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## SUBTROPICAL CITIES 2013: DESIGN INTERVENTIONS FOR CHANGING CLIMATES

**2013 ACSA FALL CONFERENCE CO-CHAIRS**

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Sustainable inhabitation can be defined as prolonged engagement of a physical environment to facilitate human existence without depleting or permanently damaging that environment. Human beings must alter their environments to serve their own needs, but most people never experience the infrastructure, systems and processes that make life possible. As technology and culture become more complex, our simple relationship with the places we inhabit has become equally complex and obscure.

Under the pressures of unprecedented energy consumption and climate change, how can we begin to question the way we inhabit a given place – especially rapidly changing deltaic landscapes such as that of the Mississippi River? We must begin to look critically at our relationship with these places and how we use their resources in order to make informed, responsible decisions about how we build and how we live into the uncertain future.

Historically, building existed as a natural response to the way people lived within a specific landscape. In his book The Control of Nature, author John McPhee tells us that the Louisiana landscape “…exists in its present form because the Mississippi River has jumped here and there within an arc about two-hundred miles wide, like a pianist playing with one hand - frequently and radically changing course, surging over the left or the right bank…” The Mississippi River carries one fourth of the watershed of the United States and created the land on which Southeastern Louisiana was built. The region is home to the largest combined port in the world in cargo tonnage between Baton Rouge and New Orleans and is a major producer and processor of domestic oil and seafood. Currently, Louisiana’s deltaic plain is also rapidly changing – losing 30 square miles of crucial wetlands every day due to sea level rise, subsidence and tidal erosion. It exists in a precarious state while the land-building power of the river has been truncated by the levee system that protects the livelihood of human settlement. This region is a critical juncture of natural systems, industry and humanity. How can site-specific events and processes such as natural and man-made geologic systems, agricultural and aquatic practices, plant and animal adaptations and historic settlement patterns inform the tectonics and mechanics of a new means of occupying such a place? The project aims to establish a paradigm for occupying the boundary between land and water, promoting an understanding of our unique relationship to this boundary and facilitating ways to live with it instead of control it. Its intention is to function as a catalyst for community-based sustainability and learning through direct interaction with the landscape and its resources. As such, the project includes mobile dwelling units and a permanent land-based component. Tourism, infrastructure and public venues for leisure, local trade and cultural immersion are key program components. The end-users include tourists, seasonal hunters and fishers, and permanent residents. Other relevant considerations include land-loss prevention, living with water, necessary infrastructure for modern life and how these elements interact with one another and the landscape.
Between Land and Water

"...How can we sustainably inhabit a given landscape?"

A synthesis of site-adaptive and life-sustaining activities throughout a cyclical calendar year according to season, geography and bathymetric and geomorphic conditions of the region. The program for the sustainable prototype is comprised of four key activities: rainwater collection, utility navigation, dredging and deposition, and hunting and fishing. Each activity is designed to work in concert with the natural and man-made systems of the Deltaic Region, facilitating ways to live with the boundary between land and water. It is our charge as global and local citizens to hold onto the wisdom of the place we live while simultaneously addressing the complexities of the world. We must employ a comprehensive and critical understanding of the local in order to establish a relevant and sustainable practice in the world.

SYNTHESIS OF SITE + HUMAN NEEDS

A 'tour barge' acts as a vessel to house the programmatic response to Southeastern Louisiana's diverse landforms and rich resources. It includes tourism, infrastructure and public venues for leisure, local trade and cultural immersion and facilitates a sustainable means of habitation.

HUNTING + FISHING
RAINWATER COLLECTION
LIVING
LEISURE
AGRICULTURE
DREDGING + DEPOSITION
UTILITY + NAVIGATION

A sustainable prototype

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Camino Nueva Vida is a design project in Las Pintitas, Mexico, just outside of Guadalajara. The development is an education center to teach vocational skills, entrepreneurship, management, community building and life skills. The neighborhood of Las Pintitas is high poverty, high density, high crime, and low opportunity. The project goal is a facility that embodies a sense of opportunity through education, community, and a clear direction for a new life. The design goals for Camino Nueva Vida (currently under construction) focus on engaging the client and the community through the impact of services provided within the building, the configuration and functionality of the spaces, and the construction of the development. It was decided early on that the palette of materials would be as exclusive as possible to items available within the community of Las Pintitas, both in terms of products and labor. Pulling inspiration from the traditional vernacular of the Hacienda, the project would also focus on the use of natural passive systems, roof top planter gardens, and the development of skilled labor to become self-sufficient with a low carbon footprint and the potential to move “off the grid” over time. The process began with simulation in the programming (discovery) phase to drive formative qualities and spatial relationships by building quantifiable data to inform the design potential within the local climate.

The core design idea for Camino Nueva Vida came directly from the client who wanted the design to stay in the vernacular of the Hacienda. Looking specifically at the Hacienda typology, it is important to note several key concepts directly influencing the project’s design: First, the Hacienda was a self-sufficient design, meeting all the core needs within the development. Camino Nueva Vida was designed with the spatial capacity to provide all of the food for the employees, students, and visitors as well as the ability to grow enough food to generate income. The capability of providing all power requirements (the current design takes advantage of passive systems) are currently being developed, as well as water retention, storage, and filtration. This will take the focus off of consumption within the development while emphasizing the quality of providing for the community. Second, the Hacienda combined productive activity with living spaces. All the spaces are designed with an emphasis on action, activity, and multiple uses. This creates an economy of size, will allow for future growth, and will seek to accommodate general activities over specific functions that will not be permanent as the services within the building begin to shape the community. Third, the project diverges from the Hacienda by reversing the physical and organizational pattern of the inner courtyard as an exclusive space for the Haciendado. Preserving the inner courtyard’s location maintains a familiar typology, while opening the courtyard on the major circulation axis evokes a sense of opportunity and equality.
Entry Plan: The lower level connects the staff and visitors entering on the South (bottom), to the Las Pintitas neighborhood on the North (top). The primary spaces on the entry level are the community room, class rooms, workshop classes, staff offices, and an on-site residence. Below: Axonometric section cutting through the first floor spaces.

Second Level Plan: The upper level is home to the primary dormitories for visitors to the site and school. Housing on the upper level provides additional security/safety, opportunities for passive cooling, and a direct connection to the roof gardens. Also on the second level are the residence bedrooms, and community rooms. Below: Axonometric section through upper floor spaces.

Camino Nueva Vida

The Camino Nueva Vida project, located in Las Pintitas, Mexico, is an education center to teach vocational skills, entrepreneurship, management, community building and life skills. The neighborhood of Las Pintitas is high poverty, high density, high crime, and low opportunity. The project goal is a facility that embodies a sense of opportunity through education, community, and a clear direction for a new life. Conceptually based on the traditional Hacienda, the design identifies itself with three key qualities of the typology: self-sufficiency by meeting all the core needs within the development, a combination of activity/work spaces and living spaces, and an inner courtyard. However, the project diverges from the Hacienda by reversing the physical and organizational pattern of the inner courtyard as an exclusive space for the Hacienda. Preserving the inner courtyard's location maintains a familiar typology, while opening the courtyard on the major circulation axis evokes a sense of opportunity and equality.
Kennedy Homes, Affordable Housing _A New Paradigm

In April 2012, the Department of Housing and Urban Development, Office of Policy Development and Research, for the first time, included “Using Housing as a Platform to Improve the Quality of Life”, as a research goal out of four primary goals in its Strategic Plan. Cited as priorities, was education, early learning and development, improvement of health, economic security and self-sufficiency, in various low to very low income population groups.

Kennedy Homes, Florida, provides a case study demonstration project on how housing can improve “quality of life”, creating a new paradigm for affordable housing. National and regional examples are reviewed for comparative climate sensitive and architecturally distinctive affordable housing references, with emphasis on the creation of multi-dimensional public, semi-public, private and semi-private, “collective and individual” spaces with an emphasis on architecturally significant project design as a basis for change.

At Kennedy Homes, local and regional confluences of climate, financial and urban constraints provide for a population of individuals and families of between 28% and 60% of area median incomes in Sailboat Bend, an historic district of Fort Lauderdale, Florida. Located on a significant urban corridor linking downtown and I95, the eight and a half acre site is a transit oriented greenway project exploring landscape and site as an historical redevelopment construct. Kennedy Homes is rooted in an architectural tradition of regional subtropical modernism with local construction techniques and a strategy of efficiency and innovation for affordable design. This USGBC LEED Gold for Homes project, currently being completed, includes adaptive use non-residential structures, eight new two to five story Senior and Multifamily residential buildings in a verdant two city block, including 132 unit urban sustainable courtyard environment of one, two and three bedroom units and community facilities.

Concepts and alignments are paired to provide measurable outcomes. Process and product, city and site, global and local, community and individual, modules and standards are explored in relation to the individual and the whole, the historical and contemporary, the city and the unit. Complex relationships between public and private spaces, safety and security, measured and balanced between the celebration of views, intimate spaces, and notions of place are inspired by the Florida Everglades and paired with urban form, climate responsiveness and traditional housing typologies. Concepts and solutions for volume and scale within the mega block and the unit are explored within the framework of conventional and modular construction systems and historic preservation.

Kennedy Homes proposes inclusive design oriented sustainable affordable housing with demonstrable outcomes for “quality of life” and the greater good.
Bamboo is an exceptional material. It can grow in almost any climate, but it is native to the tropical and sub-tropical areas. Although it is a very light material, bamboo is stronger than steel in tension, and more resistant than concrete in compression. Bamboo can be used at any stage of its growth, from early stages as a food, paper, and clothes, to its later stages for furniture, scaffolding, and finally as a building material.

As a plant, bamboo has remarkable ecological properties. It grows naturally without requiring fertilizers or pesticides, and it can capture carbon from the atmosphere and release 35% more oxygen than equivalent stand of trees. Additionally, because of its high nitrogen consumption, bamboo roots help mitigate water pollution by removing toxins from contaminated soil. And because bamboo regenerates within only two to three years - compared to trees that can take up to 10-20 years - it can serve as an alternative material to wood. In addition to its unique material characteristics, bamboo performs exceptionally well and survives under extreme conditions, such as fire, earthquake, cyclone, and even nuclear blasts, but also has the ability to prevent earth erosion, water run off, and mud slides.

But above all, bamboo is a highly sustainable material, not only because of its exceptional ecological properties, but also due to its socio-economic value. Because of its rapid growth, harvesting bamboo can be quite frequent and the return on investment comes much quicker. As a result, bamboo plantation projects are economically more appealing especially for farmers with little capital. In addition to that, because of its lightness and ease of handling, bamboo can serve as a social agent in creating jobs and empowering women in under-served communities.

Today, the complex nature of our problems – climate change, scarcity of our resources, and rapid urbanization - require a transdisciplinary approach. We need to re-think housing models, neighborhood typologies, energy and infrastructure, mobility and transportation, and finally building materials and construction technologies. In fact the building and construction industry is a major contributor to climate change and a key player in sustainable development. According to the International Energy Agency, buildings account for up to 40 percent of the total consumption of energy. But oftentimes a small-scale change, such as exploring materials and construction technologies, can have a larger impact on potentially addressing some of the pressing issues of our time.

But despite all this, we still know relatively very little about bamboo. There are over 1500 species of bamboo worldwide, yet the theoretical knowledge and practical application of bamboo have largely remained localized and have not been disseminated. Our research presents itself as a guidebook, which provides the basic introduction in using bamboo, and combines the contemporary knowledge on plantation, harvesting, treatment, and handling of bamboo, together with its application in construction and design. “BAMBOOKLET” promotes the application of bamboo as an ecological as well as socio-economic agent for sustainable growth and development in low-income communities especially in the tropical and sub-tropical areas worldwide.
INTRODUCTION

ECOLOGY
The bamboo plant is a versatile and adaptable species. It thrives in various conditions, from tropical climates to temperate zones, and can grow in a wide range of environments. Bamboo's rapid growth rate and ability to regenerate from underground shoots make it a valuable resource.

FLEXIBILITY
Bamboo's natural flexibility allows it to be used in a variety of applications, from traditional construction to modern design. Its ability to adapt to different forms and shapes makes it a unique and versatile material.

DURABILITY
Bamboo is highly durable, withstanding weather conditions and pests. It can last for decades, even centuries, depending on the species and care it receives.

LIGHTNESS
Bamboo is lightweight, making it easy to transport and handle. Its density is also adjustable, allowing for a wide range of applications from light footbridges to heavy-duty structures.

PRACTICAL APPLICATIONS

GROWING & HARVESTING
Bamboo grows rapidly, making it an ideal material for construction and other applications. Harvesting typically involves cutting the bamboo culms at the base, allowing the plant to regrow.

TREATMENT
To preserve bamboo, treatments such as drying, seasoning, and chemical preservation are used. These processes help to improve the material's strength and durability.

DRYING & HANDLING
Drying bamboo is crucial to remove excess moisture and prevent fungal growth. It involves several stages, from initial exposure to direct sunlight to final seasoning.

EDUCATION & TRAINING
Training on bamboo use and application is essential for its widespread adoption. Educational programs and workshops can help increase awareness and promote sustainable use.

JOINTEES, CONNECTIONS AND GOOD PRACTICES

PROJECT PROPOSAL: BAMBOO ROOF MACHINE

The bamboo roof machine is designed to provide shading, ventilation, and water collection while maintaining the aesthetic and functional qualities of traditional bamboo architecture. The roof system is constructed using bamboo poles and natural fibers, ensuring durability and sustainability.
Materials understanding is becoming more directly linked to architectural practice and to architectural education. Large-scale mock ups, prototypes of portions of assemblies, and design-build academic programs connect design decisions to understanding specific material properties. Tactile and visual qualities of a material are but a small fraction of the information regarding building materials that is available to and useful to designers and students.

We see our materials database and research projects as a bridge that connects students with area professionals on matters of innovative materials and sustainable materials. We receive little internal funding and therefore must seek grants for particular research projects. We have completed an analysis across twenty sustainable criteria for eight material applications for a new day care building. This work allowed the architects and building owner to select the materials that best aligned with project’s specific sustainability priorities. We are currently completing a carbon analysis for an office building under construction and tracking the carbon emissions used in the construction of the building including: manufacturing and transportation of building materials, waste, on site energy, and transportation of workers. This analysis will allow the developer client to be more strategic with carbon emissions for future projects.

We have also documented and cataloged building materials made within 500 miles of our city in order to serve as a resource to area professionals doing work in the area. We have also recently completed a database of local manufacturers and fabricators; this is a valuable resource to our students as well as area architects and designers.

Additional programs that connect students with area professionals include: monthly materials newsletters, lectures, exhibits, and tours of local manufacturing sites. Part of our mission is to get students excited to know more about building materials and their visual and tactile qualities. We also know that we have a responsibility to increase their technical understanding of materials and the implications of their material choices on this fragile environment.

Donna Kacmar
University of Houston
RESEARCH PROJECT TWO

CARBON @ 3009 POB

This research project, supported by a local developer, involves the carbon analysis of the construction of a concrete frame office building.

We documented the carbon emissions form the manufacturing and transportation of the largest items according to the schedule of values, along with the transportation of all materials to the site. The waste generated in the construction process, as well as all electricity and water used during construction. We are waiting for the building construction to be complete by September 2013.

The information gathered in all projects is shared with the local professional and student communities through our web site, electronic documents, physical exhibits in our materials library, and lectures.

carbon emissions analysis

We are exploring multiple ways to support our physical materials library and increase material understanding in our college through required student research and specific research projects. We are engaged with supporting the work of local professionals, including the architectural community, as well as contractors and developers, through semester end and academic year duration projects that provide opportunities for our students that link back to their increased awareness of the complexity of material decisions.

materials research collaborative
UNIVERSITY OF HOUSTON GERALD D. HINES COLLEGE OF ARCHITECTURE
Skin Treatment: Subcutaneous and Superficial Enhancements to a Legacy Curtain Wall

This paper coincides with the completion of the actual project for the south and west facades of a 20,000 sf two-story office building in suburban Baltimore originally completed in 1961.

‘Skin Treatment’ will look at a project for the curtain wall of 1961 office building in suburban Baltimore. It is an ordinary building of its period with ordinary problems like poor thermal and solar performance and a general need for TLC. As a child of the 60’s this building exhibits a visual composition of solids and voids rooted in the international style and implemented globally in the postwar years in which the voids in the style’s compositional binary are broadly translated into building systems as a curtain wall. While the iconic flat roof and its attendant leaks might have taken the brunt of the early building systems criticism of the modern movement, EPDM and other membranes have settled this issue leaving a more significant legacy of problems presented by the ubiquitous single pane, non-thermally broken aluminum curtain wall for today’s building owners and designers to wrestle with.

In looking at the legacy curtain wall, one is caught between the ongoing expense of ‘fueling’ the solution to the underperforming curtain wall through the continuous operation of the buildings mechanical systems or of ‘grafting’ a new insulation rich skin which will likely alter the patient/building beyond recognition. Sustainability, not to mention energy codes limits the first option and an appreciation of modernism or at least its historic significance as it passes the 50 year mark is cause for concern with the second option.

‘Skin Treatment’ involves both ‘subcutaneous’ and ‘superficial’ modifications to the building which address both the performance and the image of the legacy curtain wall. The ‘subcutaneous’ enhancements take place beneath the skin and include the application of additional low ‘e’ glazing, sealant and insulation producing significant gains in the systems thermal performance including a tripling of the buildings ‘R’ value equating to a 20% energy savings for the building overall. The ‘superficial’ and arguably more interesting of the performance enhancements take place above the skin in the form of a perforated metal rainscreen. The rainscreen both leaves the legacy curtain wall intact in an act of preservation and shades the surface of the building from direct solar gain. The act of penetrating one façade to support another provides the designer opportunities to reconfigure the building appearance as a form of aesthetic renewal that preserves rather than erases the original skin off the building.

The ‘skin treatment’ is presented as a sensitive approach to one of Modern Architectures common ailments not only with regards to improved comfort and performance, but also sensitive to what it doesn’t require including the need to dispose of an existing system or purchase a new one.
In looking at the legacy curtain wall, one is caught between the ongoing expenses of “slicing” the addition to the underperforming curtain wall through the continuous operation of the building mechanical systems or of “guting” a new exudation rich sec which will likely alter the performance beyond recognition. Sustainability, not to mention energy codes limit the first option and as an appreciation of modernities or at least its historic significance so it passes the 50 year mark is cause for concern with the second option.

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The “superficial” and arguably more interesting of the performance enhancements take place above the skin in the form of a perforated metal sunscreen. The sunscreen both leaves the legacy curtain wall intact in all its preservation and shades the surface of the building from direct solar gain. The act of permeating seems to support another idea, the designer opportunities to reconfigure the building appearance as a form of aesthetic renewal that preserves rather than erases the original skin of the building.

THE "SKIN TREATMENT" IS PRESENTED AS A SENSITIVE APPROACH TO ONE OF MODERN ARCHITECTURE’S COMMON AIEMENTS NOT ONLY WITH REGARDS TO IMPROVED COMFORT AND PERFORMANCE, BUT ALSO SENSITIVE TO WHAT IT DOESN’T REQUIRE INCLUDING THE NEED TO DISPOSE OF AN EXISTING SYSTEM OR PURCHASE A NEW ONE.
Learning from Environmental Energies and Building Form in the Gulf Region

This project presents a recent architectural design studio experience in which students in the Middle East were asked to design a Scientific Research Facility in the desert oasis city of Al Ain in the United Arab Emirates.

Coupled with a seminar entitled, Environmental Energies and Building Form, the studio investigated vernacular habitation patterns and craft of ancient desert dwellers in order to develop techniques for inhabiting this harsh environment.

In contrast to the incredibly incongruous development patterns of contemporary Emirati urban environments such as Dubai and Abu Dhabi, students recognize and appreciate the lost cultural and building traditions that were lost due to a shift from maritime industries to oil production. These building techniques have been examined and reinterpreted to align with modern construction and ways of living.

To frame this investigation, hybrid conceptual models were created. Rooted in the process of making, the models are hybrid in nature because they are roughly the size and scale of the assigned building program but unlike an architectural model, they are not meant to represent larger architectonic assemblies.

Students are asked to imagine a construction partially authored by the site; and in so doing, create a proposal that is extremely site specific and therefore inherently sustainable. The “graining” of the landscape or the fabric of the natural context is revealed as an ordering system that is not constrained by the limitations of imagining their projects, first and foremost, as buildings.

The process allows students not only to challenge counterintuitive notions of sustainability but also forces them to make things with their hands and bodies. Students engage in craft at a large scale; one that allows them to understand the muscular memory of making something that moves beyond an intellectual exercise alone.

The vernacular techniques examined have allowed people to exist in the region for tens of thousands of years and include courtyard house typologies, Arish (palm) construction, Bedouin weaving, Mashrabiya screens, Dhow boat-making, sand baffles, sewing of lateen sails, wind towers, qanat tunnels, and falaj channels, to name a few.

Through a variety of modeling approaches such as soldering, welding, casting concrete, working with carpentry tools, or CNC routers, the students create an objet d’art that stands autonomously to reveal and reconcile site forces such as sun direction, prevailing winds, watershed and erosion, ecological patterns, and zoning/contextual constraints. The piece establishes sensibilities in solving site strategy, programmatic configuration, building systems, form, and materiality.

Beginning with orthographic projection, architectural drawings are produced that encode programmatic relationships and an architecture emerges from these sensibilities that aspires to be both environmentally sensitive while maintaining cultural authenticity.

Joe Colistra
University of Kansas

Nilou Vakil
University of Kansas
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The vernacular techniques examined have allowed people to exist in the region for tens of thousands of years and include courtyard house typologies, Arish (أريش) construction, Bedouin weaving (تطريز)، Mashrabiya screens (نافورة)، Dhow boat-making (بناء سفن دحى)، sand baffles (مصفافات الصحراء)، sewing of lateen sails (تطريز علائم)، wind towers (رباع)، qanat tunnels (قنات)، and falaj channels (فلاح)، to name a few.

Through a variety of modelling and construction techniques, they reveal and reconcile site forces such as sun direction, prevailing winds, watershed and erosion, ecological patterns, and zoning/contextual constraints.

An architecture emerges from these sensibilities that aspires to be both environmentally sensitive while maintaining cultural authenticity.
Our planet requires designs and construction methods that are energy efficient, environmentally stable, and socially responsible. Collaborative design teams of architects, engineers, consultants, and clients recognize typical construction activities consume enormous amounts of resources and produce vast quantities of waste. As the EPA reports, “building construction, renovation, use, and demolition together constitute about two-thirds of all non-industrial solid waste generation in the U.S.” This presents opportunities to think and design outside the typical recycled and/or newly manufactured environmentally friendly material palettes often considered the go-to wheelhouse for sustainability.

What if scrap materials, re-appropriation of salvaged materials, and typical soil spoils from excavation become inspiration? The volume of waste and how waste can be appropriated represents both stewardship of material economy and the resultant eclectic composition of found and/or reconditioned objects providing a unique combination of aesthetics and functionality. Research, experimentation, and physical design projects can demonstrate novel ways of using salvaged materials or bi-products. Declining and decaying landscapes can be reimagined through the functionalism and aesthetic nature of salvage-based design. Pedagogical approaches can introduce students and frame an understanding of the inspirational potential for salvaged materials, reducing waste, and addressing compound climate changes.

Designers in the twenty-first century are becoming increasingly aware of the long-term costs of consumption and waste in the building industry. They are not alone. There is an emerging consciousness of the global societal costs of our dirty little habit of mindlessly throwing things away. Faculty and students at The University of Oklahoma have exercised theory into practice by designing and constructing various projects from mining landscapes of waste into inhabitable spaces. Reclaimed wood, salvaged acrylic, and earthen construction practices were catalysts allowing multi-disciplinary collaborative teams opportunities to explore design concepts and materiality at full-scale, benefiting both students and the local community. The approach of sustainability as infectious to all phases of design and construction has led to three collaborative projects: [1] 2012 CASA Playhouse, [2] current construction of a Compressed Earth Block residence with Habitat for Humanity, [3] and the development of an interactive database for regional salvaged materials. This paper explores recent advancements in design and construction pedagogy of the aforementioned projects, demonstrating imaginative potential for reusing existing materials.
Mining Landscapes of Waste: Finding Imaginative Potential in Discarded or Salvaged Materials

Daniel J. Butko
The University of Oklahoma - College of Architecture

Designers in the twenty-first century are becoming increasingly aware of the long-term costs of consumption and waste in the building industry. They are finding that there is an emerging consciousness of the global economic costs of our using finite resources, redefining and rethinking various aspects of the built environment. This is especially true of those in the architecture profession, who are increasingly turning to sustainable practices to explore design innovation and materiality at all scales, benefiting both students and the local community.

The approach to sustainability as an interplay of design and construction has led to the development of new collaborative projects. One such project is the Casa Playhouse, designed and built by students from the University of Oklahoma. The project involved the construction of a Compressed Earth Block residence with Habitat for Humanity using reclaimed and salvaged materials. The project aims to demonstrate the potential of reusing existing materials and fostering a more sustainable approach to design and construction.

For more information, visit www.architects-ranch.com, an online database of environmentally responsible projects relating to the CPI's 10 Principles of Regionalism. The database showcases projects and materials that are currently being used in the design and construction industry.

2012 CASA PLAYHOUSE PARADE ENTRY

WHY WE NEED TO USE RECYCLED & RECAPTURED MATERIALS

Published reports and textbook Fundamentals of Building Construction define:
- 30% of our energy use and associated greenhouse gas emissions
- 30% of our materials consumption
- 2/3 of U.S. consumption

Launched May 2011
First year = $400 per ton Second year = $380 per ton Averages 700 lbs/ton.
Embedded Hydrologies - Combatting Water Scarcity through Local Water Capture

In a situation of rapid environmental change and resource insecurity, socially disadvantaged groups are often increasingly marginalized by unequal access to state infrastructure. In the Aral Sea crisis, an iconic example of unsustainable water management, subsistence farmers and fishermen whose livelihoods are threatened by desertification also lack the political and economic power to improve their own water access in the existing distribution systems. However, not only does the existing transboundary water network enable uneven distribution; a survey of the farmers’ own perspectives reveal that cultural values associated with water and its use are influenced by the local visibility of water. Recognizing mechanisms in the everyday environment that prevent or promote water sharing can lead to more ecologically-sensitive urban design. A design method that draws upon local knowledge and materials to harvest water can empower disadvantaged communities and improve human relationships to the vital resource of water.

The “death” of the Aral Sea in Central Asia - which shrank from 68,000km³ to 5,000km³ in forty years - is primarily caused by water diversion for agriculture. The extensive irrigation infrastructure, built to enable prosperous industrial farming under Soviet rule, now facilitates water trade amongst former Soviet states with dams, reservoirs and canals regulating the movement of water to each country according to agreed quotas. Downstream communities rely on a distant water source and its uncertain flows through contested geopolitical spaces for their water supply. Individuals with political or financial power may improve their own water access priority using private pumps, and a cultural memory of water abundance associated with modern technology motivates this practice.

An alternative to the control and allocation of water resources is a model for local water harvesting, embedded in the materiality of the built environment. Creating a water-sensitive urban fabric that can empower local communities begins with a close scrutiny of water in the everyday environment and its impact on how scarcity is locally experienced. For rural groups in the Aral basin, linear systems of water delivery through modern infrastructure conflict with traditional beliefs of water as a God-given gift and a shared responsibility; far from limiting water use, consumption patterns are exacerbated by religious values that free-flowing water in the canals should not be wasted or left to evaporate. Sociological studies indicate that a mentality of water-saving is challenging to endorse in the absence of water storage spaces within the community.

Vernacular examples from this region of ancient oases show that water can be captured, filtered and distributed through urban material interfaces to create cities with self-sustainable water cycles. Traditional building technologies and nature-inspired material systems interact directly with climactic forces and are capable of harvesting atmospheric moisture and retaining water, holding tremendous potential to restore local water sources.

By increasing the visibility of water in the urban landscape and fostering more intimate connections to the dynamic water processes, this can not only augment local water access, but can promote better water stewardship.
Embedded Hydrologies

Contesting Water Scarcity through Local Water Capture

In a situation of rapid environmental change and resource insecurity, socially disadvantaged groups are often marginalized by the political and economic forces that determine access to water. This is exemplified in the case of the Aral Sea crisis, where upstream states (e.g., Kazakhstan) divert water from downstream states (e.g., Uzbekistan) to support engineering projects such as irrigation canals and reservoirs. This water trade amongst former Soviet states with dams, reservoirs and canals has contributed to the shrinking of the Aral Sea, which was once the fourth-largest lake in the world. The “death” of the Aral Sea in Central Asia—which shrunk from 68,000km² in 1960 to 5,000km² in 2011—is primarily caused by water diversion for agriculture. The extensive irrigation infrastructure built to enable prosperous industrial farming under Soviet rule now diverts water from upstream sources, leaving downstream communities依赖于遥远的供水源，如阿姆河和锡尔河，这些河流流经的国家现在由于政治和经济力量而难以获得水。在阿德尔海危机中，一个更具象化的水管理系统是，那些工作参与水循环的当地政府和农民农民的视角揭示了与现代技术驱动的实践相反的文化价值观。

Traditional building technologies and nature-inspired material systems interact directly with the built environment. Creating a water-sensitive urban fabric that can capture, filter and distribute water through natural materials and mechanisms in the everyday environment that prevent or promote water sharing can lead to more ecologically-sensitive urban design. A design method that draws upon local knowledge and materials to harness water can empower socially disadvantaged communities and inform local water relationships to the total resource of water.

"There will be water as long as the heads of the countries [...] get along.” — Khorezm farmer
**Geometric Flood Control System (GFCS)**

**DESIGN PREMISE:**
According to the National Oceanic and Atmospheric Association, the U.S. records $7.82 billion in damages every year as a result of fresh water flooding not including the damages resulting from coastal storm surges. In trying to prevent the effects of flooding on an area, various systems are employed, most notably the stacking of sandbags along rising waters. The sandbag system has been effective in offsetting flood waters since the 18th Century yet emerging technologies in materials and computational design have provided the opportunity to redesign this age old method to increase efficiency and sustainability.

The research centers on the idea of creating a new module to replace the sandbag in order to increase the quality, efficiency, and sustainability found in a flood control system. The research process will focus on three categories of research: geometry, material, and performance. By using this approach, the research evolves through a non-linear process in order to continually edit and test the design to produce the maximum performance possible in both geometry and materiality. The three-part process is further below:

**GEOMETRY**
The study of geometry will allow for the creation of a system that is successful due to the influence of the geometry of the module offsetting the lateral hydro forces which are most commonly offset by mass in existing modular systems. The geometry of the module will result in research conducted on the strength of geometric shapes and the performance of structural forms used in larger scale applications such as dams. The goal of refraining from a mass derived system is to create a module that is more democratic in use in order for it to be easily handled by everyone from a strong laborer to an elderly homeowner.

**MATERIAL**
Materials research was conducted in tandem to the study of geometry in order to find a material suitable for both the geometry used and the application of the material in retaining flood waters. In order to meet the secondary goal of sustainability, the material’s embodied energy as well as its recyclability will be taken into account when choosing a material.

**PERFORMANCE**
Throughout the research of geometry and material, the designs produced will be continuously evaluated for their performance in retaining flood waters through physical and virtual testing. The testing of module design and material will allow for continuous design improvement throughout the course of research and design development. The ultimate goal is to be able to test the final design iterations in real world applications to determine the full scale feasibility of the solution.

We hoped to create a system that can be deployed quickly and efficiently to areas expecting and/or experiencing flooding for use by both civil institutions in large-scale applications and individual home and business owners in small-scale applications. This system will also allow for a more sustainable solution to flood control in an age where sustainability is a forerunner in design consideration and weather trends are resulting in more areas experiencing flooding.
**Geometric Flood Control System (GFCS)**

**Advisor:** Wendy W Fok, Digital Media & Design Program

**University:** University of Houston

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**Flood Damages by State (2007-2001)**

*Data collected from NFIA*

**Causes of Floods**

- Hurricane/Tropical Storm
- Rain
- Levee/Dam Failure
- Snow Melt
- Storm Surge

**Annual Flood Damages (2000-2001)**

- $1,000,000+
- $500,000-$999,999
- $50,000-$99,999
- Under $10,000
- $100,000-$499,999
- $10,000-$49,000

**Flood Damage Affects:**

- Homes
- Vehicles
- People
- Infrastructure
- Crops

**Precedents**

- Gravity Dams
- Olivenhain Dam, California

**Issues with Using Traditional Sandbags**

- Large quantities of sand have to be acquired to fill bags
- The polypropylene bags most commonly used can begin to disintegrate after being in the sun for extended periods of time
- Sand absorbs flood water which can be contaminated, making disposal of sand an issue
- One-time use only
- A lot of man power is needed to fill bags and build barrier

**Iterations**

- Force Diagram

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The damages for 2005 do not include the damages incurred due to Hurricane Katrina. Damages include only those for fresh water flooding.

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**Geometric Flood Control System**

**Advisors:** Wendy W Fok, Digital Media & Design Program

**University:** University of Houston
We have all heard the saying “We are what we eat”. Another idea that is just as true is, “We are what we grow”. With this in mind, the Farm Project brings together business, school and community around the concept of reclaiming impacted urban space and turning it into a working farm and urban green space. The one-acre organic farm will consist of a half-acre of growing plots and raised beds, a chicken coop, beehives and meeting and workspace. The Farm Project will provide space for gathering and enjoying the outdoors, teaching space for a local K-12 school and community groups, and it will have a farm store that will sell organic produce at affordable prices. The farm will not only provide students and community residents with nutritious meals, but will also get them connected to their food and introduce the various user groups to models of sustainable agriculture and healthy and sustainable lifestyles.

The first completed component of the Urban Farm is the “urbaRn” project; a classroom / meeting / lab facility which has been designed and constructed almost completely from waste stream materials and is intended to extend the lessons of the Urban Farm to that of the built environment. The urbaRn was designed and fabricated by a group of fourth year architecture students, and employs two repurposed shipping containers, which have been extensively modified for use at the Urban Farm. The students were challenged to design the facilities using low / no impact materials, and after some research came to recognize the containers as a potential waste stream resource. In addition to being at the end of their useful life, the containers selected for the project were contributing to a surplus of shipping containers in the region due to a regional trade imbalance. The choice of containers also facilitated the staging of the project, which was fabricated largely off-site and then delivered to the Farm, and allows for the potential of relocation in the future. Modifications included creating large openings with sliding panels and fitting out the interiors with shelving, rolling farm tables and windows created from salvaged materials diverted from the local landfill.

The students also used digital technologies to minimize waste in the production of 18 chairs for the facility. The chairs were designed to “scissor” together and could be milled and fabricated without the use of any adhesives. In addition to being light and functional, the chairs demonstrate an approach to sustainable design by being extremely efficient in their use of materials. Nesting programs allowed all components for the chairs to be milled out of sheet goods; a yield of four chairs coming from one 4’ x 8’ sheet.

Educational materials directed to various user groups ranging from community members to grade school students frame these principals and extend the lessons of the farm to the built environment.
The Farm Project: We Are What We Grow

We have all heard the saying “We are what we eat.” Another idea that is just as true is, “We are what we grow.” With this in mind, a groundbreaking collaboration involving educators, students, local farmers and local professionals is working together to create an urban farm on an abandoned brownfield site on the near north side of Indianapolis. The farm project is intended serve as a model for developing partnerships between schools and urban farmers in every Indianapolis neighborhood.

The Farm Project brings together business, school and community around the concept of reclaiming impacted urban space and turning it into a working farm and urban green space. The one-acre organic farm will consist of a half-acre of growing plots and raised beds, a chicken coop, bee hives and meeting and work space. The Farm Project will provide space for gathering and enjoying the outdoors, teaching space for a local K-12 school and community groups, and it will have a farm store that will sell organic produce at affordable prices. The farm will not only provide students and community residents with nutritious meals, but will also get them connected to their food and introduce the various user groups to models of sustainable agriculture and healthy and sustainable design.

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Other sustainable strategies included capturing rainwater and using low/no VOC paints and adhesives. Photovoltaic panels and a wind turbine are envisioned for future installation on site.
The creation and sustenance of greened roofs has required a concerted effort ever since the Hanging Gardens of Babylon improbably thrived in the deserts of Mesopotamia. Even with the advancements of today’s engineered systems, a collaborative design process is necessary to satisfy the architectural and the biological, the functional and the aesthetic requirements of these displaced gardens.

A team of students in biological systems engineering, landscape architecture, and architecture collaborated on the design of a green roof for Cheatham Hall at Virginia Tech, which houses the university’s College of Natural Resources and Environment. The project is a microcosm of the subtropical urban condition: an existing, uninspiring roof visible from adjacent spaces, at a nexus of local activity. Beyond merely being a design problem to be solved, this roof begs to be occupied, to be transformed into a viable, living space. The design project was mentored by faculty in biological systems engineering and architecture with additional guidance from both the end users of the space and from green roof system experts. Designed to elevate and illustrate the potential of vegetation in buildings, the project was intended to develop both an accessible roof garden and a living and evolving demonstration project for the college. The design process gave students the opportunity to investigate the transformative potential of these systems to create a beautiful space for faculty and students to converse, learn, and relax; to establish a location of increased biodiversity; and to provide a seasonally changing view through expansive windows of a lush, flowering carpet of creeping sedums and flowing grasses. The students took a creative approach to incorporation of architectural and landscape elements to create shade, texture, path, niche, and rhythm, while simultaneously considering real issues of access, life safety, structure, drainage, heat flow, fire protection, cost, and maintenance.

By observing this first attempt at interdisciplinary design cooperation, and learning the students’ reactions to it, the faculty mentors have generated ideas intended to assist the students in overcoming these obstacles in similar exercises in the future. These approaches would bring more structure to a process that may have suffered from a lack of adequate framing. Despite the difficulties, the exposure to students in other fields seemed to be a valuable educational experience for this group. Perhaps more valuable still was the authenticity of the project with its real site, real products, and a real client. At the end of the process, the team presented their design proposal to the Dean of the College of Natural Resources and Environment, who will be sharing it with his leadership team. Faculty and students are hopeful that funding can be secured to bring this project to fruition.
Collaboration between architecture and landscape architecture students led to the identification of schemes for an occupied garden, deemed critical to the project's success. Early discussions focused on the development of a team meeting on the existing design scheme to the dean of the College of Natural Resources and Environment. The engineering students investigated the performance of the green roof regarding runoff management, the cooling potential of green roofs, and the durability of sedums and grasses. The students took a creative approach to designing and developing their knowledge base through examples of prior class projects and developed their skills in team-building exercises.

**SURVEY RESULTS**

Below are results of a survey administered to the students at the beginning of the project and the end of the design process. Students were asked to rate their agreement with the following statements:

- Very different opinions exist between the various types of green roofs.
- The images at least somewhat depict the evolution of this exercise for the students.
- The scope of the project changed half-way through the design process.
- The scope of the project didn't change during the design process.
- Very different opinions exist between the various types of green roofs.
- The decision-making process for the project was collaborative.
- The decision-making process for the project was straightforward.

The students were then asked to remember what their answers were and rate the same thirteen statements again.

The design team presented the final design to the Dean of the College of Natural Resources and Environment. The students were hopeful that funding could be obtained for the project. The team at the end of the process presented their design proposal to the Dean of the College of Natural Resources and Environment, who was impressed with the final design. The students were hopeful that funding could be obtained for the project. The team at the end of the process presented their design proposal to the Dean of the College of Natural Resources and Environment, who was impressed with the final design.