



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: OUTDOOR COVERED SINK PROJECT

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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.

OUTDOOR COVERED SINK PROJECT

An improved outdoor wash area for the PDA 'Good Earth Village'
Houma, Louisiana

Design of a covering that addresses the following:

- Be more than a sink and wash area!
- Act as a sanctuary and meeting point
- Development of an innovative 'water wall'
- Use of recycled materials, specifically PET water bottles
- Adaptable and semi-permanent use



A project of the SIGUS design-build workshop 'Sweat! Design! Build!' in January 2007 focused on practical solutions in the hurricane areas of the bayou communities.

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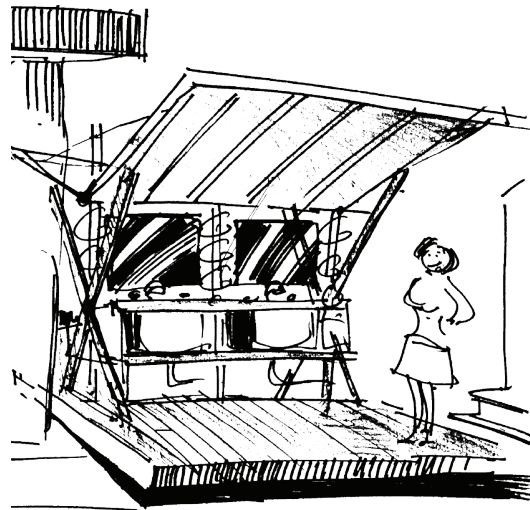
INTENT

We tackled the problem of building a rain screen covering for the sink area at the Presbyterian Disaster Assistance volunteer camp in Houma, Louisiana. The camp is a bare bones, temporary operation intended to house up to 80 volunteers at any one time. Outside of the single shower trailer, there existed four fully exposed outdoor sinks. In South Louisiana, it rains a lot, so the basic need for a rain shelter over the sinks was clear. We decided to push this need further and create a structure that would act as a little sanctuary and meeting point within the camp. We reconfigured the sinks to face each other, providing a division between men's and women's sinks. We wanted to incorporate the idea of flowing water into the project, it being very much part of the program, so we conceptualized a water wall where one could physically observe the convenient redirection of water provided by our little piece of overhead architecture.

Ultimately, we decided on a Y-shaped roof structure, draining centrally to a water and mirror wall, which symmetrically divided the men's' and women's' sinks. After noticing the piles of plastic water bottles discarded daily at the camp, we decided to incorporate them sculpturally into the water wall. Their use resulted in the creation of something beautiful out of a waste material, while concurrently calling attention to their omnipresence in our collective waste stream. We lit the bottles with recessed spot lights so that they would double as light diffusers at night. The roof was hinged at the center, so that it could be folded down to create an inverted "V" during a hurricane evacuation. In this configuration, the structure would be much more likely to survive hurricane force winds.



Original Sink Area
Note showers in trailer at back.



Concept sketch

ADAPTABILITY A KEY ISSUE

While some of the teams in our group undertook projects with the intention of creating prototypes that could be broadly applied throughout the Gulf coast region, the sink project at the Presbyterian Disaster Assistance camp was designed and built with a specific area at the PDA camp in mind. Nestled between the shower trailer and the kitchen structure, the project was site-specific, with decking connecting the showers with the existing plywood walkways, and sinks centered between the showers. However, certain design elements could be applied on a broader scale and adapted for use throughout the region.

Three areas were explored in the design development with particular concern for adaptability to the hurricane prone region: semi-permanence and storm resistance, and material use with intent to use recycled materials as much as possible.

Semi-Permanence

The PDA camps in the Louisiana region are designed as temporary shelters. In the event of a major storm, the official evacuation plan calls for the disassembly of all pods and tents, removal of trailers, and complete evacuation of the camp. While some permanent buildings are being constructed on the sites, the camp will most likely be demolished at the end of the PDA's eight-year commitment to the region. The evacuation plan has not been tested, but it is unlikely that there would be sufficient time or available resources to disassemble the camp in the event of a storm, and the majority of the temporary structures would have to be rebuilt. While it seems foolish to set up temporary structures in a hurricane prone region, it is inefficient to build permanent, hurricane resistant structures that will be torn down in less than eight years. Our semi-permanent design fits in between these two extremes. Its design features allow it to be able to resist hurricane force winds, yet could be easily disassembled with a minimal loss of material resources.



The 'iPods' shelters in the PDA Volunteer Village



The dining tent and toilet facilities

Storm Resistance

Several elements of the sink structure's design could be adapted for use in other projects around the region. The use of cable supports between the roof wings allow the majority of the load to be carried down the center wall, and the diagonal bracing along the sides is only required to balance the two wings. Because the wings fold down in the event of a storm, the bracing does not have to prevent uplift, and maximum roof coverage can be achieved with minimal bracing. When the roof wings fold down into an inverted 'V', they allow wind to flow directly over the structure, protecting the central drainage and mirror wall and creating down-force on the structure instead of uplift. Because the outer edges of the roof can be secured directly to the wide deck, the overall stability of the structure is enhanced, and it can resist hurricane winds with minimal material use. This could be used in other semi-permanent structures, or in permanent buildings for larger roof overhangs that fold down in the event of a storm, protecting glass windows and walls and negating the effects of uplift on roof eaves.



Roof in normal upright position



Roof folded down during storms

Material Use

Our intention was to build the structure out of recycled materials and scraps we found on our site. We were able to reuse the existing sinks, mirrors, and some plumbing lines; and we found the water bottles and corrugated metal roofing at the PDA camp. However, the majority of the framing lumber was bought at the store. Lumber is often difficult to salvage, but scrapped conventional building materials such as corrugated metal and PVC piping are readily available in the region, and can be reused to provide an efficient and safe roof. Items that are not typically used in building—in our case empty bottles—can also be adapted for use as a building material.

Bottle arrangement for 'water wall'



Plastics

In response to the use of as many recycled materials as possible in our design, the Sink and Awning Team was determined to find a way to incorporate PET [*polyethylene terephthalate*] bottles into their design and reduce the ever increasing quantity of spent water bottles at the camp. Why so many bottles at the camp? While the water at the camp was certainly potable, most of the resident volunteers were of the habit of drinking bottled water and found that habit hard to break, despite the fact that upon arrival we each received our own PDA-issue refillable water bottle. Furthermore, there is as of yet no recycling of plastics in the state of Louisiana.

Perhaps it was merely because we were unable to think 'outside the box' and separate our understanding of bottle form from our understanding of bottle function, but through a series of mock-ups we determined that the best way to incorporate the bottles into the sink structure design was as some sort of drainage or trough system. As the sink design became clearer, it occurred to us that the bottles could be used to create some sort of 'water wall'. This wall would serve four purposes: provide a translucent screen between the men's and women's sides of the sink area, transfer water collected by the roof away from the sinks and down underneath the deck structure, utilize a large quantity of PET plastic bottles, and be a pleasing display that enhances the aesthetics of the wash area.

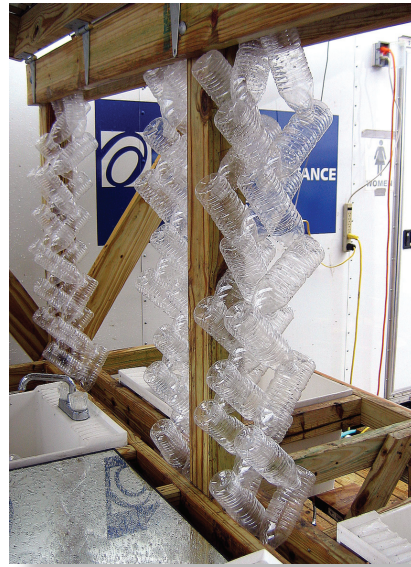
Our first intention was to connect the bottles end to end in a helix configuration that would coil about each of the three main posts. Finding the design to be fairly weak structurally and that there was a considerable amount of space left open about the mirrors—effectively negating our attempts to create privacy for both the male and female campers—we opted for a denser, more intensive use of the bottles. Again linking the bottles end to end, we created a 'herringbone' design. In order to link the bottles, we used utility knives to cut an 'X' on the side of each bottle near the base, then inserted the neck of the next bottle in the string into the incision of the first, thereby 'locking' it in place. Once we had three herringbone strings of eight bottles each, the strings were sandwiched together and adhered to one another by well-concealed dabs of clear silicone caulk. Allowed to dry, the water-wall sections were sturdy and ready for installation.

We used a 4" diameter PVC pipe cut in half lengthwise as a gutter trough between the two wings of the roof. A series of holes were drilled into this trough at points, aligning with the tops of the water bottle herringbones. Next, weighted strings were dropped through the hole with one end tacked to the trough with silicone. The idea was that water caught by the trough would flow through the drip holes, down the strings, and into the bottle system. The method worked, for the most part. Water did flow down the strings into the bottle network, but it also tended to run along the underside of the PVC and drip at will at a number of points. Luckily, that minor flaw was overshadowed by the wondrously pleasing--both aesthetically and audibly--way in which the water danced in the light as it trickled and flowed through the clear bottles down to the drainage pipes hidden by the sinks.

Sheltered as they are by both the awning structure and other surrounding structures, the bottles will likely suffer little in the way of wind or sun damage and be able to serve their intended purpose over the next 2-3 years of the camp's operation. Hopefully, when the time comes to dismantle the camp, recycling centers that accept plastics may be found in the area and the bottles can then be properly disposed of. Currently in Louisiana there are no public recycling centers that accept plastic, but there is hope for the future as it has been reported that a recycling center which accepts plastic is in the works for St. Bernard Parish and the 9th ward of New Orleans.



Rain collection trough to feed 'water wall'



The 'water wall' of recycled bottles

CONSTRUCTION SEQUENCE



AN UNANTICIPATED PHENOMENON

After installing the mirrors, which were suspended by thin steel cables in the dividing wall between the water bottles, we noticed an interesting and unexpected phenomenon. Because one can see through to the sinks on the other side in the space under the mirrors, and because the sinks are perfect mirror images of one another, when two people are washing their hands in opposing sinks an illusion occurs where it seems that the other person's hand is an extension of your own when operating the faucet. The effect is uncanny and can be observed in the photograph in this document, but to experience it in person really is amazing. This was an unexpected and pleasant result of our careful construction and attention to detail and symmetry.



Whose hands?

CONCLUSION AND REFLECTIONS

The project was remarkably successful for a six-day design/build project. By the end of day one, we had pretty much figured out what we wanted to do and started gathering materials. We knew it would be a lot of work, and it was, but we spent the next five days working tirelessly in order to complete the project before we left. It was a relatively small project, but it incorporated many different elements and skills: deck framing and laying, basic framing carpentry, roofing, plumbing, electrical, finish carpentry, bolting and working with steel cables. It had a little bit of everything and not too much of any one thing. We worked well as a group and were all motivated to leave the camp with a beautiful addition that will be used by hundreds of volunteers during the next two to eight years.

Shortcomings

In critiquing the shortcomings of our project, we felt that we could have made an attempt to better incorporate used or salvaged building materials. Although we used some salvaged materials in the bottles, mirrors, and metal roofing, all of the framing lumber was new. This was due mostly to the fact that new material is simply less time consuming to work with, and we were very much time constrained. Although the structure is probably overbuilt, we lacked an engineer on hand to reduce our anxieties about using less material or smaller members. So we played it safe and fast, but possibly another iteration of this design could be more structurally efficient.

In retrospect, we also would have used a different connection between the gutter trough and the water bottles. Instead of strings, we would have glued in smaller, short lengths of PVC tube into the holes, eliminating the possibility of surface tension allowing the water to flow along the underside of the gutter and drip freely. If only we had had another half-day, we could have fixed this, and possibly an MIT group in the future will be able to make this minor modification.



Reflections on future projects

Pedagogically speaking, the project was a success. It was an almost ideal design/build project in that it had a little bit of everything, was of an appropriate scale to complete in a week (albeit with several late nights working under lights), and it offered the instant gratification of a useful, unique product. The groups who worked on building components had a more difficult problem, as they weren't really working on something real. That is not to say that their work wasn't valuable, in fact, it has potentially more future value than a one-off project like a sink awning, but from a pure design/build project perspective, there is nothing like knowing that people, real people, are actually going to have to use, and hopefully enjoy using, the actual thing that you are making. Small projects like this offer a great way to train people in the basics of the building skills and demonstrate an immediate tactile connection between an idea, a drawing, and a built object.

We can begin to formulate a list of necessary components to assure the success of such a trip in the future. These 'success indicators' are:

Enough small projects that can be tackled by groups of 3-6 people in the allotted time. Time: the more, the better.

Projects that will result in something that is immediately useful and useable. This is a motivation that architecture students long for. The design should be left wide open, but it needs to be clear that this thing has to actually get built in the time allotted.

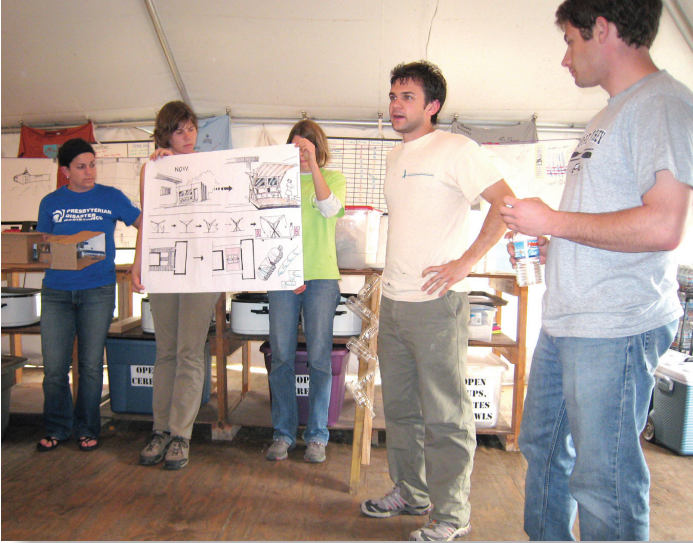
Tools, space: There should be enough tools for everyone to use, and there needs to be a space to work that is tolerant of being turned into a construction site for a week.

Skilled help. There should be at least one person in each group with a good breadth of construction experience. This person also should be comfortable in a teaching role, and he or she should be familiar with the philosophy of design education.

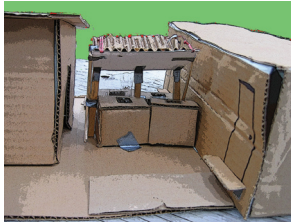
Sufficient budget: There needs to be a limit on spending, but there should be some budget, hopefully generous enough to allow each group to realize their vision.

Available materials: This is in many ways the trickiest and most time-consuming part of the equation. Trips to the hardware store can take half a day. At the least, there needs to be some good transportation to hardware stores. A generous collection of salvaged materials on hand is also a good idea.

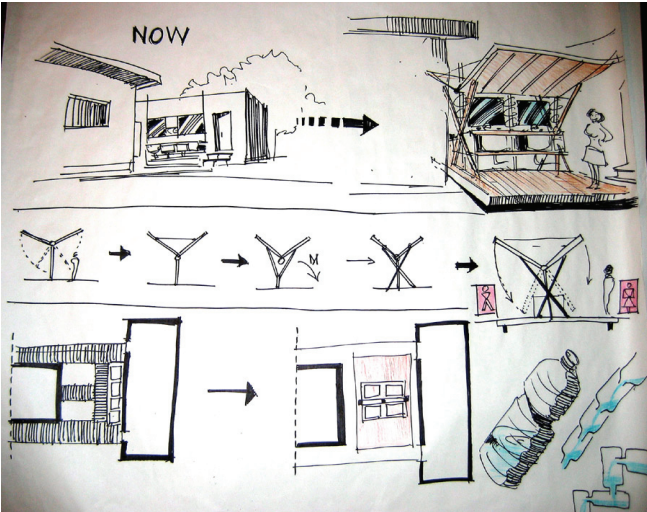
THE DESIGN-BUILD TEAM



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Early study model



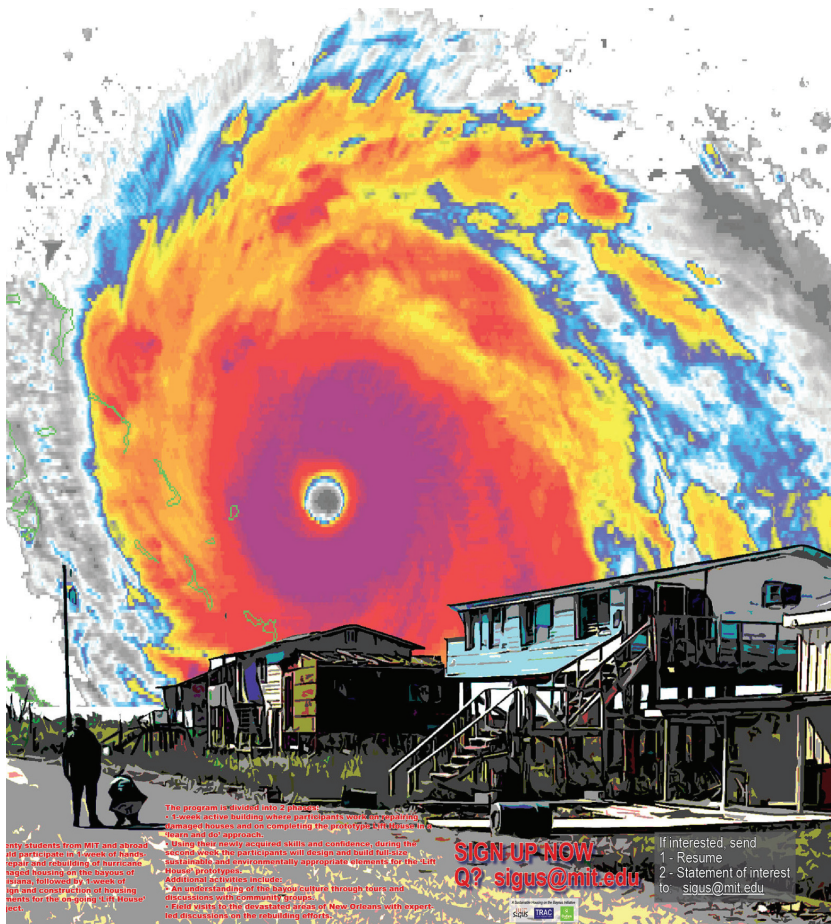
Sketch studies of sink+cover

SWEAT! DESIGN! BUILD!



A Challenge to the Hurricane Twins Katrina and Rita

**An International Two-Week Workshop
In Louisiana – January 6-20, 2007**



MIT students from MIT and abroad will participate in a week of hands-on design, building, or sustaining modest housing in the bayous of Louisiana. This workshop will focus on the construction of housing units for the ongoing "Life House" project.

The program is divided into 2 phases:
 1. Weeks of two meetings serve as a pre-workshop to investigate damaged houses and to composing the prototype and technical design and its approach.
 2. During their newly-acquired skills and confidence, during the second week, the participants will design and build full-size, functional, and environmentally appropriate housing for the "Life House" prototype.
 Additional activities include:
 • An understanding of the bayou culture through tours and discussions with community leaders.
 • Field visits to the devastated areas of New Orleans with expert discussions on the rebuilding efforts.

SIGN-UP NOW
 Q? sigus@mit.edu

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

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