

**AC 2010-331: SCHOLARSHIP OF ENGAGEMENT AND PROJECT BASED
LEARNING: EXPERIENTIAL BASED LEARNING PROJECT FOR
CONSTRUCTION MANAGEMENT STUDENTS AT WESTERN CAROLINA
UNIVERSITY**

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Scholarship of Engagement and Project Based Learning: Experiential based learning project for construction management students at Western Carolina University

Abstract

The Peggy Crosby Center located in Highlands, North Carolina is a multi-use complex that was built in the late 1800's. Originally built as a private dwelling and after many years it was donated to the village of Highlands. The structure received renovations and additions over the years when it became the regional hospital for the area. Upon the recent completion of the new regional hospital the Peggy Crosby Center became a not for profit establishment for the community. It currently houses a computer training center, day care center, used bookstore, Red Cross offices, and a catering business, along with other use groups. During the fall of 2008, members of the Peggy Crosby Board of Directors approached the faculty of the Construction Management program to assist them with needed updates and renovations for their building. The faculty provided plans, estimates and recommendations for a various number of issues. This paper discusses the results of the consultations by Western Carolina University faculty members for the Peggy Crosby Center and student work.

Areas of Concern and Question:

What is currently in place for energy efficiency and is it adequate?

What can be done internally to make the building more energy efficient?

What assessment can be made about the current heating system?

What alternative energy sources can be applied to the structure as upgrades?

Would the alternative sources be beneficial over time?

What building components need to be updated and replaced?

What renovations can be done to expand the use within the existing building footprint?

What costs would be incurred?

How long will renovations and upgrades take?

Key words: engagement, project based learning, experiential learning.

Introduction

The Peggy Crosby Center located in Highlands, North Carolina is a multi-use complex that was built in the late 1800's. The structure was originally built as a private dwelling and then after many years, the building was donated to the village of Highlands. The structure received renovations and additions over the years and eventually became the regional hospital for the area. Upon the recent completion of a new regional hospital, the Peggy Crosby Center became a nonprofit establishment for the community. It currently houses a computer training center, day care center, used bookstore, Red Cross offices, and a catering business, along with other groups.

In 2008, the Construction Management Department became involved in a lengthy discussion with the Board of Directors of the Peggy Crosby Center. The board became concerned with the rising costs of electricity and heating fuels and felt that alternative energy may be needed to meet the economic demands of the Center, therefore, keeping it a viable asset for community development. Various rooms have become vacant and renovation projects have been discussed. Many updates and upgrades to the structure must be considered due to lack of upkeep in previous years.

The board had several issues which they planned to address. Specifically, their primary questions were:

1. What is currently in place for energy conservation?
2. What may be done to make the building more energy efficient?
3. What improvements may be made about the current heating system?
4. What alternative energy sources may be of benefit to the structure?
5. What building components require update or replacement?
6. What renovations can be done to expand the use within the existing building footprint?
7. What costs would be incurred?
8. How long will renovations and upgrades take?

Discussion

These are a few of the concerns that the board expressed to the construction management faculty during meetings early in the project.

This engagement project was viewed by faculty members as an excellent way to open up relationships between the community and the university. Service and outreach are important elements in the mission of Western Carolina University. Three faculty members developed plans for an outreach project involving the Peggy Crosby Center which included student engagement, faculty interaction, university service, and construction industry and supplier interaction as elements. The first step for the faculty members involved in the project was meet with the Peggy Crosby Board of Directors to hold a question and answer session defining the needs of the center, the degree of appropriate student participation, services to be performed by faculty, and future possible uses for the Center.

The next step for the faculty and students involved in the project was to conduct an initial site visitation. The faculty received floor plans, toured the complex, assessed the windows and roof, and inspected fire suppression systems, heating and cooling systems, lighting, and insulation. After the site visit, students and faculty members reviewed all notes and assessments, discussed options and action plans, performed critical thinking for price point considerations, started energy audit calculations, and solicited outside supplier quotes.

The findings of the site visit and subsequent analysis were presented to the Peggy Crosby Center Board of Directors in a meeting to discuss plans for the continuation of the project and re-

evaluate the scope of work after preliminary estimates for the renovation of the porch area and window replacement were submitted. The scope of work was also presented to students in the Estimating II and the Scheduling classes, and criterion was developed for a formal estimate and schedule by individuals of the respective classes. This new information was reported to the Peggy Crosby Board of Directors during the summer of 2009. The Board is currently seeking funding resources for the continuation of the project.

Energy audit synopsis

On September 17th, 2008, an energy audit of the Peggy Crosby Community Service Center (the Center) was performed by Western Carolina University faculty from the Construction Management Department to determine if any savings could be realized through modifications or updates of facility systems. The building is a brick building, generally well-maintained. The building lighting system consists mostly of four feet fluorescent fixtures and incandescent lamps. Air conditioning is provided by seven (7) modern, split type Trane air conditioning units.

There are a catering kitchen, Early Head Start daycare facility, bookstore, Red Cross Response Center and various office spaces within the Center. The Center operates from 6:30 am – 9:00 pm weekdays with reduced hours on the weekends. The annual power bills for the facility amount to about \$23,154 per year for electricity and propane. Electricity accounts for about \$7695 per year, averaging about \$662 per month, see figure below.

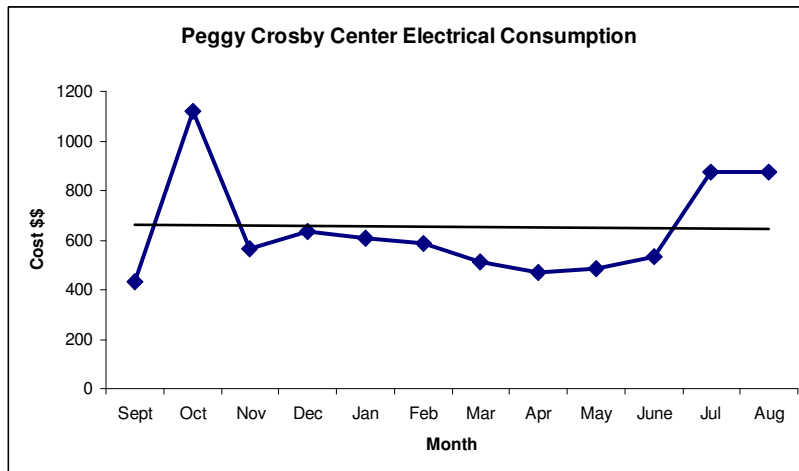


Figure 1: Electrical Consumption

From observation of the bills, it appears that about 10% of the costs are due to demand charges. With the information given, we were unable to determine the reason why the demand charges varied so much, from \$9.36 to \$156 per month. We recommend that you meet with Highlands's city officials to determine if the meter is read by the same person each month and that the demand charge is consistently determined.

Propane is the primary fuel, in terms of cost, used at the Center. From observation of the bills, it is clear that propane is used primarily for heat in the winter-time. Propane usage amounts to about \$15,459 with most deliveries occurring during the winter months see figure below.

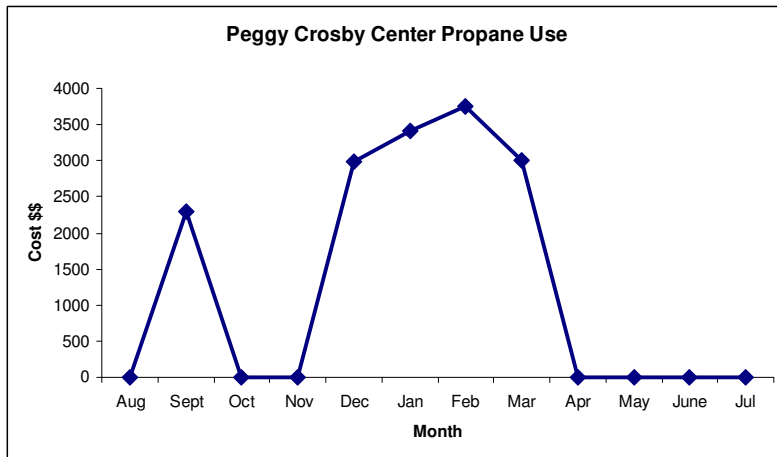


Figure 2: Propane Use

The thermostats through-out the building should be set on 68 degrees F in the winter and 78 degrees F in the summer according to the US Department of Energy (USDOE). But, everyone has different comfort levels. It may be difficult to deal with the tenants on this issue, but we would recommend electric baseboard heating to keep the colder natured folks happier in the winter-time, if they can be controlled and not left on all the time. Electricity costs the center between \$1.90 and \$3.37 per 100,000 BTUs, whereas propane costs about \$3.42 per 100,000 BTUs. Electricity is generally a cheaper fuel for the Center. If electrically operated heaters, with carefully controlled thermostats, are installed through-out the Center, a savings of almost \$4500 per year could be realized assuming the use of baseboard heaters, comparable equipment efficiencies, propane cost of \$3.14 per gallon and an electricity cost of \$0.071 per Kw-Hr. Even more could be saved with heat pumps. We recommend installing a packaged type heat pump in the daycare area which will provide heat for the small children with a minimal amount of ductwork. A new unit will cost between \$6000 and \$10,000 installed, depending on the size required, will have a very good payback and will provide more flexibility for Center users in comfort temperature choices. Installation of new, gas filled windows through-out the building will also contribute to a reduced consumption of propane, a quote is attached.

An Extech, Easy View 31 light meter was used to check lighting throughout the building. The lighting levels appeared to be adequate in the hallways and the offices checked. Task lighting seemed to be available where needed. Most of the hallway lighting had been replaced with T-8, 32 watt type fixtures. In most of the offices, the old type T-12, 40/34 watt fixtures and lamps were still used. We did not recommend any replacement of fixtures in offices which are little-used. We did recommend that all T-12 fixtures be checked to ensure that the 34 watt energy-saving bulb is used instead of the standard 40 watt bulb. For every ten fixtures with 34 watt bulbs, about \$4.00 per year could be saved on the electric bill by using the 34 watts instead of the 40 watts bulb. On the back porch, open area, incandescent bulbs are used to light the area. We recommended compact fluorescent lamps (CFLs) be used instead. Considering the extended

lifetime of these bulbs versus the standard incandescent bulbs, they do not cost more to purchase and cost considerably less to operate. For the seven bulbs, each of 60 watts, about \$30 per year could be saved assuming the porch is lit only about 4 hours per weekday, on average. In summary, the Center appears to be well maintained. The largest savings potential is reducing propane usage. The primary recommendation of this audit is to install a packaged heat pump unit in the vicinity of the Early Head Start area. In addition, the demand charge calculation method needs to be clarified.

Structure Assessments

The building structure was reviewed and several areas needed attention. Minor items were addressed such as ceiling penetrations (sealant needed), ceiling insulation, attic insulation, and minor sealing for air infiltration. The windows and doors were the major issue to be addressed. The rear portion of the structure was constructed of concrete block with steel frame louver windows. Many of the windows had been covered with Plexiglas or plastic sheathing. Several window frames were in need of repair and total replacement was recommended. An estimate was sought from an independent supplier and submitted to the Peggy Crosby Center Board of Directors.

The roof system needed repair and by the second visit had been replaced. It was later discussed if a Photo Voltaic Roof System would have been more efficient and would have reduced energy costs. With the new roof system in place, it would have been cost prohibitive to redo the roof system, and savings would not have been realized for years.

The rear porch portion of the structure was one area identified for future expansion. A design was needed to facilitate offices and a conference room. Working outside the Construction Management program, a student with a dual major degree in Interior Design was selected to undertake a design request. The following illustrations depict design applications that would meet the current needs of the facility expanding the usable space and opening avenues for future income.

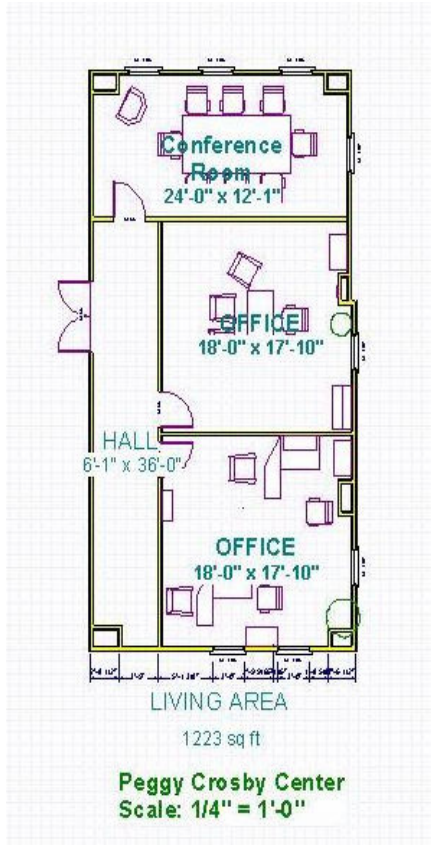


Figure 3: Porch Reconfiguration Design



Figure 4: Conference Room Layout



Figure 5: Dual Desk Office Space



Figure 6: Executive Office

Estimates and schedules were created for the windows and porch renovation portion of the project. The porch renovation will be an extensive undertaking and a list of some of the takeoff items is as follows:

1. Enclose foundation between columns – stud and plywood, siding, insulation
2. Vapor barrier under porch
3. Insulate floor joists
4. Sub floor – underlayment
5. New windows
6. New entry door
7. Interior wall partitions
8. Interior insulation – sound proof conference room
9. Gypsum and taping
10. Interior wall finishes
11. Baseboard moldings
12. Interior door and window trim

13. Grid type ceiling
14. Ceiling panels
15. Grid lights
16. Grid type ceiling insulation
17. Finish floor materials
18. Electrical wiring system
19. Heating system
20. Emergency exit signage

This project assisted the community by broadening the outlook of a not for profit environment that through the use of the computer training center, daycare center, and community outreach will greatly enhance the quality of living within the town and the community as a whole.

Conclusion

Teaching problem identification is the first step in developing students with problem solving skills. Assessing situations and drawing conclusions to requests from a client is requisite for all architects, engineers, and construction management students. Problem resolution in a step by step approach leading to creative development of the project outcomes leads directly into critical thinking processes. Outcomes are based and assessed on the participation, creation, reflection, resolution and acceptance by a client. Orientation and transition of students into their careers can be dependent on the processes undertaken in problem based learning and is relevant to the Peggy Crosby Center Project. Real life situations lend themselves to develop creative thinkers that can present their results in a professional manner. This project is still a work in progress. Further studies will be done and developed as funding issues are addressed and processed.

Bibliography

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Appendix

Presented: 03/26/09
 Valid thru:
 Reprinted:
 Submitted:

Quote for:

5 Crushy Court Center Addition

Qty	SKU	Description	Component	Price	Extended Price
(This quote was prepared 3/26/2009 5:49:37 PM)					
EXTERIOR WALL					
2 EA	60462	12in x 80f COPPER FLASHING LAMINATE	TERMITE SHIELD	122.96	\$205.92
8 EA	2516ACQ	2X8X16 ACQ TRIMMENT	TREATED PLATE	9.47	\$75.76
88 PC	2895	2X8X9 PET	STUDS	4.47	\$393.42
15 PC	2816S	2X8X16 SPF	TOP PLATE	5.88	\$87.75
INTERIOR WALL					
6 EA	2616ACQ	2X8X16 ACQ TRIMMENT	TREATED PLATE	9.47	\$56.82
85 PC	2895	2X8X9 PET	STUDS	4.47	\$379.55
14 PC	3318S	2X8X16 SPF	TOP PLATE	5.88	\$82.35
FIRST FLOOR SYSTEM					
3 EA	90416	40' 3 1/2" BEAM SEAL	SILL SEALER	4.95	\$14.97
36 PC	7160GB	7' 8 X 2 X 8 HUBER OGD SQ E GF	EXTERIOR SHEATHING	6.63	\$237.00
1 EA	90211	6' X 15' TYVEK	HOUSE WRAP	178.69	\$178.90
1 EA	90213	WHITE TYVEK TAPE	WHITE TYVEK TAPE	13.59	\$13.00
1 EA	90212	6X150 FOOT WINDOW WRAP	WINDOW WRAP	24.49	\$24.49
DOORS & WINDOWS					
1 EA	SC01N	SPECIAL ORDER DRWDWS quote #2020 in packet	WINDOW PACKAGE	42,809.72	\$42,809.72
INSULATION					
19 EA	R1510K	R15 31/2X15X98 FG INSUL 67.01	WALL	45.65	\$871.15
23 EA	R0624K	R38 24" OC, 64 SCFT/ROLL	CEILING	54.93	\$1,261.09
1 PK	90470	16" JOIST TEETH BOX	JOIST TEETH 16" BOX	22.63	\$22.63
84 PC	90006	1/2 X 4 X 12 SHEETROCK	DRYWALL	11.21	\$941.84
INTERIOR TRIM					
1 EA	43724	30" L.H. DW - 8 PNL INS Flush Metal Door	2'8"-30" STEEL	179.27	\$537.01
3 EA	88304	F10 SIC 718 PASSAGE SCHLAGE	HALL & CLOSET DOORS	31.80	\$95.07
1436 LF	18RADI4	1X6 RADIATA PINE	CASING	1.37	\$1,963.52
1435 LF	18RADI4	1X6 RADIATA PINE	CASING	1.06	\$2,820.23
305 LF	EC1195	EC1195 1 1/16 X 2 1/2 STOOL	2 1/2" STOOL	0.97	\$299.60
12 EA	91812	3/4 X 12" FIRE RATIO WALL MOLD	CEILING TILE COMP	9.17	\$110.04
16 EA	93813	CUSTOM WHITE 12" MAIN RUNNER (Wall)	CEILING TILE COMP	13.76	\$220.96
120 EA	91817	CUSTOM WHITE 2" CROSS TEE (Main)	CEILING TILE COMP	2.86	\$343.00
7 EA	81846	8US CEILING 12" TIE WIRE (2T)	CEILING TILE COMP	1.31	\$9.17
144 EA	11372004	ACOUSTICAL LAG Z 14X4 (Lags)	CEILING TILE COMP	0.27	\$38.88