

Case study: Vernacular seismic culture in Chile

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ABSTRACT: As Chile is one of the most seismic countries in the world; different vernacular earthquake-resistant strategies have been created adapted to each context in this vast territory. In this case study, four examples of these strategies will be presented, based in the geometrical configuration and the use of lightweight structures or wooden reinforcements.

1 CHILEAN SEISMIC CULTURES

In Chile, an earthquake with a magnitude higher than 7, occurs approximately every 10 years. There have been more than 100 of these earthquakes since 1570 to date (National Seismological Centre, Universidad de Chile). This, along with the geographic, climatic and cultural diversity of the Chilean territory, has prompted a variety of vernacular architectures and ‘seismic cultures’ or technical strategies to face earthquakes, where they are frequent (Pierotti & Olivieri, 2001). In the arid north of Chile where stone, earth and cactus materials are the only building materials, earthquake-resistant strategies are based in the geometry of the buildings. In the centre and south of the country, where the temperate and cold climates allow the growth of large trees, wooden reinforcements are the most common seismic resistant solutions.

2 GEOMETRICAL STRATEGIES IN ANDEAN MASONRY ARCHITECTURE

Andean vernacular architecture is built in adobe and stone masonry, the only available resources in the highlands of the arid regions of the north of Chile (17°30′–26°05′S). There, the absence of wood obliges the use of very massive walls and the adoption of trapezoidal shape geometry, both in the entire building as in every single wall. These strategies allow lowering the centre of gravity of the building by concentrating its mass closer to the ground. In larger buildings, like churches, buttresses and side chapels are used in more stressed areas to counteract horizontal forces caused by earthquakes (Fig. 1).



Figure 1. Andean church of Cariquima, region of Tarapacá (credits: Natalia Jorquera, 2014).

3 LIGHT-WEIGHT CANE STRUCTURES IN PICA AND MATILLA

In Pica and Matilla, two little oases in the Tarapacá, region (20°5′S–69°3′W), the growth of cane and the anhydrite soil (Ca SO₄) are used together to build vernacular architecture with *quincha*. *Quechua* is a term for a timbered structure with a secondary cane structure fill with soil (Fig. 2). The elastic properties of wood and the lightness of cane and anhydrite soil allow the deformability of walls during an earthquake, without reaching the breaking point. The church of Matilla, built originally with *quincha*, was inadequately intervened with modern techniques during the 80’s, but in the 2007 restoration project (Fig. 3), the original technique was re-used to recover its good performance during earthquakes.