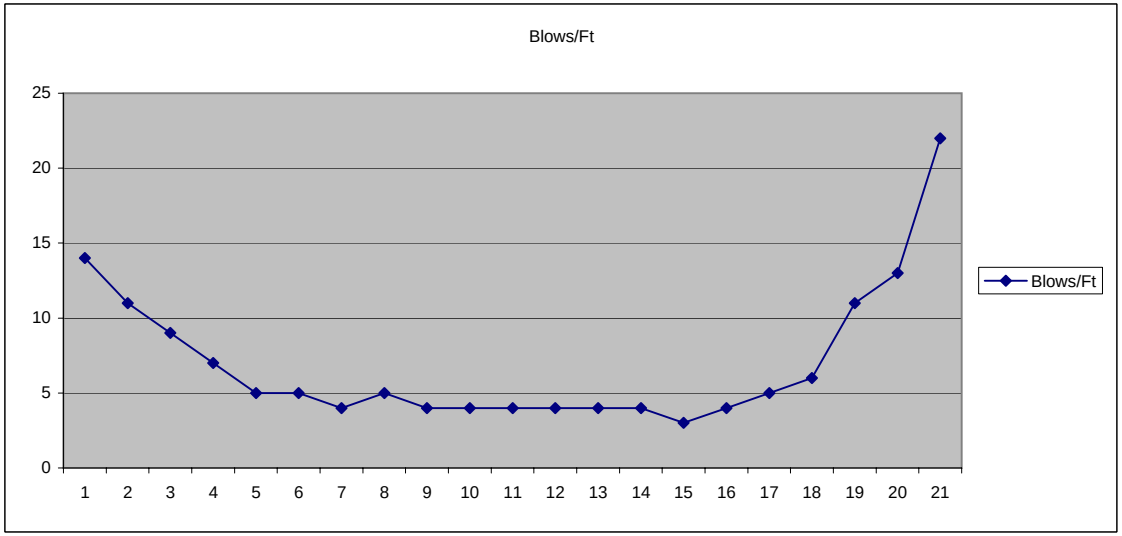
Appendix VIII. Capstone Design Items

1. Mat Depth

Pile No. 140,000 Ft.-lbs blows per 5 ft.

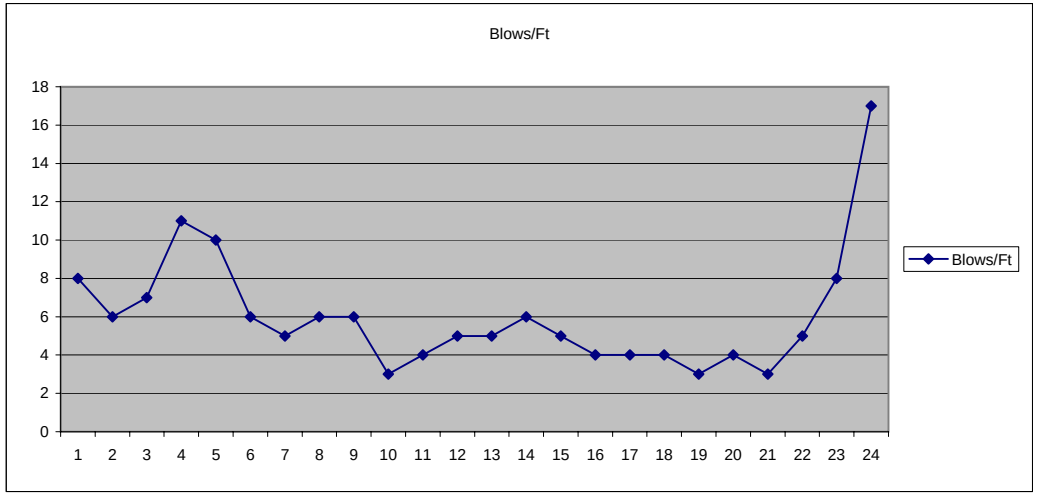
Location: B-2 Top Elevation 470

Ground Surface 460



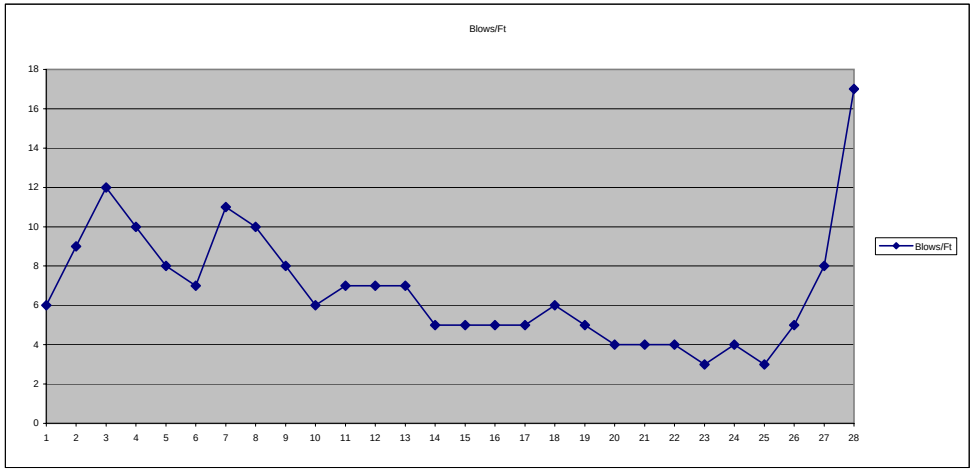
Depth	Blows/Ft
1	14
2	11
3	9
4	7
5	5
6	5
7	4
8	5
9	4
10	4
11	4
12	4
13	4
14	4
15	3
16	4
17	5
18	6
19	11
20	13
21	22

Pile No. 140,000 Ft.-lbs blows per 5 ft.
Location: B-3 Top Elevation 466
Ground Surface 460



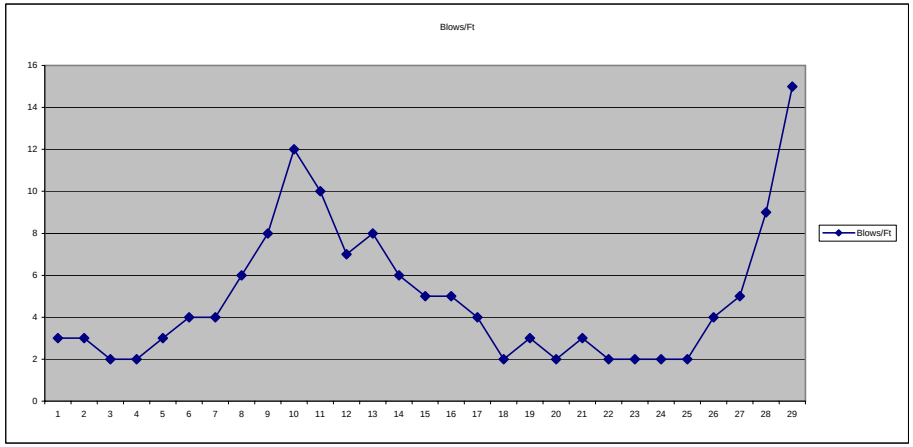
Depth	Blows/Ft
1	8
2	6
3	7
4	11
5	10
6	6
7	5
8	6
9	6
10	3
11	4
12	5
13	5
14	6
15	5
16	4
17	4
18	4
19	3
20	4
21	3
22	5
23	8
24	17

Pile No. 1,029 140,000 Ft.-lbs blows per 5 ft.
Location: A.3-17 Top Elevation 473
Ground Surface 460



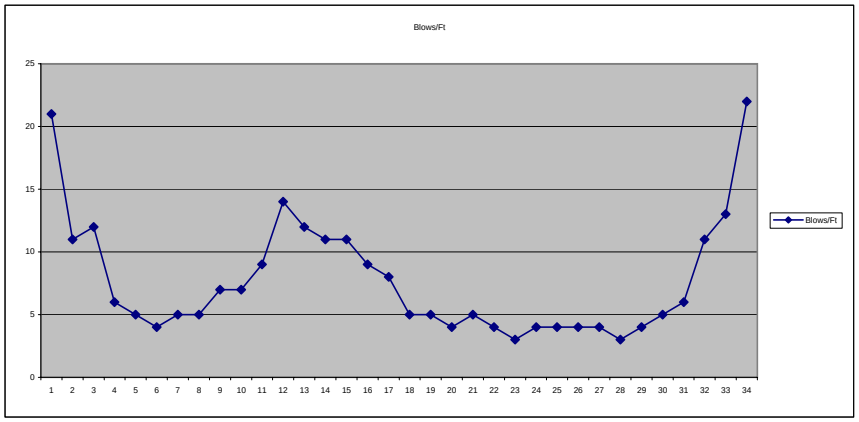
Depth	Blows/Ft	
1	6	
2	9	
3	12	
4	10	
5	8	
6	7	
7	11	
8	10	
9	8	
10	6	
11	7	
12	7	
13	7	
14	5	
15	5	
16	5	
17	5	
18	6	
19	5	
20	4	
21	4	
22	4	
23	3	
24	4	
25	3	
26	5	
27	8	Top of Outwash
28	17	

Pile No. 1,042 140,000 Ft.-lbs blows per 5 ft.
Location: L.8-16.5 Top Elevation 460
Ground Surface 460



Depth	Blows/Ft	
1	3	
2	3	
3	2	
4	2	
5	3	
6	4	
7	4	
8	6	
9	8	
10	12	
11	10	
12	7	
13	8	
14	6	
15	5	
16	5	
17	4	
18	2	
19	3	
20	2	
21	3	
22	2	
23	2	
24	2	
25	2	
26	4	
27	5	
28	9	Top of Outwash
29	15	
30		

Pile No. 1,070 140,000 Ft.-lbs blows per 5 ft.
Location: A-16 Top Elevation 468
Ground Surface 460



Depth	Blows/Ft	
1	21	
2	11	
3	12	
4	6	
5	5	
6	4	
7	5	
8	5	
9	7	
10	7	
11	9	
12	14	
13	12	
14	11	
15	11	
16	9	
17	8	
18	5	
19	5	
20	4	
21	5	
22	4	
23	3	
24	4	
25	4	
26	4	
27	4	
28	3	
29	4	
30	5	Top of Outwash
31	6	
32	11	
33	13	
34	22	

2. Mat Design

		Units			
Design Capacity	80,371,200	lb	Trench of Building	457	Ft Elevation
P	1,288	Kips	Weight of Concrete	150	pcf
Concrete Capacity			Slump		
F'c	3,000	psi	Max	3"	
F'y	60,000	psi	Min	1"	
Mat Size			Volume of Mat	6,933	yrd3
Footing size	240' x 260'		Weight of Mat	1,040,000	lbs
Net Bearing Pressure	6000	psf	Capacity		
Needed Area	26790.4				
Actual Area	81600	OKAY	Volume of Excavation	57,296	yrd3
			Volume of Fill	50,363	yrd3
Thickness of Mat					
Commerical Street	1.00	meters			
Main Street	1.00	Meters			
Depth of Mat					
Commerical Street	464	Ft Elevation			
Main Street	464	Ft Elevation			
Reinforcement					
Bottom and Sides					
Depth of the Water table	10	Feet			

Results

Size	240' x 260' x 3'		Concrete Capacity		
Volume of Mat	6,933	yrd3	F'c	3,000	psi
			F'y	60,000	psi
Depth of Mat					
Commerical Street	464	Ft Elevation			
Main Street	464	Ft Elevation			

3. Total Load

Total Load for Mat Design		
Area of the Building	62,400	SqFt
Total Number of PIFS	837	
PIF Capacity	120	TON
Total Load	100,440	Tons
	200,880,000	Ibs
Toal Mat Capacity:	3,219	PSF

4. Design Calculations

Page 1

Dimensions – 240' × 260'

1. Compute the factored loads.

$U = 3220$ psf lb/ft² → lb/in² lb/144

This includes all safety factors. (backtracked from PIF capacity)

2. Factored net soil pressure

$q_n = {}^{*}6\,ksf - (\text{weight/area soil + floor loading})$

footing width = 36"

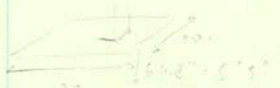
Estimate the thickness of the footing = 1.8 × 36"
= 64.8" = 5' 5"

$q_n = 6.0 - \left(\frac{64.8}{12} \times 0.15 + 6" \times 0.12 + 6' \times 0.15 + 0.100\right)$

$= 4.955$

$\frac{1288}{4.95} = 260.2\ ft^2 < 400$ ✓

Trib area = 400.



∴ factored net soil pressure =

$\frac{1288}{20^2} = 3.22$ ksf

3. Check thickness for 2 way shear

Average d = 64.8" − (5" in cover) − (1 bar diameter).
$d = 58.8$

Critical shear ACI Section 11.12.1.2.

$V_u = 3.22\left[20^2 - \left(\frac{\;}{\;}\right)^2\right] ft^2 = 1250.4$ kip

Length of critical shear perimeter

$b_o = 4(36 + 58.8)$ in $= 379.2$

(ACI Eq. 11-33 → 11-35)

(a) $\phi V_c = \phi\left(2 + \frac{4}{\beta_c}\right)\sqrt{f'_c}\, b_o d$

$\beta_c = \frac{\text{long side of column}}{\text{short side of column}} = 1.0$

$\phi V_c = .75(2 + 4/1)\sqrt{3000} \times 379.2 \times 58.8$
$= 5485$ [illegible]

(b) $\phi V_c = \phi \left(\frac{\alpha_s d}{b_o} + 2 \right) \sqrt{f'_c}\, b_o d.$

$\alpha_s = 40$ for interior
30 for edge
20 for corner.

$\phi V_c = 0.75 \left(\frac{40 \times 58.8}{379.2} + 2 \right) \sqrt{5000} \times 379.2 \times 58.8 = 2513.04$ kips

(c) $\phi V_c = 6(4) \sqrt{f'_c}\, b_o d = 0.75(4) \sqrt{5000} \times 379.2 \times 58.8 = 3663.75$ kips.

Because $\phi V_c = 3663.75$ kips is greater than $V_u = 1250.4$ kips, the footing is adequate in shear.

(d) Force per unit length:

$V_u = 3.22 \left[20 \times \frac{(42/12)}{1} \right] = 225.4$

$\phi V_c = \phi 2 \sqrt{f'_c}\, b_w d = 0.75 \times 2 \sqrt{5000} \times 240 \times \frac{42}{1000} = 321.16$ kips

321.16 kips $>$ 225.4 kips ok ☺

(e) Design for flexural reinforcement:

$M_u = 3.22 \left[20 \times \frac{(84/12)^2}{2} \right] = 1577.8$

Assuming $j = 0.9$ & $f_y = 60$ ksi, area of steel required:

$A_s = \frac{1577.8 \times 12000}{0.9 \times 60000 (0.9 \times 42)} = 9.22\ in^2$

minimum A_s (ACI sections 10.5.3 & 7.12.2)
$= 0.0018\, bh$
$= 0.0018 \times 240 \times 59.8 = 27.9936$ in.

Try 11 No. 8 bars each way $A_s =$ (check ACI manual)

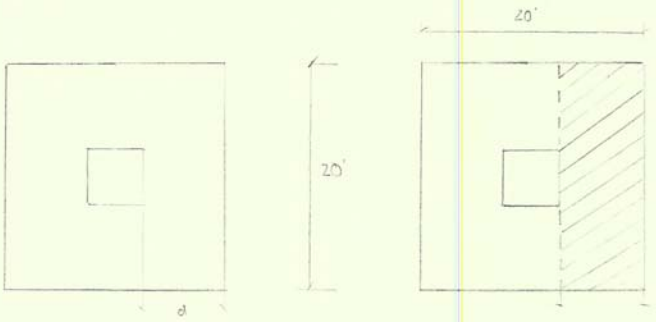
Maximum spacing: 12" or use 12" spacing

$A_s = 10.27$ in 13 no. 8 bars
Recompute ϕM_n as a check

$a = \frac{10.27 \times 60000}{0.85 \times 3000 \times 240} = 1.00$ in

$a/d = 1.00/42 = 0.023 < 1.00$

∴ Beam is tension controlled $\phi = 0.9$


20'
20'
d

(6) check for development.

No. 7 & larger bars =>

Table 8-1 case 2: $l_d = \frac{f_y \psi \epsilon \lambda}{20\sqrt{f'_c}} d_b$

Other cases: $l_d = \frac{3}{40} \frac{f_y \psi \epsilon \beta \lambda}{\sqrt{f'_c}} d_b$

Case 2 or 2: $f'_c = 3000$ psi

A-11	Bar No.	Bottom	Top
	7-18	54.8	71.2
0.5 cor	7-18	56.3	106.8

No. 8 bottom bar in 3000 psi concrete

$l_d = 54.8 \, d_b \, \beta \lambda =$ $\beta = 1.0$

$= 54.8 \times 1.00 \times 1.0 \times 1.0$ uncoated reinforcement = 1.0

$= 54.8$ in ψ_d

Use No. 8 bars each way; $A_s = 7.72$ in²

(7)

Bearing Pressure

$q = \frac{P + W_p}{A} - U_0$. U_0 = Pore Pressure = 0 (∇ lower)

P = 1288000 lbs.

W_p = weight of the foundation.

$q = \frac{1288000 - (5.5 \times 150 \times 20 \times 20)}{400}$ = $5.5' \times 150 \times 20 \times 20$

= 2395 lb/ft².

The mat foundation passes by a large factor. so we will use soil that are within ranges of 130 lb/ft³. We have selected Well Graded ~~on~~ Silty Gradded Gravel. After filling the excavation, our soil should have an N value greater than 20.

$N_{60} = 25$

$\sigma'_z = \sigma_{vo} D - u$

$u = 62.4 \times 26 = 1622.4$

462 - 436 = 26 feet

$\sigma_w = 130 \times 10 + 120 \times 16 = 3220.$

$\sigma'_z = 3220 - 1622.4$

$\sigma'_z = 11597.6$

$\phi' \approx 30°$.

Assume c' reserved.

BEARING CAPACITY OF SHALLOW FOUNDATIONS
Terzaghi and Vesic Methods

Date April 1, 2007
Identification MQP

Input

Units of Measurement		
	E	SI or E
Foundation Information		
Shape	SQ	SQ, CI, CO, or RE
B =	20	ft
L =		ft
D =	3	ft
Soil Information		
c =	0	lb/ft^2
phi =	29	deg
gamma =	128	lb/ft^3
Dw =	10	ft
Factor of Safety		
F =	3	

Results

	Terzaghi	Vesic
Bearing Capacity		
q ult =	19,641 lb/ft^2	20,393 lb/ft^2
q a =	6,547 lb/ft^2	6,798 lb/ft^2
Allowable Column Load		
P =	2,619 k	2,719 k

5. Bearing

BEARING CAPACITY OF SHALLOW FOUNDATIONS
Terzaghi and Vesic Methods

Date April 24, 2007
Identification Example 6.4

Input

Units of Measurement
E SI or E

Foundation Information
Shape SQ SQ, CI, CO, or RE
B = 20 ft
L = ft
D = 3 ft

Soil Information
c = 0 lb/ft^2
phi = 30 deg
gamma = 120 lb/ft^3
Dw = 4 ft

Factor of Safety
F = 3

Results

	Terzaghi	Vesic
Bearing Capacity		
q ult =	17,856 lb/ft^2	19,063 lb/ft^2
q a =	5,952 lb/ft^2	6,354 lb/ft^2
Allowable Column Load		
P =	2,381 k	2,542 k

Unit conve	1000
Gamma w	62.4
phi (radian	0.523599

Terzaghi Computations

a theta =	3.350802
Nc =	37.16
Nq =	22.46
N gamma	20.12
gamma' =	60.72
coefficient	1.3
coefficient	0.4
sigma zD'	360

Vesic Computation

Nc =	30.14
sc =	1.61
dc =	1.06
Nq =	18.40
sq =	1.58
dq =	1.04
N gamma	22.40
s gamma =	0.60
d gamma =	1.00
B/L =	1
k =	0.15

W sub f	0

6. Analysis

Prices

		PIF	Mat
Exacavation		N/A	N/A
Fill		$755,445	$1,107,986
Compaction		None	$166,198
Concrete			$561,600
Reinforcement	81120' of No. 8 Bars		$116,417
Forms	3000		$26,100
Labor		Specialized	Only Need Concrete Labors
Time	After excavation n compaction	3 month	1 month

http://stats.bls.gov/eag/eag.ma_worcester_mn.htm

Just general overhead cost is equal to $200,000

labor

Labour productivity is output per worker or worker-hour

Foundation (Formwork + Concrete + Reinforcement) -
assuming 9 hour days, 5 days a week @ a productivity rate of .4 per c.y.
6,933 cubic yards

2800 hours 31 days

Filling
50363 cubic yards 57917.45 cy with shrinkage factor
load capacity of one truck - 25 c.y.

3217.63611 loads 311.11111

assuming cycle dump time per truck is 4 dumps per day
with a fleet of 18 trucks, = 40 dumps per day for 9 hour days

1800 per day
32.1763611 days to fill

7. Soil Report

Record Copy

McPHAIL ASSOCIATES, INC.

Geotechnical Engineers

November 8, 2002

Shepley Bulfinch Richardson and Abbott
40 Broad Street
Boston, MA 02109-430616

Attention: Mr. Steven Kosilla

Reference: Proposed Worcester Trial Court House; Worcester, Massachusetts
Foundation Engineering Report

Gentlemen:

Enclosed herewith are five copies of our Foundation Engineering Report for the proposed Worcester Trial Court House structure to be located in Worcester, Massachusetts. Our services were performed and this report was prepared in accordance with our proposal to Shepley Bulfinch Richardson and Abbott for geotechnical engineering services dated April 19, 2002 and the verbal authorization of Mr. Steven Kosilla..

The proposed Worcester Trial Court House will occupy an entire city block in Downtown Worcester. The site is bounded by Thomas Street to the north, Commercial Street to the east, Central Street to the south and Main Street to the west. A four-story brick building currently occupies the western portion of the site. Currently, the majority of the site is utilized as a surface parking lot.

Based on the architectural plans and the information provided to us, it is understood that the proposed Worcester Trial Court House will consist of a 5-story steel-framed structure having plan dimensions of about 240 by 340 feet. It is understood that the existing 4-story building will be demolished as part of the proposed construction. The proposed lowest level slab at the east end of the site is indicated to be at Elevation +463 which appears to be approximately coincident with the existing ground surface along Commercial Street. The lowest level slab at the west end of the site is indicated to be at Elevation +477, coinciding with the existing ground surface along Main Street. It is indicated that an underslab trench system for smoke evacuation supply air ducts will be constructed as part of the proposed construction. The trench system is indicated to include an approximate 26-foot wide corridor having its floor slab located at about Elevation +457.

Our recent subsurface exploration program indicates that the site of the proposed Court House structure is underlain by a 9 to 18-foot thick deposit of granular fill consisting of a loose to compact dark brown well-graded mixture of silt, sand and gravel containing various amounts of brick, ash, and cinders. Underlying the fill, the explorations generally encountered intermittent layers of alluvial fine sand and silt, and organic deposits resulting from the meandering of the former Blackstone River across the site. The alluvial and organic deposits are indicated to extend to depths ranging from about 15 to 40 feet below the existing ground surface. The organic deposit consists of a soft dark brown silt and peat with occasional fine sand lenses. The loose to compact, gray to brown, alluvial deposits range from a silty sand to a silt with some sand.

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McPHAIL
ASSOCIATES, INC.
Geotechnical Engineers

Underlying the fill and the intermittent layers of alluvial and organic deposits, the boreholes encountered a deposit of compact to dense, brown to gray glacial outwash consisting of sand and gravel with a trace to some silt . The glacial outwash deposit, is indicated to be underlain by a dense, gray to brown glacial till deposit at depths varying from about 30 to 60.5 feet below the existing ground surface. The glacial till deposit generally consists of a well-graded mixture of silt, sand and gravel with cobbles and boulders and is generally underlain by the bedrock surface. It is estimated that the top of bedrock varies from about 45 to 80 feet below the existing ground surface. Our experience in working in the areas adjacent to the proposed Court House site indicated that the bedrock generally consists of a very hard, fresh to slightly weathered, sound to extremely fractured granite.

Groundwater was observed at elevations ranging from approximately Elevation +454.7 to about Elevation +453.3 across the project site, corresponding to depths of about 9.1 to 21.5 feet below the existing ground surface.

Based upon the results of our subsurface investigation program, it is recommended that the proposed structure be founded in the compact to dense glacial outwash deposit which underlies the existing fill, organic, alluvial and lacustrine deposits, across the site.

Foundation support for the proposed structure is recommended to consist of pressure-injected footings (PIFs) bearing in the outwash deposit which underlies the site. The lowest level floor slab, including the floor slab for the underslab trench system for the smoke evacuation supply air ducts, should be structurally supported.

For support of the heavily loaded structural columns, 120-ton design capacity PIFs are recommended. For intermediate support of portions of the structurally supported lowest level slab, PIFs with a design capacity of 50 tons per unit are recommended. Several foundation related construction issues are discussed including the presence of below grade remains of the former structures which have occupied the site, construction dewatering, reuse of on-site fill material and disposal of excess fill soils.

Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, INC.

Ibrahim S. Gursoy

Robert C Hoyler

Robert C. Hoyler, P.E.
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ISG/rch

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Geotechnical Engineers

INTRODUCTION

This report presents the results of our subsurface investigation and foundation design study for the proposed Worcester Trial Court House to be located in Worcester, Massachusetts. Refer to the Project Location Plan, Figure 1, for the general site locus.

The subsurface investigation was conducted and the foundation engineering services were performed in accordance with our proposal for geotechnical engineering services to Shepley Bulfinch Richardson and Abbott (SBR&A) , dated April 19, 2002 and verbal authorization of Mr. Steven Kosilla of SBR&A. This report and our services are subject to the limitations enclosed in Appendix A.

PURPOSE AND SCOPE

The purposes of our subsurface investigation are to define the subsurface soil and groundwater conditions at the site as they relate to foundation design and construction and, based on this information, to provide recommendations for economical foundation design and construction for the proposed Worcester Trial Court House.

Foundation design includes foundation support of the proposed structure and its lowest level slab, treatment of the lowest level slab in consideration of groundwater, and seismic design considerations in accordance with the provisions of the Massachusetts State Building Code. Foundation construction considerations are also addressed herein.

AVAILABLE INFORMATION

Information provided to McPhail Associates, Inc. by SBR&A included a set of architectural design drawings in electronic format dated October 29, 2002, as well as a 20-scale topographic site plan entitled "Topographic Site Plan" and dated September 24, 2002 and prepared by Harry R. Feldman, Inc. We were also provided with an Environmental Investigation report dated July 19, 2002 prepared by O'Reilly, Talbot and Okun Associates, Inc.

Record Copy

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McPHAIL ASSOCIATES, INC.
Geotechnical Engineers

SITE DESCRIPTION

The Worcester Trial Court House is proposed to occupy a city block in Downtown Worcester. The site is bounded by Thomas Street to the north, Commercial Street to the east, Central Street to the south and Main Street to the west. The project site is currently utilized as a surface parking lot with one existing 4 story brick building occupying a small part of the west portion of the site. The existing ground surface across the proposed project site slopes down from west to east, varying form about Elevation +477 at the southwest corner of the site to approximately Elevation +464 along the east site boundary, across a horizontal distance of about 430 feet.

Elevations as noted herein are referenced to the Project Datum which is understood to be the National Geodetic Vertical Datum (N.G.V.D.).

PROJECT DESCRIPTION

Based on the above referenced architectural plans and the information provided to us it is understood that the proposed Worcester Trial Court House will consist of a 5-story steel-framed structure occupying a rectangular plan area having side dimensions of about 240 by 340 feet encompassing the majority of the site. It is understood that the existing 4-story building will be demolished as part of the proposed construction. The proposed lowest level slab at the east end of the site is indicated to be at Elevation +463, which appears to be approximately coincident with the existing ground surface along Commercial Street. The lowest level slab at the west end of the site is indicated to be at Elevation +477, which coincides with the existing ground surface along Main Street.

The structural columns of the Court House structure are typically planned to be located on a 20 by 40-foot rectangular grid. It is understood that, the interior column loads are estimated to range from about 480 kips to 1800 kips and the exterior column loads range from about 480 kips to 960 kips.

An underslab trench system for smoke evacuation ducts will be constructed as part of the proposed construction. The trenches are indicated to be 26 feet in width and have their floor slab at about Elevation +457.

INVESTIGATION PROCEDURES

A subsurface investigation program was conducted at the site during the period of October 15 through 22, 2002 consisting of twelve (12) soil borings and four (4) observation wells installed in completed boreholes. The borings were performed by New England Boring Contractors of Ct., Inc., of Glastonbury, Connecticut under contract to McPhail Associates, Inc. The boring locations are indicated on the enclosed Subsurface Exploration Plan, Figure 2, which was prepared based on the above referenced 20-scale site plan.

The field explorations were monitored by a geologist from our staff who performed field layout, prepared detailed field logs, obtained and visually classified soil samples, monitored groundwater conditions in the completed boreholes and observation wells, made minor relocations of the explorations and determined the required exploration depths depending upon the actual subsurface conditions encountered.

Field locations of the subsurface explorations were determined by taping from existing site features identified on the referenced 20-scale site plan. The existing ground surface elevation at each boring location was determined by a level survey utilizing a vertical control point identified on the above referenced 20-scale topographic site plan.

The borings were advanced using the hollow stem augers and the wet rotary boring drilling techniques. The hollow stem augers had a 3-1/4-inch diameter and the cased holes utilized both 3-inch NW and 4-inch I.D. HW casing. Standard 1-3/8 inch I.D. split spoon samples and standard penetration tests were obtained generally at 5-foot intervals of depth in accordance with the standard procedures described in ASTM D1586.

The boreholes were generally terminated within the dense to very dense glacial till deposit at depths ranging from about 36 to 80 feet below the existing ground surface. Boring logs prepared by New England Boring Contractors of Ct., Inc. are presented in Appendix B.

Groundwater observation wells were installed within completed boreholes B-1, B-4, B-9 and B-12 to permit monitoring of the groundwater levels across the site. The well tips were installed to a depths varying from 20 to 30 feet below the existing ground surface with a 10-foot length of slotted PVC pipe attached to the bottom of each well. Groundwater observation well monitoring reports are included as Appendix C.

LABORATORY TESTING

At the completion of the field work, the soil samples were transported to our laboratory for more detailed classification, analyses and testing. The laboratory testing consisted of sieve analyses to obtain representative grain size distributions of samples of the fill, glacial outwash and till deposits. Laboratory test procedures were in general accordance with applicable ASTM Standards and/or "Soil Testing for Engineers", by T.W. Lambe, 1951. Results of the laboratory testing appear in Figures 7, 8 and 9.

SUBSURFACE CONDITIONS

A detailed description of the subsurface conditions encountered in each soil boring is documented on the logs contained in Appendix B. Locations of the explorations are as indicated on the enclosed Subsurface Exploration Plan (Figure 2). Generalized subsurface profiles through the project site are presented in Figures 3 through 5.

The following is a discussion of the generalized subsurface conditions across the site which are inferred primarily from the recent explorations monitored by McPhail Associates, but also from the site geology, the site topography, and from local foundation design and construction experience, namely at the adjacent Worcester Convention Center, Worcester Redevelopment Authority Parking Structure and Fallon/-

Saint Vincent Medical City site, as well as from the boring logs enclosed in the above indicated Environmental Investigation report.

The soil borings indicate that the site of the proposed Court House structure is underlain by a 9 to 18-foot thick deposit of loose to compact, dark brown to black fill. The fill generally consists of a well-graded mixture of a silt, sand and gravel and typically contains variable amounts of brick, ashes and cinders. Deposition of the fill is believed to be associated with backfilling conducted during the initial phases of site development in the early to mid-1800's. Grain size distributions of selected fill samples are presented in the enclosed Figure 7.

With an exception of boring B-1, underlying the fill, the explorations generally encountered intermittent layers of alluvial and organic deposits, resulting from the meandering of the former Blackstone River which once occupied the project site. The alluvial and organic deposits extend to depths ranging from about 15 to 40 feet below the existing ground surface. The organic deposit consists of a soft dark brown silt and peat with occasional fine sand lenses. The loose to compact, gray to brown alluvial deposit generally varies from silty sand to a silt with some sand.

The borings B-1, B-4, B-8 and B-12 encountered a stratified (varved) compact to very dense, gray to tan lacustrine deposit at depths ranging from 21 to 50 feet below the existing ground surface. The lacustrine deposit typically consists of a stratified fine sand and silt. At B-1, the lacustrine deposit was encountered immediately underlying the fill and in the remaining boreholes the lacustrine deposit was encountered underlying the glacial outwash deposit.

Underlying the fill and intermittent layers of alluvial and organic deposits, the boreholes generally encountered a compact to dense, brown to gray glacial outwash deposit. The glacial outwash deposit generally consists of a sand and gravel with a trace to some silt. The surface of the glacial outwash deposit ranged from Elevation +466 in borehole B-9(OW), along Main Street, to Elevation +424 in borehole B-4(OW),

along Commercial Street, corresponding to depths of 9 to 40 feet below the existing ground surface, respectively. A contour plan indicating the elevation of the top of the outwash deposit is presented as Figure 6. Grain size distributions of typical samples of the outwash deposit are presented in Figure 8.

Underlying the outwash deposit, a dense, gray to brown glacial till deposit was encountered at depths varying from about 30 to 60.5 feet below the existing ground surface. The glacial till deposit generally consists of a well-graded mixture of silt, sand and gravel with cobbles and boulders.

Although not encountered during our subsurface investigation, based on our local experience in the vicinity of the site, it is anticipated that bedrock is present directly below the glacial till deposit across the site. It is estimated that the depth to the top of bedrock varies from 45 to 80 feet below the existing ground surface. Our previous subsurface investigations in the areas adjacent to the proposed Court House structure indicated that, bedrock generally consists of a very hard, fresh to slightly weathered, sound to extremely fractured granite.

As indicated in the monitoring reports contained in Appendix C, groundwater was generally encountered at elevations ranging from Elevation +453.7 to +453.3 across the project site in the observation wells installed within borings B-1, B-4, B-9 and B-12, corresponding to depths of about 9.1 to 21.5 feet below ground surface. It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, periods of heavy precipitation, and alterations of existing drainage patterns.

RECOMMENDED FOUNDATION DESIGN CRITERIA

Based upon the structural configuration of the proposed Court House structure and the anticipated subsurface conditions as indicated by the subsurface explorations conducted at the project site, it is recommended that the proposed structure be supported on the compact to dense glacial outwash deposit underlying the existing fill, organic, alluvial and lacustrine deposits. We recommend that the proposed structure be pile supported to transfer the building loads to the outwash

deposit which was encountered at depths of approximately 9 to 40 feet below the current site grades. The lowest level slabs across the east and west portions of the proposed building, and the underslab trench system slab should be structurally framed. Due to the presence of loose fill and deep loose organic deposits, it is recommended that all underslab utilities be supported from the lowest level structural slab.

The most economical type of pile for support of the proposed garage structure is considered to be pressure injected footings (PIFs). Based upon the relatively large anticipated column loads, it is recommended that the PIFs be designed for a maximum design capacity of 120 tons per unit in compression for support of column loads. For intermediate support of the lowest level structural slab, where required, PIFs with a maximum design capacity of 50 tons per unit in compression are recommended. The PIFs should be installed utilizing cased shafts.

A pressure injected footing is a relatively short pile driven through unsuitable foundation bearing soils, and then "based up" in the upper portion of a primarily granular deposit. The base consists of zero slump concrete, having a 28-day compressive strength of at least 4,000 psi, driven and compacted in 5 cubic foot batches by a drop hammer delivering not less than 100,000 and 140,000 foot-pounds of energy per blow (corresponding to the 50 and 120-ton design capacity PIFs, respectively). The number of blows of the compaction hammer per 5 cubic foot batch has been empirically correlated with pile capacity. After completion of the base, the pile shaft is formed by pouring concrete into a corrugated metal shell having a minimum diameter of 12.25 inches (50 ton capacity PIF) or 16- inches (120 ton capacity PIF) which has been attached to the enlarged base.

The minimum center-to-center pile spacing shall not be less than three times the shaft diameter of the PIFs in accordance with Section 1820.4.6 of the Massachusetts State Building Code. Seismic pile reinforcement should be provided in accordance with Section 1820.1.2.1 of the Massachusetts State Building Code.

All exterior pile caps should be provided with a minimum 4-foot cover of soil as frost protection. Columns supported by a single pile should be designed to accommodate a 3-inch eccentricity between the centroid of the column and the centroid of the supporting pile.

Tension foundation loads are anticipated to be present at some column locations. In general, the design uplift capacity of PIFs to resist these tension loads directly increases with pile length. For example, given the general site subsurface conditions, the recommended design uplift capacities of 16-inch diameter PIFs, 15 to 30 feet in length, are 5 and 10 tons per pile, respectively. For specific tension loads requiring foundation uplift capacity in excess of 10 tons, it is recommended that the PIF design uplift capacity be evaluated on a case-by-case basis. Higher PIF uplift capacities may be obtained by stipulating minimum pile embedment lengths into the sand and gravel deposit.

The lowest level structural slabs should be immediately underlain by a minimum 9-inch thickness of 3/4-inch crushed stone which is spread across the surface of a filter fabric such as Mirafi 140N, which is placed over the slab subgrade.

The lowest level, structurally framed slab should be designed in accordance with Section 1816.11.2 of the State Building Code. This section requires that pile caps be interconnected by structural members capable of carrying 10 percent of the larger column dead plus live load in both tension and compression. This requirement may be satisfied utilizing the structural slab, provided it is doweled into the pile caps.

For purposes of determining the total lateral seismic force or base shear for earthquake design, the site is considered to have a S_3 soil-profile type; therefore, the site coefficient "S" for this site should be 1.5. The bearing stratum is not considered to be subject to liquefaction during the design earthquake based on the criterion of Section 1805.3 of the State Building Code.

Lateral forces can be considered to be transmitted from the structure to the soil by passive pressure against the pile caps, tie beams and grade beams utilizing an equivalent fluid density of 120 pounds per cubic foot providing that these elements are designed to resist these pressures.

It is anticipated that a portion of the excavated fill material on the site may be reused as ordinary fill within the proposed building area. Ordinary fill placed around pile caps and grade beams should be free from organic materials, loam, wood, trash and other materials which may be compressible or which cannot be properly compacted. Additionally, all materials having a largest dimension greater than 6-inches present within the ordinary fill should be culled out prior to backfilling. It is recommended that, ordinary fill be placed in lifts having a maximum loose thickness of about 8-inches, and be compacted to a dry density of at least 92 percent of the maximum dry density determined in accordance with ASTM D 1557.

Based on the proposed lowest level slab elevations and indicated site grades surrounding the proposed building, it is considered that underslab and perimeter drains will be required partially across the footprint of the proposed building to protect the lowest level occupied space against groundwater intrusion. Perimeter drains should be provided wherever the lowest level floor slab is more than 2 feet below the adjacent exterior grade.

Where required, the perimeter drain lines should be located adjacent to the outside of the perimeter foundation walls and consist of 4-inch diameter perforated PVC pipe having its invert located no higher than 12 inches below the bottom of the adjacent lowest level slab, and pitched down at a minimum 0.5 percent slope in the direction of flow. The perimeter drain pipe should be embedded within a minimum 6 inch thickness of crushed stone which is surrounded by filter fabric.

Perimeter foundation walls should be backfilled with a 2-foot wide free draining gravel fill "chimney" extending vertically to within 2 feet of finished grade. The upper 2 feet of backfill under non-paved areas

should be relatively impervious ordinary fill containing a minimum of 30 percent by dry weight material passing the No. 200 sieve. Under paved areas, the compacted gravel fill should extend to the pavement subgrade elevation. Roof drains should be piped, and the finished grade pitched, away from the perimeter walls to minimize surface water infiltration. The perimeter below-grade foundation walls should receive a trowelled-on bitumastic damproofing.

An alternative to the gravel "chimney" at the exterior wall is a the utilization of a prefabricated drainage board, such as Miradrain 6000, placed against the foundation wall and backfilled with compacted ordinary fill. The Miradrain 6000 should be tied directly into the crushed stone envelope surrounding the perimeter drain.

Underslab drain lines should be provided under the underslab trench system and under the west half of the floor slab at Elevation +463.

Where required, the underslab drainage system should consist of a network of 4-inch perforated PVC pipes installed on approximate 30-foot centers and embedded within a 9-inch thick blanket of 3/4-inch crushed stone. The underdrain pipes should be surrounded by a minimum 6-inch thickness of 3/4-inch crushed stone. It is recommended that the foundation drainage system discharge to the site by gravity or be connected into a site stormwater drainage system which is not subject to surcharge as determined by the project site civil engineer.

All elevator pits and other depressions in the lowest level slab extending below the invert of the underslab drainage system pipes (such as elevator pits) should be provided with properly tied continuous water stops in all construction joints and metallic waterproofing on properly prepared interior surfaces.

Below grade foundation walls receiving lateral support at the top and bottom (i.e. restrained walls) should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 60 pounds per

cubic foot. Free standing or cantilevered retaining walls backfilled with free draining material and provided with a drain line or weep holes should be designed for a lateral earth pressure corresponding to an equivalent fluid density of 40 pounds per cubic foot. To these values must be added the pressures attributable to earthquake forces per Section 1612.4.9 of the Code.

FOUNDATION CONSTRUCTION CONSIDERATIONS

Foundation construction considerations include removal of below grade obstructions, construction dewatering, reuse of on-site fill material and disposal of excess fill soils.

It is understood that the existing 4-story building at the site will be demolished prior to the proposed construction. It is recommended that, during the demolition of the existing structure, all below grade portions of the existing building within the plan area of the proposed pile caps be removed in their entirety. In addition, the Environmental Investigation Report provided to us indicates the presence of former structures within the site limits. Hence, when encountered, the obstructions and remains of the former structures should be removed in their entirety wherever they interfere with the new construction, however, they may remain in place under the proposed structure provided that they are in excess of 2 feet below the lowest level slabs and do not interfere with the pile installation.

In consideration of the indicated depth of groundwater below the existing ground surface, it is not anticipated that groundwater will adversely impact the proposed construction. However, trapped surface water may accumulate within localized depressions in the ground surface across the site after periods of heavy precipitation which could require localized sumping.

Given the existing site grades and the proposed lowest level floor slab, quantities of excess excavated fill soils are anticipated to remain after all site filling operations are completed. Off-site disposal of the excess material should be conducted in accordance with the current policies of the Massachusetts Department of Environmental Protection.

FINAL COMMENTS

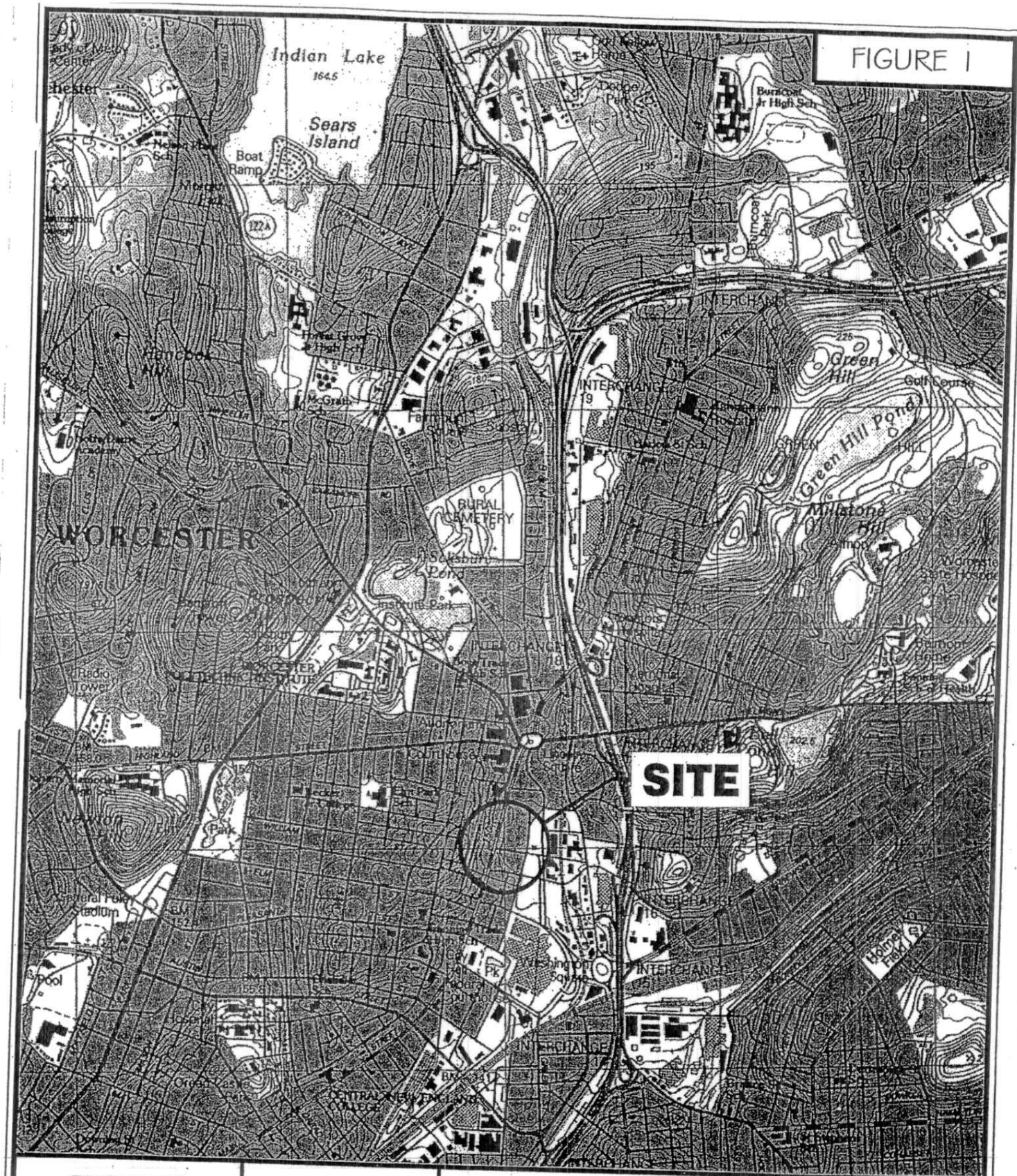
It is strongly recommended that McPhail Associates, Inc. be retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement is to review the drawings and notes for conformance with the recommendations herein and to generate or review the earthwork and PIF specification sections for inclusion into the Contract Documents for construction.

In addition, it is recommended that McPhail Associates, Inc. be retained during the project construction period to monitor the 120-ton and 50-ton production pile installation in accordance with the provisions of the Massachusetts State Building Code. In the event of any construction difficulties or differing conditions, our familiarity with the subsurface conditions and foundation design would aid in arriving at an expeditious and economical solution.

McPHAIL ASSOCIATES, INC.

FIGURES

FIGURE 1



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N

SCALE 1:25,000

PROJECT LOCATION PLAN

PROPOSED WORCESTER TRIAL COURT HOUSE

WORCHESTER MASSACHUSETTS