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ROATÁN PRÓSPERA RESIDENCES: A DIGITAL ARCHITECTURAL PLATFORM

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Authorship: Proposal by Zaha Hadid Architects.

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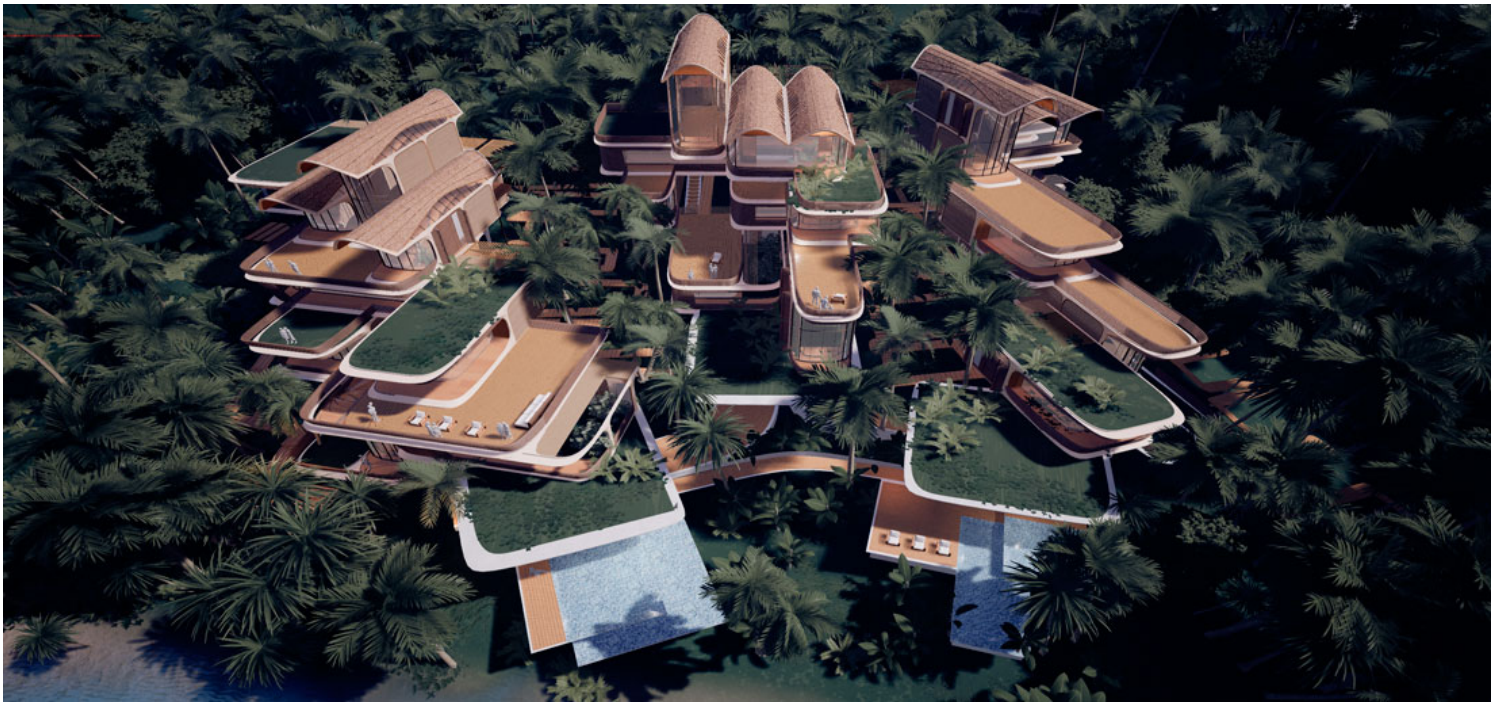
Zaha Hadid Architects with AKT II and Hilson Moran have developed a digital architectural platform to create homes for Roatán Próspera. The residential designs are a specific ecological and social response to the climate, terrain and culture of Roatán in the Caribbean, the largest of the Bay Islands of Honduras.

The designs learn from the wisdom of the past, integrating the local vernacular tradition of timber construction, climatic appropriateness and spatial experience with new digital design, engineering and construction techniques.



Working with AKT II, the design approach starts from a comprehensive understanding of the local supply chain, logistics and construction techniques to promote the use of local materials, craftsmanship and manufacturing facilities which support the economy of the region.

The design's modular system is founded on the use of sustainable timber, sourced nearby from certified forests on the Honduran mainland and treated locally, to form the main structural elements. Digital information technologies will optimize the use of all parts of the sustainably forested logs to minimize waste and pollution. This process also contributes to reducing the embedded construction

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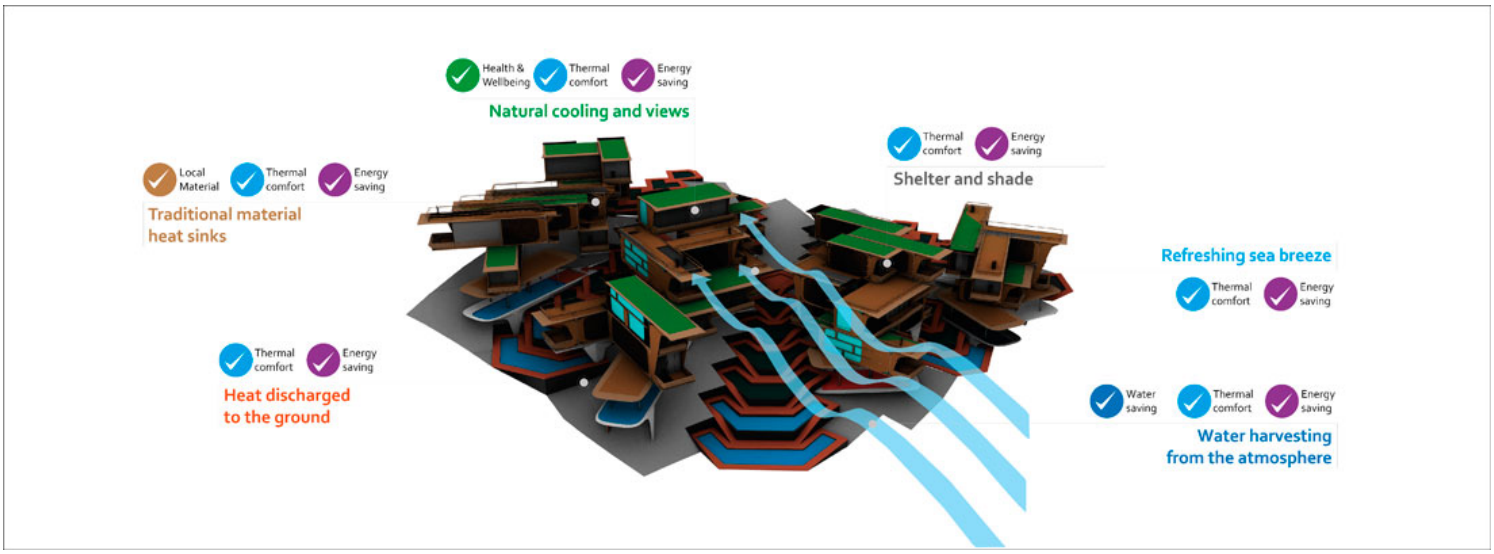
energy and carbon footprint of the development.



Erick A. Brimen, CEO of Honduras Próspera LLC, explains: “The design prioritizes sustainability and is integral to our vision for Roatán Próspera. The island of Roatán is already a renowned tourist destination. Roatán Próspera will strengthen and diversify the local economy while creating homes defined by their natural environment.”

With a considerable reduction in waste material, and a higher quality of construction due to the greater precision achieved by off-site fabrication, this modular system of assembly is a cost-controlled solution specifically tailored to local supply chains, transportation and installation.

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The dimensions of the structure's base timber units have been established to follow the constraints of the local transportation networks to ensure carbon emissions and logistics costs are minimized.

The use of lightweight timber results in a reduced and adaptive foundation system that can be fabricated off-site, keeping intervention on the site minimal and giving maximum protection to the site's native flora and fauna.

Divided into a 'kit of parts' that is quickly assembled on site, the design approach is centered around ensuring local craftspeople, tradespeople and construction teams also benefit from the knowledge and experience obtained by working with new technologies, building lasting relationships between homeowners and the local community that will help new residents to integrate with local culture. All suppliers will be given full assistance to adapt their product lines to the 3D digital information model of the houses and the terrain.

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Hilson Moran developed the design's passive environmental control and water cycle strategies to minimize energy consumption by reducing temperatures to improve thermal comfort, with little or no requirements for mechanical ventilation. Dynamic thermal modelling was used to validate user comfort and energy consumption parameters.

Optimizing renewable resources to reduce energy consumption and generate water, the modules are designed to be self-shading, open and oriented towards the prevailing sea breeze for natural cooling. Local, natural materials and ground coupling provide further cooling to interior spaces. When required, water is removed from the atmosphere for supplementary cooling by dehumidification. This water is harvested and filtered and available for use in each home. For self-sufficient and net zero carbon operations, shading canopies are optimally shaped to accommodate photovoltaic arrays for renewable power generation. Batteries will store renewable electricity for future use.

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The design for manufacture and assembly (DFMA) approach has been carefully instilled into the design of the structural kit of parts, while smart timber connections allow for quick assembly and disassembly, giving the potential to reconfigure the residence or recycle any element of the modular kit. Integrated services and insulation will be pre-assembled and installed within this structural system, which performs as a robust structural frame and building envelope with enhanced thermal and acoustic performance. The configuration platform ensures adjacent units have consistent service locations to minimize on-site connection.

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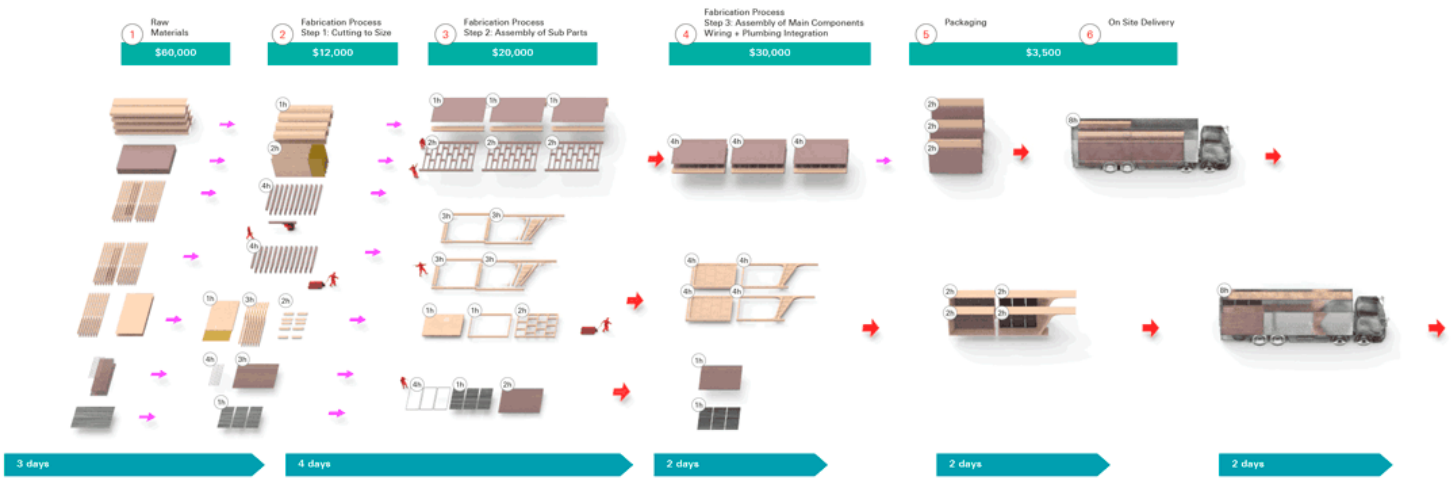

The digital configuration platform allows homeowners to plan their homes and connect with local suppliers, offering the construction and operational benefits of the digitization of the buildings. The platform can be used to accommodate the specific spatial needs of family members, share resources and costs with neighbors, and allow flexibility for communal modules such as a children's play area. Applying parametric design software developed by the Computational and Design Group at ZHA (ZHCODE) and the Computational Engineering Team at AKT II, (P.ART), the platform ensures that each residence is developed specifically to the configuration defined by each homeowner. It also ensures that each home is fundamentally sustainable by using as little material and energy as possible in its construction and operation with the shapes of each element within the building being environmentally appropriate, particularly from a solar and ventilation perspective.

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Extensive feasibility studies have informed the design of the platform's kit of parts using a library of spatial and building elements tailored to the ecology and supply chain of Roatán. These adapt digital design and fabrication methods to incorporate the skills, experience and craftsmanship of local building traditions and culture. Particular care has been given to ensuring the designs are sustainable and feasible within the environment of Roatán, incorporating vernacular design features such as *palapas* and other naturally ventilated spaces, the use of locally sourced timber, passive shading, rain water collection and cooling pools.

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A principle underpinning the configuration platform is three-dimensional property rights, with homeowners acquiring occupational and exclusion rights for units of 3D space called volume-pixels or voxels. Their residences will be algorithmically computed to fit within their chosen arrangement of voxels. Each voxel is 35 square meters in plan-area and 4 meters high. Residential units vary from 35 sq.m studios (1 voxel), to 175 sq.m family homes (5 voxels). This parametric approach to the design of each residence and overall composition of the development yields many different possibilities united by a coherent formal logic and materiality.

Homeowners can use the platform to customize the spatial layout of their residence to fit their preferred number of voxels. These choices are exponential in nature, with at least 15,000 different variations to configure the maximum of 5 voxels.

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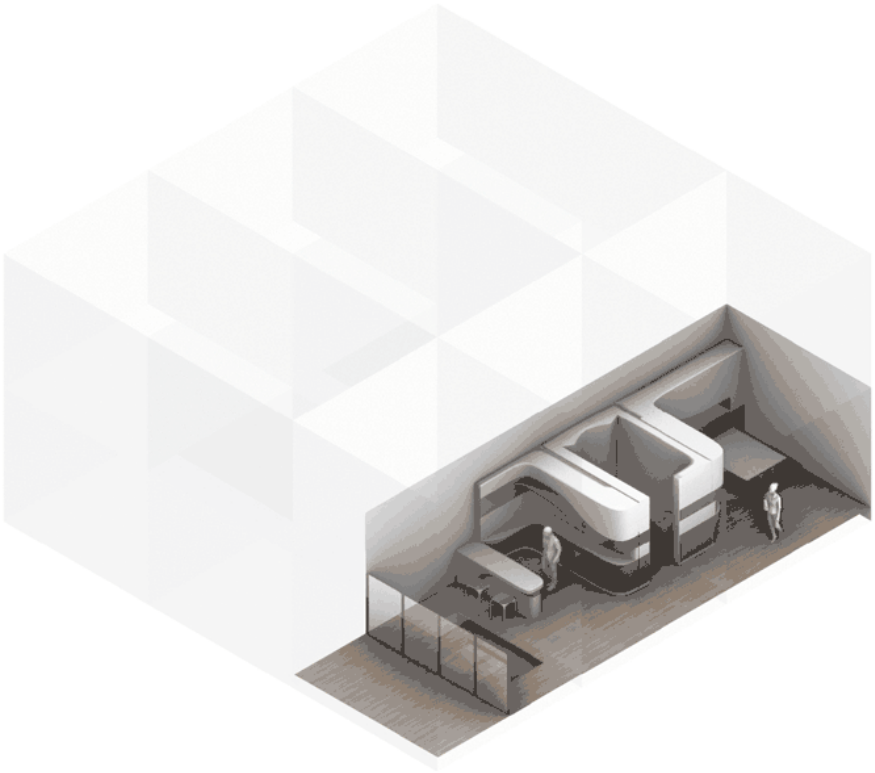

Sleeps: 2

Bedroom: 1

Bathroom: 1

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The configuration platform adapts each residence to the terrain and other particulars of the site include views and minimizing any earthworks during assembly. The platform also gives a choice of built-in furniture modules and spatial arrangements to suit individual lifestyles and preferences. These modules include walk-in wardrobes and conversation pits and are designed to integrate into the walls or be contained in islands within each room. Homeowners can also appoint local suppliers to create furniture specific for each room using the digital assets provided by the configuration platform, including the 3D model of the home.

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