

## Tono Mirai

Tono Mirai architects, Karuizawa/Nagano, Japan

# Shell house – The language of the forest

In the centre of Japan, a small villa has alighted in the forests of Nagano Prefecture – a self-contained house made of local wood and earth, constructed using traditional techniques and designed to meet contemporary environmental performance requirements. The building is a product of the client's request for a work of "architecture that is unusual, beautiful, and does not make you feel old in time" as well as two primary conditions: the strict need to observe the retreat line of the landscape regulations and to occupy no more than 20% of the 290 m<sup>2</sup> site.

Taking this as its starting point, the house presents a closed facade to the streets and waterway to the north and west sides and an open south-facing frontage to the forest to receive light and heat from the sun. Its organic shape and open frontage help it "totally blend into the surrounding forest" to the south and east.

The house minimises its environmental impact through the use of local FSC-certified wood, earth, human craftsmanship, and no petrochemical materials – materials such as plywood, laminated timber or gypsum plasterboard were not used.

The interiors are finished with locally sourced earth and wood. The earth plaster of the internal faces gently stretches in a continuous flow across the curved interior. By retracting the sliding sections of the southeast window frontage, the interior extends out onto the deck and into the forest beyond. The first floor takes the form of an open platform reached via a curved stair with a bathroom at the rear concealed behind a continuous wooden door.

The house is designed according to passive design standards. The external walls and roof have an average heat transfer coefficient of  $UA = 0.49 \text{ W/m}^2\text{K}$



## SHELL HOUSE – THE LANGUAGE OF THE FOREST

and the building has achieved a five-star S-rating for the Japanese CASBEE Comprehensive Assessment System for Built Environment Efficiency. It undercuts the primary energy consumption standards in Japan by 11%. The earth wall is insulated with 180 mm of wool insulation with a thermal coefficient of  $U = 0.207 \text{ W/m}^2\text{K}$ .

The building structure is designed around seven curved beams born from the organic earth wall that express the cycle of human life and of the cosmos. The two inscribed circles represent the correspondence of the two. The shell house is a work of architecture that resonates with human life and is born of and will return to the earth.







*Concept*

Architecture born from and return to Earth using local Earth and Wood with traditional and Contemporary Japanese technique.

Wood shell structural roof Vertical 180mm □ pillar and curved 7 beams.

Overhanging 2.7meter eaves : Japanese traditional round beam method.

Contemporary Japanese energy saving performance.

Wall insulation  $U = 0.207$  (W/m<sup>2</sup>K)  
 $UA=0.49$  (W/m<sup>2</sup>K)

- Japanese primary energy consumption standard 11% reduce.
- CASBEE S rank☆☆☆☆☆。

**7** Structure

**1** Advantage

**2** •Exterior : Organic form in the forest.  
•Interior : Organic Earth space.

**3** Novel form and structure with

- Traditional technique
- Domestic materials
- Domestic craftsmen.

**4** •All local Earth and Wood in 150 km.  
•SFC wood : local structural and Furniture wood.  
•No use of plywood, laminated wood and gypsum board

**5** Social Proposal

**6** Energy Saving

**7** House using local natural material with low impact to Earth.

Seven Beams : Life Cycle of human and Universe

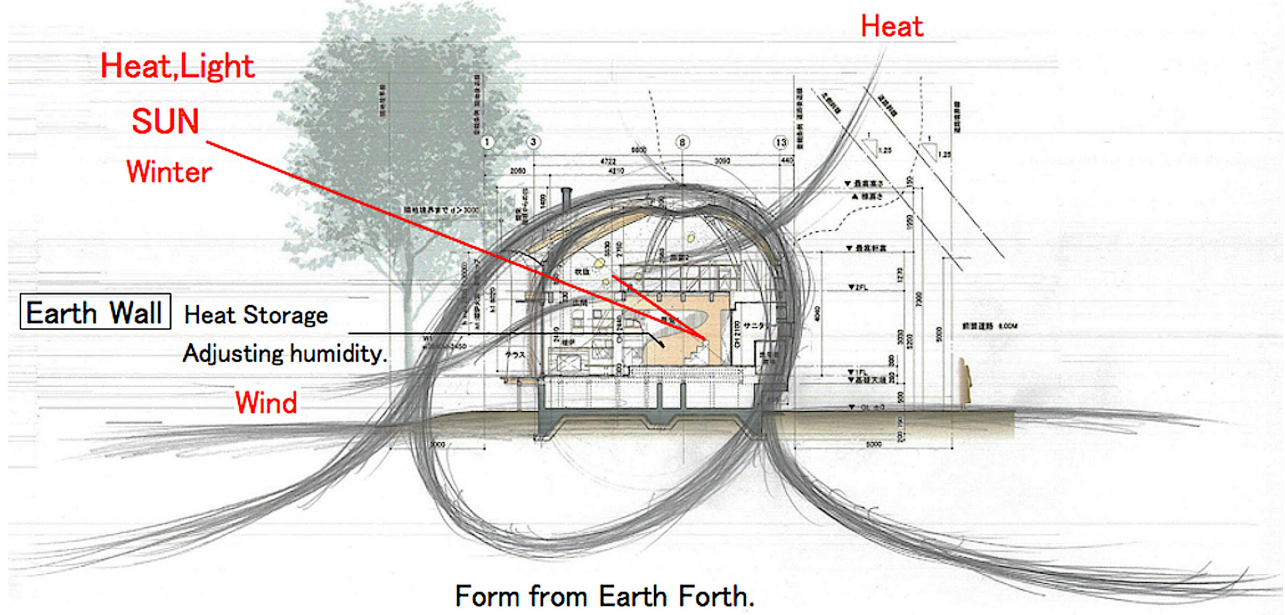
Talking to human

Organic Earth Wall

Two circles : Concordance between human and the universe



**PASSIVE DESIGN** Sun Light and Heat Direct Gain



Form from Earth Forth.

**Key data**

Architect: Tono Mirai architects / Tono Mirai  
 www.tonomirai.com  
 nest@tonomirai.com  
 Contractor: Terashima Construction Company  
 Structure: Timber  
 Footprint: 37.80 m<sup>2</sup>  
 Floor area: 58.04 m<sup>2</sup>  
 Site: 290.94 m<sup>2</sup>  
 Design: October 2011 – April 2016  
 Construction: April 2016 – July 2018

**Finishing materials**

External roof & walls: Asphalt shingles  
 Internal wall & ceiling: Locally sourced earth  
 Floor: Wood flooring and locally sourced earth  
 Fireplace: Rammed earth  
 Window and doors: Timber sliding door and window panels made of aluminium and resin composite with double and triple glazing.

**Photo and drawing credits**

Photos of the completed building: © takeshi noguchi  
 Drawings, model and site photos: Tono Mirai architects