# Children Activity and Learning Centre, Koh Kood, Thailand

# 儿童活动与学习中心，苏梅沽岛，泰国

**客户** Six Senses Bangkok
**建筑设计** 24H > architecture
**建筑师** Boris Zeisser, Maartje Lammers, Olav Bruin, Anne Laure Nolen
**竹结构顾问** Jorg Stamm
**结构顾问** Ove Arup Thailand
**资料提供** INBAR, 24H > architecture

Soneva Kiri（Six Senses旗下度假村品牌）度假村是一个六星级酒店，位于泰国湾的Koh Kood岛屿上。在这个特别的小岛上，荷兰建筑师事务所24H>architecture设计了一系列生态的标志来凸显Six Senses“设计融于自然”的特色。最突出的是儿童活动和学习中心，这将为来访的孩子们提供广泛而又寓教于乐的活动来提高他们的生态意识水平。这个建筑空间像是一个小洞穴，设有电影、演讲及礼堂，还设有保存当地传统及永久性文化书籍的图书馆、一间画室和一间时尚影音室，让孩子们在玩耍的同时激发创造力和生态意识。

## 设计

设计师们从热带的海底世界中找到了灵感，在海洋美丽的彩色珊瑚和鱼类中，将俗称“魔鬼鱼”的Manta Ray（学名蝠鲼的一种鱼）作为建筑设计的概念。因Manta Ray的巢穴一般位于靠近海边处岩石旁的斜坡上，建筑师按照Manta Ray的形状建造的泰竹穹顶就位于一处高地之上，居高临下地俯瞰着周围的壮丽海景，似乎想一跃回到海里。为了适应潮湿的热带环境，建筑师采用逐层内缩的楼面和高架屋顶的开放式设计，实现良好的自然通风。类似于传统的泰国房子，为

了实现更好地对流通风，结构上将底层适当抬高。这样建筑对自然环境的影响也达到了最小化。8m高的屋顶悬挑着就像一把大伞遮风避雨，其中心还设有玻璃天顶，可以充分接收自然光，极大减少了建筑的能源消耗。

该项目的主要挑战是传统材料在当代建筑中的应用。除3D电脑模型外，设计师还搭建了一个1：30的实体模型来辅助进行竹结构的设计，并在奥雅纳工程顾问工程公司人员的监督下，在曼谷政法大学对此模型进行了风洞测试。此外，曼谷的Mongkut国王理工学院对“Pai Tong竹”（Dendracolamus asper，泰竹的一种）也进行了拉伸、压缩、剪切和弯曲的测试。竹子是一种非常独特的建材，质轻且强度高，但如果应用不当，也容易受到白蚁和气候的侵蚀，因此所有的竹子已用硼处理，以防止受到侵害。此外，设计师们还应用了“保护性设计”，如提高竹结构使其距离地面超过30cm，以及采用屋顶悬挑以保护整体结构不直接接触雨水和紫外线。屋顶悬挑的基本经验是每当墙或柱高度增加2m时，屋顶就多悬挑1m。

## 室内

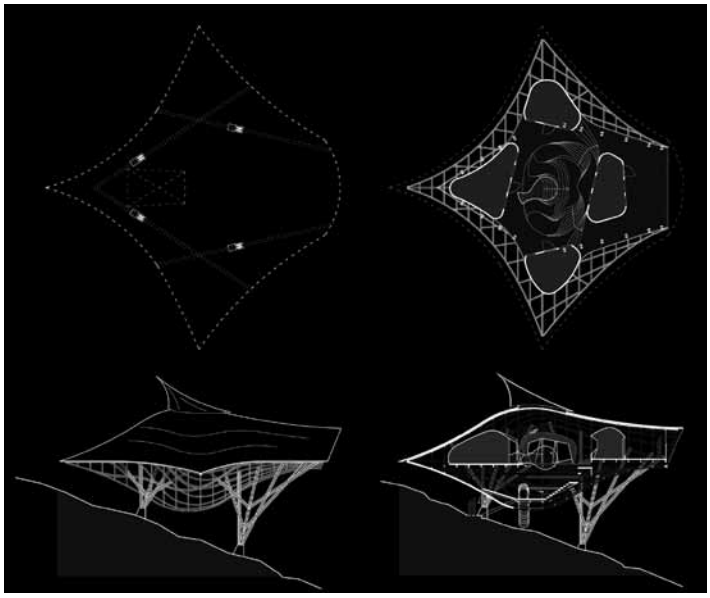
室内的4个房间就好像动物的“器官”，使用当地的藤条来构建，地板则使用了人工种植的赤桉木材。在建筑前部的露台就可以看到度假村海湾的美景。房间的墙壁由蚊帐制成，表面覆盖竹木屑、红色土壤、白色沙子或木屑，使每个房间都拥有自己独特的氛围。音乐室墙面采用纤维素进行了绝缘处理，室内的墙上还挂满了专辑封面。在建筑的中心，楼梯的圆环状踏步和上方藤条编成的阳台共同形成了一个河豚（泰语pla pakpao）形的小剧场或电影院。考虑到孩子们的安全，所有门窗都由有机玻璃制成。

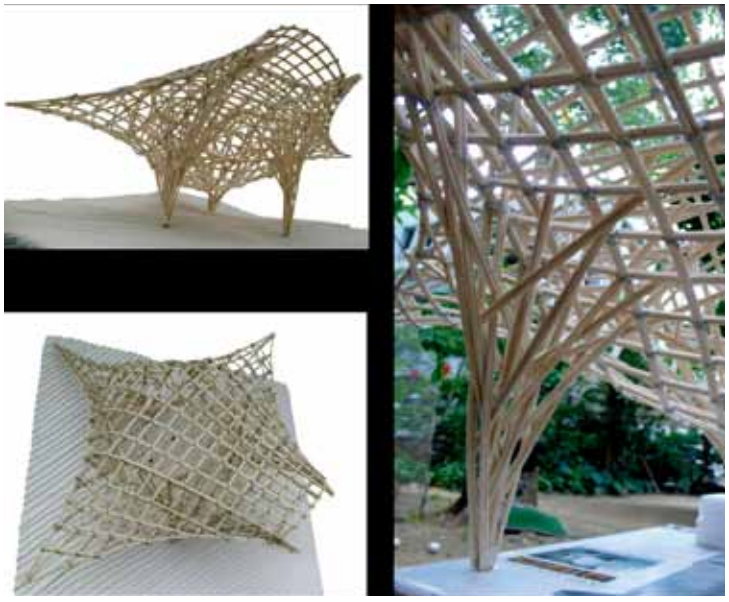
## 建构

建筑中所有的梁都在三维模型中生成。为了制作曲梁，将竹子放入专门研发的蒸汽炉中加热，1小时之后再将其放入一个可调模板中，制成70多根单独曲梁。建筑主体结构混合采用了现代和传统的连接技术。由于高度12m、跨度28m结构的超大荷载，主体结构中多处使用螺栓进行连接。在这些节点中，将水泥灌入竹子，以防止竹子开裂崩坏。对于次级屋顶和弯曲凸起结构，利用竹销钉连接缠绕竹竿束的藤条。屋顶部分也由竹子制作，天花板顶部设置了防水卷材，屋顶上面还覆盖着竹制瓦片。

## 泰竹

竹子是在世界上使用最广泛的建筑材料之一，但主要是由穷人使用。因此，它的绰号是“穷人的木材”，只要人们有足够的钱，他们





都将使用石头或混凝土建造房子。这个项目旨在改变竹子的坏名声，同时向人们和其他建筑师展示竹子是一种多么令人赞叹的优异建材，竹子也是适合现代建筑的。此外，竹子是最绿色环保的建筑材料之一。它在生长4~5年后，就可以达到建筑结构要求的强度。由于竹类植物每年都长出新笋，在收割了生长4~5年的竹枝后它也不会死。这是一个持续不断的收获、成长过程。相比生长超过40年才能满足结构强度要求的树木来说，这是一个巨大的优势。

建筑主体结构采用长度9m、直径为10~13cm的“Pai Tong竹”（Dendracolamus asper）建造。次级屋顶和肚皮般弯曲凸起的结构是由长度4m、直径大约5cm的“Pai Liang竹”（Bambusa multiplex）建造。这两种类型的竹子都产自泰国邻近的Prachinburi省。（译/张岩，校/吴春花）

**Background of the project**

The 6 star hotel resort Soneva Kiri is located on Koh Kood, an island in the Gulf of Thailand. At this unique site, 24H–architecture designed a series of ecological icons to contribute to Six Senses' high ambitions in design and ecology. Most prominent is The Children Activity and Learning Centre, which will provide visiting children a wide range of entertaining activities as well as raise the level of ecological awareness with them. This Den provides an Auditorium/Cinema for films, lectures and plays, a library with books on permaculture and local traditions, an Art room, a Music room and Fashion room, thus giving children both creative and ecological education while playing.

**Design**

The objective for the project was to design a fun an inspiring surrounding for the children's activities. Inspiration was found in the tropical underwater world, with it's beautiful coloured corals and fish, of which the amazing manta ray was chosen as reference for the building's concept. He Den is located at a rocky slope close to the sea. With its Manta–ray inspired bamboo dome, perched in an elevated position so as to offer magnificent views, it seems to launch itself into the bay.

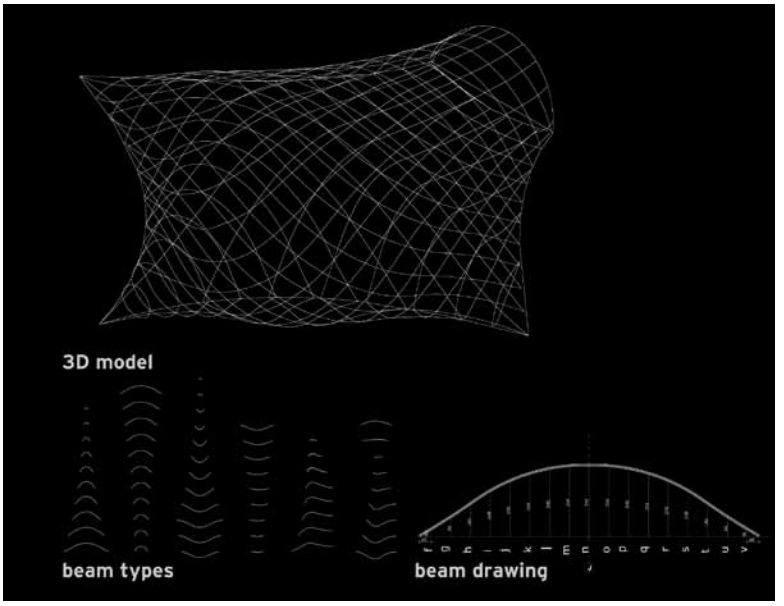
The design adopts all bioclimatic aspects to suits its humid tropical environment. The open design with the setback floors and elevated rooftop provide natural cross–ventilation. Similar to traditional Thai houses, the structure is elevated for a better cross–ventilation. In addition, it's footprint in the natural surroundings is minimized.

The roof cantilevers up to 8m acting like a big umbrella providing shade and protection from the heavy rains. The translucent elevated rooftop in the centre of the building allows natural daylight in the building, limiting the energy consumption.

**Interior**

The 4 rooms in the interior are the 'organs' inside the animal. Local rattan was used to construct these organically shaped volumes and plantation river red gum wood was used for the floor. In the front, a balcony provides an amazing view over the resort's bay. The walls of rooms are made from mosquito netting, clad with bamboo sawdust, red soil, white sand or wood chippings, giving each room it's own atmosphere and identity. On the inside, the Music Room is insulated with cellulose insulation and clad with note music.

In the centre, the circular steps of the stairs form a small theatre or cinema with a rattan chill balcony above, shaped like a blowfish (in thai: pla pakpao). For the children's safety, all doors and windows are made from acrylic.




**Design process**

The main challenge of the project was to make a contemporary design with a traditional material. Therefore, material and design research had to be made and experts had to be consulted during the design process.

Besides a 3D computer model, a big 1:30 scale model was built helping designing the bamboo structure. This model was tested in the windtunnel of Thammasat University in Bangkok, supervised by the engineering company Ove Arup. Furthermore, Pai Tong bamboo has been tested on tension, compression, shear and bending in the King Mongkut Institute of Technology in Bangkok.

Being one of the most experienced bamboo builders in the world, Jorg Stamm from Eco Bamboo was consulted. Project architect Olav Bruin joined a bamboo workshop by Stamm in Germany and visited impressive bamboo structures in Bali which Stamm built over the past years. Bringing in Stamm's bamboo expertise was crucial in the realization of this project since bamboo is a very specific building material which is very light and strong but also vulnerable to termites and climate, if not applied properly. Therefore, all bamboo has been treated with Boron, a natural salt based treatment, to protect it from termites and other insects. In addition, 'protect by design' has been applied by elevating the bamboo minimal 30cm from the ground and protecting the whole structure from direct rain and UV light by the cantilevered roof. Rule of thumb is to cantilever the roof 1m for every 2m height of the wall or column.

**Construction**

All beams have been generated from a 3D computer model. For making the curved beams, the individual bamboos have been heated 1 hour in a specially developed steam oven, after which they were assembled in an adjustable formwork with a coordinate system, forming each of the more than 70 individually curved beams.

The structure uses a mix of modern and traditional joining techniques. Due to the heavy loads in the 12m high and 28m wide structure, bolted joints were used for the main structure. At these joints, the bamboo has been filled with a cement injection to prevent the bamboo from splitting. For the secondary roof– and belly–structure, bamboo dowels were mainly used in combination with rattan which was winded around the bamboo bundles. The roof consists of a ceiling of split bamboo with a waterproof membrane on top, covered with bamboo shingles.

**Bamboo**

Bamboo is one of the most widely used building materials in the world, but mainly by poor people. Therefore, it's nickname is the 'poor man's timber' and as soon as people have enough money they will build a house of stone or concrete.

The aim of the project is to chance the bad reputation of bamboo and inspire people and architects by showing that it is an amazingly beautiful material which is also suited for making modern architecture. Besides, bamboo is one of the most environment–friendly building materials. It can be harvested after 4–5 years when the bamboo is strong enough for structural purposes. Since the bamboo plant grows new shoots each year, it won't die by harvesting the 4–5 year old ones. It's a continuous process of harvesting and growing. This in comparison to a tree which takes over 40 years to grow before being useful for construction.

The main structure has been made using Pai Tong bamboo (Dendracolamus asper) in lengths up to 9m and a diametre of 10–13cm. The secondary roof– and 'belly' structure is made from Pai Liang bamboo (Bambusa multiplex) in 4m lengths and a diametre around 5cm. Both types of bamboo come from plantations in the neighboring Thai province of Prachinburi. AT