

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



שערי תפילה



Monday, April 14th 2008 Presentation Date



THESIS Outline

Project Overview

Analysis 1: Spanish-English Language Barrier in Construction

- Industry Need
- Construction Professionals
- Construction Students
- Recommendation

Analysis 2: Acoustical Breadth: Acoustical Analysis of Worship Space

- Worship Space Acoustics
- Design Alternative
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Geothermal System Life Cycle Cost Analysis

- Current System
- Alternative System
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Summary & Conclusions

Acknowledgments/ Questions?





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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



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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**





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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**
- 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>



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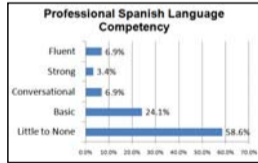
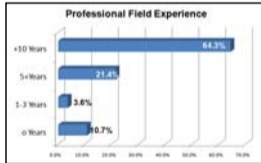
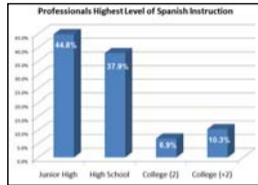
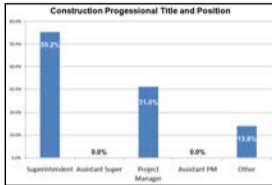
COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Construction Professionals



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



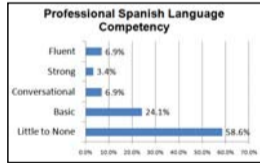
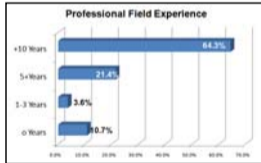
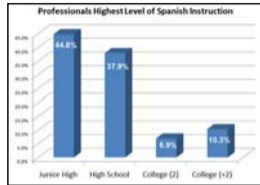
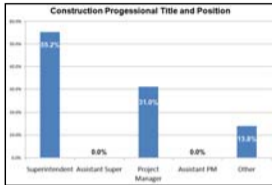


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Construction Professionals



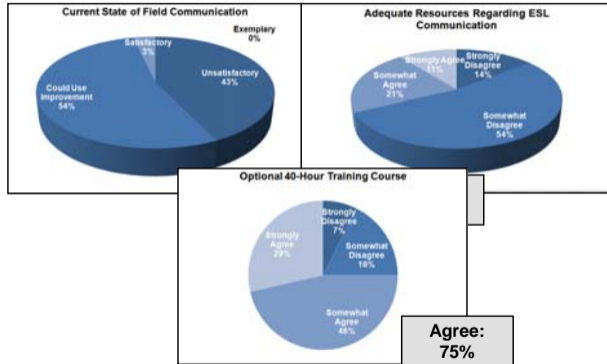
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“My company requires an **english speaking foreman.**”
- *Anonymous Superintendent, Washington DC*

“We are in an **English speaking Country**”
- *Anonymous Superintendent, Maryland*

“[Spanish training sessions] with **Spanish food** served for the training course, as well.”
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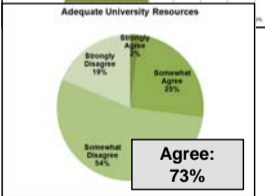
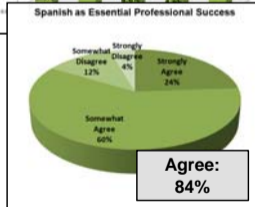
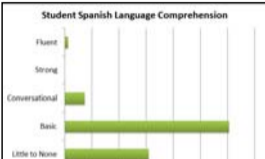
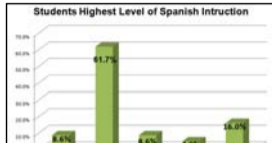
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COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Construction Students

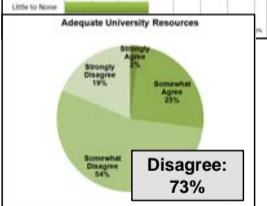
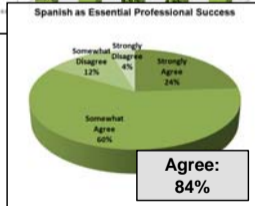
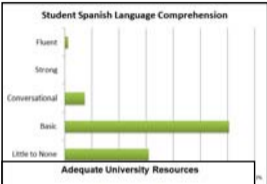
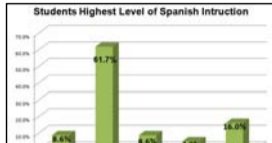




COMMITMENT to PAST, PRESENT & FUTURE: Spanish-English Language Barrier in Construction

Construction Students





“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.**”

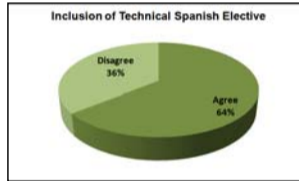
-Anonymous CM Student, Arizona State University

“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%

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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



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

Recommendations:

Manage the present conditions, and invest into the future...

Construction Students:

- 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



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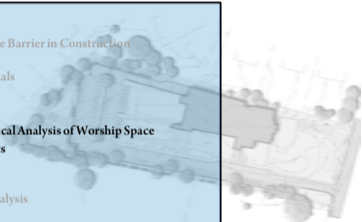
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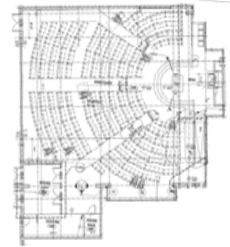
COMMITMENT to PAST, PRESENT & FUTURE: Acoustical Analysis of Worship Space

Problem:

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

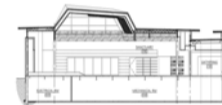
Design Criteria

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

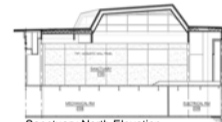


Sanctuary Floor Plan

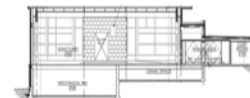
Worship Space- Design Goals



Sanctuary South Elevation



Sanctuary North Elevation



Sanctuary East Elevation



Sanctuary West Elevation



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

Worship Space Acoustics

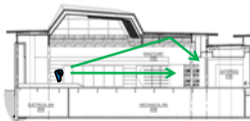
Sanctuary Dimensions: 67' x 77' x21'

Area: 5,159 SF

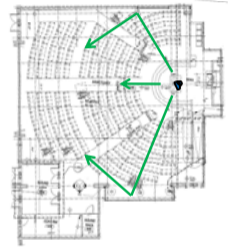
Volume: 108,340 CF

Volume

- Speech 180 to 300 ft³ per person
- Music 200 to 400 ft³ per person



Sanctuary South Elevation



Sanctuary Floor Plan



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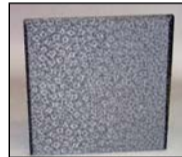
Recommendation:

BAD RPG – Binary Amplitude Diffisorber

- For combination of sound dispersion and absorption

Reverb Time:

$$T = 0.5 V/a = 1.83 \text{ sec @ 500 Hertz}$$





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

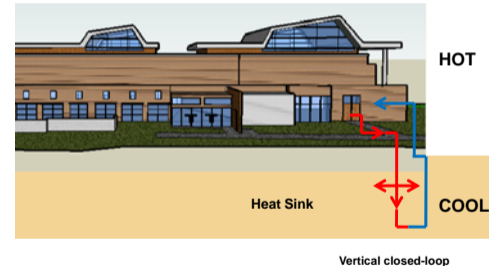
Problem:

- 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





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

Initial Cost:

Assuming \$17/ vertical foot construction cost⁶, considering installation, drilling, testing, trenching and backfill, pumps and controls.

$$\text{\$17/ft} * 542 \text{ ft} * 30 \text{ geo wells} = \text{\$230,520}$$

$$\text{\$17/ft} * 542 \text{ ft} * 55 \text{ geo wells} = \text{\$422,620}$$

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

-  30 Geothermal wells
-  25 Additional well locations for future





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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



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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
Lapwai Middleschool	140 tons	1140MBH	58

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



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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



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

Recommendations:

GSHP w/ 30 geo wells simple payback period for Is **12.89 years**

GSHP w/ 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.



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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



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Forrester Construction Company:

Daniel McCloughlin, Raissa Wetcher, Luis Ortiz, Kim Etezadi, Seth Glinski, Andre Dondero, David Forrester, & Rick Forrester

Dick Corporation: Dennis Hanna

MACTEC Consulting, Inc.: Vance Williams

Mass Electric Construction: Gina Goldstein

Davis Construction: Allison White & Sarah Cash

OSHA: hris Matthewson, Gilbert Trujillo

McQuay International: Charles Kovac

Hotel Energy Group Inc.: Warren Linnerooth

Virginia Tech Building Construction Program: Dannete Gomez Beane

Arizona State University Webb School of Construction: Kathleen Meyer, Sue Mueller, Matt Eicher

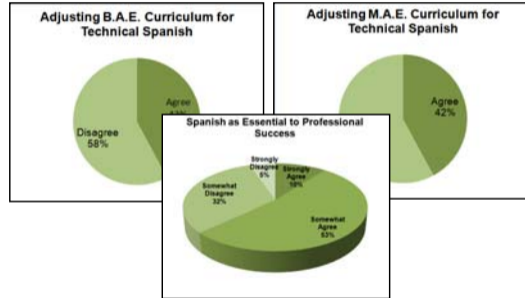
Penn State AE Faculty:

Moses D. F. Ling, PE, RA Dr. Michael J. Horman, PhD. Kevin Parfitt, PE, Dr. James D. Freihaut, PhD, Dr. John I. Messner, PhD, Robert J. Holland, RA, Dr. David Riley, PhD

Penn State AE Students:

5th year CM Class, 4th Year CM Class , Jay Witterman – Mechanical, Tyler Lobb – Mechanical, Steve Haines – Mechanical, Krystan Maruszewski –Lighting, Jeremy Powis – Structural, Maxwell Chien – Mechanical

To my Family and Friends



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

"If a Spanish course were offered it would be helpful - our **need for learning Spanish** also **depends on where** we plan on working post-graduation"
-Anonymous CM Student, Virginia Tech

"It should be **elective** to take the course."
- Anonymous 5th Year CM, Penn State University

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 = $50 * 160(\text{hrs}/\text{mo}) * 13 \text{ mo} = 104,000 \text{ mh}$ total project

Recorded rate of loss time (after training) = $0.42/200,000 \text{ mh}^4$
National Average = $3.68/200,000 \text{ mh}^5$

Project Lost time /wi training = $0.21 \text{ hr}/\text{man} * 50 = 10.5 \text{ hrs} \sim \mathbf{1.3 \text{ days}}$

Project Lost time average = $1.91 \text{ hr}/\text{man} * 50 = 95.7 \text{ hrs} \sim \mathbf{2.3 \text{ weeks}}$

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)