



A TRAC-Oxfam-SIGUS/ MIT collaboration toward 'Sustainable Housing on the Bayous'. This project is a part of an initiative to rebuild homes destroyed by Hurricanes Rita and Katrina on the bayous of southern Louisiana, and to protect against future hurricane challenges. A broad range of interventions are considered: rebuilding and repair, outreach and training, and regulatory processes, for the formal and informal construction sectors.

Occasional Working Papers



Design-Build Research: TRELLIS System for Hurricane Areas

Christopher Guignon and Alice Rosenberg
8 April 2007

A report from the SIGUS design-build workshop 'Sweat! Design! Build! in January 2007 led by Zachary Lamb, focused on practical solutions in the hurricane prone bayou communities.

Design-Build Trellis Team:
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TRELLIS SYSTEM IN HURRICANE AREAS

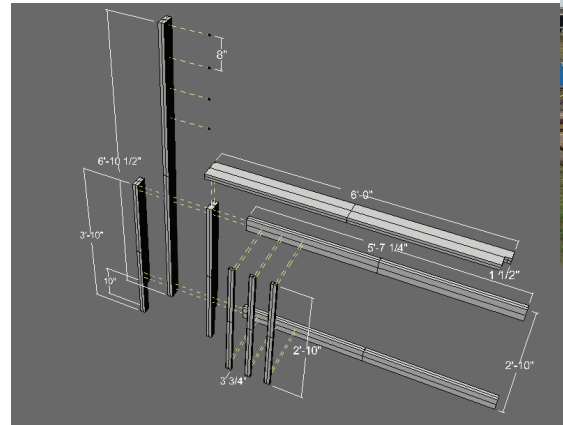
The integrated trellis/railing system addresses the following issues:

- Climate: High wind and temperature were the driving considerations: structure provides shade while allowing heavy winds to pass through with minimum damage.
- Safety: Secure railing system encircles the house on three sides.
- Economic: Materials affordable and available locally
- Construction: Easily constructed by volunteer labor
- Image: Sensitive to local aesthetic



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A project of the SIGUS design-build workshop 'Sweat! Design! Build!' in January 2007 focused on practical solutions that resist hurricanes while affordable to the bayou communities.



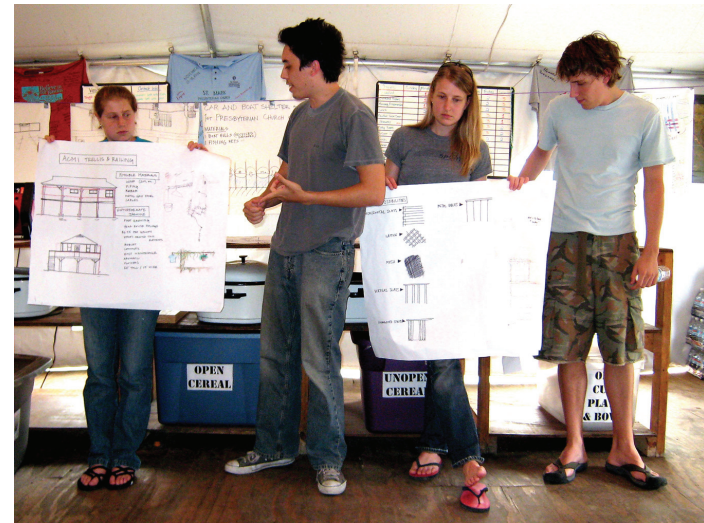


Trellis and railing system as envisioned in the Lift House.

Preface

In January of 2007 a team led by Christopher Guignon and Alice Rosenberg, with the help of Ian Kaminski-Coughlin and Marika Kobel, set out to design and build a prototype railing/trellis system for the 'Louisiana Lift House'. The initial reaction was to use lightweight materials not commonly associated with deck railings--metal electrical conduit could be bent and connected to produce an innovative, if not totally secure, lightweight trellis system.

However, after spending a week working with residents of Houma, Louisiana, and talking with Miss Betty Adams, the first Lift House resident, it became clear that this design/build exercise was less a matter of "contemporary design" and more a matter of offering a smart solution that might start to replace that which had been lost. With this in mind a lightweight, easy-to-construct system was developed that would be familiar and manageable by the inhabitants of future Lift Houses.



Alice Rosenberg

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1 - DESIGN CONSIDERATIONS FOR THE TRELIS AND RAILING

1.1 Introduction

The integrated railing/trellis system was designed for the Louisiana Lift House project to tackle the following issues:

- **Climate:** Semi-tropical winds and temperatures were the driving consideration in the design of the trellis. Needed was a structure that would provide shade while allowing heavy winds to pass through with minimum potential damage;
- **Safety:** A secure railing system was requisite for the deck, which encircles the lift house on three sides;
- **Economic:** Materials must be affordable and available while being suitable for the climate;
- **Construction:** The system must be easily constructed by volunteer workers;
- **Context:** Design of the railing/trellis should offer a familiarity that is sensitive to the regional or neighborhood aesthetic.
- **Customization:** The user should have the ability to modify the system to personal specifications.



Full size mockup of trellis/railing system



Fig. 1 Confederate Jasmine

1.2 Climate

Southern Louisiana has a humid subtropical climate; summers can be oppressively hot and humid, while winters tend to be relatively mild. Hurricanes pose a serious threat to the area, and the land's low elevation makes homes extremely susceptible to flooding. Our main objectives for the trellis were to make it structurally durable against wind and rain, as well as shade the sides of the house and porch area from excessive solar heating.

Our solution was to provide a lightweight structure that could be used as a support structure for a climbing plant. Confederate Jasmine (Fig. 1) is the suggested variety of climbing plant. A vinelike evergreen, Confederate Jasmine maintains its leaves throughout the year, is affordable, and requires minimal upkeep.

Lightweight, water-resistant rope or clothesline acts as the actual trellis structure on which the plants can grow. High winds are able to pass through this structure and the potential for damage is reduced due to the lightweight nature of the materials.

The trellis posts are supported by the railing posts and are designed to "float" two inches above the deck, thus minimizing the potential pooling of water against the structure due to Louisiana's frequent precipitation.



Fig. 2 - Example showing bolted posts and raised 2x4s.

1.3 Safety

The railing provides a necessary perimeter to the deck and is supported by cut 2x4's anchored into the side of the ten inch thick deck.

As stated, the trellis system was designed to minimize material and weight to reduce stress on the railing into which it is integrated. Additionally, clothesline or cable can be attached from the top of the trellis posts to the rafter tails to provide additional support for the entire system.

1x2 rails are positioned less than 4 inches apart due to code restrictions on railings.

Material	Length (ft)	Price (\$/ft)	Per Bay	Total (x23)
1x2	36	\$2.64	\$12.96	\$298.08
2x4	27	\$3.26	\$15.12	\$302.40
2x6	6	\$6.26	\$5.16	\$103.20
3/4"x1/4" Eye Rings	13	\$0.74	\$9.62	\$192.40
Lag Bolts	4	\$4.32	\$17.28	\$345.60
1/4"D x 5' Cable	1	\$8.74	\$8.74	\$8.74
Confederate Jasmine	1	\$6.99	\$6.99	\$6.99
			TOTAL	\$75.87
				\$1,257.41

Fig. 3 Approximate cost breakdown

1.4 Economy

The railing/trellis was designed to minimize both material and labor. The entire structure is built almost entirely with 1x2, 2x4, and 2x6 dimensions of lumber, readily available from most lumber outlets in the region.

Because all of the structural elements are of standard grade and conventional sizes, materials can be bought in bulk, reducing costs. Materials can also be retrieved by volunteer labor, due to their availability.

Figure 3 shows a rough estimated cost breakdown of the materials required for one standard six-foot bay as well as the entire perimeter railing. Bought in bulk, these prices will vary considerably.

1.5 Construction

The railing/trellis system was designed specifically with volunteer labor in mind. Each six-foot bay can be assembled by 1-3 volunteers in a short amount of time. Assembly requires simple techniques and requires no skilled labor. After a short safety workshop for a chop saw or table saw usage, any volunteer should be ready to assist on any aspect of construction.

Complex cuts are eliminated and connections are intuitive. This eliminates potential error, minimizes difficulty, and increases speed of construction.

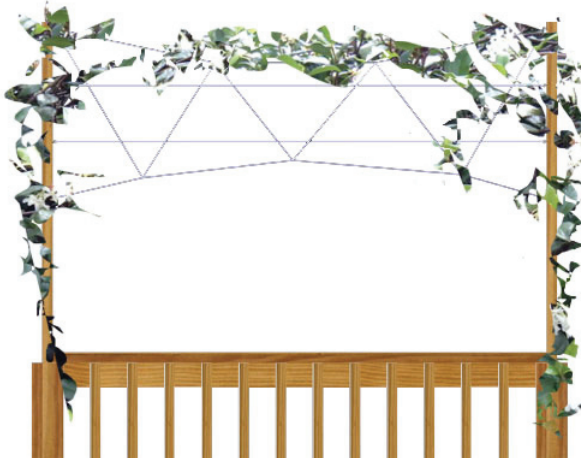


Fig. 4 Two variations for trellis configuration

1.6 Context

It became apparent, after speaking with the client, that the Lift House should provide a sense of familiarity of “home.” Therefore, the railing/trellis was designed to be innovative in its integrated systems but conservative in its aesthetic.

The Confederate Jasmine was chosen as a suggested shade-provider due to its evergreen qualities of keeping foliage year-round, its affordability, as well as its availability in Southern Louisiana. The jasmine is a popular choice for climbing plants and is common in the region.

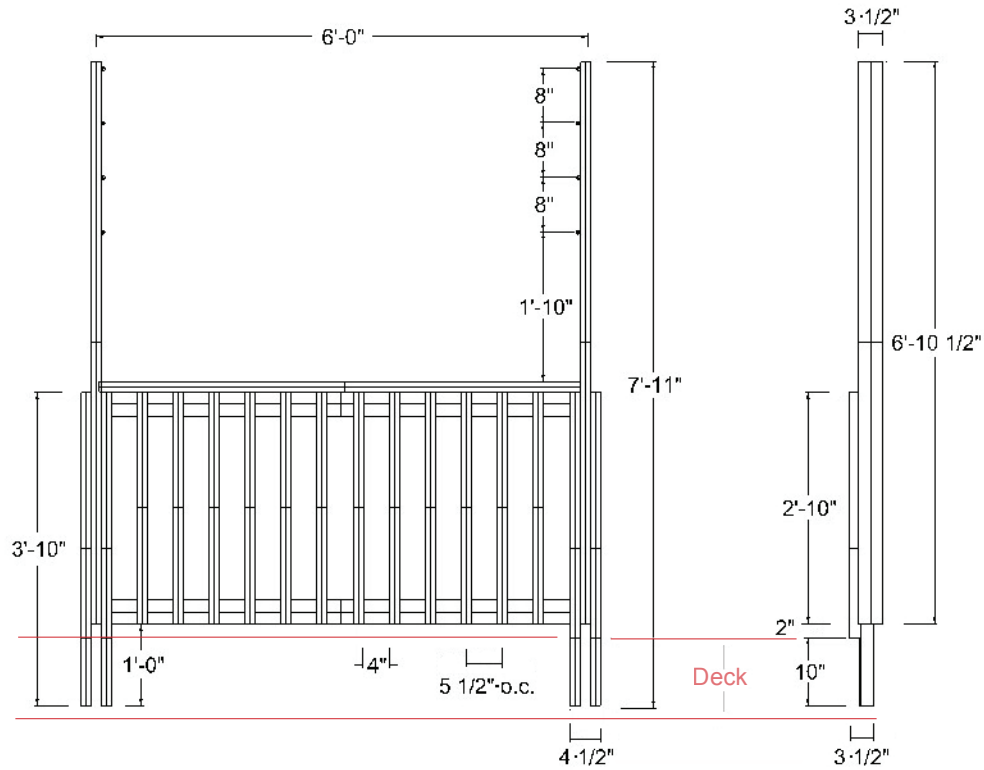
1.7 Customization

Early on we decided that we would like to allow a certain amount of user customization in the design of the trellis. Therefore, we offer Confederate Jasmine as only a suggested solution. Other varieties of shading can be employed by the user, including hanging potted plants, fabrics, etc... Or the user can decide to open certain bays for chosen views, by discarding the string trellis system or reducing it to preference.

Figure 4 shows two potential configurations for the string trellis, though countless variations are possible.

2 - SPECIFICATIONS AND DRAWINGS

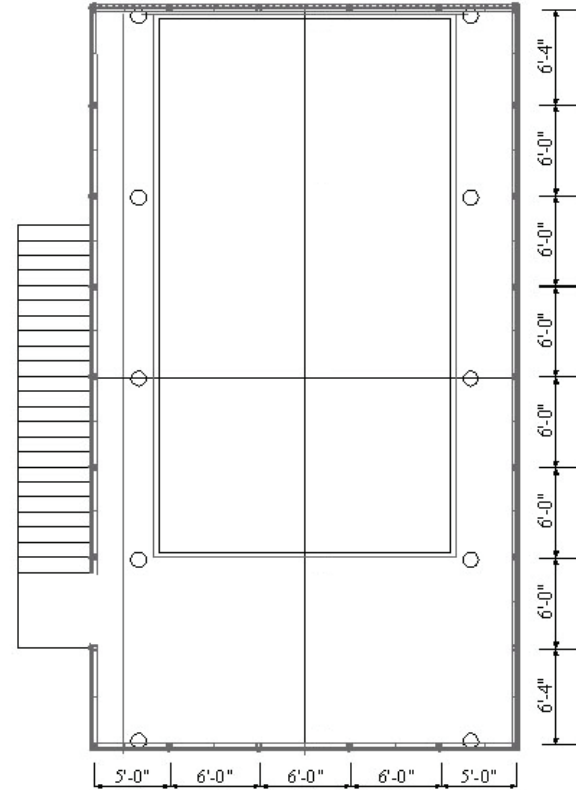
2.1 Standard Bay



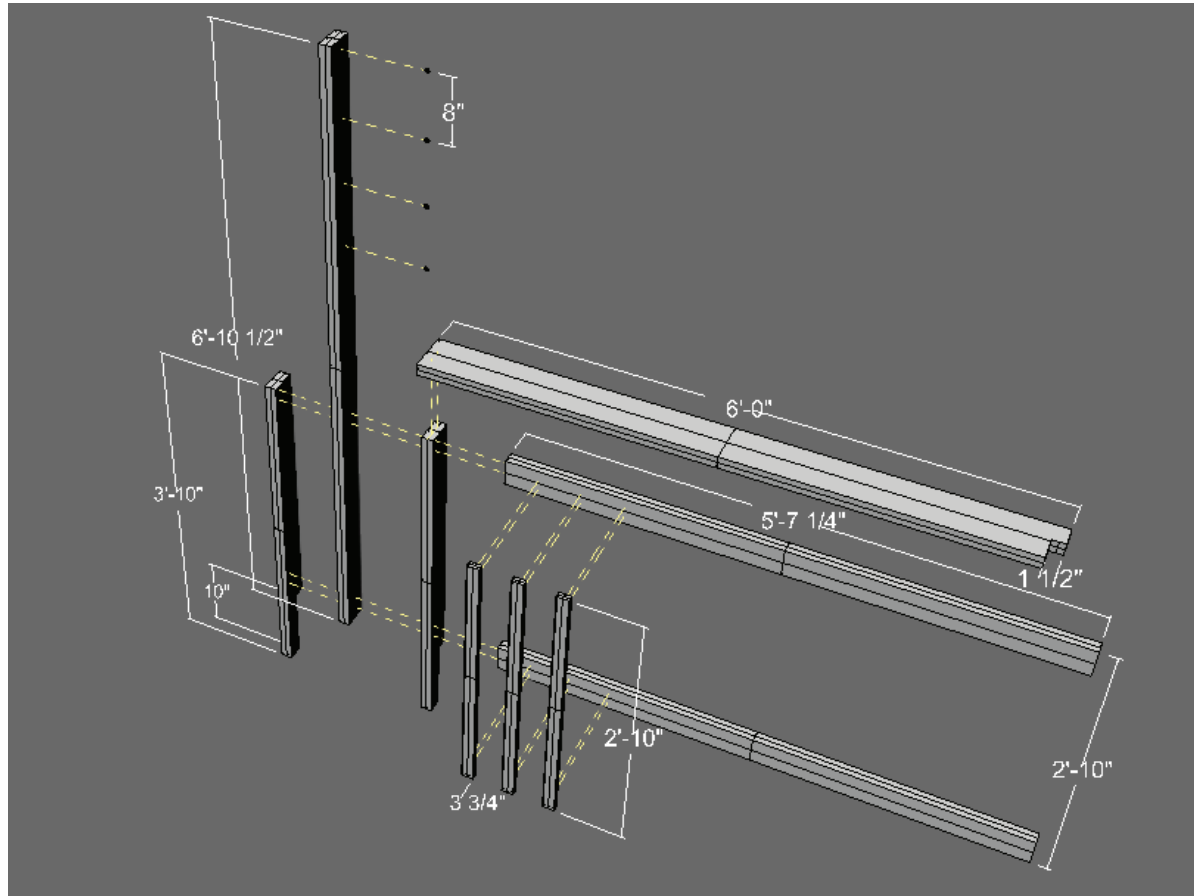
Front Elevation

Side Elevation

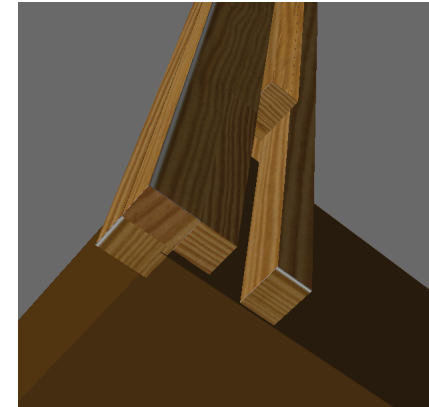
2.2 Plan showing standard bay and approximate corner bay lengths



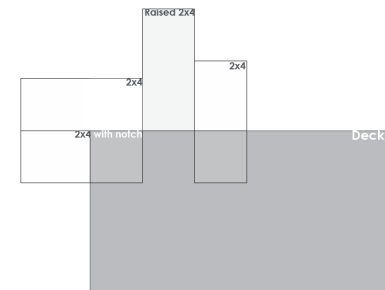
2.3 Dimensions and assembly of parts



2.4 Corner details



Isometric rendering

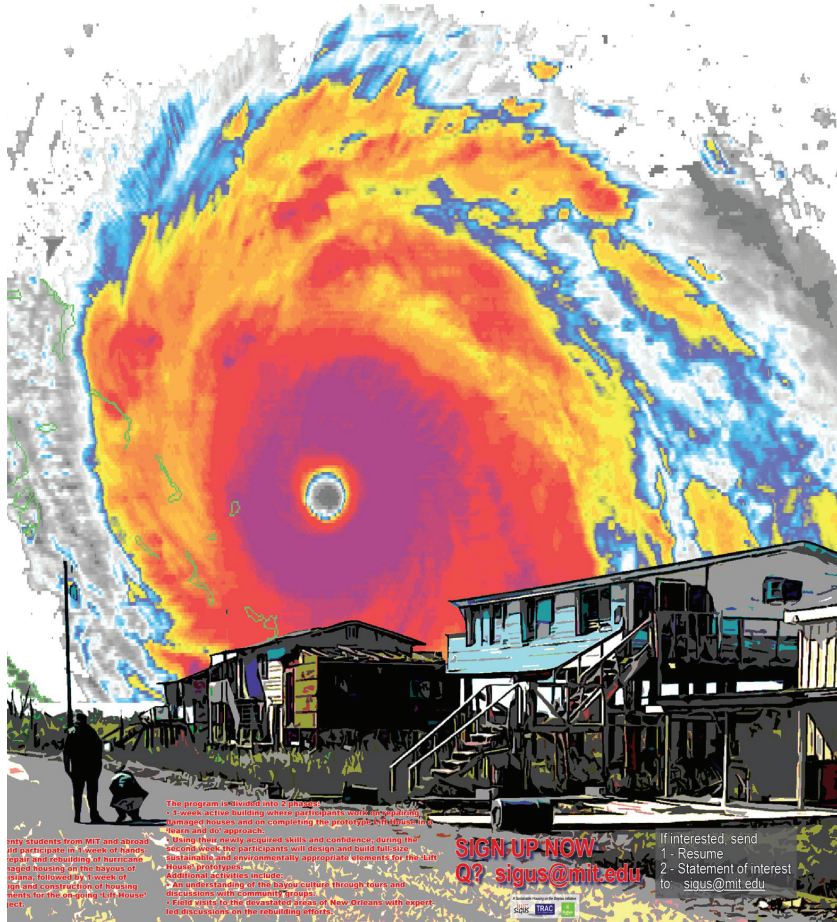


Corner detail plan

SWEAT! DESIGN! BUILD!



A Challenge to the Hurricane Twins Katrina and Rita
An International Two-Week Workshop
In Louisiana – January 6-20, 2007



The program is divided into 2 stages:
 1. A week of active learning where participants will be designing sustainable houses and completing the plan of their houses.
 2. A week of design and construction of the houses.
 During the design week, participants will gain hands-on experience with sustainable design and construction. They will be working with local architects and engineers to design and build houses that are sustainable and environmentally appropriate for the Gulf Coast region.
 Additional activities include:
 - A week of design and construction of the houses.
 - A week of construction of the houses.
 - A week of construction of the houses.
 - A week of construction of the houses.

Sign up now!
Q? sigus@mit.edu

If interested, send:
 1- Resume
 2- Statement of interest
 to: sigus@mit.edu

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