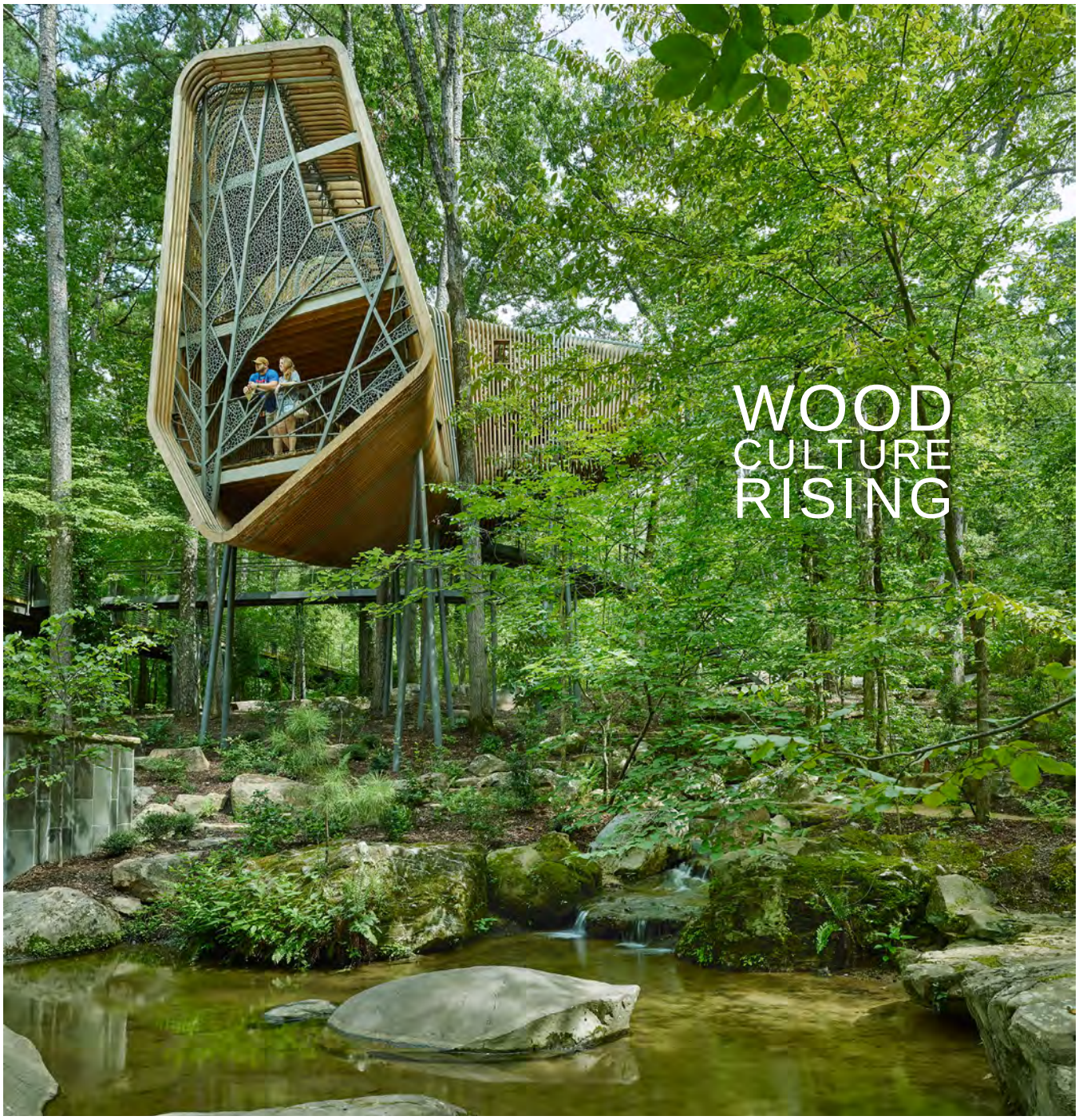
WOOD DESIGN FOCUS
A JOURNAL OF CONTEMPORARY WOOD ARCHITECTURE AND ENGINEERING

SUMMER 2022 | Volume 30.01



WOOD CULTURE RISING

Timber Bridge in Gulou Waterfront
LUO studio

The Evans Tree House at Garvan Woodland Gardens
modus studio

Ultra-Fast Charging Stations for Electric Vehicles
Cobe

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WOOD DESIGN FOCUS (ISSN 1066-5757)

Published for over 30 years, Wood Design Focus is an open access electronic journal providing articles on topics of contemporary wood design; including architecture, construction, engineering and design. Wood Design Focus is committed to featuring the people, places and practices that move the wood focus narrative forward as we envision a more sustainable, resilient and beautiful built environment constructed of wood.

A publication of the Forest Products Society
251 S.L. White Blvd
LaGrange, GA 30241
Phone: +1 (706) 443-1337
www.forestprod.org

Cover Image: The Evans Tree House at Garvan Woodland Gardens, Hot Springs, Arkansas (2018) by Modus Studio
Photography: Timothy Hursley

@wooddesignfocus

It [is] clear to me that wood has actually played a central role in our history. It is the one material that has provided continuity in our long evolutionary and cultural journey. The foundations of our relationship with wood lie in its remarkable properties. As an all-round structural material it is unmatched. It is lighter than water, yet weight to weight is as stiff, strong, and tough as steel and can resist both being stretched and compressed. It is easy to shape, as it readily splits along the grain, and is soft enough to carve, especially when green. It can be found in pieces large enough to hold up houses, yet can be cut up into tools as small as a toothpick. It can last for centuries if it is kept permanently dry or wet, yet it can also be burned to keep us warm, to cook our food, and drive a wide range of industrial processes. With all these advantages, the central role of wood in the human story was not just explicable, but inevitable. So it is time to reassess the role of wood... For the benefit of the environment and our own physical and psychological health, we need to return to the Age of Wood.

Roland Ennos, "The Age of Wood"

From the beginnings of the human experience, mankind has relied upon and celebrated our relationship with wood. From this versatile material we crafted sailing vessels to cross rivers and vast oceans on our quest to explore the unknown, we constructed our first primitive huts as we sought shelter from the elements and other predators, and we have learned from trees how to harness the power of the sun to clean our environment and fuel our future.

The selected projects in this issue of Wood Design Focus are small-scale works of architecture and engineering, but don't be fooled by their size. They artfully and carefully hearken to our primal and evolutionary relationship with wood while at the same time further advance our understanding of the material by responding to their environmental and cultural settings.

The Timber Bridge in Gulou Waterfront is an amalgamation of timber elements that showcase the elegant attributes of a redundant timber frame system. By carefully considering the spatial and tectonic relationship between the various components, LUO Studio captures a work of architecture that is both highly functional and fully experiential. The bridge is no longer a simple means for traversing a waterway, but instead creates an immersive experience that frames views and embraces users - whether bridging across or gliding beneath. The timber connections are simple and non-assuming as they seek to support the filtering of light and adding stability. The large arcing glulam beams gracefully span from bank to bank and celebrate the composite characteristics of engineered wood.

The Evans Tree House at Garvan Woodland Gardens by modus studio is a wonderland of exploration and parametric form. Arriving along an elevated walkway, suspended in the tree canopy, you slip into the cocoon of the tree house through a part of the exoskeleton that has been peeled away from the main body. At once you are both inside and outside, protected yet vulnerable. While the tree house is structured primarily with steel columns and a steel central spine, the elegance of the form is accentuated by the 113 thermalized southern yellow pine ribs that make up the majority of the enclosure - striking a symbiotic relationship with the natural surrounding.

Lastly, the Ultra-Fast Charging Stations for Electric Vehicles takes to heart the question, What if? What if we didn't rely on petrol and fossil fuels? What if we re-imagined our transportation infrastructure? What if humanity and relaxation was integral to everyday activities? What if we sequestered more carbon than we emit? Cobe imagined the charging stations as an urban forest with tree canopies that filter light and absorb CO^2. The structural supports are based on an inverted conical form, utilizing a combination of 6 glulam tapered beams which transition into 6 clamped roof beams. Connection detailing is also thoughtfully considered and executed.

Together, these projects are a sampling of what we might call a reemerging wood building culture. A culture which values deeply the versatility of this renewable and beautiful material. It's been a long time coming, but it is about time that we all become reacquainted with the vast design possibilities of building with wood.

Jacob Gines
Editor-in-Chief, Wood Design Focus
Associate Professor
School of Architecture
Mississippi State University

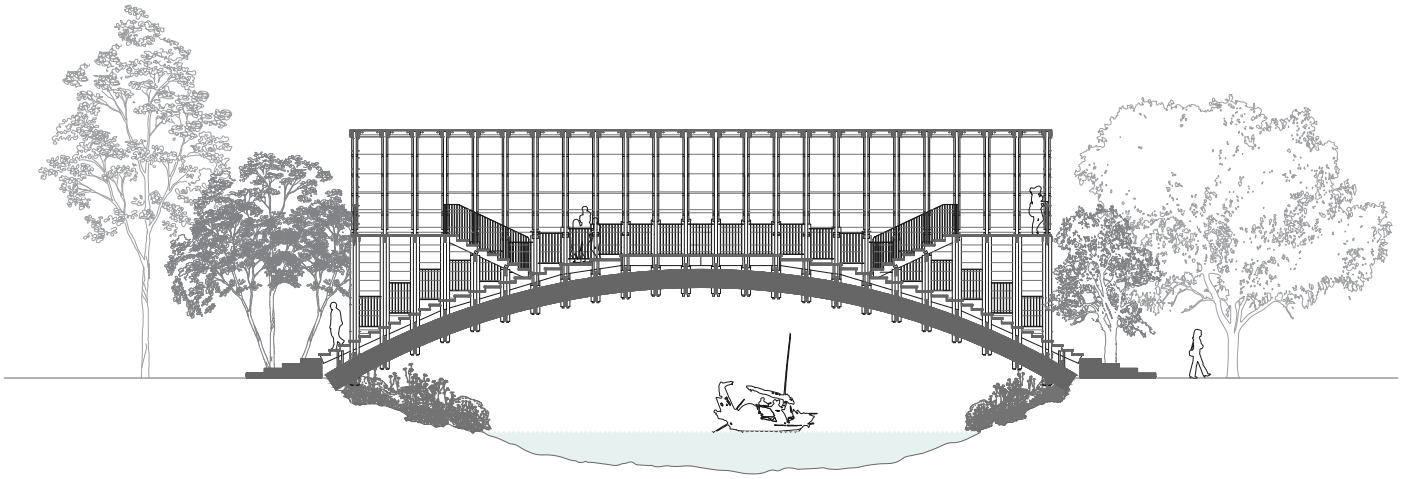
Timber Bridge in Gulou Waterfront
by LUO studio

Due to the unique tidal flat landform, Gulou in Jiangmen City established the tradition of making use of the water system to dig ponds and form mounds for fishing and farming. As the water system and fish ponds occupy a large area and form a fragmented spatial pattern in local villages, many bridges have been built to connect the areas segmented by water. With rapid urbanization in the Guangdong-Hong Kong-Macao Greater Bay Area, many local villagers have abandoned the traditional fishing lifestyle in favor of living a more urban life. For this reason, water villages in which people make a living by fishing have been gradually disappearing.

Gulou Waterfront is an eco-cultural tourism resort developed by OCT in the context of rural revitalization, aiming to combine rural development with the cultural background of local villages on the premise of preserving the unique spatial fabrics featuring mounds and ponds. The resort maintains the form of the basic local water system while organically integrating nature education, parent-child recreation, and fishing & husbandry activities.

Those operations in the resort require several bridges in certain areas, to facilitate the movement of people and fishing boats.

Gulou Waterfront, Jiangmen, Guangdong, China
2022

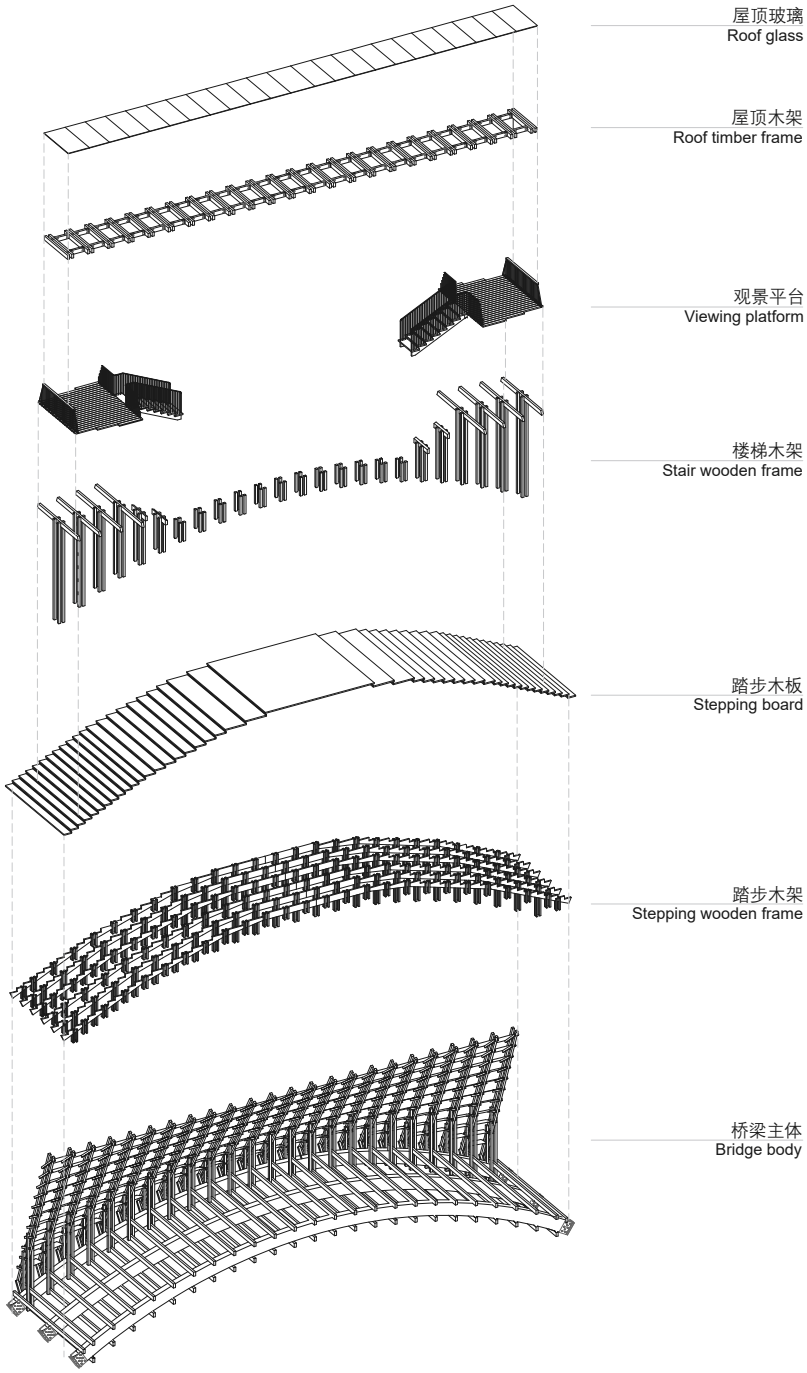


+ longitudinal section

Arched wooden bridge

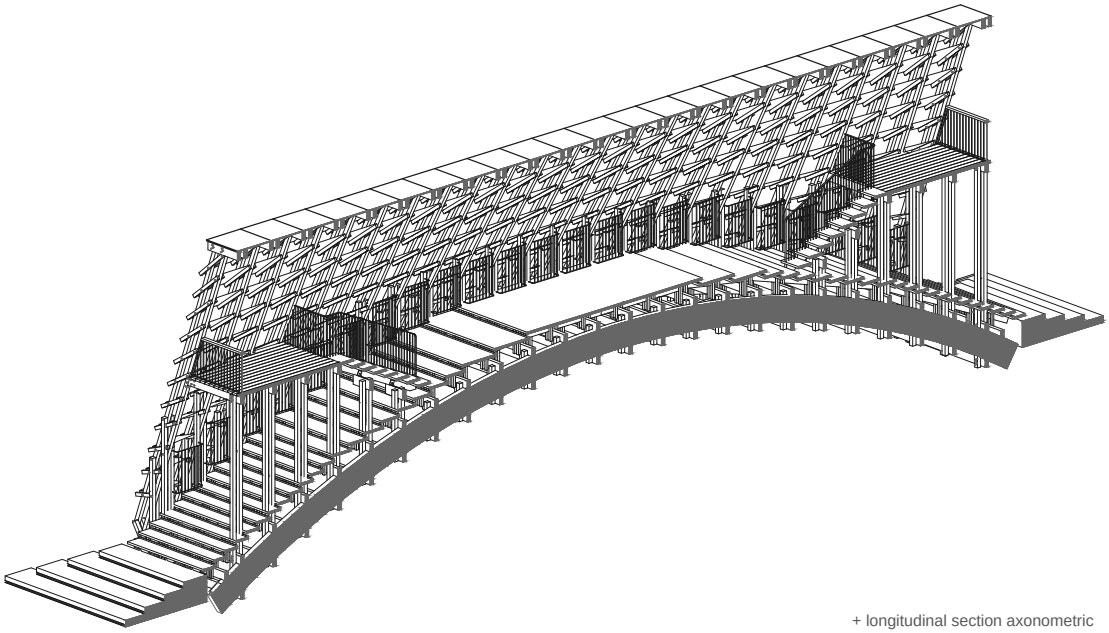
During the fishing civilization period, roads were poorly developed, so water systems became the key route for transportation and logistics. Since bridges need to be walkable while also ensuring more space for boats underneath to pass through, traditional bridge construction techniques in China adopted “arches” to create space for the passage of boats under bridges, and enhance the effectiveness of the structure. Due to the abundance of wood, Southern China has the tradition of applying timber to build bridges.

This project is a timber bridge, which is one of the many in Gulou Waterfront Resort. To differentiate it from urban constructions and revitalize traditional rural culture, LUO studio adopted natural wooden materials to construct an arched bridge. The resort provides access for small fishing vessels, as well as large tour ships. To enable boats of various sizes to pass under the bridge smoothly, the load-bearing platform at the bottom of the arch which is 1.35m higher than the normal water level, combined with the 2.8m arched structure, forms a space more than 4m higher than the normal water level. This meets the clearance requirements for large tour boats to pass through. Based on geological surveys, the span of the bridge is set at 25.2m.



+ exploded material assembly axonometric

Through structural calculation and construction analysis, LUO studio utilized 3 large curved beams as main structural components, which are arranged in a parallel manner with a 2.8m spacing between each other. With full consideration of manufacturing and transportation costs, each main beam was divided into three sections at appropriate positions, connected and assembled by steel-strengthened bolts on the site, to form the complete wooden beam.



+ longitudinal section axonometric

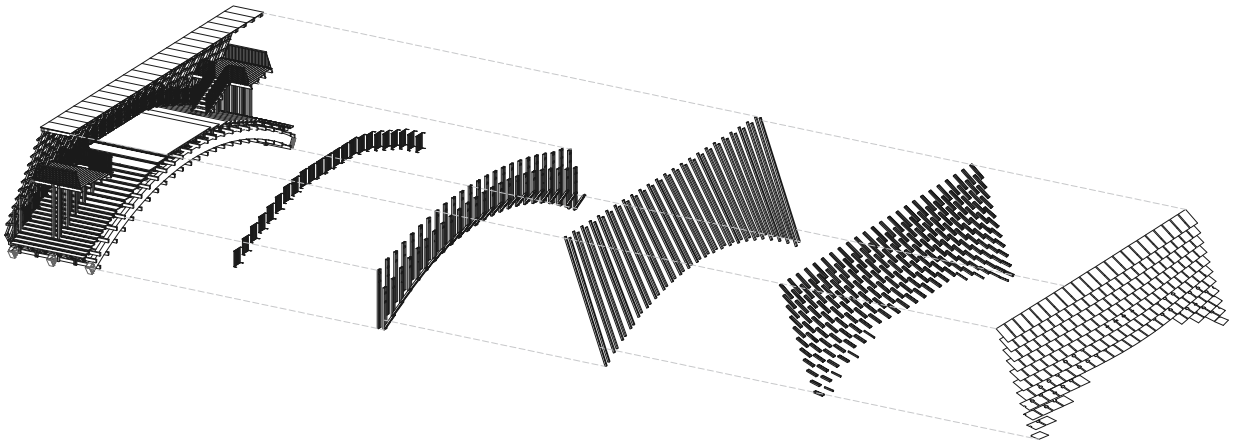
Providing a covering

The bridge is located in the joint area between a dense traditional commercial street area and a children's recreation area. LUO studio created a relatively "closed" corridor space on the timber bridge, which is different from other open landscape bridges in the resort. The aims were to accentuate the transition from the "practical" commercial street area to the relatively "dreamy" children's recreation area, allowing visitors to feel a sense of ceremony in the moving process.

Constructing a covered corridor on bridges has been an old tradition that dates back to the Spring and Autumn Period and the Warring States Period. The initial intention was to strengthen the bridge structure, resist rain and moisture, keep the wood dry and prevent it from corrosion.

This project also inherits the construction wisdom of ancient covered bridges. The covered corridor enhances the overall structural stability and protects the arched wooden structure beneath from exposure to sun and rain.

The west area of the Pearl River Delta where the timber bridge is located has abundant rainfall, so the corridor was constructed in a relatively closed form. The exterior of the corridor space is covered by layers of metal plates, which effectively protect it from rain and also create a sense of cohesion for the space.



+ exploded material assembly axonometric

Defining the tectonic

Sub-structural system formed by small wooden components
Apart from the three large wooden arched beams that bear the main load of the bridge body having a section size of 600mm x 300mm, other wooden components adopt small sections. They are either 100mm x 100mm or 100mm x 50mm. Small wooden components are interlocked and anchored to the three main arched beams, functioning as sub-beams on upper and lower levels. In addition, the two ends of these sub-beams are combined with upward components to form a stable triangle of forces.

The plane of the bridge's roof is a complete rectangle. The top, left, right edges of the bridge's side facades also consist of rectangular silhouettes, while only the lower edge is a natural curve. This generates height variations of the corridor space that is higher on the two sides and lower in the middle. To ensure the structural stability of the covered corridor space, the design team set horizontal connecting rods in the middle section and added two viewing platforms on either side, which also avoid the monotonous feeling when viewing the corridor space from the entrance and exit. The small-section sub-structural system not only enhances the sense of structure in the corridor space but also reveals the elaborate craftsmanship and details to visitors on tour boats and offers them a unique visual experience.

Construction modules & material specifications
The small-scale wooden components are arranged with small spacing in between. The spacing between neighboring substructures is set at 1,000mm equally. This perfectly matches the scales of the steps and metal plate exterior. Between neighboring sub-beams, three steps are set at the steep sections of the arch, while two steps are set at the gentle sections. The length of each external metal plate is controlled at about 900mm, which is appropriate for manufacturing, transporting, and installation. The 900mm length of timber frames also provides a suitable space for a single person to stand, lean, and rest.

The neighboring upper and lower steps of the corridor have a clearance of 70mm. A gap of about 200mm is set in between layered metal plates on the exteriors of the corridor space. A 1,500mm-wide daylighting belt is set at the middle of the corridor roof. When walking slowly into the corridor space from the entrances at both ends, visitors can catch the sparkling water under the bridge through the narrow gaps between steps. As they continue to climb the bridge, the bright light refracted by the upper and lower metal plates attract them to look out through the side gaps. Such a special "collected" viewing experience distinguishes this timber bridge from other open bridges. While passing through the platforms from two ends to reach the center of the bridge corridor, visitors can fully experience the light and shadows from the top, feeling calmness and openness in the mind. Such design forms a continuous spatial rhythm that gradually reaches the climax.

Industrialization and handwork

The materials utilized were manufactured and processed by factories based on industrialization standards, and all the necessary timber and metal components were treated by modern industrial technology and methods. During the installation and construction, only the three main beams were hoisted by large machinery. All other follow-up construction steps were fully adaptable and transportable through the hands of the workers in response to the local context. The whole construction process not only effectively harmonized with the surrounding construction sites and took advantage of efficient industrialized methods, but also conveyed rural warmth as well as the "localization" of construction.

Project information

Completion: January 2022
Client: Jiangmen OCT Co., Ltd.
Architect: LUO studio
Structural engineer: LaLu Structural Consulting
Construction firm: Shenzhen Zhenhui Architectural Eng. Co.
Wood material suppliers: Shengtehaosen, Kingspine-House
Lighting fixture supplier: Meteor Shower
Photography: Jin Weiqi

About the Architect

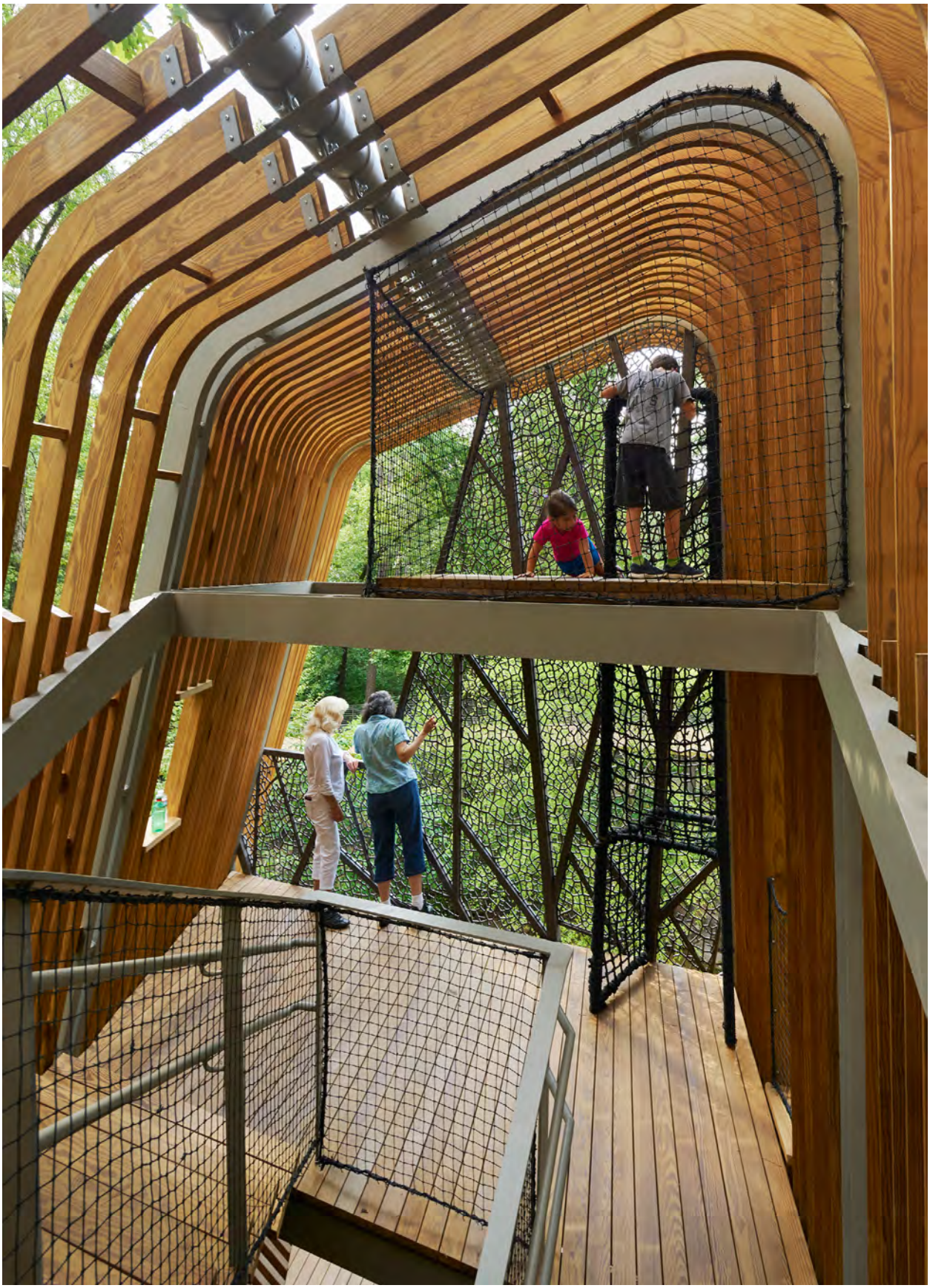
LUO studio pays attention to sustainable construction, and advocates using minimum materials to create more "universal" space. We insist on applying natural materials to construction, study and design wooden buildings that adopt prefabricated steel and wood structures, and work to build a connection with Oriental traditional timber constructions through utilizing local techniques. We explore creative ways to solve some social problems, such as the approaches of reusing temporary buildings to the maximum extent possible. In addition to conventional projects, we're committed to improving activity and learning spaces for children in backward areas, and focus on the innovative reuse of abandoned spaces and materials in urban and rural areas. Moreover, we work to promote the construction of ecological farms and communities based on "Permaculture" concept, and engage in and initiate workshops on sustainable construction.

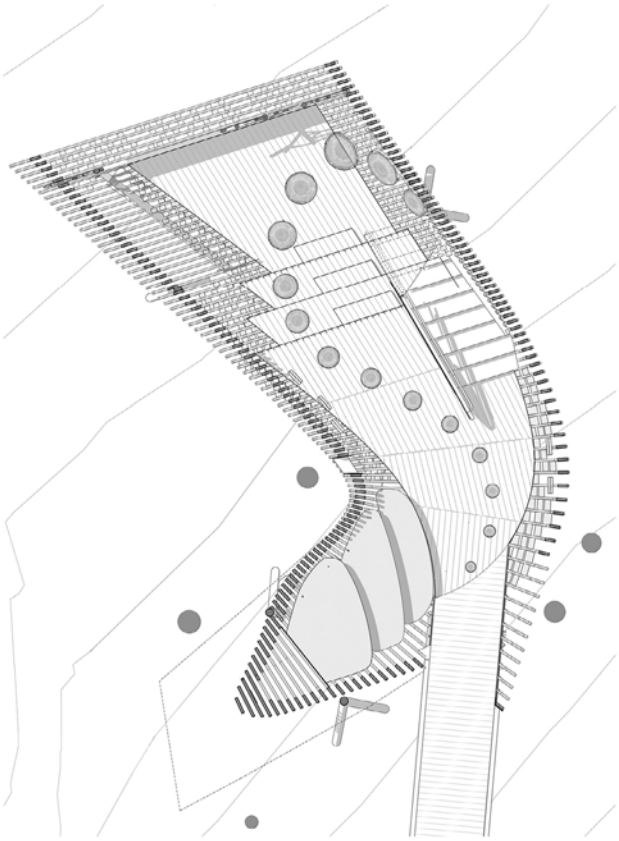
The Evans Tree House at Garvan Woodland Gardens
by **modus studio**

Nestled in a natural Ouachita Mountain hillside along Lake Hamilton at Garvan Woodland Gardens in Hot Springs, Arkansas, the Evans Children's Adventure Garden welcomed a new tree house to the grounds in summer of 2018. This tree house is the first of three planned for the garden that will provide an interactive educational experience for visiting children as part of an ambitious plan to bring children back into the woods.

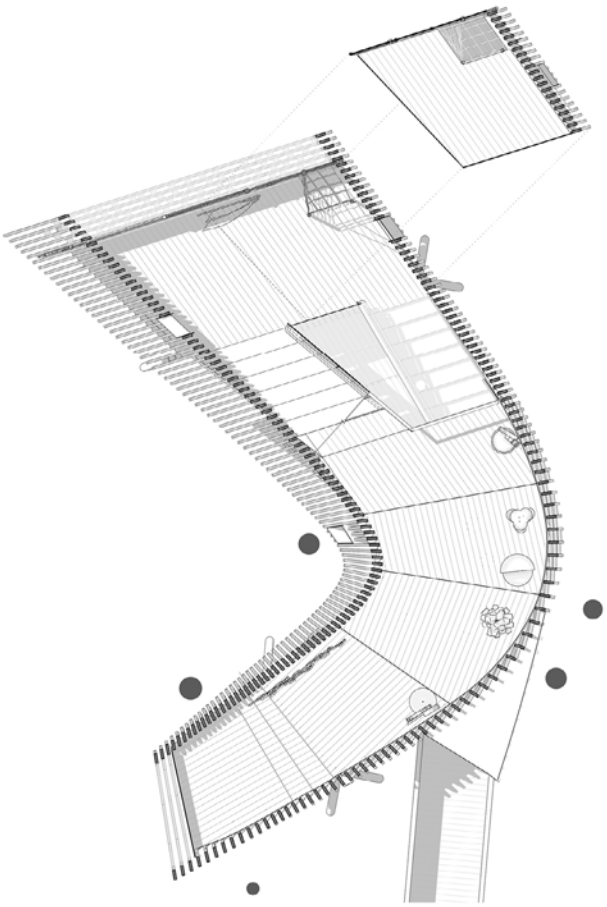
The tree house uses a rich visual and tactile environment to stimulate the mind and body to strengthen connections back to the natural world, while accommodating the needs of all users. This unique structure is a defining small project for modus. From design to fabrication they were able to merge their childhood-earned knowledge of the natural world with their hard-earned think, make, do philosophy. Because of their own mostly-rural upbringing, it is easy to take for granted their strong connection to the creeks, forests, insects, and animals of Arkansas. However, many children in the modern world are unfortunately disconnected from this type of play.

Garvan Woodland Gardens, Hot Springs, Arkansas
2018





+ level 01 plan

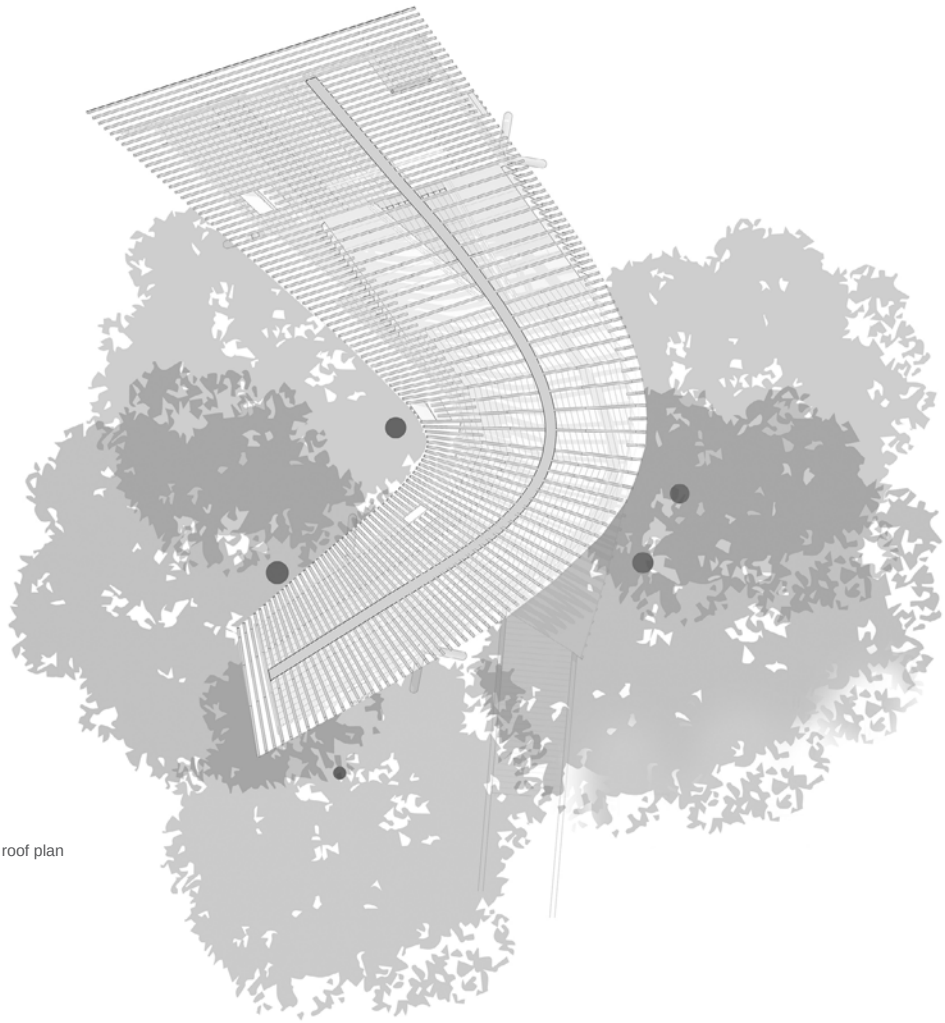


+ level 02 plan and loft plan

Defining the form and program

The underlying theme of dendrology, the study of trees and wooded plants, drives both the form and program of the structure. The 113 fins comprising the thermalized Arkansas-sourced Southern Yellow Pine screen creates a semi-transparent and an evocative form dynamically shrouding multiple levels of spaces for children and adults alike that refocus attention to the natural wonders of the forest canopy. The thermalization process involves using heat and steam to increase a wood's durability and resistance to weather.

Boomerang-shaped in plan, the building is lifted 13 to 25 feet (four to 7.6 meters) off the ground via six pairs of slender, steel columns. By elevating the structure, the team was able to protect the earth below, while providing visitors with a feeling of being amongst the tree canopies. An elevated walkway leads to a central opening within the multi-story treehouse. The mysterious form, creative play of shadow and light and sound, exploration of material, and adventure that the Tree House provides becomes a magical experience within the Ouachita Forest... easily bending among native pines and oaks.



+ roof plan

The tree house is intended to camouflage itself into the landscape and be of the ecology of the place – organic, yet alive and mysterious in nature, purposefully inspiring children's imaginations about the forest.

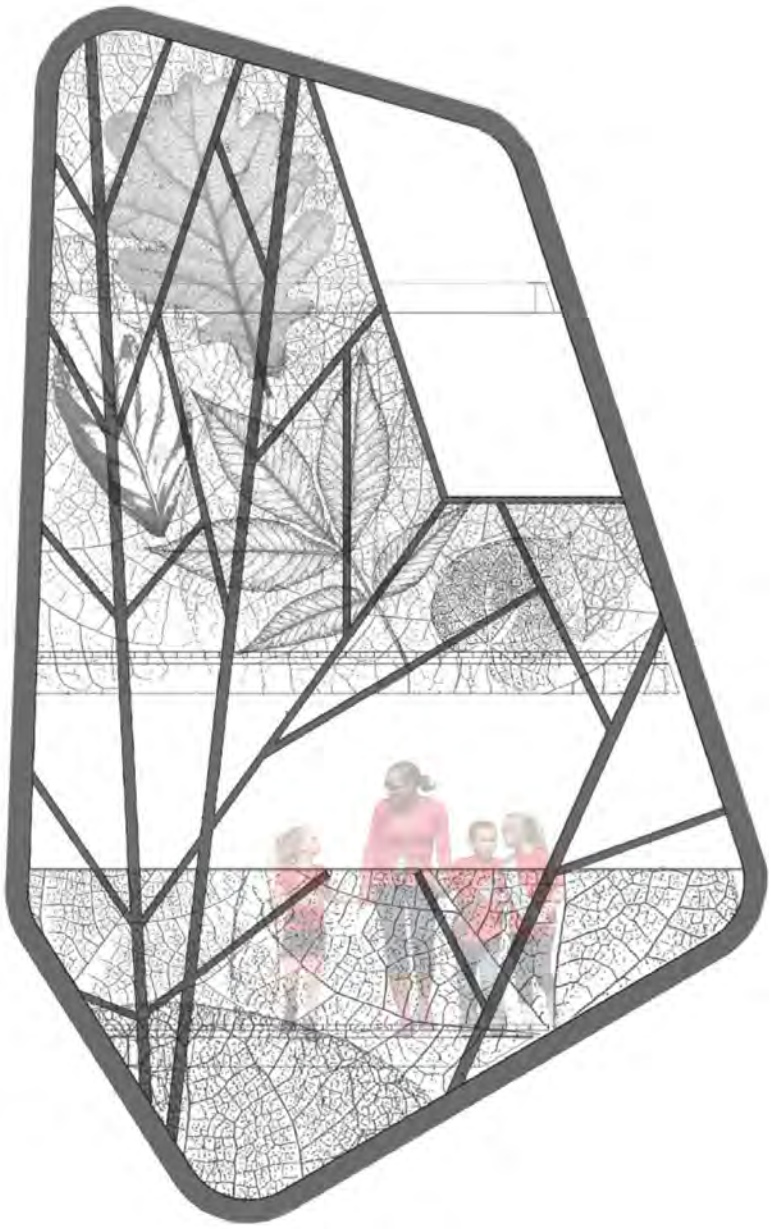
"The steel ribs and spine act as a skeleton, a vertical framework, connecting the top and bottom spines and floor plates to the six pair of columns. Steel ribs follow the same form created by the wood ribs to help conceal the structural framework of the treehouse and further the goal of creating a mysterious figure in the woods."

- modus studio

“Advanced digital modeling is evolving to support designs that transcend gratuitously complex and static geometry. Traditionally, the iterative nature of design and the need to convey design intent to builders often steer design decisions to be governed by simple geometric systems (orthogonal, linear, gridded, etc.). This is especially true for dimensional lumber design -- stick with building conventions, repeat dimensions, and default connections.”

“Visual scripting (i.e. Grasshopper and Dynamo) and fabrication automation play significant roles in the design of wood construction. Rule-based procedural scripting can afford designers the ability to be more responsive to seemingly large changes throughout the schematic and even development phases of design. With a visual script, for example, a structure of over 300 unique wood fins can be regenerated in minutes after updating a handful of input lines to incorporate more headroom (re: The Evans Tree House). Furthermore, such an update can be reflected in over 300 unique elevations and sections, ready to deploy to fabricators as a 3D model or 2D sheets.”

- Jody Verser (associate architect + director of technology)



+ conceptual illustration of screen wall

On the east and northern ends of the curving structure, the team created apertures that provide clears views of the forest. The larger opening, on the east, is partly covered by a perforated metal screen.

Created by Modus Studio's in-house fabrication shop, the screen has a pattern that resembles tree branches and veined leaves.

A net was used to cover the smaller aperture at the "tail" of the treehouse. The metal mesh infill protects visitors from falling out while still allowing people to feel intimately connected to the forest. This viewing area might even evoke an uneasy sensation, which is part of the design team's goal.

What does the future of wood architecture look like for modus studio?

"Wood has been, and will continue to be, an integral part of our work. Market-driven projects such as multifamily housing will continue to rely on the resilience and economics of wood frame construction. The exciting part is the increasing viability of mass timber to continue shaping the trends of the commercial and institutional markets. Our built environment will not only see an increased sustainability impact but will also benefit from the tangible and meaningful visual and experiential effects that wood brings to our work."

- Chris Baribeau (partner + principal architect)

Project information

Completion: July 2018
Client: Garvan Woodland Garden | University of Arkansas
Architect: modus studio
Fabrication Team: modus studio
Civil engineer: Ecological Design Group
Structural engineer: Engineering Consultants, Inc.
Exhibit Designer: 3. Fromme Design
Construction firm: CDI Contractors
Photography: Timothy Hursley

Awards

2019: American Institute of Architects (AIA) Small Project Award Winner

About the Architect

Operating on the idea that relevant and inspiring architecture can be sourced from simple, everyday experiences, modus studio departs from the general rule of form to create thoughtful architecture that begins to shape the present landscape and plan for a sustainable future. Modus is rooted in Northwest Arkansas and champions architecture as a means of navigating the threshold between the natural and man-made world. Based in a thinking/making philosophy, modus studio bridges the worlds of design and fabrication with modus shop, providing the ability to build the things they believe in, to the level of craft they seek. The firm has received numerous regional and national awards for their work, most recently receiving the 2018 Architectural League of New York's Emerging Voices Award.

Ultra-Fast Charging Stations for Electric Cars
by Cobe

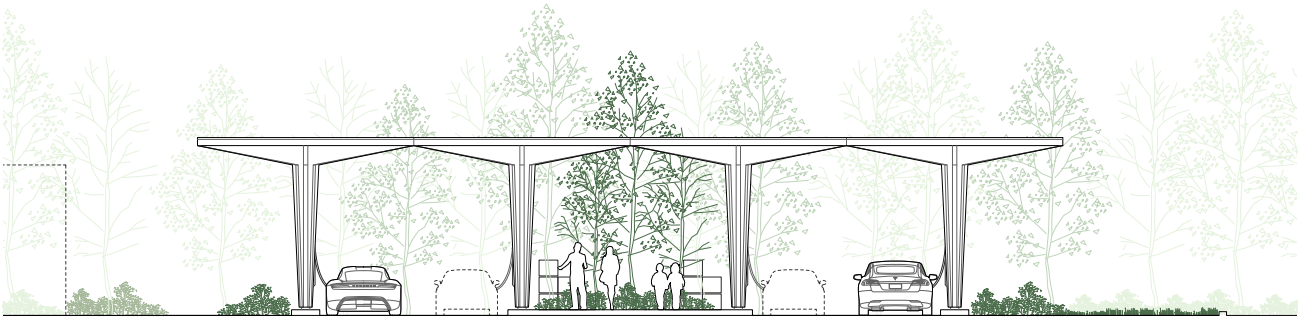
In cooperation with Powered by E.ON Drive & Clever, Cobe has designed a new type of charging stations for electric vehicles (EVs) in Scandinavia. The stations not only promise to recharge a vehicle in just 15 minutes but also offer drivers and passengers a welcome break and the chance to recharge their own mental batteries while the car is being powered up.

The new charging station is centrally located on the E20 motorway in the Danish city of Fredericia. The first of its kind, it is part of an upcoming network of 48 ultra-fast EV charging stations along Scandinavian highways.

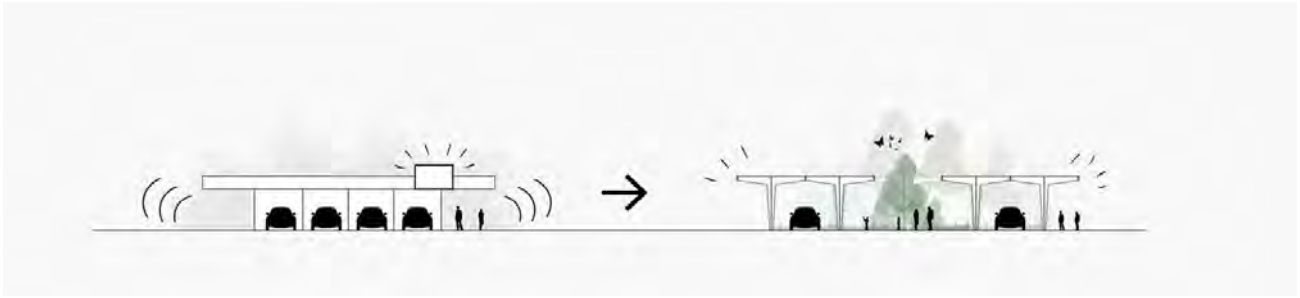
In the future, electricity will replace fossil fuels in our vehicles. However, while it currently takes around five minutes to fill up the gas tank, recharging an EV is a much more time-consuming process.

In our busy everyday lives, every minute counts. Thus, future charging stations should not only optimize the car's charging time but also offer a meaningful mental break for people to rejuvenate themselves while on the move.

Fredericia, Denmark
2019



+ building elevation



+ from gas station to charging station

A mental break in a green oasis

Cobe's design, which won the infrastructure award of the 2018 Danish Building Awards, revolves around a green rethink of the traditional gas station. The new ultra-fast charging stations are a place where drivers can quickly and efficiently recharge their vehicle and themselves.

"*Electric vehicles are the way of the future. With our design we offer EV drivers a time-out and an opportunity to mentally recharge in a green oasis. The energy and the technology are green, so we wanted the architecture, the materials and the concept to reflect that. So, we designed a charging station in sustainable materials placed in a clean, calm setting with trees and plantings that offer people a dose of mindfulness on the highway,*" says Dan Stubbergaard, architect and founder of Cobe.

The charging stations consist of a series of structural "trees". They feature with canopies much like the crowns of trees that filter and offer shade and protection from the elements while defining a green setting and a calming atmosphere. A wild contrast to a traditional gas station where lines of vehicles and the smells of gas fumes and car exhaust are the norm.

Rethinking the mobility experience

The charging stations are an oasis far away from the noise and pollution of the traditional fossil fuel-based gas stations. The light wooden canopy modules in combination with small areas of urban nature offer a break from the surrounding busy infrastructural landscapes and a chance to recharge one's mental batteries as well. The impact of electrified mobility will completely change how our cities look, feel and organize themselves in the future. According to WHO, 91% of the world's population live in areas, where the level of toxins in the air exceeds recommended limits, and CO^2 emissions are out of control.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ENKELT
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JAGUAR

+ expansion of modular components S, M, L, XL

Modularity and sustainability

Thanks to a modular design concept the stations are scalable, so a single "tree" can easily become a entire "grove" depending on the need. The stations are constructed in certified wood, topped by green roofs and surrounded by actual trees, grass and other plantings selected in cooperation with the Danish Society for Nature Conservation with the aim of enhancing biodiversity around the station. All components of the construction can be broken down into usable and recyclable materials and the choice of wood as a building material further emphasizes the building's sustainable design.

The Ultra-Fast Charging Station is covered by a wooden canopy which stores a significant amount of carbon. To produce 1 kg of wood, a tree consumes 1.47 kg of CO^2 and releases just over 1 kilogram of O^2 into the atmosphere. The size of the station can be adapted over time to meet demand while increasing its ability to sequester and store carbon long-term.

The charging station consists of 12 "trees" or canopies. The individual canopy is made of Flexwood and consists of a "trunk" and a "tree crown". Each module is square in plan and measures 6 x 6 meters. The trunk is based on an inverted conical form and is the combination of 6 glulam tapered beams which transition into 6 clamped roof beams that span 3.8 meters. The connection between column and beam is achieved through a semi-concealed steel embed plate. The bottom of the timber column is also held off the ground with a custom steel embed plate so as to protect the wood from ground deposited water.

Taking a holistic approach

The first of the ultra-fast charging stations offers a relaxed experience in nature with a capacity of recharging four EVs simultaneously. The Fredericia charging station is constructed as a grove of 12 "trees" with a total crown of 400-m^2, rendered in a mix of open and closed roof panels. The goal is for both the new and the coming charging stations to offer users a pleasant, restful and Zen-like feel that may even, hopefully, make the roads safer.

In the longer term, ultra-fast charging stations can also help make it more attractive to invest in EVs and thus promote the transition from fossil fuels to more green, more energy-efficient and CO^2-neutral transportation both in Denmark and abroad.

Traditionally, the gas station has been dominated by hardscape asphalt surfaces. The clean charging technology offers an unprecedented potential for a much cleaner environment as there are no toxic fumes or oil leaking onto the paving. In addition, the green roof of the canopy is prepared for heavy cloudbursts, as it is designed to retain water and fitted with downspouts that lead the water to natural green retention areas.

The future of electrified mobility has the potential of offering a much greener and stress-free "refueling experience" by bringing local trees and plants to the center of the station, thus supporting biodiversity and making each station unique.

+ modulated for easy assembly and disassembly

Constructed with wood

To create this more natural environment Cobe create a modular system of timber components that could be adapted to numerous site and easily assembled, demounted, up-cycled and reused. Along with creating a timber structure, the studio added trees, grass and planting into the station, which is also topped with a green sedum roof.

"*We decided from early on to reject artificial materials, poisonous paint and lacquer, and asphalt, in favour of natural and honest materials. We wanted to create a green structure, that matches the green energy. Therefore, the station canopy is built in certified wood. Timber is the only renewable building material that actually absorbs CO^2. At the same time, timber has a warmth and tactile quality that is lacking in today's infrastructural environments*," said Stubbergaard.

Project information

Completion: January 2022
Client: Powered by. E.ON Drive & Clever
Architect: Cobe
Landscape architect: Cobe
Construction firm: Flexwood A/S, AAB, Tásinge
Engineers: ARUP & AB Claussen
Photography: Hjortshøj - COAST

Awards

2022: EU Mies van der Rohe Award 2022 Nominee; Danish Design Award 2022 Finalist
2021: Auto Awards 2021 - News of the Year
2020: ArchDaily Building of the Year Awards 2020
2018: Building Awards 2018 – The Infrastructure Award

About the Architect

Cobe is an architecture firm founded in Copenhagen, DK, in 2006 by the architect Dan Stubbergaard, and aspires to create surroundings that actively contribute to extraordinary everyday life. Among the firm's most distinctive projects are The Silo in Copenhagen's northern docklands - a transformation of a former grain-storage silo into an apartment building, the urban space Karen Blixens Plads at Copenhagen's University, and Adidas' global headquarters HALFTIME in Germany. Read more here: www.cobe.dk.

About Powered by E.ON Drive & Clever

The Danish e-mobility provider Clever and the European energy company E.ON have formed a joint venture called Powered by E.ON Drive with the purpose of building and operating ultra fast charging stations along Scandinavia's main highways. The goal of Powered by E.ON Drive & Clever is to tie the main cities in Denmark, Norway and Sweden together with a total of 48 ultra-fast charging stations. Powered by E.ON Drive & Clever thus meets the commitment it made to the European Commission of building 28 co-funded stations in Denmark and Sweden as part of the Connecting Europe Facility project. In addition to this, Powered by E.ON Drive & Clever builds 20 stations in Norway without co-funding from the European Union.


BILVAS

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CONTENT SUGGESTIONS WELCOME!

Do you have a project (built or unbuilt) that you think should be featured in Wood Design Focus? Then we want to know about it!

We have a growing database of exceptional projects that we'll be showcasing in future issues, but we are always on the lookout for the next best thing in wood/timber architecture, engineering and design. Shoot us an email or connect with us on Instagram.

jgines@caad.msstate.edu

@wooddesignfocus