THESIS FINAL REPORT

Shaare Tefila Synagogue Olney, Montgomery County, Maryland Spring 2008

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Forrester Construction Company
Penn State Architectural Engineering

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Shaare Tefila Congregation

Olney, Montgomery County, Maryland

PROJECT TEAM

Owner– Shaare Tefila Congregation
Architect– Walton Madden Cooper Robinson Poness, Inc
Structural Engineer– The Watkins Partnership
Civil Engineer- A. Morton Thomas and Associates, Inc
MEP Design– Weigand Associates, Inc.
General Contractor– Forrester Construction Company

PROJECT FEATURES

Project Construction- Feb 2008—Mar 2009
Overall Project Cost- $10.79 Million
Project Size– 43,000 Sq Ft; 2 Stories
Delivery Method– Guaranteed Max Price
Building Function-Design-Bid-Build

ARCHITECTURE

- Building Features— Sanctuary, Kiddush Hall, social hall, nursery school, classrooms, office space, meat & dairy kitchens, library & chapel
- Landscaping, parking lot, walled courtyard
- Split-face and ground-face concrete masonry, ceramic tile, and cement board cladding, with expanses of aluminum curtain wall glazing

STRUCTURAL SYSTEM

- Structural Steel and structural masonry
- Shallow foundation with 4'-1/2" strip footings
- Laminated wooden beams, steel joists and truss roof system

MECHANICAL/PLUMBING SYSTEM

- Ground Source Heat Pump
- Bypass 3 blast Boiler and 2 Cooling towers
- Enthalpy Heat Recovery Wheel
- Loads: 158 tons Cooling, 1700 MBH Heating
- Independent, Dairy & Meat Kitchens includes dual water, waste, gas equipment & service

ELECTRICAL/LIGHTING SYSTEM

- Service Load-2500 Amps, 208Y/120V. 3-Phase, 4-wire
- Dimming Ballasts for Hall, Corridors, and chapel
- Sound system and design for chapel, Kiddush and social halls, outside of contract

Steve J. Horna construction management Sponsored by FORRESTER CONSTRUCTION COMPANY

http://www.arche.psu.edu/thesis/eportfolio/2008/portfolios/SJH249

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I am so thankful for my five years in Happy Valley. I am so thankful to be moving on.

1. EXECUTIVE SUMMARY

The thesis report for Shaare Tefila Congregation consists of a project background description, three areas of research and analysis, a conclusion and an appendix of charts and calculations. Analysis I is a research study on the Spanish-English language barrier in construction. Analysis II is an acoustical analysis of the worship space. Analysis III is a life-cycle analysis of the ground source heat pump system.

Project Background

This section describes the project background and history of Shaare Tefila Congregation. Details include detailed information on client information, project delivery, staffing plan, local conditions, building system descriptions, project schedule summary, and cost evaluation. The purpose of this section is to better acquaint the reader with the project from the perspective of the owner, architect, engineers and general contractor.

Analysis I: Research: *Spanish-English Language Barrier in Construction*

This section investigates the Spanish-English language barrier as an issue with several innovative solutions. Research will focus on construction professionals, construction workers of varying experience levels, construction management students, and building construction professors. In addition this research will be applied to the Shaare Tefila Congregation worksite in terms of constructability and project acceleration.

Analysis II: Acoustical Breadth: *Worship Space Acoustical Analysis*

This section analyzes the sound quality in the worship space of Shaare Tefila Congregation in terms of intelligible speech and reverberance. Different finish materials, as well as sound systems will be analyzed for optimum affect. This analysis focuses mostly on value engineering.

Analysis III: Mechanical Breadth*: Geothermal Life-Cycle Analysis*

This section analyzes the life-cycle cost associated with the building's geothermal system, including ground source heat pump and geothermal wells. This analysis will focus on value engineering, as well constructability.

Conclusions

This section summarizes the research and analyses from the previous sections. The intention is to make an overall comment on the thesis study, including lessons learned and any additional notes.

Appendix

This section consists of all supplementary materials including schedule, charts, calculations and preliminary presentation slides.

2. PROJECT BACKGROUND

Located in the small town of Olney, the project is currently in pre-construction, with Forrester Construction Company as the general contractor, and Walton Madden Cooper Robinson Poness, Inc. as the architect. Shaare Tefila will serve as a new place of worship for the Jewish community of Montgomery County, Maryland. The two story building area footprint is 43,000 SF and has a total project cost of $10.79 million.

The project construction includes a 90 person sanctuary and worship space, a social hall, a kosher dual kitchen, classrooms, library, administrative offices, parking lot and walled courtyard. The structural system includes cast-in-place foundation walls, concrete and steel composite framing, as well as a wood- beam, steel joist roof system. The mechanical building systems include indoor/ outdoor ventilation zones, occupancy sensors, and geothermal well renewable energy systems.

Project delays have pushed back the 13 month construction schedule until January. The site work is quite extensive including demolition of an existing residential building, garage, greenhouse and trees. A mobile crane will be for steel erection. The design also allows for expansion on the south courtyard. Shaare Tefila Congregation, as a thesis building provides an excellent backdrop for investigation into research topics ranging from value engineering, to constructability to schedule reduction. The multi-use functionality, additional mechanical systems, and potential for expansion, all open opportunity for analysis and investigation. Additionally the theme of education and community, which Shaare Tefila embraces, serves to reinforce the purpose of thesis exploration; to improve and learn.

2.1 Client Information:

The owner of this project, and the group providing funding is Shaare Tefila Congregation. Their goal is to provide their community with opportunities for comfort and growth. Education and discussions as well as family values are the cornerstones of this Synagogue. The building will serve as a new and more spacious home to the members of Montgomery County's Jewish community. The congregation celebrates a message "committed to the past, present & future" as seen in figure 2.1. This is a theme that I will seek to explore throughout this thesis study.

Figure 2.1 Shaare Tefila Banner

The owner is an inexperienced builder with limited budget. As such, the keys to success are constructability, research, schedule acceleration, and value engineering. Quality and value are of the utmost importance to the congregation. Investment in renewable energy systems is an example of this forward looking client.

2.2 Project Delivery:

The project delivery method is design-bid-build, with preconstruction services added. With the addition of preconstruction services including value engineering, the delivery has been executed up to this point as: preconstruction services/design – bid – purchase – build.

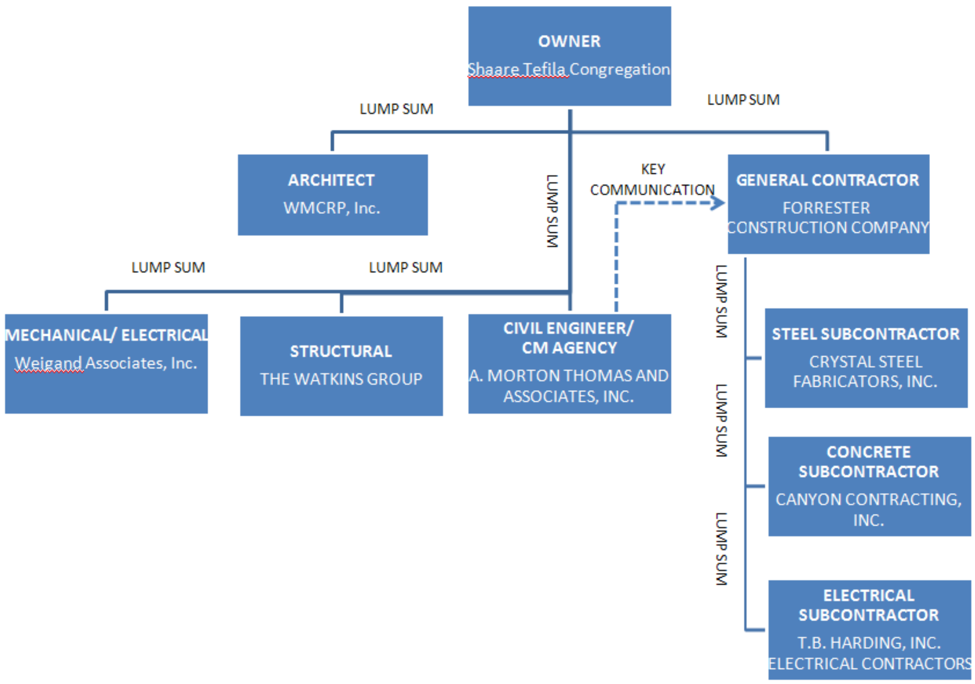


Figure 2.2 Project Delivery Organizational Chart

Forrester Construction Company's contract with the owner is a lump sum negotiated bid. The contractor was selected based on experience providing quality VE solutions, working with non-profit organizations, and performing quality work in the Education and Institutional markets. The remaining owner contracts were also acquired as lump sum.

One unique aspect of the project organizational structure is the role of the Civil Engineer, A. Morton Thomas and Associates. For this project, the Civil Engineer is acting as both a CE, and as the owner's representation. In this capacity the CE has a direct relationship with the GC, as noted in the figure 2.1. The reason for this assignment is the direct relationship that the CE has as a member of the Shaare Tefila congregation. As a cost solution this dual removes the cost of hiring a CM Agent.

2.3 Staffing Plan:

Forrester Construction Company, the General Contractor, staff their projects based on Building type and function. Shaare Tefila, being a Religious Education project is designated to the Education and Government group headed up by Mike Slattery. Specifically Steve Houff, the project executive in the Education group would correspond with the owner and manage the office side of the project.

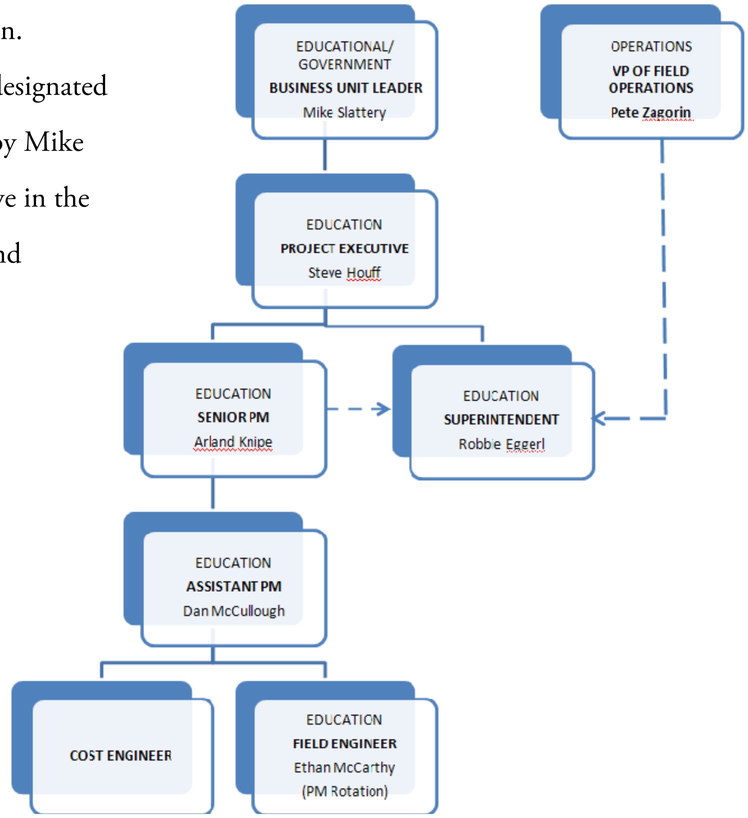


Figure 2.3 Forrester Construction Company Staffing Plan

The VP of Operations, Pete Zagorin usually gets with the Business Unit Leader and decides which PM and Superintendent is the best fit for the job, based on experience and availability. Mr. Zagorin has limited interaction beyond quality control with the superintendent at this point.

The project manager and superintendent, for all intents and purposes, run the project from this point. The assistant PM's responsibilities vary from job to job. On Shaare Tefila, Dan McCullough has taken more of the lead Project Manager role, while under the supervision of senior PM, Arland Knipe. The last tier of support is the field engineer. These team members are in a rotational program and their responsibilities will vary from field rotation, to project manager rotation, to purchasing rotation. On this job, Ethan McCarthy is assisting Dan in the office and field responsibilities.

2.4. Local Conditions:

The construction site is located in Olney, Maryland, an unincorporated area of Montgomery County. At about 4 acres (178,000 SF), the area is predominantly grass and trees with spread out 2 story residential homes north and west of the property. Vehicular and pedestrian access is restricted to the Georgia Avenue service road, located on the eastern boarder of the site. For construction, a gravel road will give vehicle access to the site. Due to the expanse of the property lot, ample room is available for on-site parking, on the south and western borders, as well as staging areas for steel. Montgomery County also has regional permit and fee requirements.

Figure 2.4 Vicinity Map

When a building is being razed or removed from a lot it is required to obtain a Demolition Permit, the purpose of which is to ensure that the lot is clear of debris and other health hazard material as well as that utility connections have been plugged and sealed. For areas over 5000 SF, a builder must apply for a Demolition Permit and Sediment Control Permit as well as pay required fees. These fees include Demolition fee, Automation Enhancement fee, Sediment Control fee, and Public Right of Way Permit fee, if there is no existing construction entrance. If asbestos is found on the property it must be removed in accordance with the Maryland Department of the Environment prior to demolition. Additionally, all contractors performing work in Montgomery County are required to have recycling collection services at the project site and must sort items for collection. The county provides its own solid wastes hauling and collecting services through the Division of Solid Waste Services, (https://www.montgomerycountymd.gov).

The soil in According to an Environmental Report performed by Schnabel Engineering North, the underlying material in the vicinity consists of sandy silts, silty sands, clayey silt, and silty clay. According to the same 2003 report, ground water could be encountered at 8 - 20 ft below the ground surface. Ground water is also expected to flow northwesterly direction toward North Branch Rock Creek.

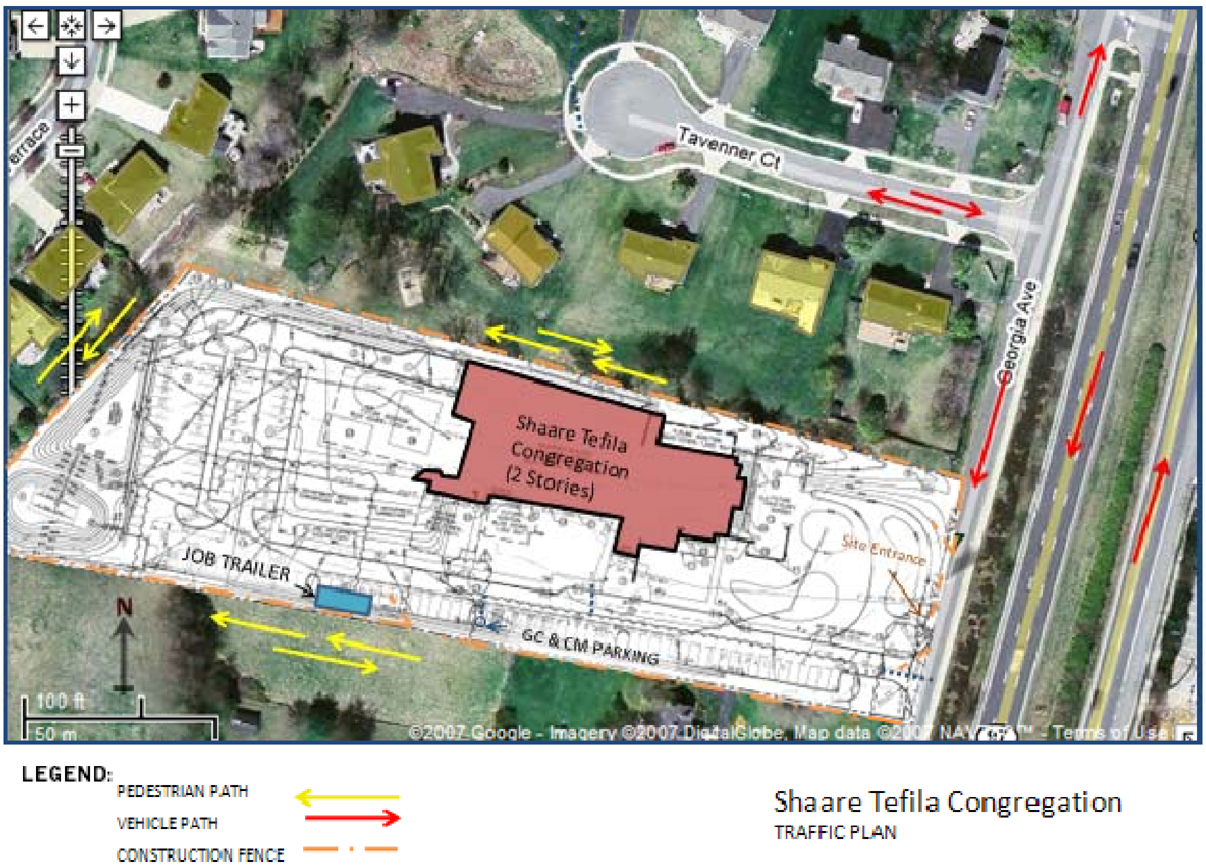


Figure 2.5 Traffic Plan

The traffic plan in figure 2.4 demonstrates the expected vehicle and pedestrian traffic for Shaare Tefila Congregation. The site is actually very convenient in terms of access to and from the construction site from the service road on Georgia Ave. The service road is excellent for controlling material delivery and crew transportation, as an off ramp from the main highway, Georgia Avenue. The temporary facilities are also indicated with the job trailer, temporary parking, and construction fences.

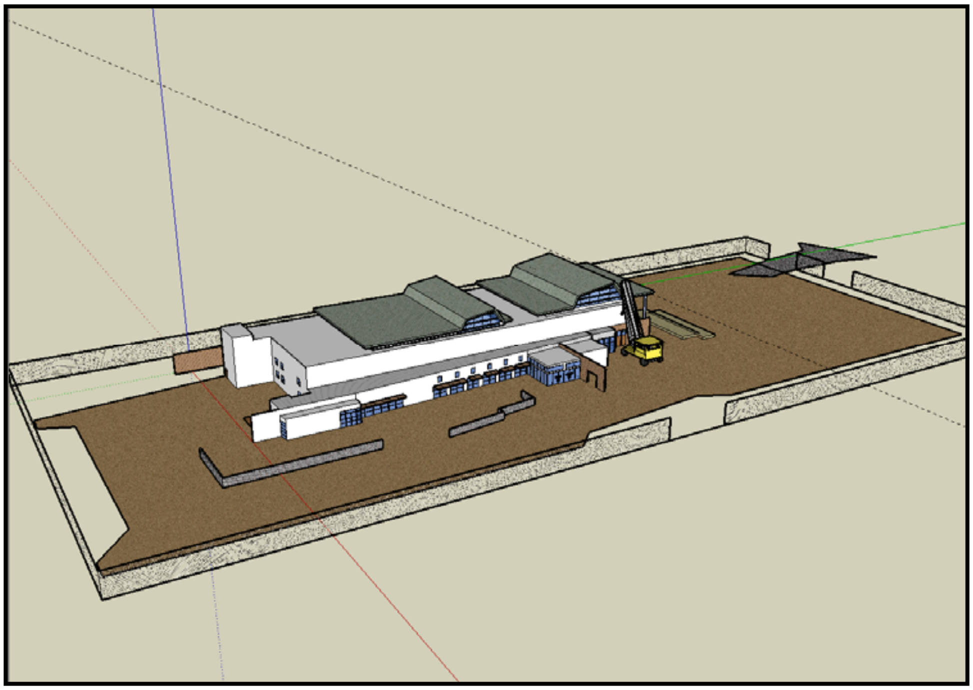


Figure 2.6 3D Render Site Layout plan

The rendered site layout in figure 2.5 details the rough grade and temporary facilities on the site. The site layout plan was rendered using Google Sketch-up 3-D rendering software, creating an accurate model for Shaare Tefila Congregation. There is included an installed rough-grade temporary road connecting to the only Vehicle entrance at Georgia Ave. Material layout and mobile crane is on the east facing façade. The temporary fence is also up and labeled very clearly.

2.5 Building System Description:

Building Envelope

The building envelope consists of fiber cement panel system, and finished CMU blocks for the exterior walls. There are two types of ceramic tile and coated copper copping. Prefinished metal coping finishes exist on the south and north Façade.

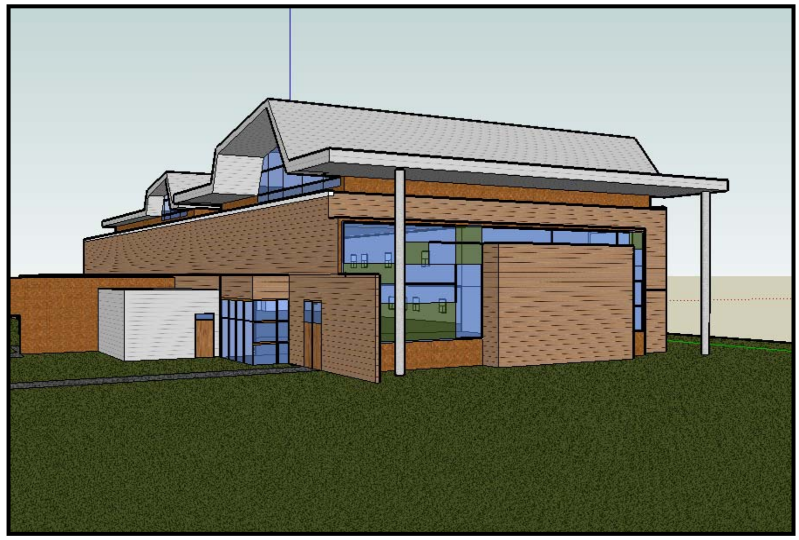


Figure 2.7 Shaare Tefila Building Envelope

Structural System

The structural system is composed of structural steel and structural masonry. Typical interior steel beam size is W16x31. Typical exterior steel column size is W8 x 28. The foundation is shallow with strip footings. Composite slabs are steel and cast-in-place concrete with a thickness of 4-1/2". The roof system is composed of glue-laminated wood beams and is supported by steel 22 gage steel framing.

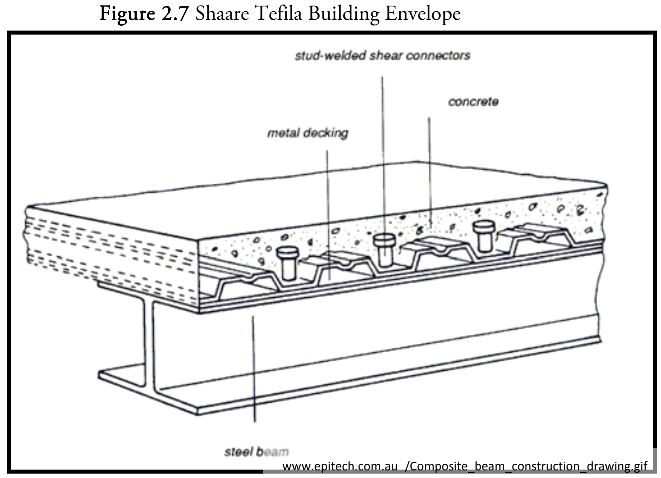


Figure 2.8 Typical Composite Steel Deck

Mechanical System

The mechanical room is located on the lower level and is approximately 1800 SF. The mechanical equipment services 1700 MBH heating and 158 ton cooling loads. The HVAC system includes a ground source heat pump serviced from 30 vertical geothermal wells on a closed-loop. The circulating loop includes a glycol refrigerant for temperatures ranging from 20°F to 110°F. During extreme temperatures in the winter and summer seasons, there is a geothermal bypass which runs through 3 gas-fueled boilers and a cooling tower. The boiler and cooling tower system is an alternative heat sink and injector to the ground temperatures. Standard duct size is 4"Φ-8"Φ, for 400 lbs/LF, and 10"Φ-12"Φ, for 800 lbs/LF. Corrugated duct size is 14"Φ-36"Φ for 2000 lbs/LF.

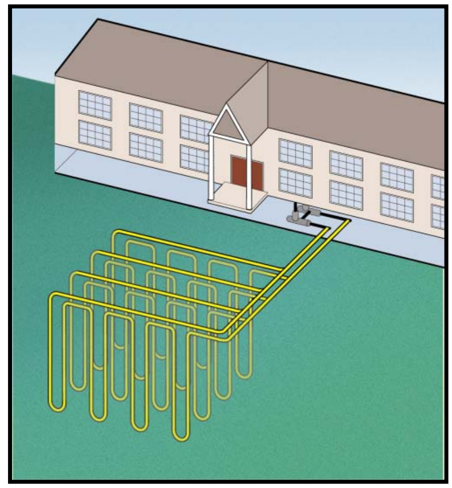


Figure 2.9 Vertical closed loop field

Two rooftop Air Handling Units provide air distribution for 8 ventilation zones. Occupancy sensors in each of the 8 zones curbs energy overconsumption. Each zone is separated based on capacity and usage.

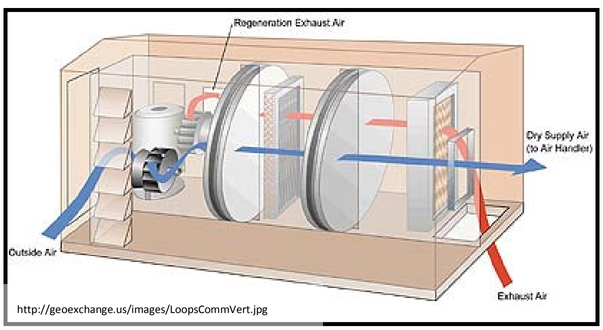


Figure 2.10 Enthalpy Wheel

An enthalpy wheel, air-to-air heat exchanger, has been implemented into the mechanical system as well. This renewable energy system is efficient since it helps to bring up the outdoor air temperature for "free," allowing the heating system to not work as hard.

Electrical System

The electrical systems which supports typical office use and school time use as well as speaker and data systems for gathering spaces is a service load of 2500 Amps. All work is to comply with requirements of the NEC, NFPA, BOCA, IBC and Montgomery county codes. All fixtures are to be connected to the emergency panel and will be powered by the generator (located in the mechanical room) in case the building loses normal power. Emergency lighting and battery pack will also be connected to standby generator.

Lighting System

Typical lighting varies based on room and function, but include: downward, decorative, wall-mounted, recessed, pendant, projection lens, and surface mounted fixtures. Area fluorescent lighting is used for most classrooms. Dimming ballasts for hall corridors and chapel are soft lighting systems. The classrooms on the lower level will have dual level switching to toggle the outer and inner lights.

Fire Protection

Shaare Tefila Congregation is covered entirely by a wet pipe sprinkler system. The automatic sprinkler system is intended for design-build installation and will be installed by the fire protection contractor. Standpipes are used in both stairwells and pressure is controlled by a fire pump. The interior walls have a 2 hour fire-rating. All sprinklers and alarms comply with codes for Montgomery County, NFPA as well as ADA requirements.

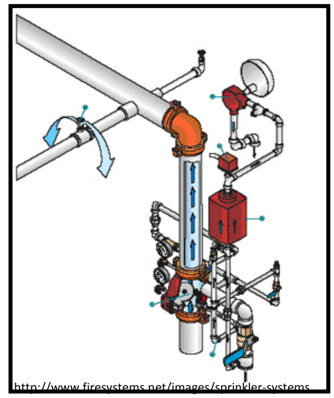


Figure 2.10 Wet Pipe System

Transportation

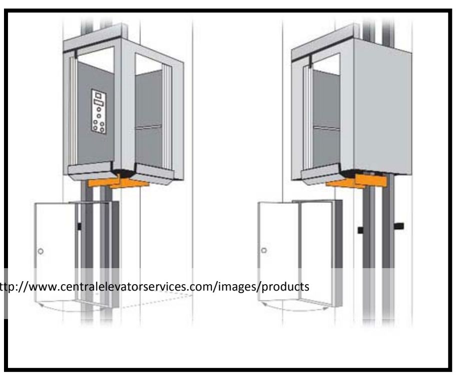


Figure 2.11 Hydraulic Elevator Jack Hole

The hydraulic elevator services both floors of the synagogue and is located in the north-west section, closer to the kitchen. The elevator is specified as a passenger elevator however it will be used as a service and loading elevator from the loading dock to the kitchen and to the upper floor. The conveyance system complies with ADA requirements as well as NFPA code and elevator codes for Montgomery County. Stairwells are located on the north-west corner as well as the south-west corner.

Telecommunication

The chapel and ceremony halls in the synagogue have been installed with a speaker system for announcements and educational functions. Full music and speaker system is to be provided by the owner. The office and administrative rooms will have data/fax and voice telecommunication systems installed and owner provided.

Figure 2.12 Interior hall of Sanctuary and Chapel

Geothermal System

The geothermal system implemented into Shaare Tefila, as indicated in the mechanical system description, is primarily a ground source heat pump, rejecting heat into the ground during the warmer months and injecting heat into building spaces from the stable ground temperature during the winter. There is a redundancy included in the building system including boiler and cooling tower. Since there is no outside water source to the site, geothermal wells are implemented into the building's mechanical system. The wells will tie into the mechanical system and then be used to circulate the building's water supply. This system is a high initial cost, however the cost and usage over the life of the building will result in utilities savings. This will be covered later in analysis II as a life-cost analysis.

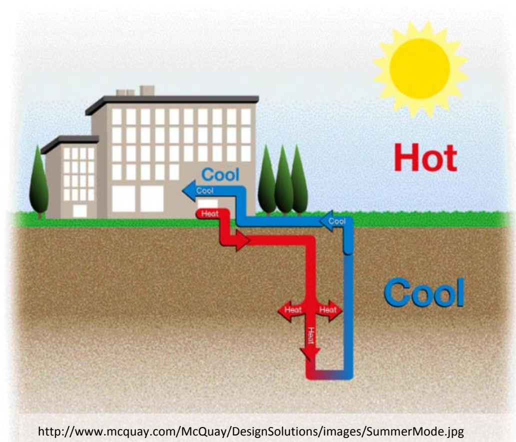


Figure 2.13 Example of heat rejection and injection

2.6 Project Schedule Summary

The detailed schedule lists 123 activities in 5 phase divisions. These divisions include preconstruction, sitework, structural, architectural, and mechanical/electrical. This thesis report has a construction start date of February 27th, 2008 and an end date for March 13th 2009. In reality, site problems and site permits postponed the demolition and construction for 8 months from the original June 25th 2007 deadline. Under the terms of the contract, the schedule delay falls under "permit delay" and not "differing site conditions". During talks with the project manager it was revealed that costs associated with delays fall upon the owner's responsibility and not the general contractor.

The schedule is represented with Primavera software, rather than Microsoft Project as in the previous technical report submissions. Appendix A shows the current construction schedule, including the 8 month delay.

2.7 Project Cost Evaluation

Assemblies Estimate

The assemblies estimate includes the curtain wall system, which are most predominant on the North and South facing façades, as well as the East facing glass wall. The curtain system is a free standing wall system composed architectural materials and is non-load bearing. The curtain wall system for Shaare Tefila Congregation is composed of an aluminum storefront, aluminum window sills, glazing, aluminum metal composite panels, a sun control louver system and glass canopy.

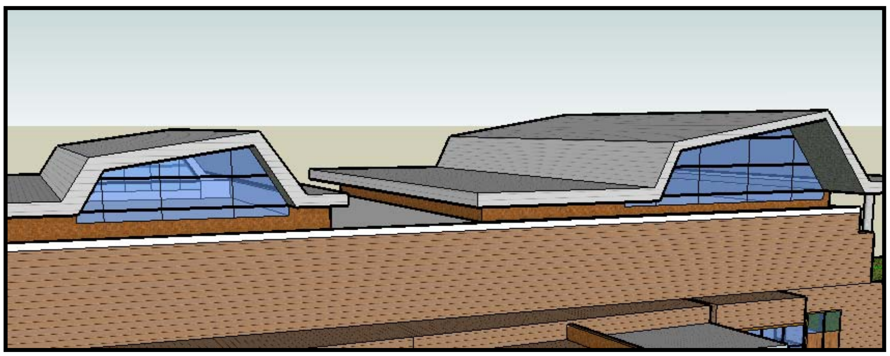


Figure 2.14 Curtain Wall System- Roof

Structural System Comparison	
Division	**Estimate**
003 Concrete	**$247,351**
004 Structrual Masonry	**$174,730**
005 Structural Steel	**$763,000**
Total Structral System	**$1,185,081**

Table 2.1 Structural System Comparison Estimate

General Conditions Estimate

The General Conditions (GC) estimate for Shaare Tefila Congregation reflects the indirect project costs including temporary utilities, temporary equipment, personnel, office supplies, quality control, insurance & bonding, fees and permitting. Home office overhead was not included into the estimate. Fees and unit costs are broken down monthly to reflect schedule changes on general costs. Temporary facilities include temporary fencing, lighting, roads, utilities, equipment and other costs. RSMeans cost data give the estimate for temporary utilities. Although building data and information has been taken from the project drawings these numbers do not necessarily reflect the final numbers for Shaare Tefila Congregation. The final numbers and estimated costs (including fees and factors) have been calculated with assumptions made by the student. These assumptions are rough figures, including assumptions for office support and miscellaneous costs, drawn from conversations with the project manager.

General Conditions Estimate	
Description	**Cost**
Bonds/ Insurance	$1,390,062
Staffing	$24,240
Temp Utilities	$9,820
Office Support	$1,784
Other	$1,784
Total GC Estimate	**$1,427,690**

Table 2.2 General Conditions Estimate

Additional costs for bonds, insurance and staffing are not final due to the extended delay. Under the terms of the contract, the schedule delay falls under "permit delay" and not "differing site conditions". During talks with the project manager it was revealed that costs associated with delays fall upon the owner's responsibility and not the general contractor.

3. ANALYSIS I: Research: *Spanish-English Language Barrier in Construction*

3.1 Problem Statement:

Language barriers in our profession is a prevalent issue which affects communication and construction, however rather than treat it as a problem that needs to be fixed, there is the potential for innovation and industry growth. This research will analyze the direct and indirect costs associated with Spanish-English language barriers in the Washington, DC construction industry. Through analysis of interview/surveys, it will be determined what strategies will most likely be successful if implemented in the field or in the class rooms.

The eventual goal of this research will be to create a prototype program for English-Spanish training which can be implemented in the field, corporate offices and in the classroom. In time this will create a viable way of helping the issue of labor shortages, as well as educate the next generation of construction professionals.

<u>Industry Need:</u>

According to industry reports, it is projected that by the year 2010 Hispanics will be 47% of the total workforce in construction[1]. In brief the problem from an industry standpoint is three fold:

- Lack of Safety training in a Bilingual workforce
- Lack of training/resources for construction management professionals and students
- Industry indifference to the growing Hispanic workforce

In order to focus this study I will be looking for the following research goals:

- Identify the language barrier as a critical industry issue facing labor workforce, construction professionals, and construction students

<u>Overview</u>

A vast majority of workers in the construction field come from Spanish speaking countries and have only a working knowledge of the English language. They are highly competent in their trade as well as in communicating with other industry peers. By the same token, construction professionals are highly skilled in management and technical skill. However it is in the exchange between technical English and technical Spanish that communication breaks down. Without effective communication, information is lost, mistakes are made, projects schedules get delayed, and people can get hurt.

According to the National Labor (NLD) 2000, listing the ten most dangerous jobs in the United States, four are construction related: structural metal workers (4th), roofers (6th), electrical power installers(7th), and construction laborers (9th). The inherent danger and need for proper safety training are obvious and implied. Even without a language barrier problem,

The 10 most dangerous jobs

Occupation	Fatalities per 100,000	Rank
Timber cutters	117.8	1
Fishers	71.1	2
Pilots and navigators	69.8	3
Structural metal workers	58.2	4
Drivers-sales workers	37.9	5
Roofers	37	6
Electrical power installers	32.5	7
Farm occupations	28	8
Construction laborers	27.7	9
Truck drivers	25	10

Source: http://construction.asu.edu/

Figure 3.1 Top ten dangerous jobs in the USA

3.2 Research Goals

This research study seeks to identify the Spanish-English language barrier as a serious issue which must be addressed. In order to encapsulate the issue it is necessary to focus on three groups, representing three entirely different perspectives: Spanish-speaking workforce, construction professionals, and construction students.

<u>Labor Workforce Research Goals</u>

It is the intention of this research to:

- Investigate the direct and indirect cost associated with the language barrier
- Determine the adequacy of current company methods and resources regarding language
- Determine the willingness to participate in additional training regarding language

<u>Construction Professionals Research Goals</u>

It is the intention of this research to:

- Gauge the Spanish language competency among construction professionals
- Determine the adequacy of current company methods and resources regarding language
- Determine the willingness to participate in additional training regarding language
- Determine an overall reaction to the critical issue

<u>Construction Student Research Goals</u>

It is the intention of this research to:

- Gauge the Spanish language competency among construction students
- Determine the willingness to participate in additional training regarding language
- Determine an overall reaction to the critical issue
- For Penn State, gauge the interest of adjusting the CM curriculum

Expected Results

I expect that construction students and labor work force will be more responsive and willing to participate in a committed language program. From cursory observations it appears that the desire for change and the willingness to learn is from the next generation of construction professionals. I believe that a developed program in the Penn State AE curriculum emphasizing technical communication in Spanish-English would be well received and successful.

Note on Illegal Immigration

As a note and clarification, this study analysis does not seek to answer or even address the issue of illegal immigration. When researching the growing Spanish-speaking workforce it becomes easy to get lost in arguments on legal responsibility and government sanction. With this in mind, the best solution is to stay clear of the arguments all together. Illegal immigration is a controversial topic with many variables and politics, so rather than detract from the issue at hand, this study will treat the percentage of Hispanics in the construction workforce as a given.

3.3 Methodology

The methodology and tools used to conduct this research topic are outlined in this section. Through various emails, phone conversations, personal interviews, career fair visits, and survey submittals, the information compiled for this analysis was painstakingly collected, analyzed and interpreted. It is the intention of the student to summarize and recount an accurate interpretation of this process, from initial design, to depth study, and everything in between. This section also includes special explanation and assumptions made by the student.

Initial Design

During the course of the proposal process, the following preliminary research-and-execution plan was drafted.

Since that time, the means and methods with which this research was conducted has changed and grown:

Step 1. Review literature and periodical information on subject of construction language barrier, paying special attention to any programs based in universities

Step 2. Get input on research topic from Forrester Construction, as well as from contacts from PACE and AE career fair

Step 3. Develop interview/survey questions with input from AE advisor, which addresses production cost, schedule delays, and time commitments. Focus on three groups: industry professionals, labor force, construction students

Step 4. Interview: 5 project managers and superintendents of varying experience levels, 5 construction workers of varying experience levels, 8-10 construction students with internship experience

Step 5. Analyze data for patterns

Step 6. Develop strategies which address the issues and present to AE advisor

Step 7. Summarize results

The approach of this execution plan was very straight forward, but entirely local and not looking at the language issue from a broader perspective. The focus was very narrow, only looking at the metropolitan Washington DC area, and limiting the surveys to 5 professionals and 8 construction students. This was far too small of a samples size to make any type of credible comment on the current state of construction, so instead the survey was expanded to include as many industry professionals with 5-10 years of experience in the field, preferably working with an ESL labor force. Similarly the construction students survey was expanded to include construction students from different universities, preferably with internship experience in the field. The updated methods plan follows:

Step 1. Review literature and periodical information on subject of construction language barrier,

paying special attention to any programs based in or around the DC metro area

Step 2 Get input on research topic from CM faculty, as well as from contacts from PACE, AE career fair and Penn State Spring Career Fair

Step 3. Develop separate interview/surveys regarding communication in the field and problem identification. Using *Surveymonkey* software. Focus on: industry professionals, labor force, and construction students

Step 4. Submit survey to: Construction students with internship experience, and Construction Professionals with 5-10 years of field experience.

Step 5. Analyze data for patterns

Step 6. Develop strategies which address the issues and present to AE advisor

Step 7. Summarize results

<u>Resources/Tools</u>

- Survey Monkey web survey
- AE CM faculty
- Internet : OSHA, Bureau of Labor Statistics
- Industry contacts, especially Forrester Construction Company
- University Building Construction Programs

Survey Research

The main depth of my research relies on an accurate and thorough surveying process. For this purpose I used *Survey monkey* web-based surveys. In order to accommodate both the survey taker and survey keeper, the website avoids lengthy collection and mailing, illegible handwriting, and honesty.

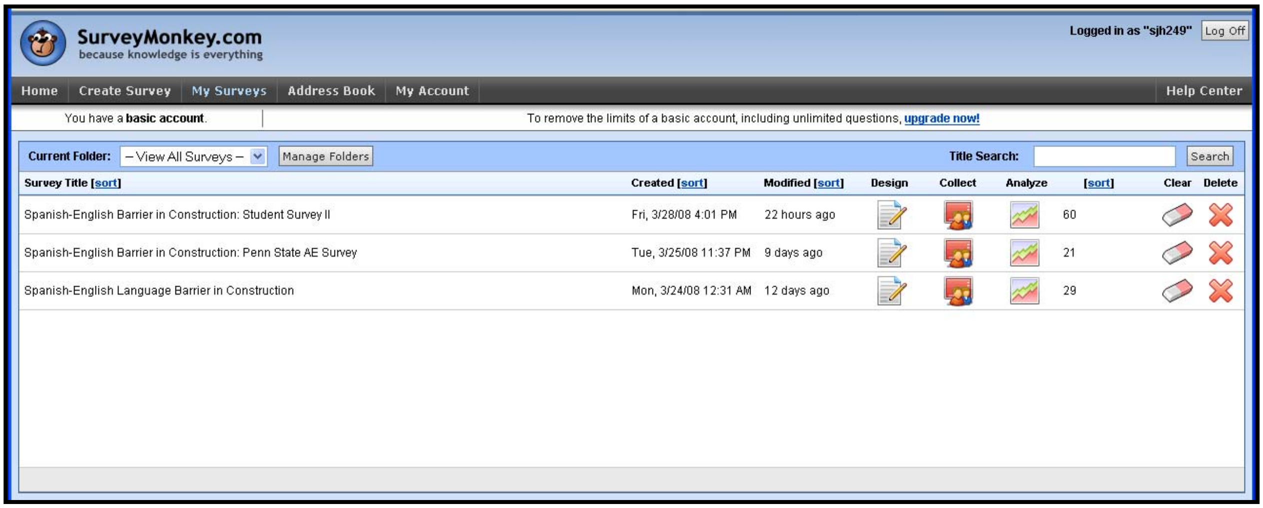


Figure 3.1 Surveymonkey web-client Data Collection Summary

As seen in figure 3.1, three surveys were created in order to meet research goals. The first is an industry specific survey meant for construction professionals with field experience. The second survey is a Penn State 5th year Construction Management survey geared towards the AE curriculum, specifically the B.A.E and M.A.E programs. The third survey is a more general construction student survey, including an opportunity to include "school name". This survey was sent out to participating Building Construction programs around the country, as well as to the 4th year Penn State CM class.

The following pages demonstrate the actual survey questions that construction professionals and students were asked to fill out using *Surveymonkey* web-based survey services. Personal information or survey profile has been omitted from the following reproduction in order to save space. In addition, a technical Spanish words-and-phrases quiz has been omitted from the individual surveys that follow, instead it is reprinted as a separated, third page. In summary:

- Copy of *construction professional* version of Spanish-English language barrier survey
- Copy of *construction students* version of Spanish-English language barrier survey
- Copy of technical *Spanish words-and-phrases quiz*

Construction Professional SAMPLE Survey

Critical Industry Research: ***The Spanish –English Language Barrier in Construction***

1. Position/Duties

I am a/n	*Superintendent*	*Assistant Super*	*Project Manager*	*Assistant PM*	*Other*

2. Spanish Language Education

Highest Level of Spanish instruction	*Junior High*	*High School*	*College (2 courses or less)*	*College (2+ courses)*	*N/A*

3. Spanish Competency

I have	*Little to no comprehension of Spanish*	*a basic knowledge of Spanish*	*a conversational knowledge of Spanish*	*a strong knowledge of Spanish and consider myself fluent*	*a strong knowledge of Spanish and Spanish is my first language*

4. Field Experience

I have had the following years of experience working with English-as-Second-Language (ESL) workers	*0*	*1*	*2*	*3*	*5+*	*10+*

5. Company Resources

My company provides adequate resources addressing communication with an ESL workforce	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

6. Proposed Training Course

I would be willing to complete a 40-hour safety training course teaching how to communicate basic construction tool names and terminology in Spanish	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

7. Current State of Field Construction

In regard to Spanish-English communication in the field, I believe that the current state of construction is:	*Unsatisfactory*	*Could Use Improvement*	*Satisfactory*	*Exemplary*

Construction Student SAMPLE Survey
Critical Industry Research: *The Spanish –English Language Barrier in Construction*

1. Spanish Language Education

Highest Level of Spanish instruction	*Junior High*	*High School*	*College (2 courses or less)*	*College (2+ courses)*	*N/A*

2. Spanish Competency

I have	*Little to no comprehension of Spanish*	*a basic knowledge of Spanish*	*a conversational knowledge of Spanish*	*a strong knowledge of Spanish and consider myself fluent*	*a strong knowledge of Spanish and Spanish is my first language*

4. Responsibilities

The majority of my time was spent…	*working on a project site*	*working from an office*	*Split evenly between field and office*

5. Interaction with ESL workers

In a given week I have interacted with ESL construction workers…	*Daily*	*4 Days out of 5*	*3 Days out of 5*	*2 Days out of 5*	*Once*	*N/A*

6. Professional Career

I believe that knowledge of the Spanish Language will be essential to my success as a Construction Professional	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

7. Undergraduate Curriculum

I believe the Building Construction undergrad curriculum should be adjusted in order to include a technical Spanish course, specifically for Construction Students	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

8. Web-based Courses

I would be interested in taking web-based courses in technical Spanish, as a major elective	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

9. University Responsibility

My University program offers adequate resources addressing communication with an ESL workforce	*Strongly Agree*	*Somewhat Agree*	*Somewhat Disagree*	*Strongly Disagree*

Technical Spanish Words-and Phrases Optional Quiz SAMPLE Survey

Critical Industry Research: *The Spanish –English Language Barrier in Construction*

1. Optional Spanish Quiz

Just for fun, please provide as many English translations to the following Spanish words or phrases as possible:

a. Seguridad

b. Escala

c. Protección Contra Caídas

d. Casco

e. Ruido

f. Hierro

g. Amarrarse

3.4 Survey Analysis

The main information gathering and research tool that I used was the survey. The survey looked at three main groups: Construction Professionals with more than 5 years of experience in the field working with a Hispanic work force.

<u>Construction Professionals</u>

Twenty eight construction professionals contributed to this research analysis. They are representing 5 different companies, from nine individual states, and combined they have more than 200 years of experience in the field and on the job site. The criteria for a good surveying candidate are a professional with more than 5 years of experience working with English-as-a-Second language student. Of those candidates selected, Project managers and superintendents are most desireable.

Surveyed Cities	# Surveyed
Washington DC	10
Maryland	6
Virginia	5
Tennessee	2
Florida	2
Ohio	1
North Carolina	1
Missouri	1
Hawaii	1
Total	**28**

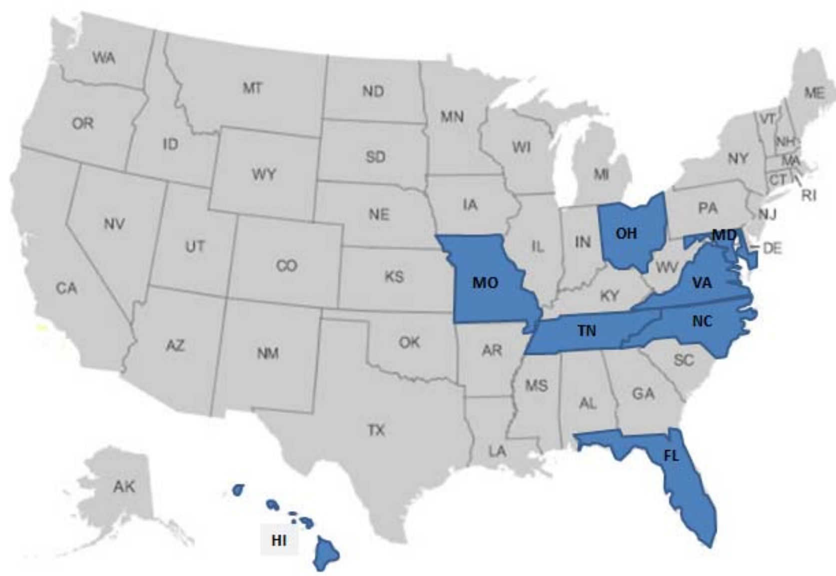
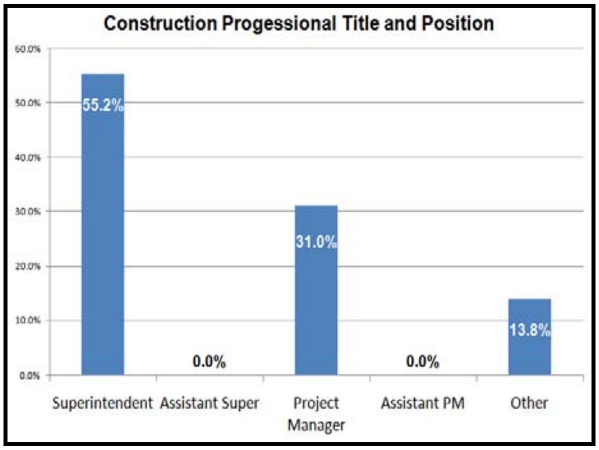
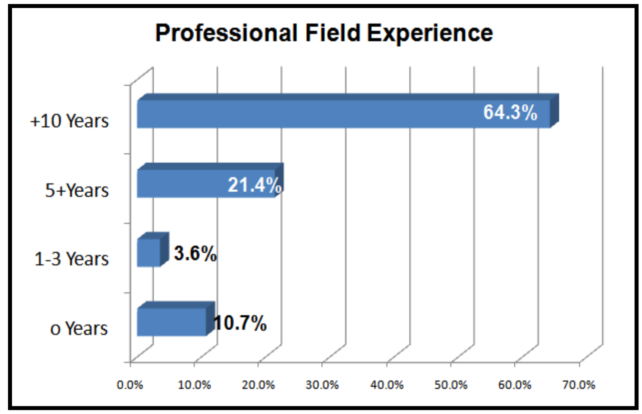
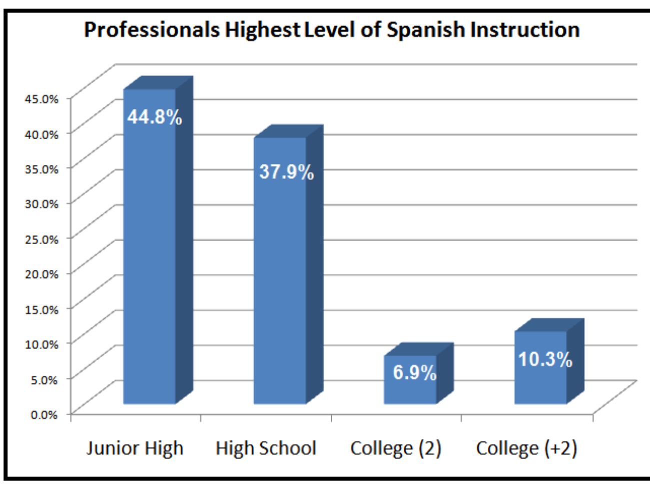


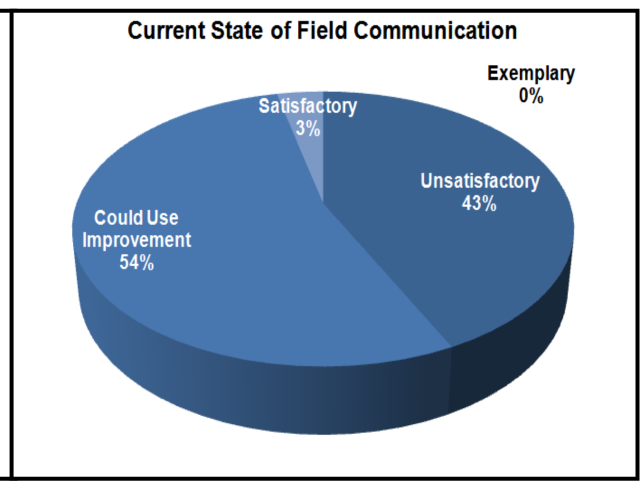
Figure 3.2 Construction Professionals demographic



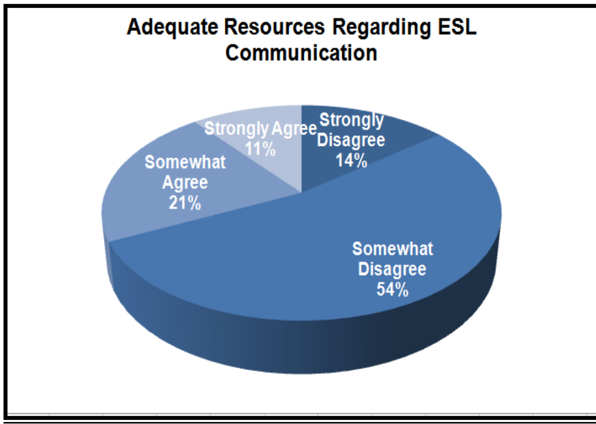


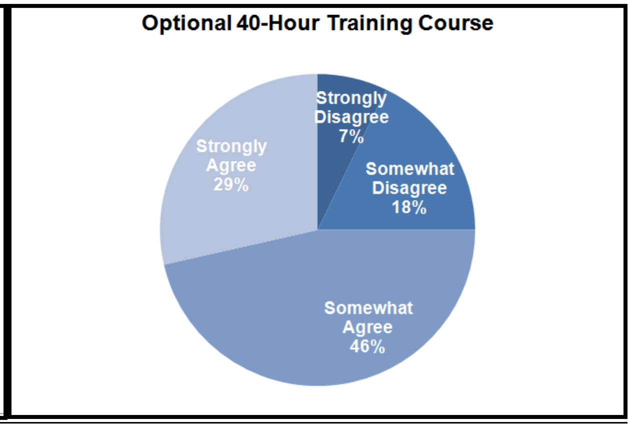
The demographic of each candidate is vital in understanding and analyzing these results. An assistant project manager with 2 years of experience would have vastly different things to say than a superintendent with Spanish as his first language.





A surprising bit of information is the correlation between years of experience and self identification of Spanish competency. The vast majority of surveyed subjects claimed to have 5-10 years of construction experience in the field and yet the overwhelming majority also self-identified themselves as having basic, little to no knowledge of the Spanish language.





As a group the construction professionals surveyed felt that there were not adequate resources available at their company or in the field. This is also apparent in the overwhelming statistic claiming that 97% of the construction professionals felt that the industry required much improvement.

The original intention was to collect results which reflected an older industry too established and worn to bother to change. I was very surprised and relieved to see the open-eyed view of the industry as well as the willingness to do something about it.

Construction Students

The perspective of the future generation of construction professionals is the most important I feel. Three building construction programs participated in this knowledge and experience survey. They are Virginia Tech Webb School of Construction, Penn State Construction Management Program, and Arizona State University Construction program.

Participating Universities	# Surveyed
Virginia Tech	18
Penn State	35
Arizona State	14
Total	**67**

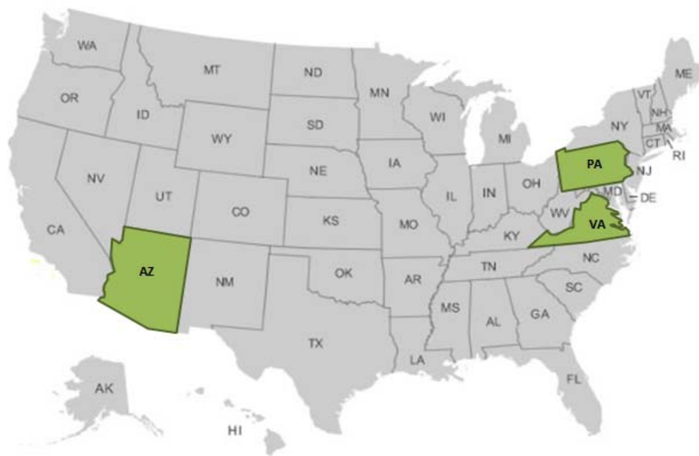


Figure 3.2 Construction Professionals demographic

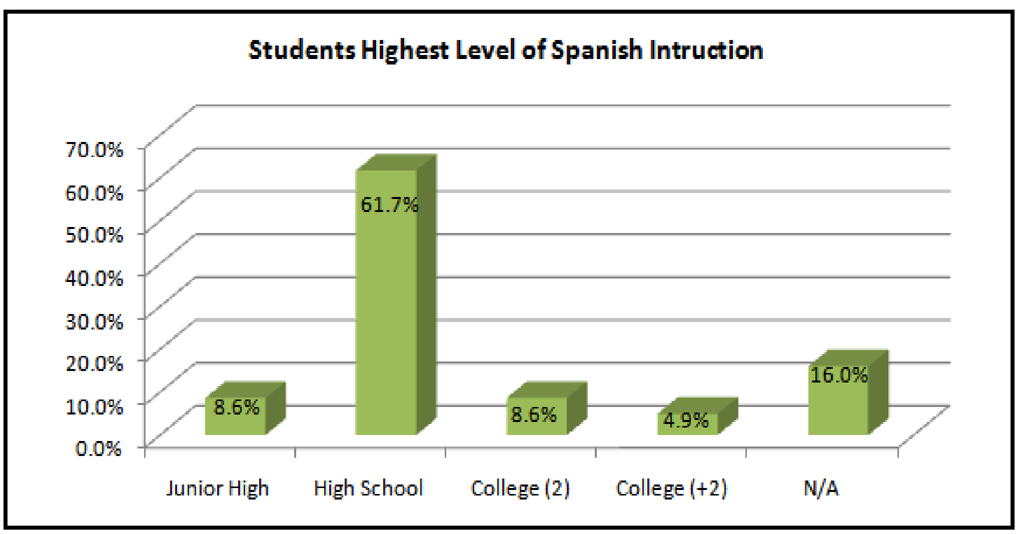


Figure 3.3 Spanish competency for university construction students

Of the large number of Construction students who participated in this survey the language competency is surprisingly low. When compared with the Spanish competency of construction professionals, this self assessment is a bit more promising.

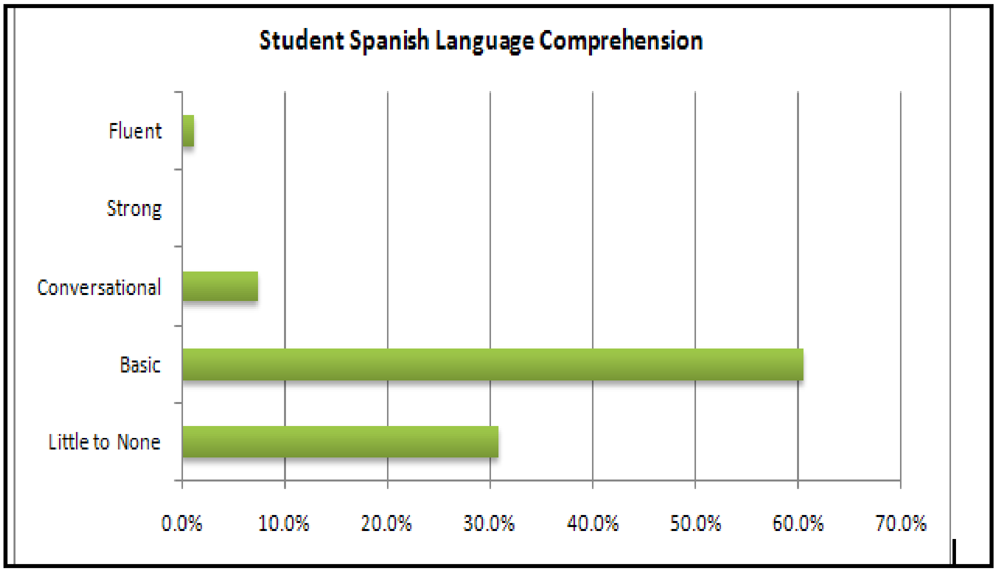


Figure 3.4 Self identifying survey results for construction students

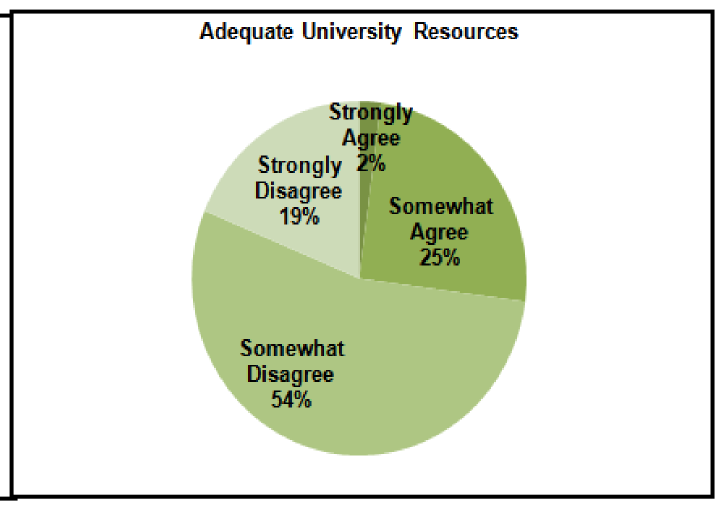
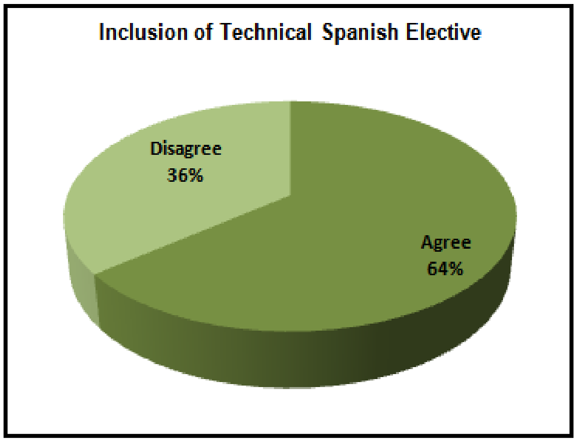


Figure 3.5



According to this statistical information several conclusions are obvious. One, construction students believe that the Spanish language is not only helpful, but essential to their success as a construction professional. Two, construction students believe that there is not sufficient resources to address the issue of Spanish labor and language communication. Third, the majority of construction students would be interested in some type of technical Spanish instruction, whether it be web-based or an undergraduate course.

Penn State AE Students

Graduating 5th Year AE students gave 21 responses to their exclusive survey. Questions on this survey include direct response to adjusting the 5 year B.A.E and M.A.E curriculum. Many students had differing opinions on this subject as indicated in figure 3.3. Due to the underwhelming results it is difficult to draw any definitive conclusions as to whether the Penn State AE CM curriculum is ready for a language overhaul. It is this student's belief that in future years, as demand and need become more prevalent, the proper adjustments will be made.

3.5 Recommendation

It is the recommendation of this student for construction professionals to engage in 40 hour training sessions that are maintained and regulated by an outside party, OSHA, or a subsidiary of OSHA. In this way there can be a move toward change and excellence in the industry.

Training Implementation: Lost Time Analysis

Language training and communication is a vital issue and extends beyond the realm of hypotheticals. On January 23, 2006 Dallas Ft. Worth International Airport began their two year experiment on safety training in a bilingual workforce. Participating construction workers, numbering in the thousands opted to take either English or Spanish course work in construction practices and safety as well as simple words and phrases in the language of choice.

It is from this OSHA success story that I am able to get many of the figures. Assuming average peak project man hours: 50 (mixed bi-lingual) workers, 13 month schedule

Total MH = 50*160(hrs/mo)* 13 mo = 104,000 mh total project

Recorded rate of loss time (after training) = 0.42/200,000 mh[4]

National Average = 3.68/200,000 mh[5]

Project Lost time /wi training = 0.21 hr/man*50 = 10.5hrs ~ **1.3 days**

Project Lost time average = 1.91 hr/man*50 = 95.7 hrs ~ **2.3 weeks**

The results here show practical application of the technical Spanish training program, positively affecting the pace, coordination and safety consciousness of the project team.

[4] Lost time rate after Spanish communication training based on OSHA success story: Dallas Ft. Worth Int'l Airport. (http://www.osha.gov/dcsp/success_stories/hispanic/dallas_airport.html)

[5] National lost time rate based on state and national average from OSHA (http://www.osha.gov/dcsp/success_stories/hispanic/dallas_airport.html)

4. ANALYSIS I: Acoustical Breadth: *Worship Space Acoustical Analysis*

4.1 Additional Background

As well as being a community center for religious education and social gatherings, Shaare Tefila is above all else a place of worship where religious programs are held daily, including group prayer and canting. With these strong singing and speaking ceremonies, it is important that the highest quality of audio engineering is implemented. To this affect, an acoustical analysis of the space including value engineering solutions will determine how to maximize the sound quality for its occupants.

4.2 Design Criteria

This acoustical investigation will analyze the finish materials and physical geometry of the worship space in order to produce optimum quality, while staying conscious of additional construction cost. This analysis will also serve as a breadth study in acoustical engineering. The sanctuary should have very specific acoustical properties that allow for dispersion and absorption of sound. The congregation's services and prayer include both singing and chant which under the wrong circumstance could create an acoustical issue. The current acoustical system servicing Shaare Tefila exists on the north and East walls, with fabric-wrapped acoustical panels. These are an affordable solution but with a space this dimensionally stunted, and considering the vaulted roof, creating a sound chamber, a quality alternative must be designed.

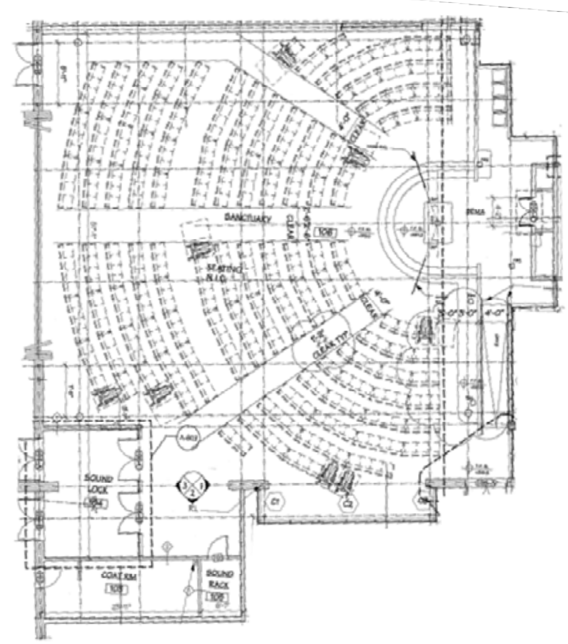


Figure 4.1 Sanctuary Floor plan

The worship space will be analyzed acoustically for the following goals:

- Intelligible speech
- Sufficient reverberance for music

In order to properly address the goal specifications, the space must be designed for long reverberation time for music. Electronic sound-reinforcing system for speech will increase intelligibility and it will also help with the issue of the Dome roof system, acting as a sound chamber.

4.3 Methodology

The methodology and tools used to conduct this research topic are outlined in this section. Through various emails, phone conversations, personal interviews, career fair visits, and survey submittals, the information compiled for this analysis was painstakingly collected, analyzed and interpreted. It is the intention of the student to summarize and recount an accurate interpretation of this process, from initial design, to depth study, and everything in between.

<u>Initial Design</u>

During the course of the proposal process, the following preliminary research-and-execution plan was drafted. Since that time, the means and methods with which this research was conducted has changed and grown:

- Step 1. Review construction drawings and specifications, focusing on materials and
- Step 2. Research literature and periodicals for audio solutions in worship spaces
- Step 3. Brainstorm ideas and receive input competent faculty
- Step 4. Develop strategies for at least two alternative systems
- Step 5. Calculate results for all acoustical scenarios using *Mechanical and Electrical Equipment for Buildings, 9th Edition* by Ben Stein and John Reynolds.
- Step 6. Present alternative systems to an authority
- Step 7. Summarize findings

4.4 Model Analysis

The calculations used to model the Sanctuary space are included in Appendix C in the supplemental materials. The important items to note are the checklist to designing an acoustically balanced worship space. The target reverberation time is between 1.7 and 2.3 seconds, for speech intelligibility and music sounds system.

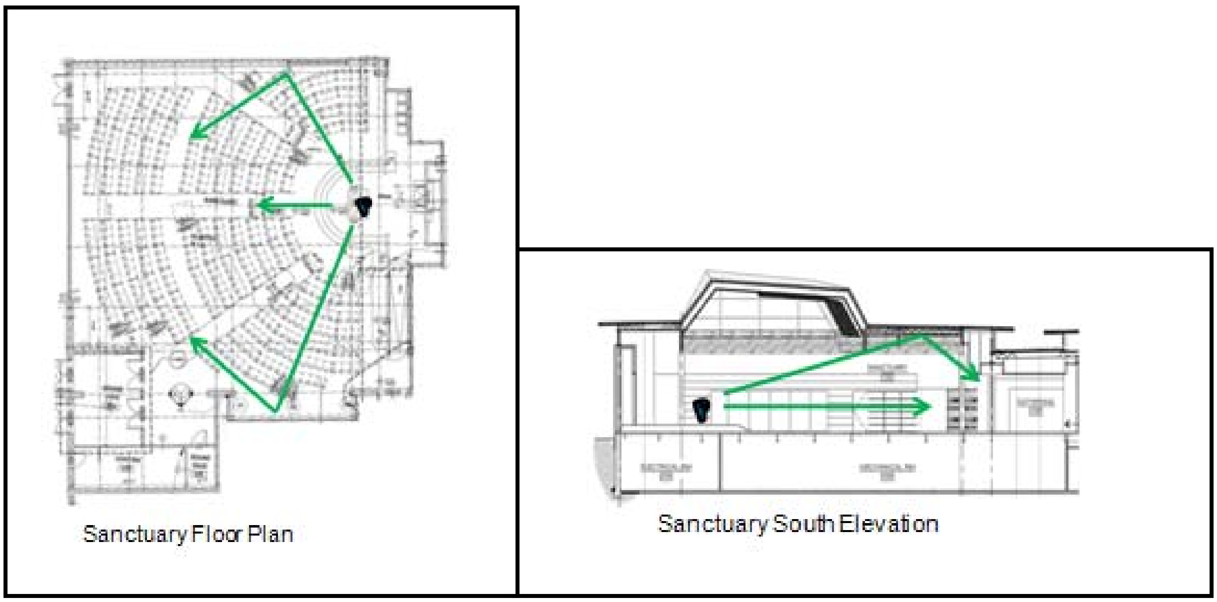


Figure 4.2 Plan and elevation view of sanctuary

Additional design criteria include the location and surroundings of the speaker's pulpit. The low hanging roof drops down at nearly 21 ft high, which one foot over the design specification which would call for sloped soffet over the podium in order to refract the sound and redirect toward the center of the congregation masse.

Mechanical Room Transmission Loss:

An acoustical advantage to having a heat pump geothermal system is substantially less noise from the mechanical system. With a traditional DX cooling and gas fueled boiler the sound transmission would presumably uncomfortably noisy. Utilizing a ground source heat pump HVAC system is therefore a great an acoustical advantage with the reduced mechanical noise. Since everything is water conductively based, there is no hard or harsh mechanical noises transmitting through or around the acoustically sealed doors and walls. The mechanical room is located directly below the acoustical space and so must be considered for transmission loss analysis.

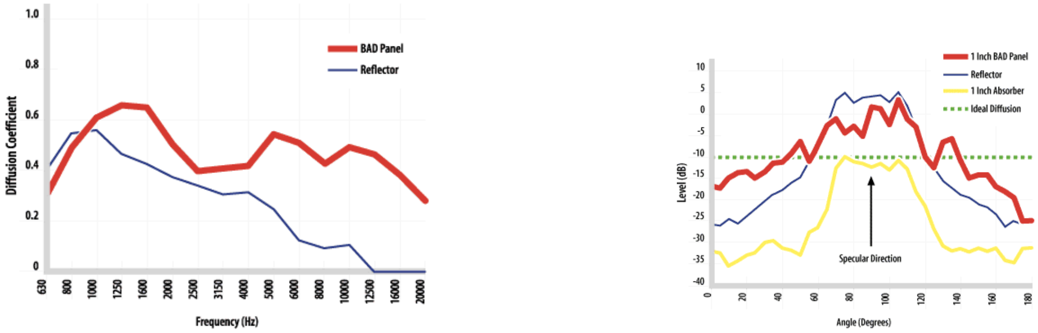
Reverb Time Calculations

Reverb time = RT60 = time to drop 60dB below original level.

	Absorption Coefficient		
Hz	1" Fiberglass A Mount	5/8" Hole A Mount	1/2" Hole A Mount
100	0.06	0.07	0.16
125	0.08	0.10	0.18
160	0.14	0.17	0.18
200	0.14	0.18	0.25
250	0.26	0.31	0.35
315	0.42	0.48	0.60
400	0.57	0.65	0.73
500	0.69	0.77	0.90
630	0.77	0.85	0.96
800	0.87	0.94	1.02
1000	0.94	0.98	1.00
1250	1.05	1.06	0.97
1600	1.08	1.04	0.92
2000	1.07	0.99	0.83
2500	1.12	1.00	0.76
3150	1.08	0.93	0.68
4000	1.01	0.84	0.60
5000	1.00	0.82	0.54

Figure 4.3 Absorption coefficients for 1" Fiberglass.

Figure 4.3 Absorption coefficients for 1" Fiberglass.



Source: http://www.rpginc.com/products/badpanel/bad_pol.htm

Figure 4.4 Typical dispersion and absorption results for RPG BAD panels

4.5 Analysis Results

BAD RPG – Binary Amplitude Diffsorber. For combination of sound dispersion and absorption, the RPG BAD panels are the most effective material available. In terms of data and meeting design specification, the following calculations have been used to get reverb time, Reverb Time: T= 0.5 V/a = 1.83 sec @ 500 Hertz.

4.6 Recommendation

For the purposes of this study I have recommended the RPG BAD acoustical panels as a design solution. The acoustical properties here are balanced and will be set on the North and East walls. The altered worship space design will

5. ANALYSIS II: Mechanical Breadth*: Geothermal Life-Cycle Analysis*

5.1 Problem Statement

The mechanical design for Shaare Tefila Congregation includes several renewable energy systems which support geothermal water heating and additional energy saving devices. Because of the additional space requirement and connections, a life cycle cost analysis will compare the initial cost versus life-cycle cost to determine when the renewable energy system will start adding value to the project. The initial design calls for 30 geothermal wells which are drilled 452 feet in to ground in a closed loop. As seen in figure 5.2, there are additional lay down areas which are laid-out well locations for future 25 well addition, 55 in total. The reason that these wells are not being installed is because of the large initial upfront cost.

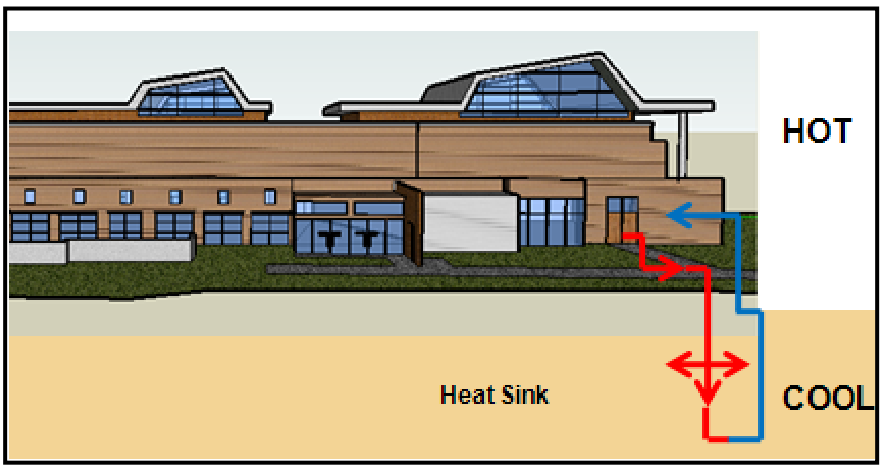


Figure 5.1 Diagram of Geothermal vertical loop

5.2 Additional Background

The site is large at nearly 4 acres and includes additional space to build on and extend. There is room for a parking lot and landscaping however there is not unlimited land for geothermal expansion. As seen in figure 5.2 the site for the geothermal drilling for future 25 wells is located parallel to the existing loops.

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Figure 5.2 Future Geothermal well sites

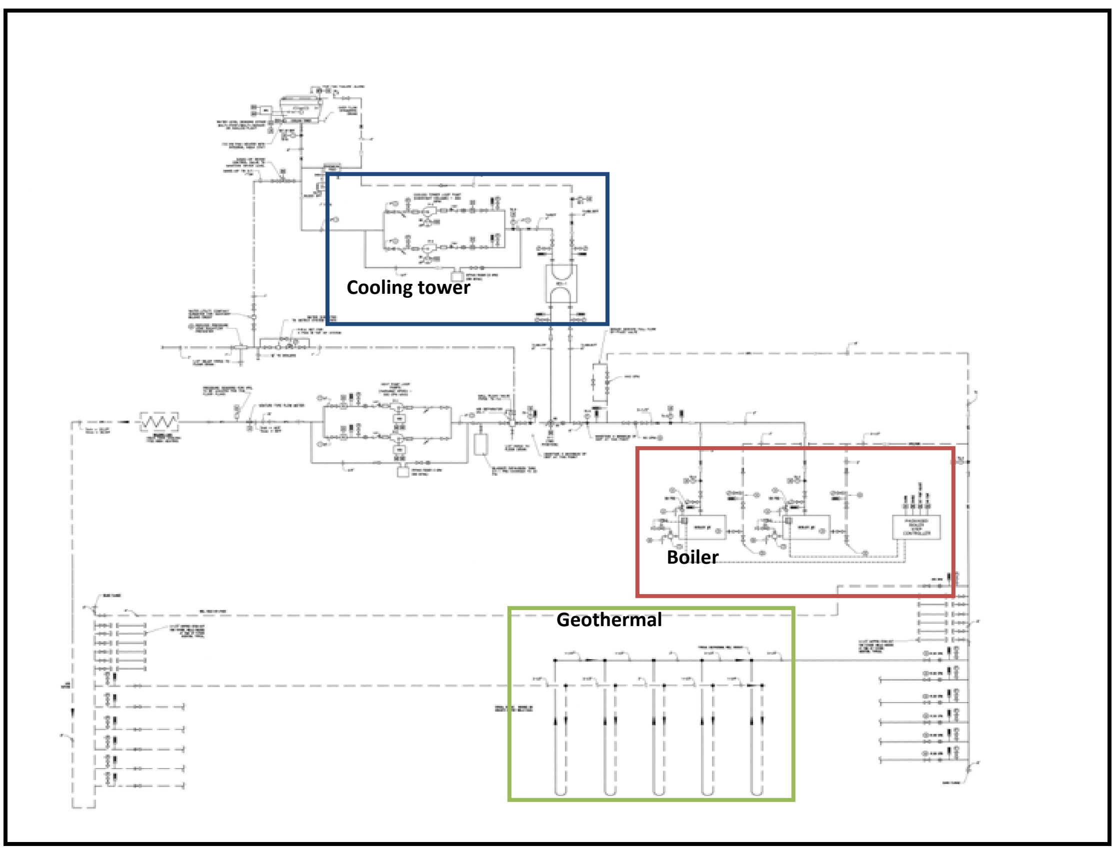


Figure 5.3 Drawing of building mechanical system with redundant system

5.3 Analysis Goals

This analysis will compare the initial cost versus life-cycle cost to determine when the renewable energy system will start adding value to the project. Additionally this analysis will serve as a breadth study in the mechanical option. Figure 5.3 shows the current well site for which tie into the vertical piping and horizontal trenching. This research topic seeks to accomplish the following items

- Research and become familiar with Ground Source Heat Pump
- Determine initial cost associated with installation for 25 additional wells
- Determine cost and payback period for 55 geothermal well system

5.4 Methodology

This mechanical breadth took the same amount of study and research as the critical industry topic. The end results required a great amount of assumptions to be mad in order to render any results. A great tool to model energy consumption and which was of great value to this project was TRACE 700 software.

Step 1. Review literature and periodicals relevant to geothermal wells and renewable energy systems

Step 2. Determine difference between ground sourcing and geothermal well

Step 3. Calculate heat and energy costs for standard heat pump system using *Mechanical and Electrical Equipment for Buildings, 9th Edition* by Ben Stein and John Reynolds

Step 4. Brainstorm and receive input from competent faculty on determining energy and cost associated with energy renewable system

Step 5. Calculate heat and energy costs for geothermal system

Step 6. Calculate future cost vs present cost using *Engineering Economic Analysis* by Michael R. Lindeburg

Step 7. Present findings before a building authority

Step 8. Summarize analysis

Assumptions

The student made several assumptions in regard to the energy consumption and output model in Trace 700 software. The reason for this is because of the fact that there was no accurate model that included a ground source heat pump, nor the redundant cooling tower and boiler system. For these reasons, the student made the following assumptions:

-Model using water source heat pump

-Simplify upper and lower room configuration, four large rooms/ level

-Assume rates and conditions for Baltimore(54 minutes away from Olney)

-Electricity rates estimated at $0.06/kWh[2]

5.5 Model Results

TRACE model issues, specifically with regard to increasing the capacity of heat source to 45% (30 to 55 geo-wells) led to unreasonable and unreliable model results. The assumptions were to great as to be acceptable in the realm of possibility. In order to elicit some results I used a case study form 2005 on the Lapwai Middle-Highschool, ID - Open Loop GSHP. Adjusting 1.09% for location and yearly differences it was these load results that I was able to use. Table 5.1 details the building data history to justify the calculation results.

Building Load comparison:

GSHP Consumption Cost comparison			
Project	Heating	Cooling	Avg Ground Water temp
Shaare Tefila Synagogue	158 tons	1700MBH	56
Lapwei Middleschool	140 tons	1140MBH	58

Table 5.1 Consumption comparison for Shaare Tefila and Lapwei middle school

Under the supposition that these output and consumptions values are close to reasonable I applied the typical cost savings, $17,880 annually, to the present value payback results.

Geothermal System	Total Capitol Cost	Annual Costs		Periodic Costs	Simple Payback (yrs)
		Energy	Maint		
30 geo wells	$230,520	$3,639	$4,721	$25,000 , Year 20	12.89
55 geo wells	$422,620	$8,086	$4,721	$25,000 , Year 20	23.63

The geothermal systems' output and assumed life cycle cost is outlined as follows:

Typical cost savings Estimate: **$17,880 annually**
Cost difference for 25 additional wells: **$192,100**
Total initial cost current system: $230,520
Total initial cost alternative system: $422,620
Assuming Energy cost is 45% more

- GSHP wi/ 30 geo wells simple payback period for Is 12.89 years
-GSHP wi/ 55 geo wells simple payback period for Is 23.63 years

5.6 Recommendations:

Due to the relatively high initial cost, it is recommended to stay with the 30 geothermal wells from the initial design. It is in the owner's best interest to continue the cost savings for a period of 13 years at which point advances in technology and better energy practices might bring installation and maintenance costs down

6. SUMMARY & CONCLUSIONS

Spanish English Language Barrier

This research topic was meant to look at the industry standards and determine the overall status of communication in our modern culture. The recommend 40-hour training for professionals and labor workforce must become a standard practice in the industry.

As far as construction students are concerned, they will be turning into the industry that has been left for them to inherent. Modern culture and construction practices change constantly however communication and safety training are the best weapons to deter the changing tides.

-University backed technical Spanish courses
-Project schedule accelerated 2 weeks

Acoustical Analysis

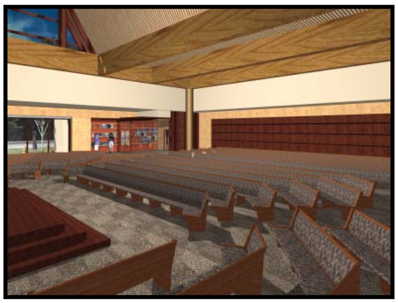
The RPG acoustical panels for sanctuary worship space accomplish all of the design criteria which were the focus of the acoustical analysis. These were intelligible speech, inclusion of a centrally located music sound system. Reverb time was calculated as 1.83 seconds, which falls within the range for a typical worship space.

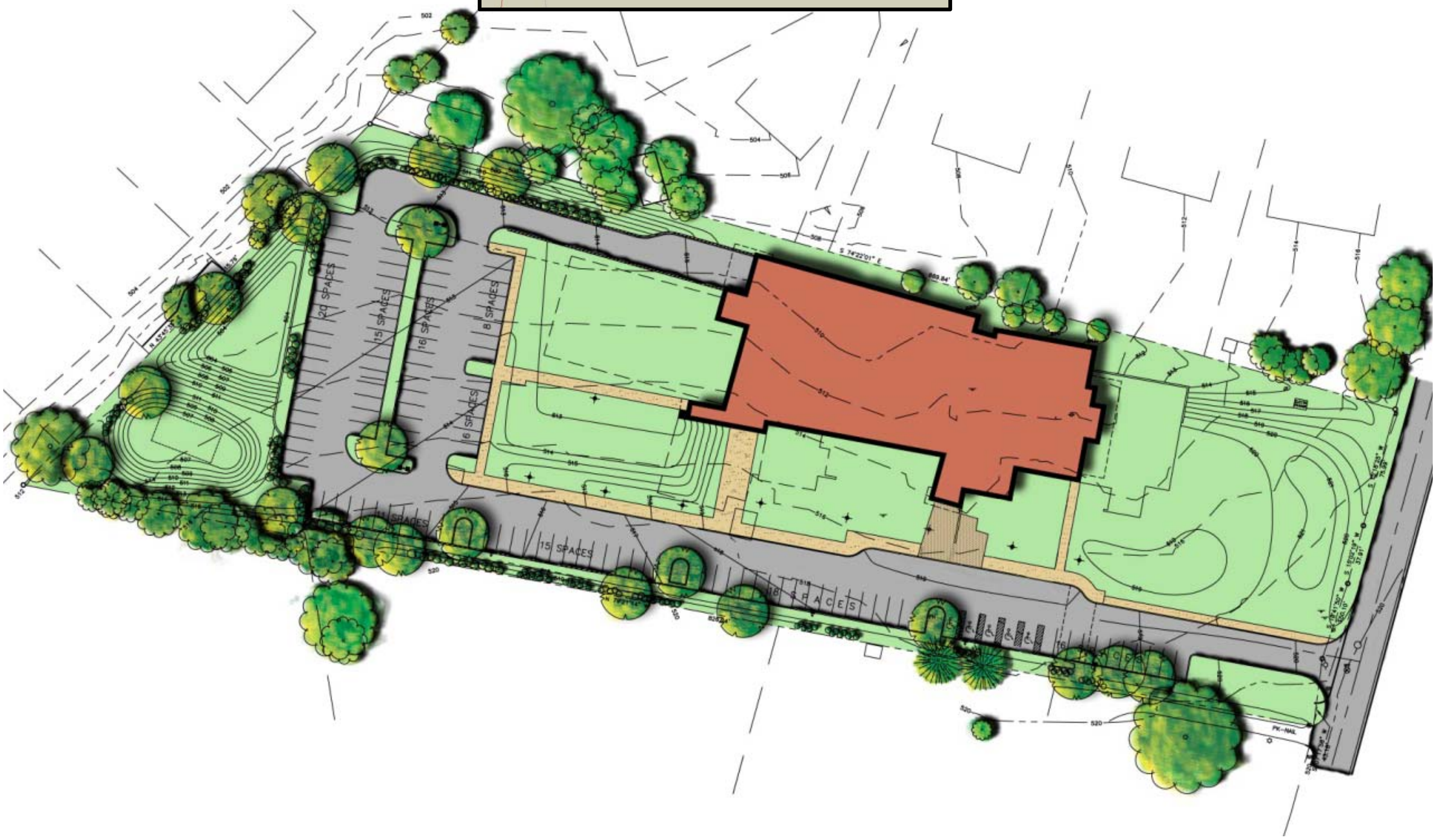
Geothermal System Life-cycle

The geothermal life-cycle analysis gave mixed results. Research and model calculations did not give accurate results and ultimately failed at being convincing. In order to compensate and have a reliable source of data and energy results, the analysis used numbers from a case study for middle school with similar weather, temperature and load characteristics. The results lead to the following conclusions:

-Continue with 30 geothermal wells with payback of 12.6 years
-Annual savings of $17,880

APPENDIX



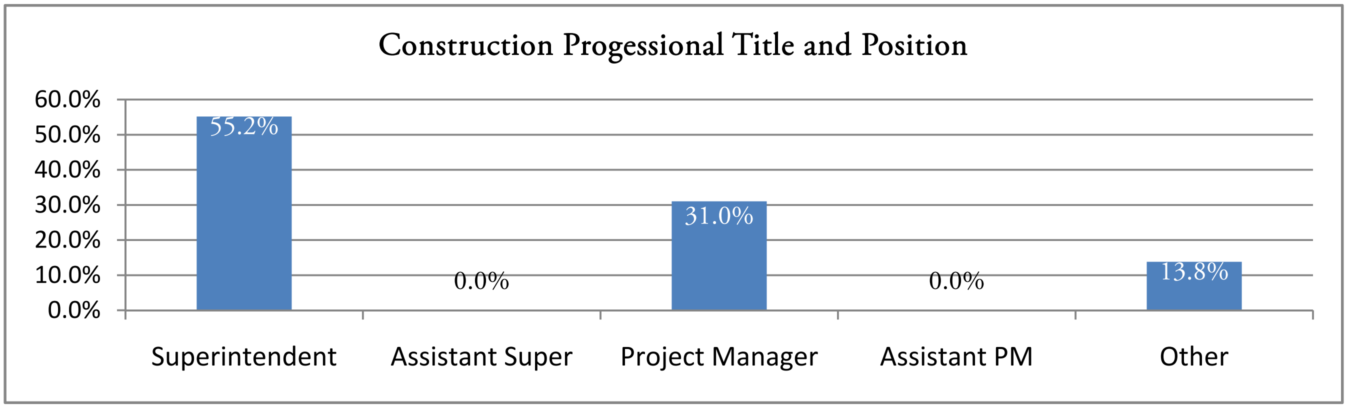


Shaare Tefila Congregation Olney, Montgomery County, Maryland **Forrester Construction Company** **Penn State Architectural Engineering**

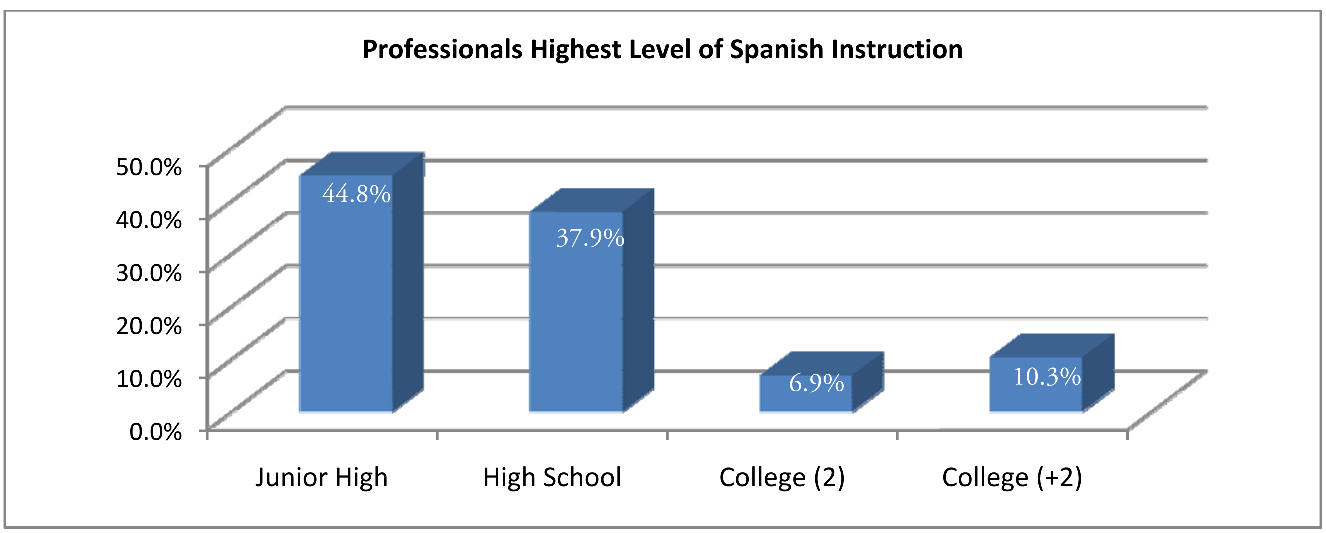
Wednesday, April 9th 2008

APPENDIX A:Survey Results

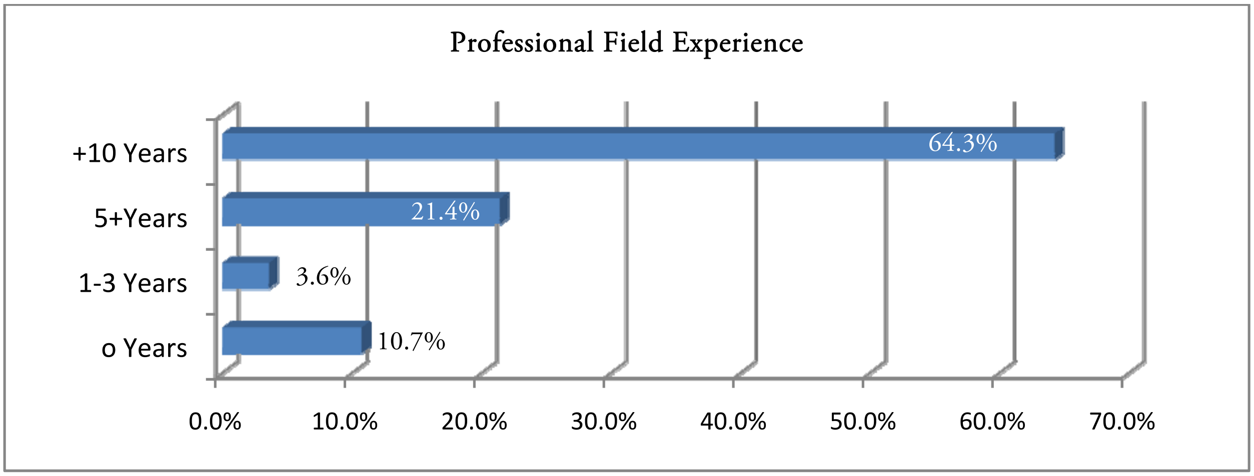
A.1 Construction Professionals



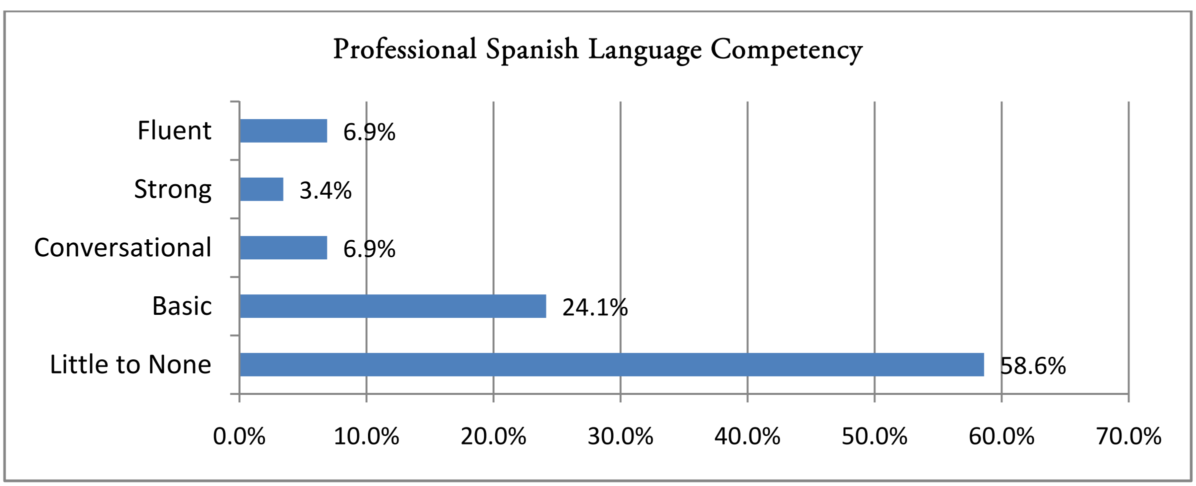
	Highest Level of Spanish Instruction			
	Junior High Level	High School Level	College Level (2)	College Level (2+)
# Surveyed	13	11	2	3
% Surveyed	44.8%	37.9%	6.9%	10.3%



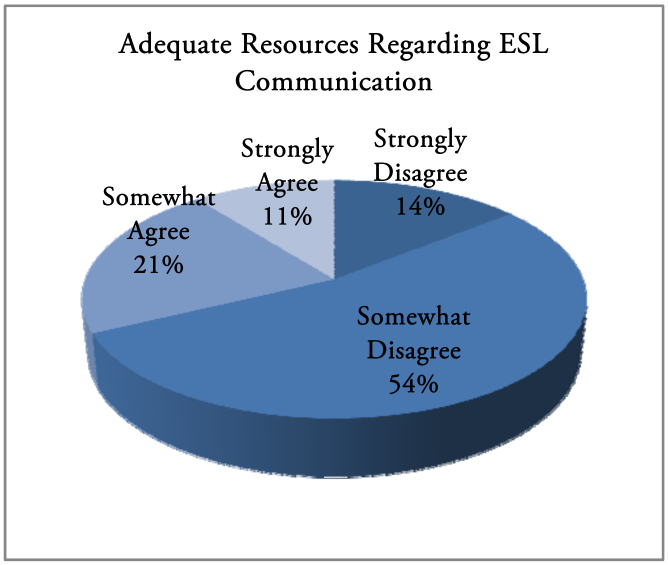
	Field Experience			
	0 Years	1-3 Years	5+ Years	10+ Years
# Surveyed	3	1	6	18
% Surveyed	10.7%	3.6%	21.4%	64.3%



	Spanish Language Comprehension				
	Little to None	Basic	Conversational	Strong	Fluent
# Surveyed	17	7	2	1	2
% Surveyed	58.6%	24.1%	6.9%	3.4%	6.9%

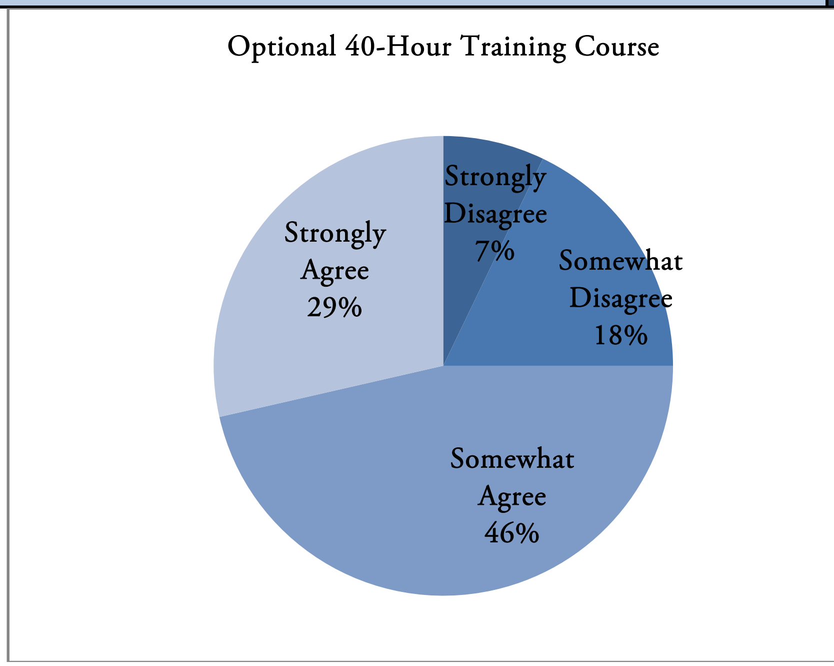


	Adequate Resources Addressing ESL Communication			
	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
# Surveyed	4	15	6	3
% Surveyed	14.3%	53.6%	21.4%	10.7%
	67.9%		32.1%	
	Disagree		Agree	



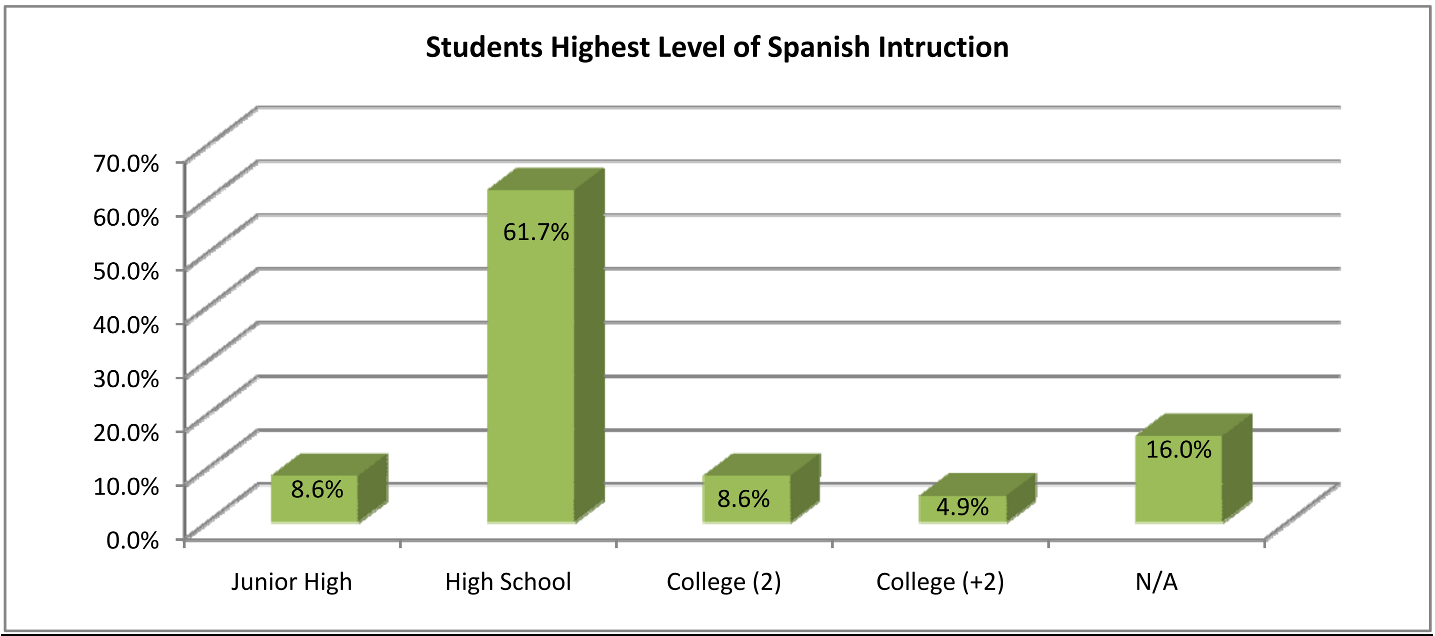
	Optional 40-Hour Training Course for Professionals			
	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
# Surveyed	2	5	13	8
% Surveyed	7.1%	17.9%	46.4%	28.6%

	Current State of Field Communication			
	Unsatisfactory	Could Use Improvement	Satisfactory	Exemplary
# Surveyed	12	15	1	0
% Surveyed	42.9%	53.6%	3.6%	0.0%
	96.4%		3.6%	

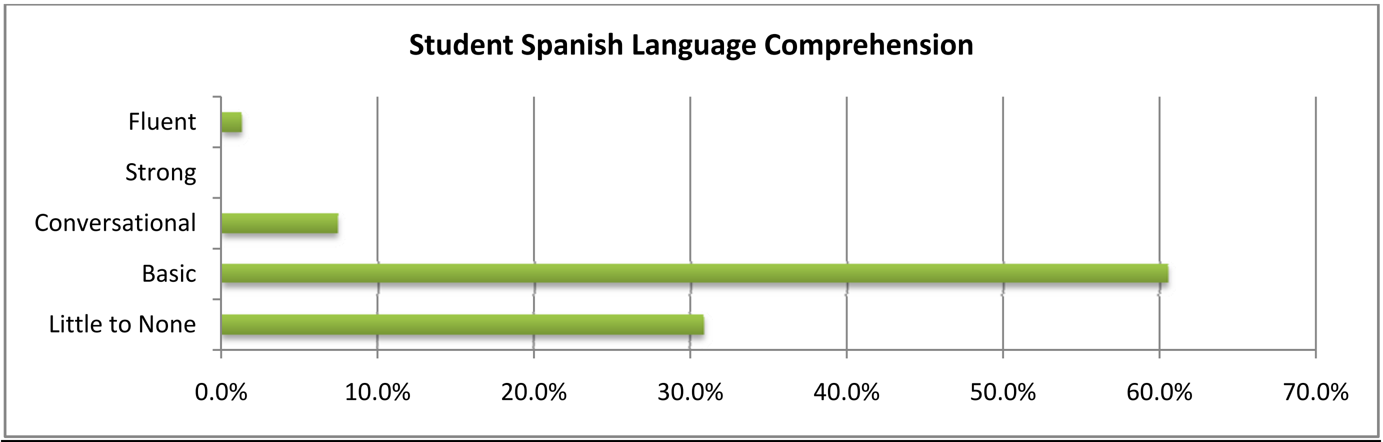


A.2 Construction Students

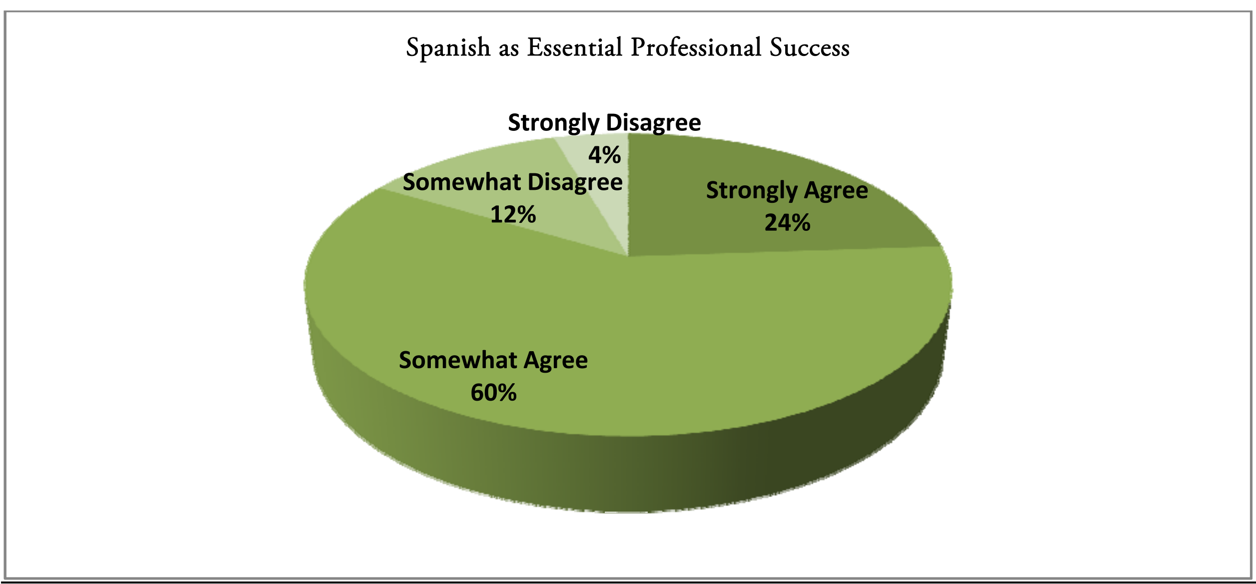
	Highest Level of Spanish Instruction				
	Junior High Level	High School Level	College Level (2)	College Level (2+)	N/A
Virginia Tech	0	12	1	2	2
Penn State	5	17	3	1	7
Arizona State	2	21	3	1	4
Total	7	50	7	4	13
Percent	**8.6%**	**61.7%**	**8.6%**	**4.9%**	**16.0%**



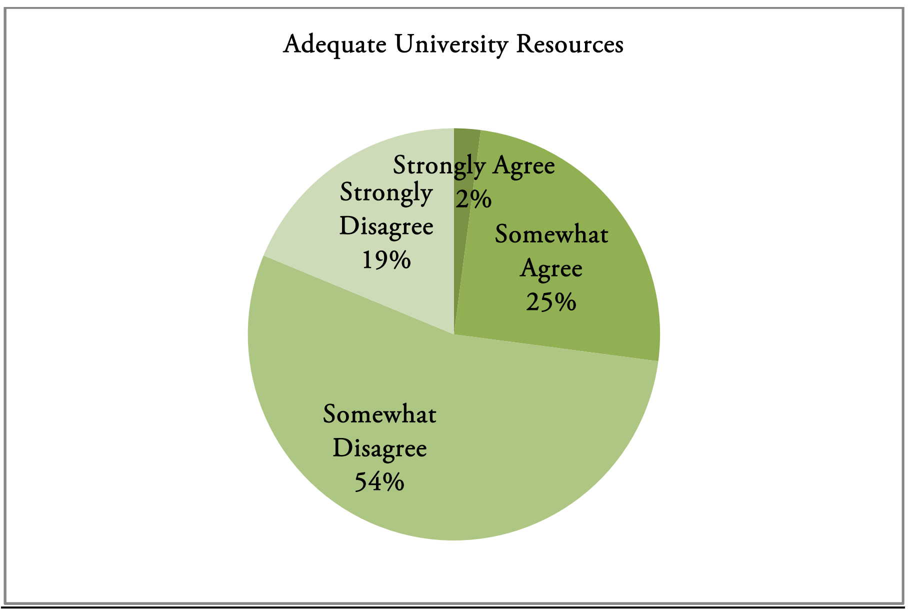
	Internship Responsibilities		
	Field	Office	Field & Office
Virginia Tech	12	0	5
Penn State	17	7	7
Arizona State	8	4	7
Total	37	11	19
Percentage	**55.2%**	**16.4%**	**28.4%**



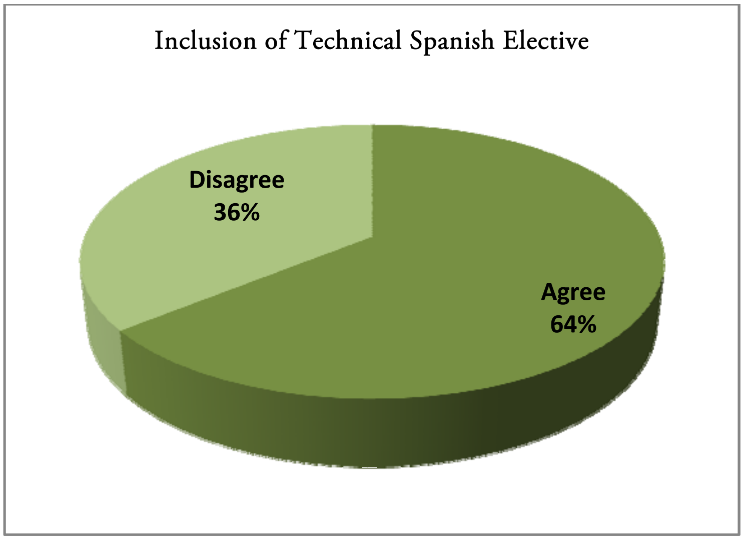
	Spanish Essential to Success as Professional			
	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Virginia Tech	7	10	0	0
Penn State	4	18	8	1
Arizona State	5	12	0	2
Total	16	40	8	3
Percent	23.9%	59.7%	11.9%	4.5%
Percent	83.6%		16.4%	
	Agree		Disagree	



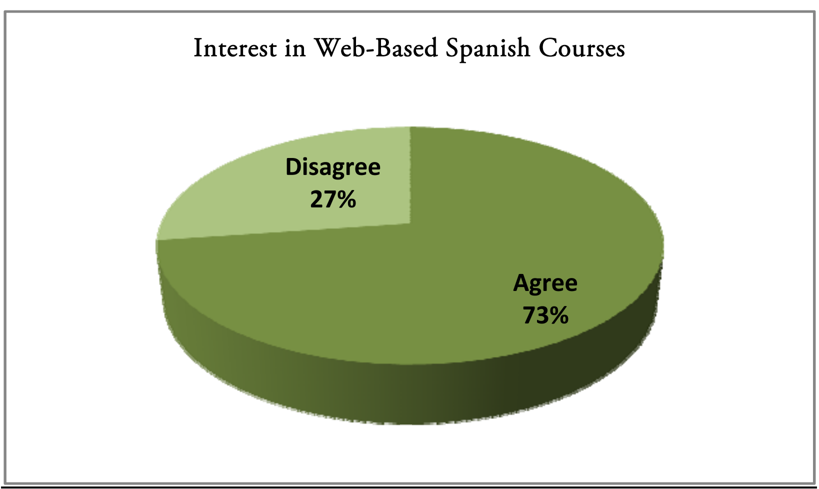
	Adequate University Resources			
	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Virginia Tech	1	6	7	3
Penn State	0	1	10	1
Arizona State	0	5	9	5
Total	1	12	26	9
Percent	2.1%	25.0%	54.2%	18.8%
Percent	27.1%		72.9%	
	Agree		Disagree	



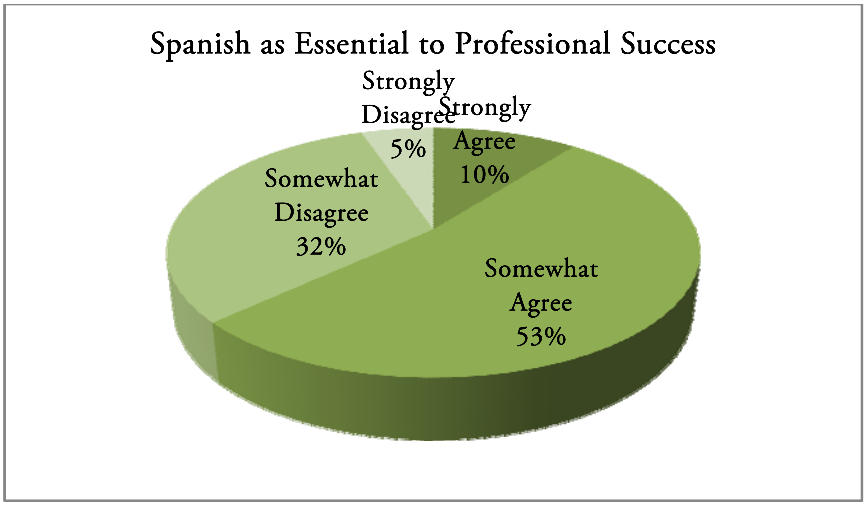
	Inclusion of Technical Spanish Course in Curriculum			
	Stongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Virginia Tech	12	5	0	0
Penn State	9	7	7	8
Arizona State	4	6	7	2
Total	25	18	14	10
Percent	37.3%	26.9%	20.9%	14.9%
Percent	64.2%		35.8%	
	Agree		Disagree	



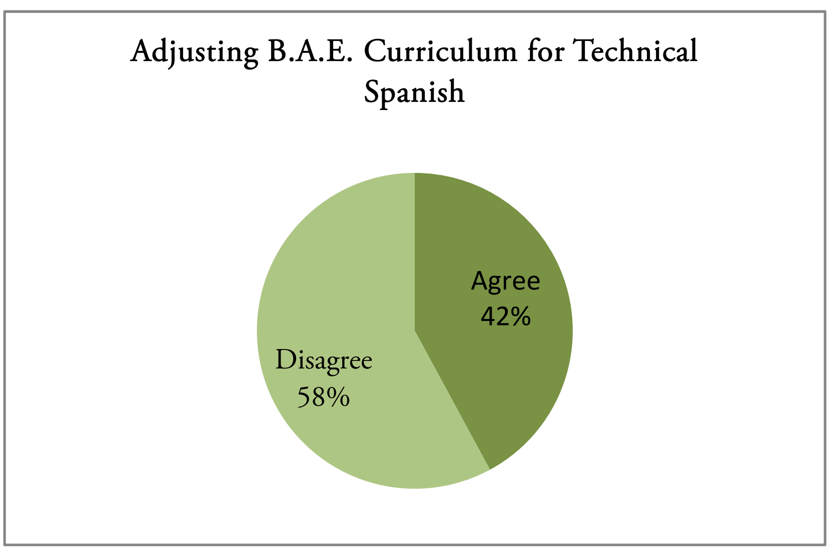
	Interest in Web-Based Course			
	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Virginia Tech	5	7	1	4
Penn State	9	13	7	2
Arizona State	4	10	0	4
Total	18	30	8	10
Percent	27.3%	45.5%	12.1%	15.2%
Percent	72.7%		27.3%	
	Agree		Disagree	



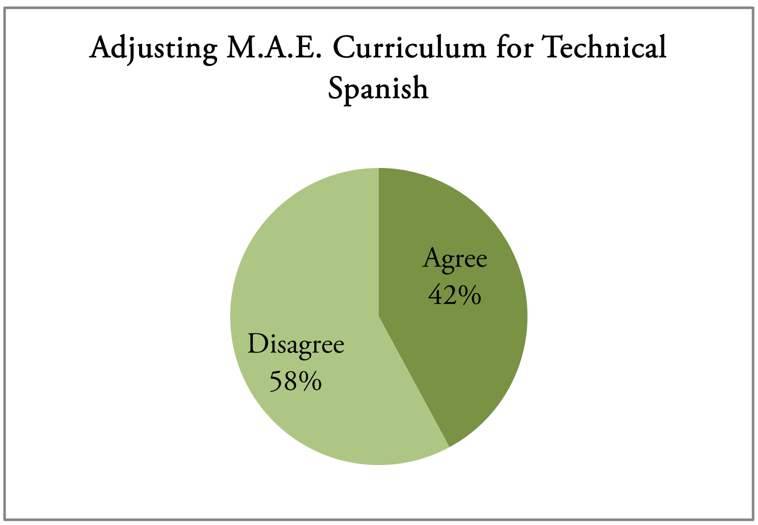
A.3 Penn State AE 5th Year CM Students :



	B.A.E Curriculum to Include Technical Spanish			
	Stongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Penn State 5th Yr	6	2	5	6
Percent	31.6%	10.5%	26.3%	31.6%
Percent	42.1%		57.9%	
	Agree		Disagree	



	M.A.E Curriculum to Include Technical Spanish			
	Stongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Penn State 5th Yr	4	4	5	6
Percent	21.1%	21.1%	26.3%	31.6%
Percent	42.1%		57.9%	
	Agree		Disagree	



APPENDIX B: Detailed Estimate

B.1 Assemblies System Estimate

Glazing System - Scope of Work/Takeoff

Item			Quantity	Units	Unit Price	Total
Glazing System	SF / EA	QTY	Total SF			
A	316	1	316	SF	$75	$23,719
A3	390	1	390	SF	$75	$29,215
B	286	1	286	SF	$75	$21,481
C1	48	1	48	SF	$75	$3,624
C2	260	1	260	SF	$75	$19,478
C3	48	1	48	SF	$75	$3,627
D1	80	1	80	SF	$75	$6,036
E1	290	1	290	SF	$75	$21,727
E2	117	1	117	SF	$75	$8,754
E3	196	1	196	SF	$75	$14,719
E4	119	1	119	SF	$75	$8,923
E5	187	1	187	SF	$75	$14,018
E6	81	1	81	SF	$75	$6,049
E7	88	1	88	SF	$75	$6,637
F1	27	1	27	SF	$75	$1,991
F2	54	1	54	SF	$75	$4,052
F4	27	1	27	SF	$75	$2,034
F4	173	1	173	SF	$75	$12,957
W-01	20	7	140	SF	$75	$10,500
W-02	36	16	576	SF	$75	$43,200
W-06	148	1	148	SF	$75	$11,134
G	50	6	300	SF	$75	$22,488
H1	24	1	24	SF	$75	$1,783
H2	24	1	24	SF	$75	$1,783
H3	118	1	118	SF	$75	$8,820
H4	81	1	81	SF	$75	$6,057
H5	96	1	96	SF	$75	$7,166
K	88	1	88	SF	$75	$6,585
M	321	1	321	SF	$75	$24,068
N	321	1	321	SF	$75	$24,068
P	453	1	453	SF	$75	$33,953
Q	403	1	403	SF	$75	$30,231
SF1 - Doors	30x70/2	4	8	EA	$500	$4,000
	40x70/2	2	4	EA	$500	$2,000
AG - Doors	30x70/4	2	8	EA	$500	

B.2 Structural System Estimate

Structural System Comparison		
Division	Item	Estimate
003	Concrete	$247,351
004	Structural Masonry	$174,730
005	Structural Steel	$763,000
Total Structural System		**$1,185,081**

Scope of Work/Takeoff					
Division	Item	Quantity	Units	Unit Price	Total
004	Spilt Face CMU- Veneer	2,892	SF	$27	$78,084
	Ground Face CMU-Veneer	3,400	SF	$20	$68,000
	Interior Wall- Type 7- 8" CMU	588	SF	$22	$12,936
	Site Wall- Note 11	480	SF	$27	$12,960
	Dumpsters	5	EA	$550	$2,750
	Total				$174,730

Scope of Work/Takeoff					
Division	Item	Quantity	Units	Unit Price	Total
003	Slab-on-grade - 4"	16,900	CY	$71	$14,814
	2nd Floor deck - 4-1/2"	24,300	CY	$71	$23,963
	Roof deck - 1-1/2"	18,000	CY	$71	$5,917
	Retaining wall A: cip concrete wall	132	CY	$550	$72,600
	Retaining wall C: cip concrete wall	74	CY	$550	$40,767
	Retaining wall D: cip concrete wall	71	CY	$550	$38,824
	Steel Reinforcement	6	Tons	$700	$26,750
	Footing for CMU wall	12	CY	$350	$4,096
	Formwork	1	CY	$350	$19,620
	Total				$247,351

Scope of Work/ Takeoff					
Division	Item	Quantity	Units	Unit Price	Total
005	Structural Steel- 170 tons	170	Tons	$3,400	$578,000
	Steel Joists- 17 tons	17	Tons	$2,200	$37,400
	Metal Deck: 2"- 210 SQ	210	SQ	$300	$63,000
	Metal Deck: 1-1/2"- 227 SQ	227	SQ	$300	$68,100
	Metal Deck: 3"- 55 SQ	55	SQ	$300	$16,500
	Total				$763,000

B.3 Structural System Estimate

Structural Steel Takeoff							
Division	Item		Length	Quantity	Unit	Unit Price	Total
005	**Steel Column**						
	W8 X 31		12	28.0	LF	24.04	$8,077
	HSS6 X 6-1/4"		6	41.0	EA	226	$55,596
	HSS12.25 X 0.25		6	72.0	EA	728	$314,496
	W8 X 48		12	52.0	LF	35.68	$22,264
	W10 X 68		12	40.0	LF	49.33	$23,678
	HSS8 X 8 X 3/8"		0.5	60.0	LF	425.5	$12,765
	HSS4.5 X 0.188		7	65.0	EA	157.5	$71,663
	W14 X 74		12	60.0	LF	53.33	$38,398
	Beams						
	W16 x 26		14	48	LF	20.78	$13,964
	W18 x 40		18	65	LF	31.38	$36,715
	W12 x 22		11	75	LF	18.53	$15,287
	W18 x 40		8	55	LF	31.38	$13,807
	W12 x 22		18	25	LF	18.53	$8,339
	W8 x 21		8	56	LF	19.62	$8,790
	W16 x 26		12	25	LF	20.78	$6,234
	W14 x 22		14	29	LF	20.82	$8,453
	W14 x 26		25	21	LF	20.82	$10,931
	W10 x 22		12	35	LF	20.27	$8,513
	W6 x 9		9	30	LF	11.52	$3,110
	Joists						
	20K6		27	38	LF	5.86	$6,012
	12K3		14	35	LF	5.49	$2,690
	12K1		15	27	LF	5.49	$2,223
	16K3		15	30	LF	5.29	$2,381
	18K9		25	68	LF	6.84	$11,628
	10K1		15	35	LF	5.88	$3,087
	14K26		32	32	LF	5.63	$5,765
	Subtotal						$714,866
						x MD Factor (0.98) + 5 % waste factor	
	Total						**$735,597**

Concrete Takeoff						
Division	Item	Length	Quantity	Unit	Unit Price	Total
003	**Column Footings/ Grade Beams**					
	2'0" x 12" x continuous	81	1.0	CY	$69	$1,242
	2'6" x 12" x continuous	135	1.0	CY	$69	$2,588
	3'0" x 12" x continuous	220	1.0	CY	$69	$5,060
	4'0" x 12" x continuous	18	1.0	CY	$69	$552
	4'6" x 12" x continuous	120	1.0	CY	$69	$4,140
	3'0" x 3'0" x 12"		11.0	EA	$69	$759
	4'0" x 4'0" x 12"		8.0	EA	$69	$981
	4'6" x 4'6" x 12"		3.0	EA	$69	$466
	5'0" x 5'0" x 12"		6.0	EA	$69	$1,150
	5'6" x 5'6" x 12"		4.0	EA	$69	$928
	6'0" x 6'0" x 12"		6.0	EA	$69	$1,656
	6'6" x 6'6" x 14"		6.0	EA	$69	$2,267
	7'0" x 7'0" x 14"		6.0	EA	$69	$2,200
	7'6" x 6'0" x 28"		2.0	EA	$69	$1,610
	8'0" x 7'0" x 28"		2.0	EA	$69	$2,004
	7'6" x 7'6" x 16"		6.0	EA	$69	$3,450
	8'0" x 8'0" x 16"		4.0	EA	$69	$2,617
	8'6" x 8'6" x 18"		2.0	EA	$69	$1,662
	9'6" x 9'6" x 20"		1.0	EA	$69	$1,153
	10'0" x 10'0" x 20"		1.0	EA	$69	$1,278
	Slab On Grade - 4"	16,900	1.0	CY	$71	$14,813
	Composite Floor Deck- 4-1/2"	24,300	1.0	CY	$71	$22,365
	Roof Deck - 1-1/2"	1,800	1.0	CY	$71	$592
	Concrete Pier					
	18" x 18"		6.0	EA	$69	$414.0
	12" x 12"		6.0	EA	$69	$414.0
	18" x 18"		2.0	EA	$69	$138.0
	22" x 22"		3.0	EA	$69	$207.0
	12" x 18"		7.0	EA	$69	$483.0
	11" x 18"		11.0	EA	$69	$759.0
	16" x 16"		11.0	EA	$69	$759.0

Concrete Takeoff (Continued)						
Division	Item	Dimensions	Quantity	Unit	Unit Price	Total
003	**CIP Concrete Retaining Wall**					
	Retaining wall A: cip concrete wall	132	1.0	CY	$550	$72,600
	Retaining wall C: cip concrete wall	74	1.0	CY	$550	$40,767
	Retaining wall D: cip concrete wall	71	1.0	CY	$550	$38,824
	CIP Formwork					
	Footing	18" x" 18"	72.0	SFA	3.4	$2,203
	Columns	20" x 12"	15.0	SFA	10	$3,000
	Composite Floor Deck- 4-1/2"	24,300	1.0	SFA	3.78	$1,176
	Roof Deck - 1-1/2"	1,800	1.0	SFA	3.78	$392
	Slab on Grade - 4"	16,900	1.0	SFA	4.56	$788
	Beams and Girders	24" x 12"	68.0	SFA	6.1	$16,592
	Subtotal					**$255,049**
						x MD factor(0.97)
						+ 5% waste factor
	Total					**$247,351**

B.3 General Conditions Estimate

General Conditions Estimate	
Description	Cost
Bonds/ Insurance	$1,390,062
Staffing	$24,240
Temp Utilities	$4410/ mo
Office Support	$1,784
Other	$300

Bonds/ Insurance	
Descirption	Cost Associated
Design Team Fees	$0
Builder's Risk Insurance	$20,292
Subcontractor's Bond	$0
Payment & Performance Bond	$80,460
General Contractor Insurances	$0
Owner's Contingency	$586,050
Gross Receipts Taxes	$0
Escalation/ GC Contingency	$234,420
Overhead & Profit	$468,840
Total	$1,390,062

Project Staffing	
Descirption	Cost Associated
Layout Engineer	$4,340
Field Personnel, P M	$7,100
Field Personnel, A P M	$6,200
Field Personnel, Super	$6,600
Total	$24,240

Temporary Utilities				
Descirption	Fee	Units	Monthly	
Temp Protection	0.53	SF		$1,899
Temp Fencing	8.03	LF		$368
Temp Utilities	48	CSF		$1,218
Temp Toilets	110	Ea		$550
Dumpster Rental	14.75	CSF		$264
Continuous Cleanup	31	MSF		$111
Total		$4,410	/mo	

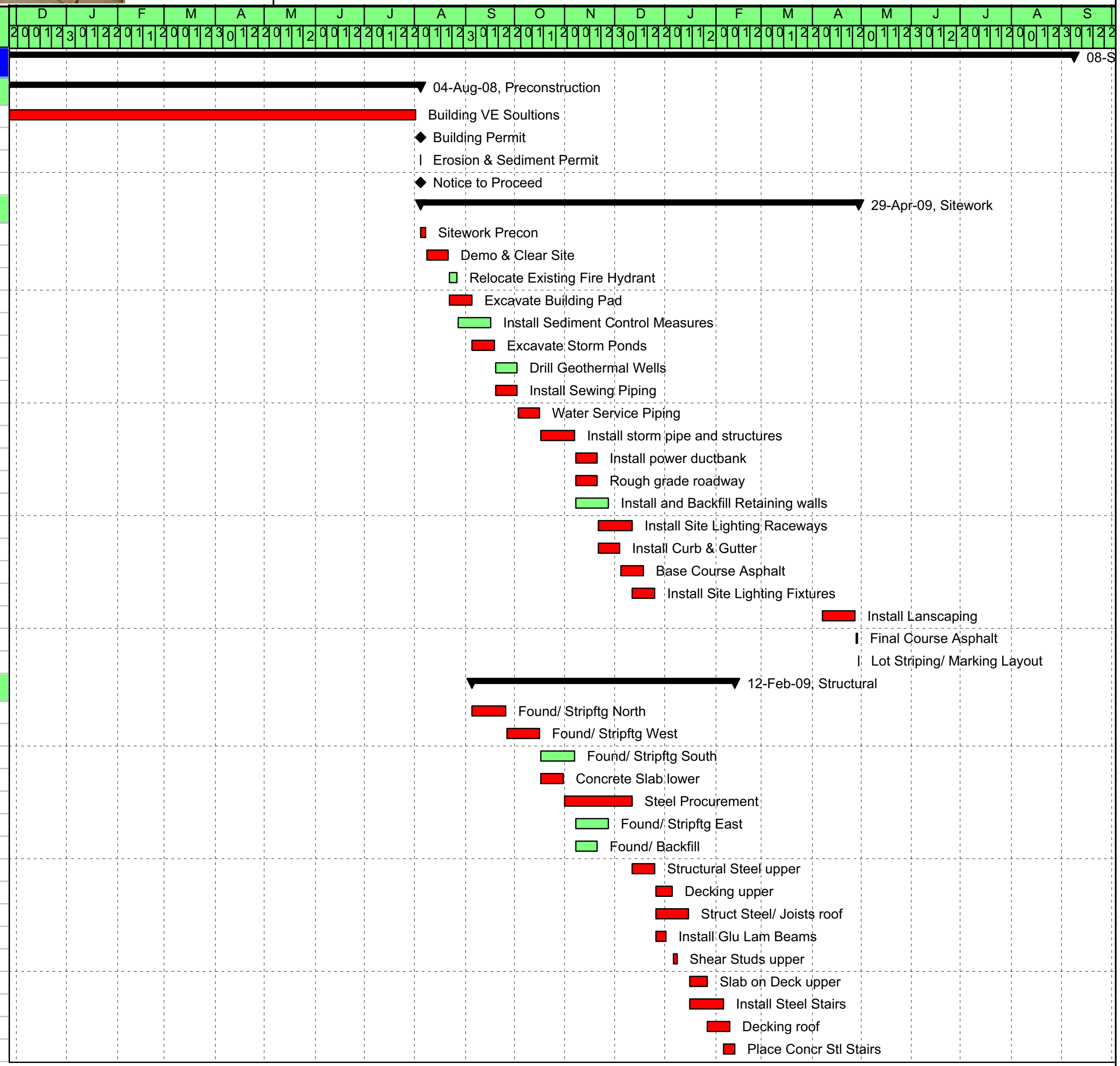
Office Support	
Descirption	
Office Trailer	$265
Field Office Expenses	$565
Project Signs	$825
Final Cleanup	$129
Total	$1,784

Other Costs				
Description	Fee	Units	Monthly	
Persn Protect Equip	50	Ea		$100
General Hand Toons	60	Ea		$200
Total				$300

Shaare Tefila Congregation

Olney, Montgomery County, MD

Activity ID	Activity Name	Original Duration	Start	Finish
Shaare Tefila Congregation ...		466	26-Nov-07	08-Sep-09
Preconstruction		180	26-Nov-07	04-Aug-08
PC 1010	Building VE Soultions	180	26-Nov-07	01-Aug-08
PC 1020	Building Permit	0	04-Aug-08	
PC 1030	Erosion & Sediment Permit	0	04-Aug-08	04-Aug-08
PC 1040	Notice to Proceed	0	04-Aug-08	
Sitework		193	04-Aug-08	29-Apr-09
SW 1010	Sitework Precon	4	04-Aug-08	07-Aug-08
SW 1040	Demo & Clear Site	10	08-Aug-08	21-Aug-08
SW 1020	Relocate Existing Fire Hydrant	3	22-Aug-08	26-Aug-08
SW 1050	Excavate Building Pad	10	22-Aug-08	04-Sep-08
SW 1030	Install Sediment Control Me...	15	27-Aug-08	16-Sep-08
SW 1070	Excavate Storm Ponds	10	05-Sep-08	18-Sep-08
SW 1060	Drill Geothermal Wells	10	19-Sep-08	02-Oct-08
SW 1080	Install Sewing Piping	10	19-Sep-08	02-Oct-08
SW 1090	Water Service Piping	10	03-Oct-08	16-Oct-08
SW 1100	Install storm pipe and struct...	15	17-Oct-08	06-Nov-08
SW 1110	Install power ductbank	10	07-Nov-08	20-Nov-08
SW 1120	Rough grade roadway	10	07-Nov-08	20-Nov-08
SW 1130	Install and Backfill Retaining...	15	07-Nov-08	27-Nov-08
SW 1140	Install Site Lighting Raceways	15	21-Nov-08	11-Dec-08
SW 1150	Install Curb & Gutter	10	21-Nov-08	04-Dec-08
SW 1160	Base Course Asphalt	10	05-Dec-08	18-Dec-08
SW 1170	Install Site Lighting Fixtures	10	12-Dec-08	25-Dec-08
SW 1180	Install Lanscaping	15	07-Apr-09	27-Apr-09
SW 1190	Final Course Asphalt	1	28-Apr-09	28-Apr-09
SW 1200	Lot Striping/ Marking Layout	1	29-Apr-09	29-Apr-09
Structural		115	05-Sep-08	12-Feb-09
STR 1000	Found/ Stripftg North	15	05-Sep-08	25-Sep-08
STR 1040	Found/ Stripftg West	15	26-Sep-08	16-Oct-08
STR 1030	Found/ Stripftg South	15	17-Oct-08	06-Nov-08
STR 1050	Concrete Slab lower	10	17-Oct-08	30-Oct-08
STR 1150	Steel Procurement	30	31-Oct-08	11-Dec-08
STR 1010	Found/ Stripftg East	15	07-Nov-08	27-Nov-08
STR 1020	Found/ Backfill	10	07-Nov-08	20-Nov-08
STR 1060	Structural Steel upper	10	12-Dec-08	25-Dec-08
STR 1070	Decking upper	7	26-Dec-08	05-Jan-09
STR 1080	Struct Steel/ Joists roof	15	26-Dec-08	15-Jan-09
STR 1090	Install Glu Lam Beams	5	26-Dec-08	01-Jan-09
STR 1100	Shear Studs upper	3	06-Jan-09	08-Jan-09
STR 1110	Slab on Deck upper	7	16-Jan-09	26-Jan-09
STR 1130	Install Steel Stairs	15	16-Jan-09	05-Feb-09
STR 1120	Decking roof	10	27-Jan-09	09-Feb-09
STR 1140	Place Concr Stl Stairs	5	06-Feb-09	12-Feb-09



Actual Work | Remaining Work | Critical Remaining Work ◆ ◆

Detailed Project Schedule

Shaare Tefila Congregation

Olney, Montgomery County, MD

Activity ID	Activity Name	Original Duration	Start	Finish
Architectural		167	16-Jan-09	08-Sep-09
Facade		60	16-Jan-09	10-Apr-09
A.F 1	Perim Frm/ Sheath North	10	16-Jan-09	29-Jan-09
A.F 1	Install CMU North	15	30-Jan-09	19-Feb-09
A.F 1	Cemnt Panl Syst North	10	30-Jan-09	12-Feb-09
A.F 1	Ceramic Tile North	5	30-Jan-09	05-Feb-09
A.F 1	Perim Frm/ Sheath East	10	30-Jan-09	12-Feb-09
A.F 1	Galazing Units North	10	06-Feb-09	19-Feb-09
A.F 1	Install CMU East	5	13-Feb-09	19-Feb-09
A.F 1	Ceramic Tile East	5	13-Feb-09	19-Feb-09
A.F 1	Cemnt Panl Syst East	10	13-Feb-09	26-Feb-09
A.F 1	Perim Frm/ Sheath South	15	13-Feb-09	05-Mar-09
A.F 1	Glaz Units/ Syst East	7	20-Feb-09	02-Mar-09
A.F 1	North Watertight	0	20-Feb-09	
A.F 1	East Watertight	0	03-Mar-09	
A.F 1	Install CMU South	5	06-Mar-09	12-Mar-09
A.F 1	Ceramic Tile South	15	06-Mar-09	26-Mar-09
A.F 1	Perim Frm/ Sheath West	10	06-Mar-09	19-Mar-09
A.F 1	Install CMU West	5	20-Mar-09	26-Mar-09
A.F 1	Ceramic Tile West	7	20-Mar-09	30-Mar-09
A.F 1	Glaz Units/ Syst South	10	27-Mar-09	09-Apr-09
A.F 1	Glaz Units/ Syst West	5	31-Mar-09	06-Apr-09
A.F 1	West Watertight	0	07-Apr-09	
A.F 1	South Watertight	0	10-Apr-09	
Roofing		62	06-Feb-09	04-May-09
A.R 1	Install Copings/ Trims	15	06-Feb-09	26-Feb-09
A.R 1	Roof Watertight	0	20-Feb-09	
A.R 1	Roof Insulation/ Membrane	20	07-Apr-09	04-May-09
Interiors		142	20-Feb-09	08-Sep-09
A.I 13	Frame Walls upper	15	20-Feb-09	12-Mar-09
A.I 13	GWB Walls/Bulkhead upper	15	13-Mar-09	02-Apr-09
A.I 12	Frame Walls lower	15	03-Apr-09	23-Apr-09
A.I 14	Finish Walls/Bulkhead upper	10	03-Apr-09	16-Apr-09
A.I 14	Install HM Frames upper	10	17-Apr-09	30-Apr-09
A.I 12	GWB Walls/Bulkhead lower	15	24-Apr-09	14-May-09
A.I 14	Install ACT Grid upper	10	01-May-09	14-May-09
A.I 12	Finish GWB/Bulkhead lower	10	15-May-09	28-May-09
A.I 14	Prime & Point upper	10	15-May-09	28-May-09
A.I 12	Install HM Frames lower	10	29-May-09	11-Jun-09
A.I 13	Finish Paint lower	10	29-May-09	11-Jun-09
A.I 14	Ceramic/ Quarry Tile upper	10	29-May-09	11-Jun-09
A.I 12	Install ACT Grid lower	10	12-Jun-09	25-Jun-09
A.I 13	Ceramic Tile lower	10	12-Jun-09	25-Jun-09
A.I 14	Doors/Hardware upper	10	12-Jun-09	25-Jun-09
A.I 13	Doors/Hardware lower	10	26-Jun-09	09-Jul-09

Actual Work | Remaining Work | Critical Remaining Work ◆ ◆

Detailed Project Schedule

Shaare Tefila Congregation

Olney, Montgomery County, MD

Activity ID	Activity Name	Original Duration	Start	Finish
A.I 14	Finish Paint upper	10	26-Jun-09	09-Jul-09
A.I 13	Prime & Point lower	10	10-Jul-09	23-Jul-09
A.I 14	Casework/ Millwork upper	7	10-Jul-09	20-Jul-09
A.I 14	Flooring upper	10	21-Jul-09	03-Aug-09
A.I 13	Casework/ Millwork lower	7	24-Jul-09	03-Aug-09
A.I 13	Flooring lower	10	04-Aug-09	17-Aug-09
A.I 14	Toilet access/part upper	5	04-Aug-09	10-Aug-09
A.I 15	Final Inspections	10	11-Aug-09	24-Aug-09
A.I 13	Toilet access/partit lower	5	18-Aug-09	24-Aug-09
A.I 15	Tack, Mrkerbrds etc	5	25-Aug-09	31-Aug-09
A.I 15	Punchlist	10	25-Aug-09	07-Sep-09
A.I 15	Substantial Completion	0	08-Sep-09	
A.I 15	Occupancy	0	08-Sep-09	
Mech/ Electr		195	26-Sep-08	25-Jun-09
ME 1540	Elevator Jack Hole	5	26-Sep-08*	02-Oct-08
ME 1550	Under Slab Piping	15	03-Oct-08*	23-Oct-08
ME 1570	Install Rooftop Equip	5	24-Oct-08*	30-Oct-08
ME 1590	Piping Rooftop Equipment	15	31-Oct-08*	20-Nov-08
ME 1600	Install AHU's/ Pump lower	15	19-Nov-08*	09-Dec-08
ME 1680	Install Elevator System	20	19-Nov-08*	16-Dec-08
ME 1640	Rough-in Electric Room lower	20	21-Nov-08*	18-Dec-08
ME 1560	Ductwork Rough-in lower	20	09-Jan-09*	05-Feb-09
ME 1650	Piping AHU pumps lower	20	09-Jan-09*	05-Feb-09
ME 1670	Water Meter inspection	0	09-Jan-09*	09-Jan-09
ME 1690	Building Conditioned Air	0	09-Jan-09*	
ME 1700	Elevator Inspected & Operat...	0	16-Jan-09*	16-Jan-09
ME 1580	Above Ceiling Piping lower	20	06-Feb-09*	05-Mar-09
ME 1610	Ductwork Rough-in upper	20	06-Feb-09*	05-Mar-09
ME 1620	Wall Rough-in lower	20	06-Mar-09*	02-Apr-09
ME 1630	Above Ceiling piping upper	20	06-Mar-09*	02-Apr-09
ME 1660	Wall Rough-in upper	20	03-Apr-09*	30-Apr-09
ME 1710	Lighting Fixtures lower	15	03-Apr-09*	23-Apr-09
ME 1740	Toilet Fixtures/ Casework lo...	10	24-Apr-09*	07-May-09
ME 1720	Lighting Fixtures upper	15	01-May-09*	21-May-09
ME 1730	Electrical Trim-out lower	10	08-May-09*	21-May-09
ME 1750	Toilet Fixtures upper	10	22-May-09*	04-Jun-09
ME 1760	Electrical Trim-out upper	10	05-Jun-09*	18-Jun-09
ME 1770	Install Kitch Fixt/ Equp Dairy	7	05-Jun-09*	15-Jun-09
ME 1780	Install Kitch Fixt/ Equip Meat	8	16-Jun-09*	25-Jun-09

Actual Work   Remaining Work   Critical Remaining Work ◆ ◆

Detailed Project Schedule

Shaare Tefila Synagogue:

Committed to the Past, Present and Future

Steve J. Horna Construction Management

Olney, Montgomery County, Maryland Location

Shaare Tefila Congregation Owner

Forrester Construction Company General Contractor

WMCRP, Inc. Architect

FORRESTER

שערי תפילה

Monday, April 14th, 2008 Presentation Date

Presentation Outline

BUILDING SYSTEMS

Architecture:

- Split –faced and ground-face concrete masonry, ceramic tile, cement board cladding, expanses of aluminum curtain wall glazing

Structural:

- Structural Steel and structural masonry
- Composite slab deck 4-1/2" thick steel and C-I-P concrete
- Glue-laminated wood beams and steel framing

Mechanical:

- Ground Source Heat Pump
- Redundant Cooling Tower and Boiler
- Enthalpy Wheel Air-to-air heat exchanger

East Elevation

South Elevation

North Elevation

West Elevation

COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Problem:

- Lack of Safety training in a Bilingual workforce
- Lack of training/resources for CM professionals, and students
- Industry indifference to growing Hispanic workforce

Design Goals:

-Identify Language barrier as critical issue facing: labor workforce, construction professionals, and construction students

-**Gauge Spanish Language competency** among construction professionals, construction students

- **Determine the adequacy of** current company **methods and resources** regarding Spanish language

- Recommend program/training plan to **change industry standard**

COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Industry Need:

- "In 2010 ,Hispanics will be **47% of workforce** in construction" [1]

- Injury and Fatalities due to communication and culture
  - Hispanic **fatality rate 5.2/100,000**[2]
  - **12% of injuries** among Hispanics is on **first day**[3]
  - Little or no safety training
  - Safety questions **unasked/unanswered**


Source: www.imotibg.com

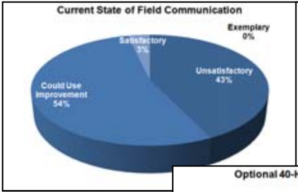
- English-Only Policy: Not the answer
  - Foreman's **English not guaranteed**
  - Liability with discriminatory laws

[1] All Business http://www.allbusiness.com/labor-employment/workplace-health-safety/6240182-1.html
[2] Bureau of Labor Statistics http://www.bls.gov/opub/cfoichartbook/pdf/appendix2.pdf
[3] Bureau of Labor Statistics http://www.bls.gov/iif/oshsum.htm

COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Construction Professionals

Surveyed Cities	# Surveyed
Washington DC	**10**
Maryland	**6**
Virginia	**5**
Tennessee	**2**
Florida	**2**
Ohio	**1**
North Carolina	**1**
Missori	**1**
Hawaii	**1**
Total	**28**


Current State of Field Communication
Exemplary 0%
Satisfactory 3%
Unsatisfactory 43%
Could Use Improvement 54%


Adequate Resources Regarding ESL Communication
Strongly Agree 11%
Strongly Disagree 14%
Somewhat Agree 21%
Somewhat Disagree 54%

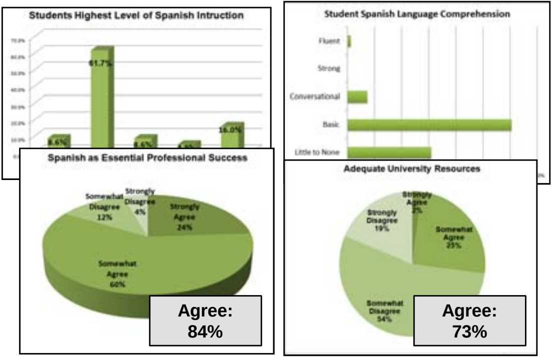

Optional 40-Hour Training Course
Strongly Disagree 7%
Somewhat Disagree 18%
Strongly Agree 29%
Somewhat Agree 46%

Agree: 75%

COMMITMENT to PAST, PRESENT & FUTURE:
Spanish-English Language Barrier in Construction

Construction Students

ARIZONA STATE UNIVERSITY


Students Highest Level of Spanish Intruction
61.7%
8.6%
8.6%
16.0%
Student Spanish Language Comprehension
Fluent
Strong
Conversational
Basic
Little to None
Spanish as Essential Professional Success
Somewhat Disagree 12%
Strongly Disagree 4%
Strongly Agree 24%
Somewhat Agree 60%
Agree: 84%
Adequate University Resources
Strongly Agree 2%
Strongly Disagree 19%
Somewhat Agree 25%
Somewhat Disagree 54%
Agree: 73%

שערי תפילה

"Upon relocating to D.C. this summer, I believe **I will need** a knowledge of the **Spanish Language**"

-Anonymous 5th Year CM, Penn State University

"If they **live in the U.S**. they should **speak English**."

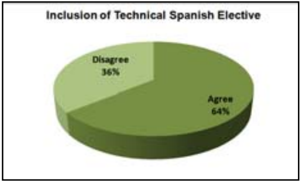
-*Anonymous CM Student , Arizona State University*

"It's beneficial to know Spanish, but it **should not be in a curriculum**."

-*Anonymous CM Student, Arizona State University*

"I think in class would be better but **anything that would help learn the language** would be great"

-*Anonymous 4th Year CM , Penn State University*



Agree: 64%

Agree: 73%

COMMITMENT to PAST, PRESENT & FUTURE:
Spanish-English Language Barrier in Construction

Recommendations:

Manage the present conditions, and invest into the future

Construction Professionals:

- **40 hour safety training**, focusing on communication with bilingual workforce.
- Comparable to **fall protection, scaffolding, TO/LO**
- **Voluntary basis,** with rewards to exemplary industry leaders

COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Recommendations:

Manage the present conditions, and invest into the future…

<u>Construction Students:</u>

- College and Universities must offer **elective courses** in technical Spanish

- Implement web-based courses as alternative
  (e.g. Interlingo Spanish: Professional Program)

- PACE industry leaders, develop Spanish safety for Internships
  Quality Control and Toolbox talks run by students

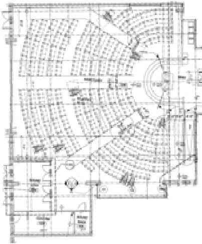
COMMITMENT to PAST, PRESENT & FUTURE:
Acoustical Analysis of Worship Space

Problem:

- Typical Acoustical fabric- wrapped wall panels
- No music sound system
- Seating flat, not steeped

Design Criteria

- Select Reverberant and Absorptive wall panel alternative
- Intelligible Speech from podium and congregation
- Target reverb time: 1.7 – 2.3 seconds



Sanctuary Floor Plan

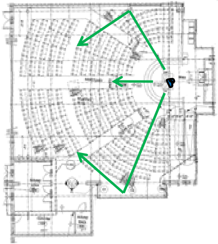
COMMITMENT to PAST, PRESENT & FUTURE: Acoustical Analysis of Worship Space

Worship Space Acoustics

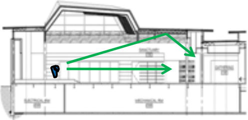
Sanctuary Dimensions: 67’ x 77’ x21’

Area: 5,159 SF
Volume: 108,340 CF

Volume
- Speech 180 to 300 ft^3 per person
- Music 200 to 400 ft^3 per person



Sanctuary Floor Plan



Sanctuary South Elevation

COMMITMENT to PAST, PRESENT & FUTURE:
Acoustical Analysis of Worship Space

Recommendation:

BAD RPG – Binary Amplitude Diffsorber

- For combination of sound dispersion and absorption

Reverb Time:
T= 0.5 V/a = 1.83 sec @ 500 Hertz

COMMITMENT to PAST, PRESENT & FUTURE:
Geothermal Life-Cycle Cost Analysis

Problem:

- Relies on Redundant Heating/Cooling system
- 25 Additional Geothermal wells, unused for future expansion
- Unknown payback period

Design Goals

- Research and become familiar with Ground Source Heat Pump
- Determine initial cost associated with installation for 25 additional wells
- Determine cost and payback period for 55 geothermal well system.

COMMITMENT to PAST, PRESENT & FUTURE:
Geothermal Life-Cycle Cost Analysis

Problem:

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COMMITMENT to PAST, PRESENT & FUTURE: Geothermal Life-Cycle Cost Analysis

Initial Cost:

Assuming $17/ vertical foot construction cost[6], considering installation, drilling, testing, trenching and backfill, pumps and controls.

$17/ft * 542 ft * 30 geo wells = $230,520

$17/ft * 542 ft * 55 geo wells = **$422,620**

Additional 25 Geothermal wells, must pay back **$192,100** for initial cost

[6] Based off of Geoexchange Forum advice from GSHP installer/designer based in Ohio

COMMITMENT to PAST, PRESENT & FUTURE: Geothermal Life-Cycle Cost Analysis

Energy Consumption and Operating Costs Comparison

- Annual heating and cooling demands determined from TRACE 700 energy estimate software

Assumptions:

-Model using water source heat pump
-Simplify upper and lower room configuration, four large rooms/ level
-Assume rates and conditions for Baltimore(54 minutes away from Olney)
-Electricity rates estimated at $0.06/kWh.

Study Difficulty

Model design with 45% larger capacity, geothermal wells

- Industry mentors (Construction and Mechanical) - unresponsive
- AE faculty – partially helpful, scheduling conflicts
- AE mechanical students – partially helpful
- Geoexchange forum – Geothermal Heat Pump Consortium
- McQuay International – GSHP manufacturer
- Loopgroup - GSHP consulting engineers

COMMITMENT to PAST, PRESENT & FUTURE: Geothermal Life-Cycle Cost Analysis

Energy Consumption and Operating Costs

Case study: Lapwai Middle-Highschool, ID - Open Loop GSHP

Building Load comparison:

GSHP Consumption Cost comparison			
Project	Heating	Cooling	Avg Ground Water temp
Shaare Tefila Synagogue	158 tons	1700MBH	56
Lapwei Middleschool	140 tons	1140MBH	58

Typical cost savings Estimate: **$17,880 annually**

COMMITMENT to PAST, PRESENT & FUTURE: Geothermal Life-Cycle Cost Analysis

Recommendations:

Typical cost savings Estimate: **$17,880 annually**
Cost difference for 25 additional wells: **$192,100**
Total initial cost current system: $230,520
Total initial cost alternative system: $422,620
Assuming Energy cost is 45% more

Geothermal System	Total Capitol Cost	Annual Costs		Periodic Costs	Simple Payback (yrs)
		Energy	Maint		
30 geo wells	$230,520	$3,639	$4,721	$25,000 , Year 20	**12.89**
55 geo wells	$422,620	$8,086	$4,721	$25,000 , Year 20	**23.63**

COMMITMENT to PAST, PRESENT & FUTURE: Geothermal Life-Cycle Cost Analysis

Recommendations:

GSHP wi/ 30 geo wells simple payback period for Is **12.89 years**
GSHP wi/ 55 geo wells simple payback period for Is **23.63 years**

Because of the relatively high initial cost, recommend staying with 30 geothermal wells from the initial design.

COMMITMENT to PAST, PRESENT & FUTURE: Summary and Conclusions

Spanish English Language Barrier

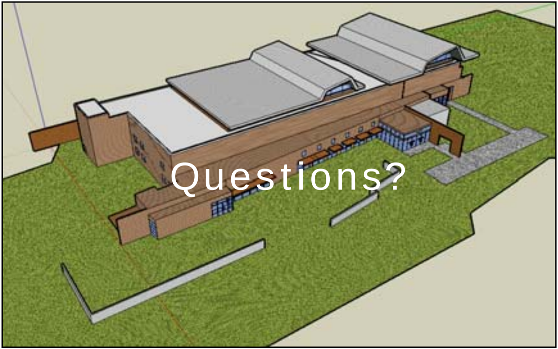
-Recommend 40-hour training for Professionals and workforce
-University backed technical Spanish courses
-Project schedule accelerated 2 weeks

Acoustical Analysis

-RPG acoustical panels for sanctuary
-1.83 reverb time

Geothermal System Life-cycle

-Continue with 30 geothermal wells with payback of 12.6 years
-Annual savings of $17,880


Questions?

COMMITMENT to PAST, PRESENT & FUTURE:
Spanish-English Language Barrier in Construction

Penn State CM Curriculum B.A.E./ M.A.E.

- Inconclusive

- Inconsistent with question on “professional development”

- AE curriculum too packed as is

COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Training Implementation: Lost Time Analysis

40 hour trained session

Assuming average peak project man hours: 50 (mixed bi-lingual) workers , 13 month schedule

Total MH = 50*160(hrs/mo)* 13 mo = 104,000 mh total project

Recorded rate of loss time (after training) = 0.42/200,000 mh[4]
National Average = 3.68/200,000 mh[5]

Project Lost time /wi training = 0.21 hr/man*50 = 10.5hrs ~ **1.3 days**

Project Lost time average = 1.91 hr/man*50 = 95.7 hrs ~ **2.3 weeks**

[4] Lost time rate after Spanish communication training based on OSHA success story: Dallas Ft. Worth Int'l Airport (http://www.osha.gov/dcsp/success_stories/hispanic/dallas_airport.html)

[5] National lost time rate based on state and national average from OSHA . (http://www.osha.gov/dcsp/success_stories/hispanic/dallas_airport.html)