



21st Century vernacular House

Location: Ayerbe, Huesca, Spain, Europe

Clients: Alejandro Ascaso Sarasa, Angels Castellarnau Visus

Architect: Angels Castellarnau Visus (*Edra arquitectura km0*)

Earthen company: Construcciones Salinero S.L, self-construction

Techniques: Rammed earth

Typology: Individual housing

Photography: Xavier d'Arquer (Doblestudio)

Construction year: 2014

Constructed area: 276 m²

This modern rammed earth house is located in Ayerbe, a little village in the Spanish Pyrenees. Rural migration in the region during middle 20th century led to the disappearance of traditional architecture techniques. This house attempts to awaken the interest of the community and the curiosity about this type of sustainable buildings that are strongly linked to the territory. The project has been inspired by old local earthen buildings regarding their orientation, morphology and the use of local materials.

Technical improvements, as adding straw to the mixture to improve thermal behavior, have been applied to the traditional rammed earth technique. It's also been applied an awareness choice of low tech, low energy and low impact materials and building systems. The 80% of the building's weight, composed by earth, stone and straw, is local. A life cycle analysis (cradle to gate) has shown a 50% reduction of CO₂ emissions.

The site is within the town, has a rectangular shape with its long side facing the north. The surrounding buildings use one or another earth construction technique (adobe, rammed earth and mixed stone building techniques). The house adapts to the street levels and is built in three floors.

Following the traditional strategies a patio was opened in the south. The passive solar design, combining big windows in the south face, little ones in the north and skylights with earth walls, ensures thermal comfort, natural light, and cross ventilation. These passive design principles maximize sunlight access trough the south façade improving benefits of earthen walls thermal mass. The strategy consists in capturing passively the climate's energy, and accumulating it in the same building in order to meet the interior comfort needs of the house.



In winter, heat is stored in earthen walls during the day and it's transmitted to the interior spaces throughout the night. In summer shadow systems as eaves, wooden curtains prevent the light access to the interior of the house.

Upper floors are built in 45cm thick earthen walls and timber decks support the housing spaces. Earth selection was objective and was tested in laboratory. A discontinuous sedimentation test and a screening test were made in order to know lime, sand and gravel's proportions. It was also made a carbonates test to quantify the carbonates proportions contained in the sample. Straw fivers were added to the mixture to increase thermal and shrinkage qualities. The interior and exterior lime plaster was built using the "calicostrado" vernacular technique. Wooden work form used was a standardized system and was mounted continuous and simultaneously fitting it immediately before the filling. The construction process was mechanized to improve execution and economical performance. The mixture, the elevation and the pouring were made by a single machine. The compression was made by hand with an electric compressor.

Coverings of interior partitions were made by local clay plasters. Swan timber floors were unidirectional and the beam fillings were made by pine wooden planks. The roof is isolated with 20cm of sheep's wool in order to avoid thermal loss during winter and overheating in summer. Inner wooden floors are isolated with natural cork boards.

Pinewood carpentry has double glazing with internal air chamber. Windows opened to north and west facades have interior wooden shutters. South windows have heavy interior curtains and roller exterior wooden shutters to manage shadows. Both strategies are the traditional ones for each orientation, adapted to local climate and it's management is known by users.

A cistern for reutilization of rain water is buried in the patio. A biomass heating boiler heats the house and produces hot water needed.

This modern earth house follows efficient vernacular architecture principles and helps to re link human to nature once again and to build a more sustainable architecture.