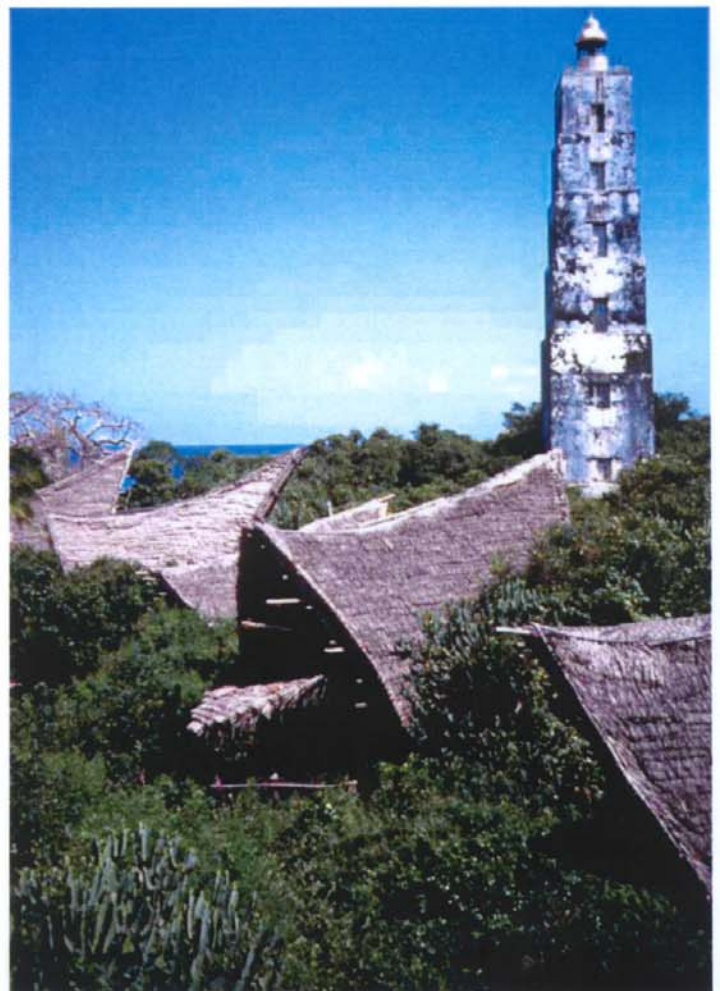




Above: Coral reefs are an outstanding feature of the sea in the vicinity of the island.



Right: The few constructions present here include a lighthouse and mosque dating from 1904, and the new bamboo-and-thatch bungalows.



Above: The structural system developed for the bandas and visitors' centre is a successful combination of local materials and construction techniques with modern architectural form.

Below: Shape was dictated by the limitations of the materials available, and the need to utilise the roof as a wind-catcher and rainwater harvester to channel water to the filter system.



Chumbe Island, Zanzibar, Tanzania



Above: Lattice-shell structures are built with kasuarinia-tree poles for the main struts and mangrove poles for the beams, joined with coconut ropes.



Right: Latticed wood and makuti shell roof on top of the solid base which forms the cistern and rainwater filter.

Chumbe Island, Zanzibar, Tanzania



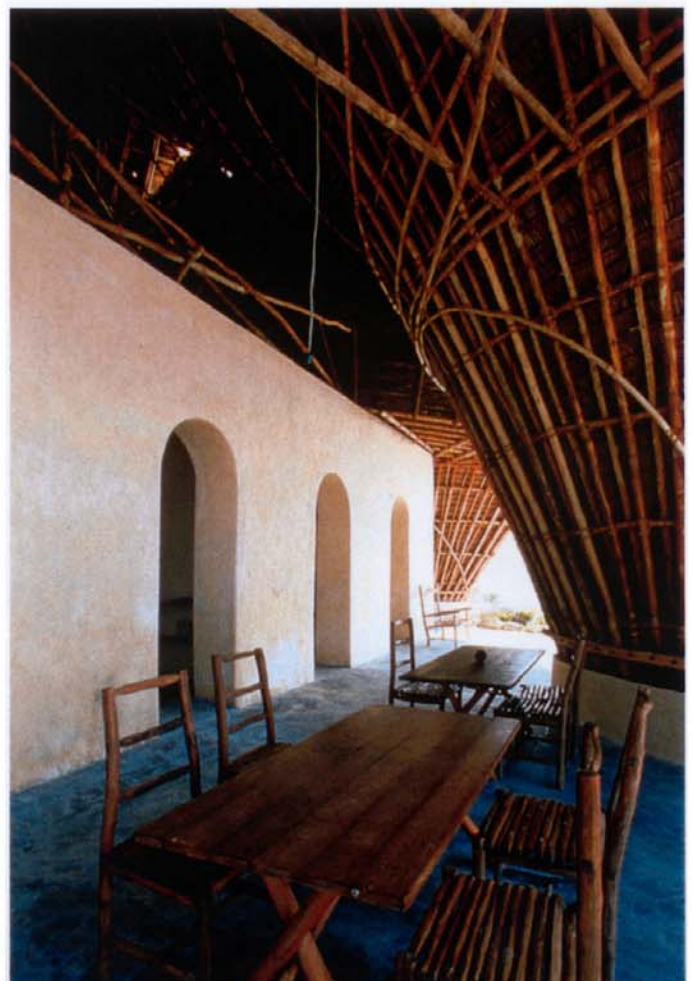
Above: The wood lattice structure covers a wide area with only few points of anchorage, allowing open views and natural ventilation.



Right: "Technical Tower" at the back of the bungalow with hot and cold water tanks and space for solar batteries.



Above: The floor is finished with coloured cement and decorated with marine motifs.



Right: The existing lighthouse-keeper's lodging was adaptively re-used as the Visitor's Centre by building a 21-metre span, wood lattice structure over it.



Above: Rainwater filter and flush basin in the Visitor's Centre.



Right: Detail of the wood lattice structure used in building the Visitor's Centre and Bungalow roofs. Note the use of vernacular "makuti" or coconut leaf shingles.

Chumbe Island, Zanzibar, Tanzania

Chumbe Island

Coral Park
Zanzibar, Tanzania

Architects	Georg Fiebig Wolfsbittel, Germany
	Jan Hülsemann Bremen, Germany
	Peter Kusch Braunschweig, Germany
Clients	Chumbe Island Coral Park Ltd. Zanzibar, Tanzania
Commission	1993
Design	1994 - 1997
Construction	1994 - 1998
Occupancy	1998
Site	25'000 m ²
Ground Floor	600 m ²
Total Floor	820 m ²
Costs	271'000 USD
Global	
Currency	Tanzanian Shillings
Programme	An eco-friendly tourism project on a small island that forms part of the Zanzibar archipelago. The project relies on environmentally-friendly systems for construction, waste disposal, hot water generation, and potable water production.

Building Type 858
2001 Award Cycle 2556.TAN



Old lighthouse, built in 1908, and the newly built dome of the Visitors' Centre form a landmark for boats sailing between Zanzibar and Dar Es Salaam.

The Project

The Chumbe Island Coral Park project demonstrates sustainable use of a tropical island for the benefit of Zanzibar society. This is achieved by protecting its coral reef, which is of exceptional diversity and beauty, and a coral rag forest by means of park management and environmental education. The project is supported by tourism and combines local traditions with modern environmental architecture.

Chumbe Island is situated 12 km south-west of

Zanzibar Town and was declared a protected area in 1994. The first Marine Park in Tanzania is managed by the Chumbe Island Coral Park Ltd (CHICOP), a private company.

All infrastructural development has been carried out in a sustainable and environmentally-friendly way, using technologies which have close to zero impact on the environment. The buildings were especially designed and built for this ecologically most sensitive island.



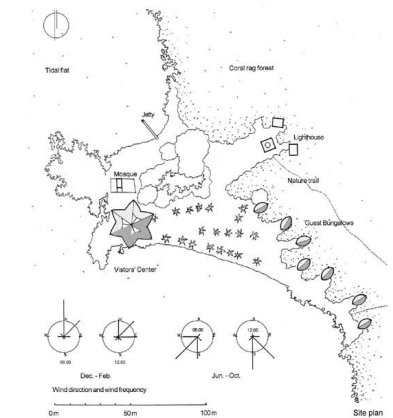
Dome of the Visitors' Centre under construction is probably the largest free-spanning dome made from slender poles and coconut ropes.



The Western terrace of the Visitors' Centre facing seawards, showing the flooring point of the dome.



Chumbe Island, Tanzania's first Marine Park, with its endemic coral rag forest and under water coral garden. The aerial photo and siteplan show the lighthouse, Visitors' Centre and the Guest Bungalows.



Lattice shell under construction



Southern tip of Chumbe Island with Guest Bungalows placed carefully into the forest

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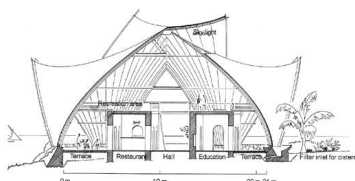
SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



View on to the dome of the Visitors' Centre



Part of the 21 m free-spanning roof construction, built from slender local poles



Cross section of the Visitors' Centre showing the impressive inner room of the new dome. The old lighthouse keeper's house divides the building into different areas on the ground and first floors.

Construction

Seven bungalows for visitors were carefully placed in the pristine forest. The former lighthouse keeper's house was converted into a Visitors' Centre and was given a new roof dome. The historic mosque and lighthouse remain untouched.

The architecture expresses the African building traditions in a modern and sustainable way and creates an atmosphere of harmony and understanding of the surrounding nature. Its innovative construction and environmental technology is based on traditional building techniques and local materials. It provides valuable experiences in sustainable housing technologies for remote areas and supports small scale industries in the local building sector.

Each building functions as a self-sufficient unit by generating its own water and energy with rainwater catchment and filtration, solar water heating and photovoltaic electricity. Sewage is avoided by using composting systems, and plant beds utilise the grey water.

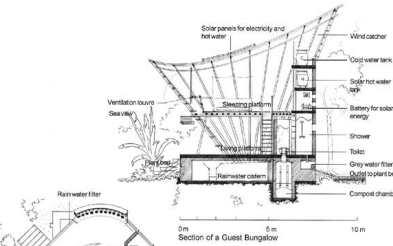
The shape of the roof enables perfect ventilation by sea breezes. The thatched roof structures follow the principle of latticed shell constructions and are made traditionally from local poles and ropes.

Since 1998 the project has proved its benefit to the Islamic society of Zanzibar by protecting the island, its surrounding reef, and educational activities.

The roof is a free-spanning latticed shell construction out of slender unbarked poles joined with coconut ropes.



Guest Bungalows placed in the lush vegetation. The roof was designed for perfect ventilation and sea view.



Each building functions as a self-sufficient unit by generating its own water and energy with rainwater catchment and filtration, solar water heating and photovoltaic electricity. Sewage is avoided by using composting systems, and plant beds utilise the grey water.



Under the newly built roof dome is the centre for education for local school classes (see picture above), fishermen and tourists. Facilities for visitors, such as a restaurant, recreation areas, reception, office and a kitchen are also integrated in the building.



Locally made furniture in a bungalow



Sea view from the bungalow sleeping platform showing the roof construction

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VISITORS' CENTRE



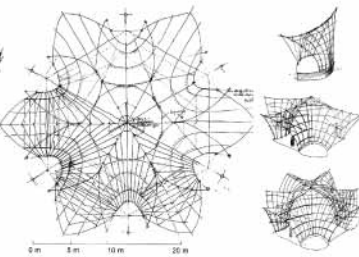
The new roof dome of the Visitors' Centre vaults over the former lighthouse keeper's house. The centre, with its reception area, restaurant and kitchen, and a classroom for environmental education, offers shaded and well-ventilated verandahs and decks with a splendid view of the surrounding nature.



Ground floor of the Visitors' Centre with surrounding landscape, showing the future position of the Centre at the edge of the enclosed coral rag platform. This converted lighthouse keeper's house now offers areas which can be closed off for different functions. Several verandahs are grouped around the core building, and harmonise it with the landscape.



The roof forms a large free-spanning lattice shell construction from slender poles and coconut rope which are bound together with a traditional technique.



Sketches of the construction principle: the lattice shell dome is the result of an addition of six single modules. These bear their origin in the construction of the guest bungalows.



The lattice shell under construction.



Section of one module showing the height of the lattice.



View of the vertex and a segment of the roof dome.



Partial view of the lattice dome showing the area on top of the right-lighthouse keeper's house.



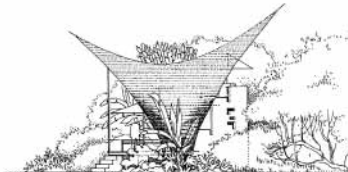
Exhibition area with stairs to the top floor.

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GUEST BUNGALOWS



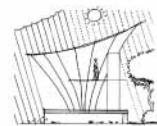
Sketch view of the Guest Bungalow from the sea.



Sketch view of the Guest Bungalow from the side.

The Guest Bungalows are small units carefully placed into natural clearings in the coral rag forest. Without disturbing the surrounding nature they offer protection from sun, rain and insects, and use the wind for ventilation. The bungalows provide the guests with water and electricity. The construction, the orientation and the interior of the bungalows give the visitors the sense of being alone on an island in harmony with nature.

Design concept:



The roof protects the guests from sun and rain. Only the evening sun can enter the building. The solid base of the bungalow protects from insects and water.



The roof acts as a wind catcher. During the south-west monsoon it is open to the sea with a closing ventilation louver in the case of storms. During the north-east monsoon the roof is high enough to catch the breeze which blows above the tree line.



The house is a composition of the solid base and tower for the technical components (these the grey parts) and the light-weight roof. The position of the bungalow was determined by the location and the natural surrounding features.

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



Lattice shell roof on top of the solid base which forms the column and rainwater filter.



The sound roofing construction is visually attractive.



The bungalows are embedded into the forest, every guest is by himself with nature.



The elevated base forms the living platform and offers a splendid view over the island.



The lattice shell framework as a model.



... and in reality



The floor is made from coloured cement decorated with marine motifs.



The floor is made from coloured cement decorated with marine motifs.



Technical Tower with hot and cold water tanks, solar power system.



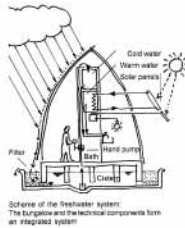
Rainwater filter and overflow.



Sleeping platform.

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SUSTAINABLE TECHNOLOGY



Introduction

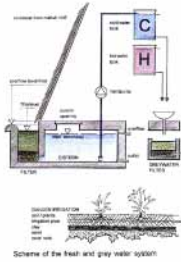
Each building functions as a self-sufficient unit by generating its own water and energy with rainwater catchment and filtration, solar water heating and photovoltaic electricity. Sewage is avoided by using composting systems, and plant beds utilise the grey water.

Solar energy

Small decentralised solar power systems provide electricity for lighting in the bungalows. The Visitors' Centre has its own solar generator lighting. A DC/AC converter enables TV sets and Video players to be used for educational purposes.

Fresh water

Chumbe Island has no source of fresh water other than rain. Therefore rainwater catchment provides the most feasible water supply for drinking and washing. From the roof of each building the rain water is funnelled via a sandstone filter into a cistern which forms the base of each Guest Bungalow and parts of the Visitors' Centre. The large size of the cistern enables

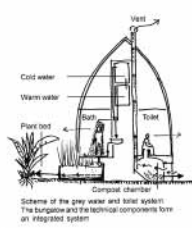


SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA

water storage during an average rainy season sufficient to provide the bungalow with water even during the following dry season. For showering, the water is heated by a solar water heater attached to the rear of the technique tower.

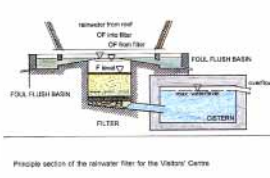
Grey water

The slightly-soiled water from the bathrooms is directed through a filter bag for large particles into a coral-stone-filled ventilated water tank. Here the first stage of microbial decomposition takes place by the process of oxygen enrichment of the water. The water is then collected in a small reservoir which empties within twelve hours via a drip-irrigation system. The whole system, including the pipes and the reservoirs, are screened from insects. The irrigation hoses are placed in a vegetated soil bed with a sealed base. Soil bacteria in the humus soil purify the nutrient-rich water completely. Specially-adapted plants absorb the water continually, keeping the ground porous and supporting microbial decomposition.



Compost toilet

Human wastes are not flushed away with water, but fall directly into a hermetically-closed container. A sophisticated ventilation system enables aerobic decomposition to take place inside the container instead of anaerobic putrefaction. During the composting process the organic wastes are completely transformed into fertilising soil and a complete decomposition of all germs takes place. During the process the waste is reduced to one sixth of its original volume. The ventilation exit is located above the roof level and the suction in the ventilation pipe ensures an odour-free environment. At approximately six month intervals, a small amount of soil can be removed and used as fertiliser. The completely-closed compost chamber is screened from insects. The toilet seats are tightly sealed, hygienic and easily cleaned. The compost toilet system on Chumbe Island is based on the Swedish 'Clivus Multrum Compost Toilet System', which proves 60 years of successful operation.



TAN.P002556

BUILDING TECHNIQUES AND SUPPORT OF LOCAL SMALL SCALE BUSINESSES



During the designing and building process many local tradesmen and small scale building enterprises were consulted and incorporated. They contributed with their knowledge of traditional building techniques and skills to define a new architectural language and construction, mainly based on the nature of the local material.



IMPRESSIONS ON CHUMBE ISLAND



Preliminary site plan of the project area during the design process.



The top platform of the lighthouse offers a superb view over Chumbe Island and its reef. To the east, Zanzibar and to the west, the African mainland can be seen.



Approaching Chumbe Island and the Victoria Centre by boat at low tide.



Northern tip of Chumbe Island showing the dense coral reef forest. A distance of approx. 12 km away is Zanzibar Town.



Three huge baobab trees are an impressive landmark close to the Victoria Centre.



The lighthouse built in 1904 by the British, is still in operation.



The mosque was built for the lighthouse keeper in 1904.



The overhanging coral reef is densely vegetated with primary forest.



Coconut palms grow in a clearing made in 1904.



View of Chumbe Island from a ferry boat travelling between Zanzibar and Dar Es Salaam, mainland Tanzania.

NATURE TRAILS ON CHUMBE

Underwater nature trail: the Chumbe coral reef sanctuary is home for more than 370 species of fish and most of the hard coral species in East Africa. Guided snorkelling tours are led by rangers.



Rangers exploring the fish identification card to a tourist, which is attached to the floating information device, moored on the reef.



Intertidal nature trail: this area is defined by the tidal changes and has many species of flora and fauna specially adapted to this harsh environment. This trail leads the visitors around the entire island.



Park rangers on the intertidal nature trail at low tide underneath a coral rag overhang. In the background the Victoria Centre can be seen.

Coral rag forest trail: a clearly marked path with information boards and accompanying booklets guides the visitors through parts of the dense forest to the other side of the island.



A group of Zanzibari villagers on the forest nature trail looking at the dense vegetation, which masks itself and is nourished within holes in the rugged coral rag.



Lionfish (Scorpaenidae), Pterois miles, hovering over the coral, Malindi, Kenya.



Digitate and branching species of Acropora corals dominate the reef crest.



The palm drinking coconut crab, Birgus latro, is common on Chumbe Island but is not listed as an endangered species.



Banner fish, Nectocarus acuminatus, with trigger fish (Balistidae) on the reef.



Brain coral, Leptastrea phrygia, showing worm tube holes.



Sea star, Proboscidea anchi.



Living giant corals, Dipsosa sp., are commonly found on the reef flat and fringed zones on the coral rag platform.



Fire bell fly.



Mangrove kingfisher, Halcyon aspergillata, is one of more than 70 bird species found on Chumbe Island.

BUILDING THE GUEST BUNGALOWS

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



The three building sites, carefully placed into existing openings of the forest, show different building stages. The bottom one shows the cistern's foundation, the middle one the concreted partitions of the cistern and the top one the as yet not covered expressive roofing construction.



Two workers concrete the platform inside the 'technique tower' which will eventually carry the hot water tank.



In contrast to the solid 'technique tower' and the partition wall to the bathroom, which are made from blocks, the light roof is made from local poles.



The rain water gutter below the roofing points of the roof frame is wide enough to collect tropical rain. The groove running around the base of the bungalow is a measure to prevent termites from entering the house.



The compost chamber has been excavated from the coral rag. The first blocks of the chamber are laid by Abd. the foreman.



The foundation of the cistern is ready to be filled with concrete. The compost chamber is shaded with coconut palm leaves to ensure curing of the plaster.



The joints between the sand-cement blocks, placed on the formwork, will be filled with concrete. Once the concrete is hardened, the formwork will be removed from the cistern chamber through the revision hatch.



Standard plastic tubes and bucheles are used to make openings for water pipes and the compost toilet refuse opening in the vault.

BUILDING THE GUEST BUNGALOWS

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



Workers attaching the ridge to the upright frames.



The ridge of the bungalow reaches over the treetops to catch the sea breeze for natural ventilation.



The roof is heavily covered on both sides with 'makuti', the local roofing material made from coconut palm leaves.



The upright frames are propped up by temporary supporting poles, until ...



horizontal beams are attached to completely stabilise the roof structure.



The lattice shell construction forms a plastic, but very stable structure.



Only the roofs of the bungalows are visible through the dense vegetation.

BUILDING THE VISITORS' CENTRE

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



Aerial photo of Chumbe Island, approaching the island from the south. The roof dome of the Visitors' Centre is not yet under construction. The Guest Bungalows are arranged along the bay.



The bare pole construction of the roof dome spans over the former lighthouse keeper's house.



One of the sea-facing modules.



For the construction of the free spanning roof dome of the Visitors' Centre, six lashed shell modules are built simultaneously to meet in the centre of the construction, forming its vertex.



The roof dome is partly covered with mauuli. Solar panels are installed to provide energy for lighting and radio communication to Zanzibar.



Two workers attaching poles with coconut ropes within the dome construction.



One lashed shell module under construction.



Finally the six modules join up in the centre, forming the vertex.



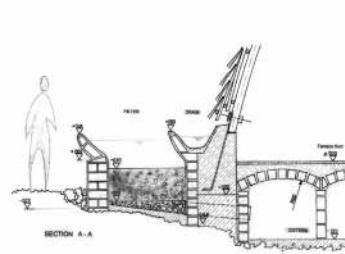
The mauuli is placed in horizontal layers, starting from the bottom to the top of the construction.

BUILDING THE VISITORS' CENTRE

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



Aerial photo of the former lighthouse keepers' house showing the footings of the roof dome, yet to be constructed.



The rain water runs of the system function as a combined filter and 'four foot' unit. These separate the first, rather 'dirty' rain water flush, from the 'cleaner' second flush which then enters the cistern through the sand-stone filter.



Much of the doors and windows of the lighthouse keeper's house are widened and enlarged.



Some of the damaged walls of the existing building are rehabilitated.



A filter and four foot unit in use. According to the prevailing water level, the water flows into the next partition.



Access base of the former lighthouse keepers' house is excavated to storm rain water.



A filter and four foot unit, which also forms a footing point of the roof dome.



at two different stages of its construction.



A revision hatch for the cistern is placed close to the filter unit.

TRANSPORTING BUILDING MATERIALS to CHUMBE



The project's transport 'dhow' loaded with building materials from Zanzibar Island is approaching Chumbe Island at high tide.



At low tide the transport 'dhow' is unloaded stock by hook, bag by bag. At the second next high tide, 18 hours later, it will set off for Zanzibar again using the constant winds during daytime.



Sand and aggregates packed in bags, and blocks from Zanzibar are deposited above the high tide water mark before being taken to the building sites.



The repetition of the dhow's being dry on the rocky tidal flat on Chumbe Island made boat repairs necessary. These were carried out by local ship builders.

Due to Chumbe Island's national park status, no building material could be taken from the island to protect the delicate ecosystem.

With a local 'dhow' all building materials were sailed to Chumbe according to the wind and the tides. It was even necessary to take sand, aggregates and some-times fresh water, to Chumbe Island before cisterns were available to store rain water.

SUSTAINABLE ARCHITECTURE for the CHUMBE ISLAND CORAL PARK in ZANZIBAR, TANZANIA



The project's transport 'dhow' at the sandy beaching ground at Chumbe Island, Zanzibar, at low tide.