It takes a team!
INTERPROFESSIONAL PROJECTS PROGRAM

Energy & Facility Planning for Delta Tau Delta Chapter House

DELTA TAU DELTA
Letters of Distinction. Lives of Excellence.

Prepared by:

Fall IPRO 311 Project Team - Interprofessional Projects Program

Joshua Bradley, Civil Engineering
Noah Cahan, Architecture
Daniel Dobbin, Mathematics
Jake Dohm, Architecture
Jeffrey Hallenbeck, Architecture
Kent Hoffman, Architecture
Davyd Jordan, Architecture
Woong-Kyo Lee, Aerospace Engineering
Brad Strandquist, Civil Engineering
Nathan Wasisath, Archiecture

Prepared for:

Brothers of the Delta Tau Delta Chapter House, Gamma Beta Chapter

December 2009

`

The Interprofessional Projects (IPRO®) Program at Illinois Institute of Technology

An emphasis on multidisciplinary education and cross-functional teams has become pervasive in education and the workplace. IIT offers an innovative and comprehensive approach to providing students with a real-world project-based experience—the integration of interprofessional perspectives in a student team environment. Developed at IIT in 1995, the IPRO Program consists of student teams from the sophomore through graduate levels, representing the breadth of the university's disciplines and professional programs. Projects crystallize over a one- or multisemester period through collaborations with sponsoring corporations, nonprofit groups, government agencies, and entrepreneurs. IPRO team projects reflect a panorama of workplace challenges, encompassing research, design and process improvement, service learning, the international realm, and entrepreneurship. (Refer to http://ipro.iit.edu for information.)

The Energy & Facility Planning for Delta Tau Delta Chapter House IPRO 311 team project represents one of more than 40 IPRO team projects for the fall 2009 semester.

`

TABLE OF CONTENTS

`

The following report is a summary of the findings from a group of 10 Illinois Institute of Technology undergraduate students organized through the Interprofessional Projects Program (IPRO) and sponsored by the local members of the Delta Tau Delta Fraternity. Over the time span of a 14 weeks, the IPRO team began to formulate a plan to study the possibility of renovating the existing Delta Tau Delta (DTD) chapter house in order to create a more modern and sustainable living environment.

The main scope of IPRO 311, Energy & Facility Planning for Delta Tau Delta (DTD) Chapter House, was to accurately identify the state of the current DTD structure by studying the existing mechanical and electrical systems of the building while also identifying how the physical spaces within the house are used to serve and house the DTD brothers. The findings of these studies are intended to provide the brothers of DTD and the DTD Housing Corporation a basis to decide whether to renovate or rebuild their existing chapter house. By looking at the building in a structural, mechanical, and an architecturally programmatical fashion the IPRO team is now able to provide a wealth of information to determine whether to perform simple modifications to the structure, undertake a major renovation, or begin the process of constructing a new facility.

At the current time the fraternity house for the Gamma Beta chapter of Delta Tau Delta is located on the Illinois Institute of Technology's Greek Quad – a section of campus that contains only fraternity and sorority houses located around a central green space. This specific chapter of DTD has existed at the Armour Institute and Illinois Institute of Technology since 1901. In this time the chapter has resided in seven houses, most being along Michigan Avenue in chapter houses designed in the classical architectural style that influenced many of Chicago's south side graystone mansions built by the meatpacking elite. The current DTD fraternity building which the chapter resides into today was constructed in 1959 during the creation of the Greek Quad and is designed in the modern style of architecture as to fit in with the Mies van der Rohe's modernist architectural style in which the IIT campus is designed under. When the current DTD house was constructed it was done so under the specifications of the DTD Gamma Beta chapter

`

with the sole intention as functioning as their fraternity house to live and grow within for decades to come.

Although the Delta Tau Delta shelter is only fifty years of age and has been maintained fairly well by its inhabitants the building is not immune to time and has begun to show its age. Dings and dents in walls, leaky pipes, faulty wiring, increased energy costs, and a growing need to update the house to today's style of student and fraternity living have begun to pile up leaving the chapter looking for solutions to their problems.

Through this IPRO the team has worked diligently to uncover the problems in the existing DTD house. The team started with identifying the following mechanical and structural systems which have become outdated or no longer function properly: heating and ventilation, plumbing, electrical, building envelope, and thermal properties focusing on the buildings perimeter structure and roofing materials. The team then conducted a full energy audit on the building to determine to overall efficiency in all the aforementioned areas of concern. Furthermore, the team investigated occupancy trends within the house to determine if the building was being used to its fullest potential. The IPRO team also briefly investigated integrating sustainable design and technology into the solutions of these problems however the team later abandoned this idea due to time constraints and instead focused in greater depth at the problems uncovered as to ensure that future solutions would be the most optimal to the fraternity house's structure and design. The concept of sustainable design has not been completely abandoned however the team quickly identified that in order to provide a solution to a problem the problem at hand had to be fully investigated to determine what, if any, sustainable design technique could be used as a fix.

Aside from looking at the inefficient use of energy within the Delta Tau Delta chapter house the issue of physical space inefficiency also was an area of concern the IPRO team looked into. The design of the DTD house as it stands now includes many large common areas such as two extremely large bunk areas along with a large partially unexcavated space underneath their living room. As the chapter looks forward towards improved growth in the years to come these spaces have generated concern as these spaces are either viewed as a misuse of space or a space

`

hich creates an overly public living environment. Although fraternity living is based on the concept of communal living, every fraternity still must configure their house in a way to meet the individual wants and needs of its current and future members. The concept of a student being able to own a personal room into today's college atmosphere has become a large draw for many campus institutions and fraternities alike. The DTD chapter would like to be able accommodate its members in individual personal rooms and update its facility in this way to meet today's college living standards.

`

Fifty years ago the Illinois Institute of Technology gave many of the Greek organizations the financing to move out of their aging chapter houses located in various places around the IIT campus and into new facilities centered around a green space on the southeast portion of campus. At the time these Greek houses were constructed they were done so to fit the wants and the needs of the fraternities they housed in the late 1950s. Since then, many years have passed and although many of the original Greek organizations at IIT remain in the same custom built structures they first moved into fifty years ago, some Greek organizations have begun recognize the shelter they built have become outdated. At this time the Delta Tau Delta chapter has recognized this growing concern and now is looking for ways to renovate their house in a way to become competitive with how students view student housing in today's collegiate atmosphere.

The recipients of this IPRO's service are the active members of Delta Tau Delta International Fraternity, Gamma Beta chapter, at the Illinois Institute of Technology. The shelter is owned and ultimately managed by the fraternity's House Corporation, a group comprised of Gamma Beta alumni. The DTD House Corporation would act as the client and would be responsible for any major financial or legal decisions regarding the shelter. In addition, the Illinois Institute of Technology is a stakeholder as the immediate property where the house is placed is owned by the school, yet the physical building is owned and maintained by the DTD House Corporation.

The Delta Tau Delta fraternity wants to make their current house as energy efficient and sustainable as possible. The scope of this IPRO is to investigate all aspects of the DTD house and their operations to create a more energy efficient fraternity. During this IPRO we will consider possible alternatives to many issues including but not limited to: mechanical heating system, building envelope, thermal properties of buildings perimeter, roofing materials, air infiltration, ventilation, and occupancy trends. In general, we will collect information regarding the existing conditions and itemize all improvements that could be made to create a more energy efficient fraternity.

`

Our team will explore all aspects of the building, site, and operation systematically, so that new and improved methods can be considered as well. The IPRO team will investigate programmatic aspects of the current fraternity living, and predict future modifications. In essence, DTD IPRO will have a road map for possible energy improvements for their facility, resulting in an example design solution for fraternity life. We hope that our example portrays qualities interesting to broader issues of fraternal housing, fraternal population, university enrollment, and university planning.

`

The IPRO team tackled the many tasks of this project by first breaking up into two groups – the research team and the programming team. By doing this the group was able to evenly distribute all the work that needed to be accomplished throughout all the team members.

The main purpose of the research portion of our IPRO team was to identify the malfunctioning systems within the Delta Tau Delta chapter house and investigate the amount of energy the fraternity uses on a day to day basis. To do this the IPRO 311 research team began by initiating a full energy audit on the structure. The team started by simply checking the watt usage of existing lights throughout the shelter and investigated alternatives to woefully outdated plumbing fixtures. The team later began to take a more in depth technical approach. Through this research the IPRO team identified many major areas in which the building was severely inefficient in terms of energy consumption and also identified several areas where quick fixes could be made to greatly reduce energy loss.

The research portion of our IPRO team consisted of six individuals who investigated six major areas of concern: mechanical systems, electrical work, plumbing, building envelope, structural system, and the City of Chicago building codes and ordnances. As each team member began to investigate their particular area of interest the first aspect which was focused upon was researching the existing Delta Tau Delta structure. This was necessary to determine what areas within the research they needed to focus on. Contractors, mechanical engineers, structural engineers, and consultants were contacted and asked to look over the complied data along with the physical house and its mechanical systems. The IPRO team also asked for simple, quick advice for guidance and to make sure that our team was on the right track.

After initial research was conducted, the data collected was analyzed in order to conclude what steps needed to be taken next in order to create the desired improvements to the house. Several calculations were completed to discover the R-Value of the building's envelope and determine how well the existing insulation had held up over the years. The R-Value found was then compared to Chicago city code along with the ideal solution the Delta Tau Delta chapter

`

housing corporation wishes to obtain in order to build a foundation of information to provide a starting point for researching possible future solutions.

Along with calculating the efficiency of the building's physical structure, in depth studies and calculations were completed on the building's mechanical systems as well. After fifty years of existence the building's boilers and fin tube heating system was initially a large area of concern in terms of efficiency as well as functionality. The research team, using heat guns along with outside sources, looked at many aspects of the building's central boiler system to find how each individual room was heated and whether or not the heat in the spaces was being distributed throughout the room as it was originally intended. The amount of energy consumed by the boiler in the DTD house was also studied and compared to other similar systems as well as another fraternity house on campus, which uses a different heating system, in order to gage how efficient the current DTD system is.

Although the research team completed a lot of research on the existing condition of the building, the team also investigated new systems that could be added to the chapter house. Fire safety was one system that the house current lacks but the chapter sees as a necessity to providing a safe living environment in the both the present and the future. Furthermore, the group investigated some alternative energy solutions such as photovoltaic cells and other use involving solar energy.

Aside from the research group, our IPRO team also created a programming team which consisted of four members. The programming team was tasked with finding out the special needs of the fraternity house and reorganizing the layout to better suit the existing and future conditions of the house. The team began by recording their observations of the existing house and the activities that go on in the specific spaces within

The programming team continued their research by creating a questionnaire to distribute in an attempt to gather as much feedback about fraternity living as possible. Questionnaires were first given out to members living within the Delta Tau Delta house to try to get a better understanding of how current members viewed their current house in terms of what spaces

`

functioned well, which spaces were inadequate for their daily activities, and what spaces members would like to see added to the chapter house. Questionnaires were distributed to DTD brothers who lived outside the chapter house in either apartments, houses, or IIT student housing as well to see what their take on the house was in from the viewpoint of using the house as a place to gather instead of permanently reside.

On top of giving out questionnaires to current DTD members, questionnaires were distributed to members of other fraternities. This was done to gather input from individuals living in different Greek chapter houses on the Quad in an attempt to gather as much information about Greek life and Greek needs as possible. These questionnaires which were distributed to Greek students who are not a part of DTD were modified in order to give the team a different perspective on house other Greek organizations use the physical spaces within their chapter house.

Questionnaires of a third variety were given to students within IIT's general student body who were not part of fraternity or sorority living at all. The programming team did this in order to gain feedback from a group of individuals who are not part of Greek life to gain their feedback of how they view a desirable Greek chapter house from an independent perspective.

From the information collected the programming team began to create conceptual diagrams to use as a starting point for future design. Adjacency diagrams were drawn up and studied to identify which spaces and rooms in the structure needed to near one another ranging from absolutely needing to be near one another to certain spaces having no relationships at all. Mass and blocking diagrams were created after the adjacency diagrams in order identify different ways to organize the spaces amongst one another as well as to determine how to change and fine tune functions of other areas within the chapter house.

After these studies were conducted the programming team was equipped with enough effective studies and conceptual ideas to move forward and begin creating floor plans. Several different floor plan options were drawn taking into account as many of the possible limitations of the existing structure. The programming team broke down the many different solutions based on cost and complexity so many different solutions could be offered. Some of the final drawings

`

created were then identified as some that could be done immediately and others that would be more of a long term goal.

After all the data was research was discovered and complied, the IPRO team developed this final project plan along with a presentation to present the group's findings. The final presentation is supported by a brochure along with an exhibit and poster to easily convey the team's findings to the general public. Throughout this final project report and our team presentation we have also included several conclusions about the state of the Delta Tau Delta chapter house and have completed a list of recommendations to approach the needed changes as well as a create some groundwork for future research and project planning.

Energy & Facility Planning for Delta Tau Delta Chapter House				
Name	**Major**	**Year/Level**	**Skills**	**Assignments**
Joshua Bradley	Civil Engineering	4	Graphic presentation skills, passive/active systems and basic understanding of calculations, structural design	Structural and Mechanical Analysis
Noah Cahan	Architecture	5	Understanding of General Construction, In-depth knowledge of energy use evaluation and recommendations	Envelope, Photo Documentation
Daniel Dobbin	Mathematics	4	Mathematics, Computer Science (C and Java), Problem Solving	Electrical
Jake Dohm	Architecture	4	Programming, Design, Green Design, and formatting documents and presentation materials	Programming, Architectural Planning
Jeffrey Hallenbeck	Architecture	4	Architectural programming, building envelope thermal retention calculations, basic mechanical systems knowledge, AutoCAD	Programming, Architectural Planning
Kent Hoffman	Architecture	4	Space planning, architectural programming, AutoCAD, Photoshop, processing and creating Word documents	Code Research and Requirements
Davyd Jordan	Architecture	3	Architectural programming, basic mechanical systems knowledge, Green Design, AutoCAD	Programming, Architectural Planning
Woong-Kyo Lee	Aerospace Engineering	5	In-depth knowledge of mechanics, thermodynamics, general engineering knowledge	Plumbing, Mechanical Analysis
Brad Strandquist	Civil Engineering	3	Graphic presentation skills, passive/active systems and basic understanding of calculations, structural design	Programming, Mechanical Analysis
Nathan Wasisath	Architecture	5	General engineering knowledge, mathematics skills, organizational abilities	Diagramming, 3D Renderings

Table 1. IPRO 311 Team Profile and Assignment chart

`

PURPOSE

Before thought is given to changing the building envelope or any of its associated parts, it is important to have documented understanding of exactly what is in place now. The following will be written and graphical information on the current: walls, windows, doors, and roof.

WALLS

The walls are built of solid masonry construction with an embedded steel W -flange to spread the load around the large window openings. The thickness is 12"and the second floor wall thickness reduces 8"s. The pattern is Chicago Common Bond, with a higher quality exterior brick than the interior. The brick used is a yellow color typical of the Chicago region do to the natural color of the sand, and characteristic of IIT's campus.

WINDOWS

Specific information about the windows is listed in an attached chart. The only original windows are the ones on the first floor that are double paned. It is also to be noted that there is not a thermal break in the original frames but it is assumed for replacement frames. The widows in the house account for a large factor in the air leaks and, specifically the first floor operable units. There is little to no weather stripping around the edge, leaving a metal to metal connection. Frost can be seen to accumulate on the glass and frames in the winter in large amounts.

DOORS

There are two doors that lead to the exterior. One, facing the north, is a metal insulated door. It is missing the weather stripping, so there are large amounts of air infiltration at this point. The main entrance of two doors made of aluminum framing with a full pane of glass in the middle. A second layer of doors makes up the entryway, which is usually kept in the open position.

ROOF

The roof construction is made up of mostly cement-based materials. According to the original drawings, what sits on top of the steel truss is sheet rock and poured gypsum, or concrete depending on the location. Upon ether of those surfaces are 1 inch of insulation and a modified

`

bitumen waterproofing. Modified bitumen roofs have a life expectancy of about 20 – 30 years, if they are properly maintained. From talking to a professional we learned that our roof has about ten year under it, so it is only about half way through its life span.

EXISTING PROBLEMS

- There is damage from UV rays that have caused cracking.
- The reflective barrier is warn away in most places.
- There was an oil-based sealant used around all punctures and that does not bond properly with modified bitumen.
- Poor flashing around the chimney.
- Minor ponding

windows	description	location	number	size	condition
type 1	double pane, horizontal sliding with screen fitting, aluminum frame	basement / north, south, north	11	48-1/2" x 31"	fair, missing screens, missing blinds
type 2	single pane, fixed upper pane w/ operable lower opening, aluminum frame	1st floor / east, west	8	75 - 3/4"x 105"	poor - fair, no screens, operable functions consistently working, some cracked panes, some small panes replaced w/ plexi glass
type 3	single pane, fixed upper pane w/ operable lower opening, aluminum frame	1st floor / south	6	100" x 96"	poor - fair, no screens, operable functions consistently working, some cracked panes, some small panes replaced w/ plexi glass
type 4	single pane, fixed, aluminum frame	1st floor / south	8	48"x 32"	fair - good
type 5	duble pane, single hung, aluminum frame, with screen fitting	1st floor / north	20	48" x 62"	fair, some missing screens
type 6	duble pane, single hung, aluminum fram, with screen fitting	2nd floor / north, south	40	48" x 64"	fair - good, some missing screens, one cracked pane, hard to open
type 7	duble pane, single hung, aluminum fram, with screen fitting	2nd floor / east west	20	35" x 64"	fair - good, some missing screens, hard to open

`

BUILDING DIMENSIONS AND CALCULATIONS FOR R-VALUES

North wall(s)	90	ft
East wall(s)	63	ft
South wall(s)	90	ft
West wall(s)	63	ft
Height of building	28	ft
Gross wall area	8,464	ft^2
Basement below grade	6	ft
Volume	188,017	ft^3

	Area (ft^2)	Current type	R-value (ft^2·°F·hr / Btu)
Roof	5,670	1" rigid r 5 per inch	5.60
Window 1	1,674	Double-pane	1.82
Window 2	842	Single-pane	0.91
Door 1	60	Main entrance (single-pane glass)	2.00
Door 2	23	Metal Insulating (2in w/ urethane)	15.00
Exterior walls, net	5,866	12" brick	4.85
Total	14,134		3.45

`

ANALYSIS & FINDINGS | WINDOWS

After inspection of the windows on the main floor of the building it is quite obvious that they are outdated and insufficient. From a deep look into past renovation records it seems as if the windows and frames are original. Some of the lower hopper windows are non-functional, and some have been permanently closed. The thermal seal on all of the hopper windows is also insufficient. The panes are ¼” thick glass with an R-Value of 0.91.

The windows on the second floor were replaced in 2002, but despite their recent installation have run into problems as well. Some of the aluminum frames have been damaged due to negligence while putting in and taking out air conditioners. It is also unclear as to whether or not the windows are thermally broken as often times, condensation forms on the inside of the window. From speaking with the residents of the building, there is suspicion that in some units during the winter there is considerable air infiltration.

Current windows of the Delta Tau Delta chapter facing east

Current windows of the chapter house on its west side

`

Delta Tau Delta – Windows on the south side of the building

Many of the windows in the building have aged over time, some becoming inoperable. In this picture one inoperable window is shown.

Air influtration into the structure in one source of high energy costs. Here one can see a visable gap in the windows allowing air to easily flow in and out of the building.

`

Interior view of one large span window found on the building's first floor.

After initially addressing the problems causes by the aging windows, the following solutions were determined to be viable options to remedy this problem:

OPTION 1

The first option to be considered is to not make any change. The price of this renovation is quite costly, so it might be most sensible to ride out the current system until their operating lifetime is over.

OPTION 2

This option includes minor repairs to temporarily prepare the windows for winter seasons. These minor repairs include permanently closing any non-functional hopper windows by simply screwing them in place. This would also include, providing weather stripping in all operable seals and possible resealing/re-caulking all aluminum/glass joints.

OPTION 3

The final option would be to completely replace all windows on the first floor of the building. Two different companies were contacted and supplied quotes for the replacement of the first floor windows. These quotes are attached. The R-Values of the products that were proposed were requested, but were never provided by the supplier. The estimated value for the proposed new windows is 3.13.

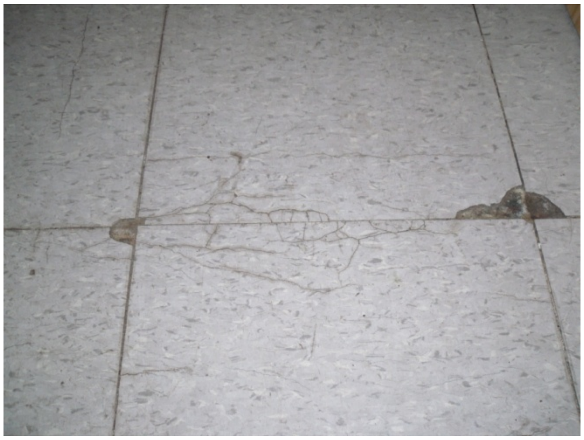
`

CURRENT STATE OF FLOORING

Due to the high traffic nature of a fraternity house, after about 10 years the tile and carpet show disrepair. In many places, tiles are broken and cracked and there are several places where the carpet has runs. Another problem with the current system is that the tile requires a lot of attention as it is stripped and re-waxed at the beginning of every academic semester. During the stripping and waxing process, it has been noticed that the adhesive holding the tiles down has started to leak between the tile joints.

Exsiting run of carpet found in the upstairs hallway of the Delta Tau Delta chapter house. Note of the wear of the carpet in the center of the photo.

Exsiting run of carpet found in the chapter house's library. After years of use the carpet has begun to come apart at its seams.



There are several areas in the building where tile is used to cover the floor. After many years of wear and tear the existing tile floor has begun to chip and crack way as pictued above.

`

PURPOSED SOLUTIONS

When it comes to flooring systems, the options are nearly endless. It's important, however, when choosing a floor finish to not only consider the cost of materials and installation, but also the benefits and disadvantages of each option.

OPTIONS PART 1: REPLACING TILE

Flooring Option	Square Footage	Price/Unit	Total Cost	Expected Life
Commercial Grade Resilient Vinyl Tile	6500	$6.50	$42,250	20 yrs
Terrazzo	6500	$14	$91,000	50 yrs

OPTIONS PART 2: REPLACING CARPET

Flooring Option	Square Footage	Price/Unit	Total Cost	Expected Life
Carpet	7000	$3.50	$24,500	10 yrs

`

TOILETS/URINALS

CURRENT STATE OF PLUMBING FIXTURES

When reviewing the sustainability of the building, it is clear that the bathroom fixtures are quite wasteful when it comes to water consumption. The current standard for the amount of water consumed by toilets is 1.6 gpf. The four toilets in the bathroom all use 3.5 gpf, which is over double the amount of the standard system. The same can be said about the water consumption of the four urinals in the bathroom. The current standard for urinals is 1.0 gpf. While the urinals in the current building use the same amount, there is much technology available to reduce greatly urinal water consumption.

View of current toilet fixture found throughout the DTD house. All toilets found throughout the house use 3.5 gallons per flush.

This 1.0 gallon per flush urinal fixture is the current urinal fixture of choice in the building.

PURPOSED SOLUTION

The newest technology for toilets is the dual flush valve which gives the option of flushing liquid waste at 1.1 gpf or solid waste at 1.6 gpf. The installation of these new flush valves would decrease our water usage by at least 50%.

The most interesting option for replacing the urinals is the water-less urinal made by Falcon Water-free Technologies. These urinals consume absolutely zero water. The waterless urinal uses a replaceable cartridge with a sealant liquid layer through which urine passes. The sealant liquid provides an airtight and aromatic barrier between the urine and the atmosphere. Cartridges need to be replaced every 4 months.

SHOWERS

EXISTING SHOWERING CONDITIONS

There are 7 showers in the shower room. The showers only have the capability of running hot water. The water temperature for all showers is controlled by the central Hydroguard mixing valve.

Hydroguard mixing valve

`

Layout of shower stalls in DTD upstairs bathroom

Hydroguard mixing valve

<u>PURPOSED SOLUTION</u>

It is fairly clear that in any contemporary student living situation it seems completely necessary to have temperature control in all showers. A plumber was contacted to present a quote for allowing the possibility of having temperature control in all showers. The quote from John's Plumbing is for $6,350. The scope of the project was to remove the existing piping and valves, and to run both hot and water pipes to each shower with new valves and faucets.

`

CURRENT SYSTEM

The Delta Tau Delta shelter currently has some Fire Safety components, but is has some significant gaps in its full scope. The shelter does have a up-to-date and comprehensive fire escape plan. Provided by System Development – Integration or SDI, the emergency plan covers recommendations and plans for all types of emergencies, including fire, disasters, carbon monoxide, and collapses. Emergency evacuation plans are posted in each room clearly identifying the quickest and safest route out of the building in case of a fire or emergency.

In addition, the shelter has a total of twelve fire extinguishers located on all three levels of the house. One of the highlights of the current fire safety system, a state of the art hood above the kitchen range and fryer with ventilation and fire suppression sprinklers, provides protection for one of the more vulnerable rooms of the house. There is some exit signage, however, much of it is not up of code and many of them are no longer functioning. Many of the common, public traffic zones have an a portion of the ceiling lighting dedicated to an emergency circuit, but the light is minimal, and it is unsure if this will remain on in case of an emergency outage.

PURPOSED SOLUTIONS

We contacted Fox Valley Fire and Safety to visit the shelter and provide advice and a price quote to give us an understanding of the scope of an improved fire safety system. The team discussed interest in having a hard-wired fire alarm and detection system with smoke a carbon monoxide capability, a full sprinkler system, and updated and more visible exit signage.

Fox Valley Fire and Safety was incredibly helpful and told us that in their professional opinion, a fire sprinkler system, especially in a home refit situation, would be far to expense to be worth it. They informed us that for a life safety factor, a hard-wired fire alarm and detection system would be sufficient in a home of the size of the house.

Additionally they supplied us with a quote detailing intelligent fire alarm control panels, annunciater panels, photoelectric smoke detectors, manual pull stations, heat detectors, a monitor

`

system for the kitchen suppression system, and a horn and strobe lighting system. This quote covered installation of all equipment listed above throughout the common areas of the house, including all areas of the basement, all areas of the 1st floor with the exception of the two living areas, and the corridors, bathroom, and rack rooms on the 2nd floor. No fire alarm devices have been included in any of the individual sleeping rooms on the second floor to avoid false alarms. All fire alarm wiring would be installed in new exposed conduit raceway. Upon completion of the installation, Fox Valley Fire and Safety would test 100% of the fire alarm devices installed. This plan would include a 5-year warranty against faulty equipment and a 1-year warranty against faulty installation labor upon completion of the final test.

Line Item	Price
Removal and disposal of existing signs that do not meet Chicago codes. 8 - Single glass "Exit" sign with battery back up. 2 - Double glass "Stairs" sign with battery back up. 2 - Double glass "Exit" sign with battery back up. 12 - Emergency light with battery back Installation Subtotal	$ 5,499.47
1 - Notifier Addressable Intelligent Fire Alarm Control Panel 1 - Key-Operated Fire Alarm Annunciator Panel 20 - Addressable Photoelectric Smoke Detector with Base 9 - Addressable Manual Pull Station 6 - Addressable Heat Detector, 135-Degree 1 - Addressable Heat Detector, 190-Degree 1 - Monitor Module for Kitchen Suppression System Tie-in 16 - ADA-Approved Horn / Strobe, Multi Candela 1 - ADA-Approved Strobe Light, Multi Candela 1 - Lot of Fire Alarm Cable & Conduit Raceway Installation, Testing, and Warranty Subtotal	$25,975.00
Carbon monoxide detection capability Subtotal	$ 5,850.00
Total Price Exclusions: Sales Tax Overtime Labor Permit and Review Fees Monitoring Fees Products and services not listed above	$37,324.47

`

CURRENT STATE OF CENTRAL HEATING SYSTEM

The current mode for heat distribution is through radiant fin tubing around the perimeter of the building. In almost all places, the fin tubes lie directly below large window spans which as stated earlier are very poor thermal barriers. Larger rooms such as the living room and the dining room have a hard time being heated sufficiently by the fin tubes. Also, there are many spots along the runs of piping that are dysfunctional. As part of making our heating distribution system more efficient, we looked into the possibility of installing a hydronic radiant floor heating system throughout the building.

Picture viewing one of the many runs of raditors that around found throughout the building.

When the cover is removed its easily seen how the many of the fin tubes in the system have been bent or broken thereby hindering the performance of the system.

PURPOSED SOLUTION

Several steps were taken towards researching the possibility of radiant floor heating. The original plan was to retrofit the current boiler and radiant fin tubes to accommodate for the floor tubing. Several mechanical/ HVAC contracting companies were contacting to give a quote for the retrofit, however, none were willing to come through to look at our system and supply us with a quote. We did have a mechanical engineer, Jim McNally, look at our boiler and mechanical room. On his visit he advised us that radiant floor heating was not a good option and that our current system, with some maintenance was sufficient.

`

CURRENT SITUATION

Currently our domestic hot water boiler runs on 80% efficiency and uses on average 375 therms/month. In order to approach the possibility of a more efficient building, solar thermal systems were researched as an alternative to the domestic hot water boiler. The idea being that the solar thermal collectors could generate enough energy to supply enough domestic hot water to suffice with the boiler as a supplementary supply.

PURPOSED SOLUTION

The plan for retrofitting a solar thermal system into the existing building involves having solar collectors on the flat roof which feed into the 2-200 gallon domestic hot water storage tanks in the mechanical room. Water would be pumped to the roof where the solar collectors are stored and then after heated the water would fall back down to the storage tanks. As stated before, this system would not completely take the place of the domestic hot water boiler. The domestic hot water boiler would still be an active part of the system but would only fire up if there were several cloudy days in a row and the panels couldn't heat enough water to meet the need of the residents.

`

The average monthly usage in DTD is 12,352 kWh/month from the electricity bill. You can see the electricity bill in App.1. I did offset 25% and 50% to be used solar energy. It means, for example, $12{,}352 \times \frac{25}{100}$ = 3,088.5 is used in actual calculation.

Offset	25%	50%
Solar Radiance (in Chicago)	4.47 kWh/sq m/day	4.47 kWh/sq m/day
Avg. Monthly Usage	12,352 kWh/month	12,352 kWh/month
System Size	28.69 kW	57.39 kW
Roof Size	2,869 sq ft	5,738 sq ft
Estimated Cost	$229,556.76	$459,113.52
Post Incentive Cost	$129	$265,537.60

<Table 1. System Specifications>

Roof size is approximate roof size need to accommodate the solar power system. The roof size of DTD house is about 5000sq.

Federal Incentives	
Tax Credit:	30%
State Incentives	
Property Tax	Exempt
Rebate:	30% ($10,000.00 max)
Rebate	$0.065/kWh - 10 year(s)

<Table 2. Incentives>

`

The incentives are the same in two variables, 25% and 50% offset.

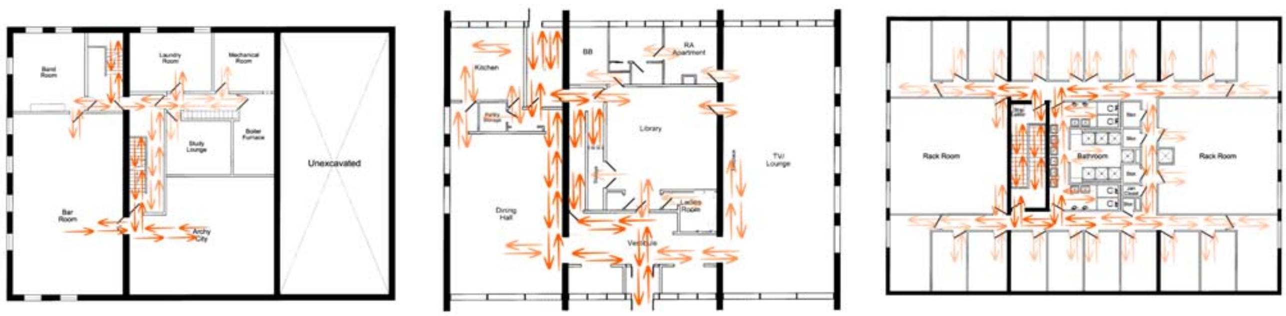
	25%	50%
Estimated Cost	$229,556.76	$459,113.52
Post Incentive Cost	$129,268.80	$534.77
Avg. Monthly Savings	$267.39	$534.77
25 Year Savings	$133,626.81	$267,253.62
25 Year ROI	103.37%	100.65%
Break Even	24.47 years	24.90 years

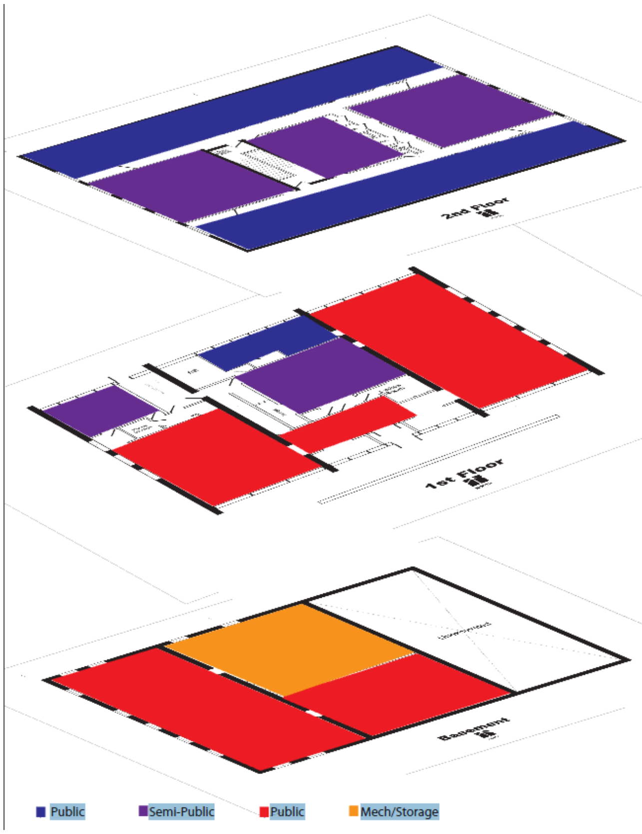
<Table 3. Savings>

The 25 year savings is based on the amount of electricity cost you save over a 25 year period assuming a yearly 4% increase in utility rates. ROI means ‘Rate of Investment’ or ‘Rate of Return’. The ROIs are high enough to accept these projects in both cases. However, the numbers show it would be wise to go with the 25% offset because the ROI of 25% offset case is higher and the breakeven point is slightly shorter. In an economical sense, ROI comparing gives more accurate result than breakeven point. Thus, the 25% offset case is the better one.

`

The programming team created diagrams to show the circulation within the house, the relationship of the house to the rest of campus, noise levels of rooms in the house, the use of space throughout the house, and the relationship of private/semi-private/public spaces to each other. From the circulation diagrams the team was able to determine the main areas of congestion in the traffic in the house such as at the top of the stairs where the hallway meets both the stairs and the bathroom. As well as the condition by the back landing where the back door, the kitchen, dining room, library, and the stairs both to the basement and to second deck all collide causing a major circulation concern.





From the noise and the special use diagrams it was realized that a lot of the spaces are next to areas that have the opposite needs of spaces adjacent to them such as the library being sandwiched between the dinning room, the living room, and the foyer. The same is true of architectural studio in the basement – know as Archy City - which is right next to the bar room which can only be accessed by passing through the study space. The newly converted study space on second deck has also had some issues resulting from being right next to all the bed rooms where people who did not work in the space wandered in far too often using it almost as a lounge and distracted people trying to work.

Similar findings were found from the private/semi-private/public spaces diagram. Guests from out of the house would have direct access to private areas such as rooms when going to the bathroom. These kinds of issues had proven to be problems in the past with people's property being damaged by unsupervised guests who current can too easily wander into a private space.

The feedback for the questionnaires the team distributed further supported a lot of this information from people in the house. The results from Greek members and non Greek members, however, differed in that the non Greeks did not enjoy the idea of community spaces such as the existing rack rooms and preferred smaller single rooms or suite style rooms. A lot of the members in the house seemed to find the living room and the library underutilized and many expressed interest in having a separate chapter room that could be used exclusively for chapter meetings and other chapter functions rather than sharing a space as we do now. Most everyone surveyed generally seemed to express an interest in having an outside space and a large interior recreational room containing items such as a pool table and ping pong table –these were found to be at the top of many people's lists. Many of the people out of the house liked the idea of having gym equipment in the house and both parties agreed that they would like to have music equipment as well.

For reprogramming the existing house, the programming team realized that the more we tried to change the existing conditions of the house the more expensive it got. Realizing this we broke into different strategies that would each modify a set number of things. The first stage just looked at moving the non-structural walls within the house and leaving the four bearing walls as they were. There were many different approaches this took from simply modifying the second deck rooms to removing and replacing nonstructural walls on the first level.

The next stage involved excavation of the un-excavated space underneath the living room. Digging out this area would be quite a bit more expensive as an outside contractor would need to be hired to come in, dig down to the foundation, punch a hole in the wall and brace it while they removed the dirt and gravel, poured the concrete slab and ultimately finished the new interior space. This plan was very similar to the first plan as far as the reorganizing of the second deck and would require the moving of non-structural walls to reprogram the spaces to make

`

appropriate use of the new space. Along with this stage the idea of moving staircases came into play. The team purposed to move the staircases to different locations in the structure in order to improve circulation. This plan to move the stairs also brought another idea forward in perhaps putting a main door on the north side of the structure to face the Greek Quad. This concept, however, was thought to be quite expensive since modifications to the buildings structural walls would have to made.

The final plan consisted of adding a third story and a passive heating and cooling system in the center of the building in the form of a large glass atrium. This would require a complete reworking of the interior spaces and would essentially just leave the foundation and the four masonry bearing walls intact with some of the exterior skin as well. This would be by far the most costly but addressed all of special concerns that the programming team found as well as making the building less reliant on forced air and heating systems.

`

ENERGY CONSERVATION FOR BUILDING ENVELOPE

When thinking about energy savings in relationship to the building envelope the user of the space is inherently attached to consumption. This is because functional comfort for the user is the goal. The building should have proper light and tempter for the given time, day and year to make the space useable. The building envelope plays a large role in shaping internal conditions based on the external environment. The mechanical systems in affect make up the rest of the difference. There for the envelope plays a role in Gas and electric uses and user comfort. For example, the less square feet of window space a room has the more electricity will be need to light it, but less gas will be needed to heat it. Air infiltration, ventilation, thermal resistance, day lighting / shading, and reflectivity / solar abortion all are reaction of the building envelope in its environment that affect comfort.

For this project, the team is working within the constraints of the existing building that has been described in section 4. The opportunity to build in passive systems has past, but we now have the experience of living in the structure and can mitigate the specific problems that are wasting energy, money, and causing discomfort.

This building consumes a large amount of natural gas, 13,151 therms on average for its heating load a year. Savings on gas can come from modification with the boiler and its controls as well as from the improvements to the envelope. The IPRO group researched possible improvements, some are harder to quantify in savings than other with the tools we have in our reach. Also, we can make educated assumptions based on concepts that we know will save us gas without know how much. For example we don't know how much air our building leaks but we know if we properly seal the doors a windows we will lose less heat in the winter. Another example is opening the blinds to allow for solar radiation, and closing them at night to prevent heat loss. The team is also are looking into thermally insulated blinds to maximize this concept of maximum heat gain in the day and minimum heat loss at night.

There are some retrofits that the Delta Tau Delta chapter can calculate the payback of and they are listed in the chart below. The prices are actual quotes from professionals based there analysis of the job.

`

Insulating the Roof Cavity

Insulating the roof cavity would require the installers to first drill a 3" holes through the drop plaster ceiling. Then they would blow in Rockwool insulation. We made the decision to use Rockwool because it is a natural material that has a R-5 of per inch. This is higher than cellulose and does not settle in a way that reduces it R value nor does it lose its thermal properties if it becomes wet. The roof cavity is 18 inches and to reach an R-38 7.5 inches is needed. R-38 is required to fall into the range of possible tax incentives regarding energy efficient design. After researching this it is logical to conclude that this is one of the best strategies to cost effectively cut down on gas consumption within the DTD structure. The savings to investment ratio, which is a good way to compare retrofits, is relatively high.

Insulating Exterior Walls

Insulating exterior walls would be extremely helpful for not only gas savings in the winter but also comfort in summer for the heat. The more percentage of the building that can be insulated the better. Exterior walls are problematic though for many reasons. If the insulation is put on the inside of the wall interior space is lost and a new interior finish must be applied. If it is put on the exterior than a new exterior cladding must be applied. This is an extremely expensive retrofit but also would have a large pay back in natural gas savings.

Roof

The solution to the problems listed in Section 4 for the roof is pretty simple but a necessity building. It was discovered the roof of the Delta Tau Delta chapter house is starting to show its age and is in need a new top coating, repairs to flashing, and replacement of sealant around vertical protrusions. Do to the cracking a normal coating will not do. It has been found that a coating that not only reflects the UV rays but that is a waterproofing as well. What was recommended is an aluminum coating made by R. M. Lucas co. (see appendix for details). This coating should prolong the life of the DTD roof for another 10 years. This coating is set to the Chicago building code standard to reduce the urban heat island affect. This reflective coating should also reduce the indoor comfort in the hot summer months as well. The IPRO team feels this is an action that should be taken in the beginning next upcoming roofing season.

`

Air Leaks

Air leaks are most abundant around the windows and doors. This can be remedied by renewing the weather stripping and door sweeps. The windows will be harder to fix than the doors because the leakage is built into the frames. The cost of replacing windows is very high and we will never see a payback.

Retrofit payback

Description	Initial cost ($)	Savings (therms/yr)	Unit price ($/therm)	Savings ($/yr)	Simple payback (yr)	Lifetime (yr)	SIR
Insulate roof to R-38	8,030	2259	1.10	2484.9	3.2	30	9.2
Insulate all exterior walls R-12	50,000	4041	1.10	4445.1	11.2	30	2.6

Windows

As the winter is upon us, temporary solutions should be performed to reduce the energy lost through the poorly sealed windows. After the winter is over, it is recommended to hire Harmon Glass to replace the windows on the first floor.

Flooring Systems

Replace both tile and carpet throughout whole building.

Plumbing

Toilets/Urinals

At the minimum install toilet flush valves that use 1.6 gpf rather than the current 3.5 gpf flush valves. The maintenance involved with installing waterless urinals seems too involved. For that reason it is probably more sensible to leave the current urinals in place

Showers

The showers should be retrofitted to have both cold and hot water controls. John's plumbing offers a quality solution therefore they should be hired to do the work.

`

SOLAR THERMAL SYSTEM

It seems very beneficial to install solar thermal collectors on the roof of the building as the residents of the building currently consume 375 therms monthly. Although it would be very energy conscious to install the solar thermal system, it is questionable how cost beneficial it would be.

HEATING DISTRIBUTION

It is probably most wise to follow the advice of the professional mechanical engineer. Maintenance should be performed on the boiler so that it runs more efficiency to heat the building more comfortably.

ARCHITECTURAL PROGRAMMING/SPACE PLANNING

One of our major concerns was meeting the client's needs as far as their budget is concerned. To address this we broke up the different phases in a manner that the house corp. of Delta Tau Delta can look at each plan individually and compare each of the solutions to the time frame that would best meet their needs allowing them to take smaller actions sooner and perhaps prepare to make larger changes further down the road.

The research team came up with some solutions that could be implemented relatively quickly which would address the energy load of the house and the comfort of the residents. Most of these could happen in the near future by simply replacing or modifying existing systems and would not require major demolition or construction. All of the simple actions that the research team recommended can also be incorporated with the other phases of the programming recommendations and can get more complex as the renovation becomes more complex.

The first phase recommendation from the programming team, as stated in the analysis and findings, only included changing the layout of the second floor. Originally the two large rack rooms were the only place people were meant to sleep and the smaller private rooms were meant only for private study with two or three people sharing a study room. Since then the roles have been reversed and the smaller rooms are used as private bed rooms and one of the rack rooms has been converted to a large common study space. The first phase involves removal of some of the nonstructural interior rack room walls and the construction of walls within the space to divide the

`

rack room into three slightly larger rooms with a lounge at both the east and west ends of the building. This would allow for more private double rooms and create a space for people to congregate and hang out on second deck itself. This would be the easiest plan to reconfigure the way the spaces are laid out and the use of the second deck.

The next phase would involve the excavation of the un-excavated space in the basement. This would be much more costly but would add quite a bit of additional space to the building. This allows for a more substantial redesign of the building while still maintaining the four bearing walls and the exterior facade. This phase would require non structural walls to be removed and others to be constructed. The freedom of having the additional space within the house allows for the program to be reworked so the study spaces are completely separated from the living and sleeping space as well as for the creation of a chapter room. Archy City, a study area for architects currently in the basement, would move over a bay to the far west end of the house allowing for windows and would be directly next to two larger study areas for the rest of the house and a bathroom would be added to the basement . The chapter room would be placed roughly where Archy City is located now and the bar/recreation room would be placed on the east end of the basement where the un-excavated space is now. This would also allow for a door and a stairwell from the bar/rec. room to the quad which would help quite a bit with security issues during parties and formal events. With the study spaces and chapter room located downstairs the library is no longer necessary and can be turned into an open lobby space with an office for administrative purposes. The layout space of the kitchen to dining room could also be redefined providing double doors for direct access to the dining room from the kitchen for serving meals more efficiently.

The third phase involves reworking of the circulation of the the entire house. It involves relocating the front entrance on the east wall of the house so it faces the quad, as this is the only house on the quad that does not face the quad, and using the three spaces defined by the four bearing walls to separate the spaces into public, semi-private, and private in that order from the quad. This allows for the natural progression of the house from the quad and the easier management of guests. As well this strategy allows the stairwells to

`

be reworked to avoid forcing people to walk through other spaces to get to the stairs to get to the right end of the house such as the dining room and the bathroom. As is, the stairs are confusing to guests and often people get lost trying to get from one end of the house to the other. This strategy also helps with the separation of spaces based on noise levels as the most public areas are often the loudest and the most private spaces the quietest. The second deck strategy in this scheme is very similar to the first proposal but with modified circulation.

The final proposal involves adding a third floor and an interior atrium as a core in the center of the building. This scheme is a complete renovation of the interior and would leave the bearing walls intact but would require some kind of reinforcement. It opens up all of the circulation to the center atrium and makes the rooms slightly larger wrapping around the central circulation core. The top two floors consist of rooms with a smaller public bathroom on each floor and the second floor has a large study space that fills an entire bay of the house and the third floor allows for a lounge and an outdoor patio. The center atrium has a glass ceiling and windows that can be opened or closed so it can be used to supplement heating for the house in the winter and cooling through stack effect in the summer. Since it is in the center core of the building all rooms can be heated or cooled by it if the doors are left open allowing for natural ventilation and solar heating. Although this plan does not require excavation of the basement, it by far changes more of the existing building than any of the other plans and requires reinforcement of the bearing walls. With all of this new construction this phase is quite costly but most addresses the culmination of all of the problems the programming team found in its research.

In conclusion, each one of these phases can be constructed independently at different times depending on the budget available at the time and the need for such changes to be made. It would be practical to start off with one of the minor changes in the near future, perhaps simply updating the systems already within the house and making some of the adjustments the research team recommended, and perhaps implementing phase one to the second floor. Then later on perhaps phase two or three can be budgeted for and put into effect and eventually phase four may be within reach and at some point in the future constructed.

`

FINAL RENDERING INTERIOR

Rendering of the interior of the purposed atrium in the Delta Tau Delta house.

`

FINAL RENDERING EXTERIOR

View from the of the south elevation of the Delta Tau Delta chapter house after the purposed atrium and third floor is added.

`

APPENDIX

`

Appendix 1 | Contacts

Jessex Installations
555 Plate Dr. Unit 8
East Dundee, Illinois 60118
847.844.3436
Obtained a quote for replacing the windows on the first floor. Quote attached below.

Harmon, Inc. (Service Glass)
4161 South Morgan Street
Chicago, IL 60609
312.726.5050
Obtained a quote for replacing the windows on the first floor. Quote attached below.

Glass Solutions Inc.
764 N Oaklawn Ave
Elmhurst, IL 60126
630.532.1234
Contractor who replaced the second floor windows in 2002
Was contacted again to replace some panes and to check other windows that are dysfunctional
Never returned call

Glass 1 Chicago
2477 E. Devon Ave.
Elk Grove Village, IL 60002
773.227.6330
Was contacted to request a quote for new windows on the first floor.
Never returned call

WarmlyYours Inc. USA
2 Corporate Dr.
Long Grove, Illinois 60047
800.875.5285
Found via the internet. There was a long phone conversations regarding the possibility of retrofitting the building to have radiant floor heating. Plans were sent via email to receive a quote. It was later realized that the company didn't create systems that were the primary source of heat. They only provide systems that are luxury systems to provide added comfort. They also only design and install electric systems rather than hydroponic systems. Correspondence was halted when it was realized that they couldn't provide us the services we were looking for.

Ujamaa Construction, Inc.
400 West 76th Street, Suite 320
Chicago, IL 60620
773.602.1100
We were referred by our professor to contact Ujamaa construction. The intentions were that Ujamaa would provide us with some basic construction estimates for our proposed renovations. Initial contact was made and the representative from Ujamaa was willing to meet with our team. Plans of the existing house as well as the proposed construction plans were sent to the representative. Unfortunately we were never contacted back even after following up twice.

`

TDH Mechanical
2136 W Fulton St
Chicago, IL 60612
312.421.5665
TDH mechanical was contacting to both look at replacing or doing some maintenance on our boiler and to give us a quote for retrofitting our building for radiant floor heating. A time was sent for one of their mechanics to take a look at our system, but their representative never showed up. Another time was set and once again no one showed.

Alternate Energy Technologies, LLC.
1057 North Ellis Road, Suite 4
Jacksonville, Florida 32254
800.874.2190
Products of AET were researched for installing a solar thermal system on the roof of the building.

AES Solar Systems
gg@aessolar.co.uk
+44 (0)1309 676911
An online quote request was filled for a solar thermal system. The companies representative responded and was willing to give us a quote for no obligation, however, it was realized in the next couple of messages that the company was not based in the United States. They were not willing to work with us any further.

Hannel Radiant Direct
steveh@radiantdirect.com
888.298.6036
A phone call was made to request a quote for radiant floor heating. Upon request by the companies representative floor plans of the building were sent so that the system could be sized. No further correspondence was made even after the group followed through several times.

Perri Aire Inc.
5901 N. Cicero Ave
Chicago, IL. 60646
773-777-4888
Perri Aire was contacted to give us a quote for a radiant floor heating system. The representative that was contacted took down our contact information, but there were no attempts to contact us back.

`

APPENDIX 2 | BUILDING PROGRAM

Delta Tau Delta Shelter Renovation

Architectural Program	Existing Area	Proposed Area
I. Public Spaces:		
Living room	1700 sq. ft.	1130 sq. ft.
Dining room	925	925
Recreation	1484	1850
Kitchen	289	310
Entry/Foyer	296	296
Restrooms (Public)	90	90
Total Public	**4784 sq. ft.**	**4601 sq. ft.**
II. Private Spaces		
Personal rooms	2520 sq. ft.	4200 sq. ft.
Communal sleeping rooms	884	0
Study rooms	1721	2121
Guest sleeping rooms	182	140
Offices/archives	0	300
Ritual room	600	700
Restrooms (Private)	450	450
RA's quarters and restroom	280	280
Total Private	**6637 sq. ft.**	**8191 sq. ft.**
III. Support		
Mechanical room	390 sq. ft.	390 sq. ft.
Laundry	238	100
Storage lockers (personal)	210	210
Storage closets	156.5	156.5
Entry closets	132	132
Mail boxes	24	24
Pantry	49	60
Cleaning closets	40.5	40.5
Total Support	**1240 sq. ft.**	**1113 sq. ft.**
IV. Circulation	**1383 sq. ft.**	**1390 sq. ft.**
Inhabitable Space (less Support and Circ.):	**11421 sq. ft.**	**12792 sq. ft.**
Total Space:	**14044 sq. ft.**	**15295 sq. ft.**

`

APPENDIX 3 | QUESTIONNAIRES

Delta Tau Delta Shelter Renovation

Programming Questionnaire - Active Members

1. What community living situation do you prefer? (Circle one of the following choices.)
   a. Smaller single rooms b. Suite style c. Larger multi-occupancy

2. Which statement best describes your feelings about a communal sleeping area?
   _____ I would never even consider it _____ I might warm up to the idea
   _____ Sounds pretty interesting _____ Sign me up!

3. Is it important to the cohesion of the chapter that all bedrooms be on a single floor?

4. List any furniture that you consider necessary to have in your personal room:
   ____
   ____

5. Which bathroom style do you prefer in a communal living situation?
   a. Small private b. Shared semi-private c. Large community

6. Do you study better individually in privacy or in a group study community setting?

7. What is most useful about our library as it exists today? (Rank 1-6, where 1 is most useful.)
   _____ It is one of the few quiet places in the house
   _____ It is good for study groups
   _____ The books are valuable resources and should be on display
   _____ Chapter meetings take place there
   _____ It is a good display case for trophies
   _____ I only use it as a hallway

8. What kinds of recreational equipment do you expect in a community living space? (Choose top 5)
   _____ Pool table _____ Ping pong _____ Air Hockey
   _____ Foosball _____ Darts _____ Poker table
   _____ Gym equipment _____ Arcade games _____ Music equipment
   Other: ______________________________

9. How important is private outdoor space to you?
   _____ Not important _____ I wouldn't be opposed
   _____ Moderately important _____ Very important

10. Which spaces in the house don't function well in your opinion? Please discuss why below.
    ____
    ____
    ____
    ____
    ____

`

Delta Tau Delta Shelter Renovation

Programming Questionnaire - Executive Board Members

1. Please provide a high-average estimate of the number of members living in the shelter per semester.

____

2. What is the maximum attendance at parties or other large events? ____________________

3. What is the maximum mealtime attendance on an average day? ____________________

During special dinners or other similar events? ____________________

4. What is the maximum attendance at chapter meetings? ____________________

5. Are special accomodations required for any live-in non-members (such as an RA or chef)?

____

____

6. Will you require any special guest accomodations? Provide details.

____

____

7. Would an allotted office/archiving space be beneficial? Provide details.

____

____

8. How many people keep bicycles inside the house? ____________________

9. Of the following cleaning items, **how many of each type** could ideally be used during the busiest period of cleaning?

_____ Mops _____ Mop buckets _____ Brooms
_____ Slop sinks _____ Dust mops _____ Hoses
_____ Rakes _____ Snow shovels _____ Spray bottles

Other: ____

10. Of the following bathroom fixtures, **how many of each type** do you estimate are required at the busiest times of the day?

_____ Sinks ____ Toilets _____ Urinals _____ Showers

Other: ____

11. Describe any needs concerning a ritual room (privacy, storage, occupancy, adjacency, etc.)

____

____

____

____

`

Delta Tau Delta Shelter Renovation

Programming Questionnaire - Non-Members

1. What community living situation do you prefer? (Circle one of the following choices.)

   a. Smaller single rooms   b. Suite style   c. Larger multi-occupancy

2. Which statement best describes your feelings about a communal sleeping area?

   _____ I would never even consider it   _____ I might warm up to the idea
   _____ Sounds pretty interesting   _____ Sign me up!

3. Is it important to the cohesion of a community that all bedrooms be on a single floor?

4. List any furniture that you consider necessary to have in your personal room:

   ____

   ____

5. Which bathroom style do you prefer in a communal living situation?

   a. Small private   b. Shared semi-private   c. Large community

6. Do you study better individually in privacy or in a group study community setting?

7. What kinds of recreational equipment do you expect in a community living space? (Choose top 5)

   _____ Pool table   _____ Ping pong   _____ Air Hockey
   _____ Foosball   _____ Darts   _____ Poker table
   _____ Gym equipment   _____ Arcade games   _____ Music equipment

   Other: ____

8. How important is private outdoor space to you?

   _____ Not important   _____ I wouldn't be opposed
   _____ Moderately important   _____ Very important

`

APPENDIX 4 | DELTA TAU DELTA ENERGY BILLS

Fiscal Year	January	February	March	April	May	Jun	July	August	September	October	November	December	Total
2002	20,040	13,850	12,480	13,710	11,170	16,040	15,660	14,300	27,830	7,980	12,130	7,000	172,190
2003	16,370	15,620	11,010	14,450	11,330	15,060	13,170	15,320	18,480	13,670	14,590	10,520	169,590
2004	19,760	12,000	16,450	12,190	10,050	11,380	17,470	15,660	15,600	13,160	13,000	9,500	166,220
2005	16,420	12,170	13,440	12,740	11,460	12,000	12,000	10,180	17,550	12,850	13,690	10,000	154,500
2006	11,110	16,620	4,620	3,480	7,170	10,000	10,000	17,920	18,690	13,720	11,270	10,900	135,500
2007	10,110	8,150	7,260	9,680	6,730	10,000	15,000	19,610	11,390	11,840	13,080	7,650	130,500
2008	9,480	9,550	9,720	8,230	8,230	7,000	10,350	11,190	9,800	8,980	8,900	7,610	109,040
Average	14,756	12,566	10,711	10,640	9,449	11,640	13,379	14,883	17,049	11,743	12,380	9,026	148,220
Monthly Avg.		12,352											

<Electricity bill in DTD>

FOX VALLEY FIRE & SAFETY

2730 Pinnacle Drive • Elgin, IL 60124 • 847-695-5990 FAX 847-695-3699 • www.foxvalleyfire.com

December 2, 2009

Delta Tau Delta
Attn: Josh Bradley
3349 S. Wabash
Chicago, IL 60616
Email: jbradle4@iit.edu

Re: Fire Alarm System Installation

Dear Mr. Bradley:

Fox Valley Fire and Safety is pleased to submit our proposal for the installation of a new fire alarm system at the location named above. Our proposal is based on my recent site visit, and based on the floor plans provided to Fox Valley Fire and Safety via email

1 - Notifier Addressable Intelligent Fire Alarm Control Panel
1 - Key-Operated Fire Alarm Annunciator Panel
20 - Addressable Photoelectric Smoke Detector with Base
9 - Addressable Manual Pull Station
6 - Addressable Heat Detector, 135-Degree
1 - Addressable Heat Detector, 190-Degree
1 - Monitor Module for Kitchen Suppression System Tie-in
16 - ADA-Approved Horn / Strobe, Multi Candela
1 - ADA-Approved Strobe Light, Multi Candela
1 - Lot of Fire Alarm Cable & Conduit Raceway

Fox Valley Fire and Safety will install all equipment listed above throughout the common areas of the house, including all areas of the basement, all areas of the 1st floor with the exception of the two living areas, and the corridors, bathroom, and rack rooms on the 2nd floor. No fire alarm devices have been included in any of the individual sleeping rooms on the second floor. All fire alarm wiring will be installed in new exposed conduit raceway.

Upon completion of the installation, Fox Valley Fire and Safety will test 100% of the fire alarm devices installed. Fox Valley Fire and Safety will begin a 5-year warranty against faulty equipment and a 1-year warranty against faulty installation labor upon completion of the final test.

Your cost for the scope of work as described above: ---------------------------------- $25,975.00

Price Exclusions:

- Sales Tax
- Overtime Labor
- Permit & Review Fees
- Carbon Monoxide Detection
- Products & Services Not Listed Above

(Continued on Page 2)

DIVISIONS

Extinguishers/Kitchen Systems • Fire Suppression • Fire Sprinkler • Security Alliance • Fire Alarm • Emergency Lights

FIRE & SAFETY.

ONE COMPANY DOES IT ALL
2730 Pinnacle Drive • Elgin, IL 60124
Phone 847-695-5990 • Fax 847-695-3699
www.foxvalleyfire.com

PURCHASE AGREEMENT

This agreement made between **FOX VALLEY FIRE & SAFETY CO., INC.** an Illinois Corporation (Seller), and Delta Tau Delta (Purchaser), and dated this 25th day of November, 2009

Purchaser hereby agrees to purchase from Seller the equipment and accessories described below, and hereby authorizes Seller, if required by the terms hereof, to install the equipment at:
3349 S Wabash Chicago, Illinois
Attn: Josh

Equipment Description

Fox Valley Fire & Safety will remove and dispose the existing signs that do not meet Chicago codes.
We will provide the following equipment per the City of Chicago Fire Department codes:

8 - Single glass "Exit" sign with battery back up.
2 - Double glass "Stairs" sign with battery back up.
2 - Double glass "Exit" sign with battery back up.
12 - Emergency light with battery back up.

Purchase Price of Equipment	$	2,043.47
Engineering, Submittals & Permits	$	Not Included
Installation	$	3,456.00
Option:	$	
Sales Tax	$	**Not Included**
TOTAL PURCHASE PRICE	$	5,499.47
Less Deposit	$	
Balance	$	5,499.47

Accepted by:
FOX VALLEY FIRE & SAFETY CO.
By: Larry O Paris
Larry Paris
Date: November 25, 2009

Accepted by:
By:
Date:

DeltaTauDelta.xls R05/08

`