



## **Pines Calyx Timbrel Vault Construction**

'Timbrel' or 'Guastavino' tile vaulting creates an arched ceiling in a building, which is capable of supporting very heavy loads even during a severe fire. Other advantages to this method are that it is extremely economical, quick to build (domes the size of St. Paul's Cathedral can be built in a few months without needing falsework or a wooden structure to support them during construction), and it is environmentally sound, as it can use locally-sourced materials and a minimal amount of concrete.

The method of construction has been used in various parts of the Mediterranean and dates back more than 600 years. Between the 1870s and 1930s, through Rafael Guastavino, the method was successfully used within many large buildings on the Eastern seaboard of the USA. Today, only a few craftsmen are practicing this method of vaulting – mostly in Spain. Researchers in the Building Technology Program of the Massachusetts Institute of Technology (MIT) are studying the history and technology of the system and, together with masons from Extremadura in Southwest Spain, MIT are assisting with the design and construction of the vaulting at the Pines Calyx.

### **Pines Calyx Tiling Methodology<sup>1</sup>**

The 'Timbrel'<sup>2</sup> technique involves using tile, laid on edge and built up in layers to produce the necessary structural thickness. In this case three layers of tile were used, with a waterproof cement screed covering the extrados acting as a fourth layer. All the tiles used are approximately 300 x 150 x 20mm.

Each layer must be built in concentric rings and each ring must be completed before beginning the next.-



Firstly there are wooden formers attached to the central pole



The shape that this first layer has to achieve is shown by 2 types of formwork. The first layer is fixed using plaster to hold the tiles in place.

<sup>1</sup> All comments refer to the Pines Calyx timbrel domes only

<sup>2</sup> Timbrel: meaning tambourine, because when you slap a single layer it resounds like a drum. Other names include Catalan, Rousollin or Guastavino vaulting depending on where they are built and who built them

<sup>3</sup> A length of wire, or similar, whose ends are attached at the top and bottom of the central pole. The middle wire is pulled out to form a triangle and the point of this triangle provides the level and radius of each tile course



Radiating out from the central pole are springing lines at regular intervals around the circumference. In between each of the formers a cintrel<sup>3</sup> is used.



Heavier grog tile is used for the 2<sup>nd</sup> and 3<sup>rd</sup> layers. Both these layers are fixed using cement mortar and are fixed directly on top of the first layer



Each layer is built using a different bond. The first layer uses stretcher bond, the second has the tiles laid at a 45° angle



and the third uses soldier bond. The finished roof is extremely strong and can take the loads of the overlying layers of insulation, earth and turf without any stresses to the structure.



**Further Details:**

Project Information: [www.pinescalyx.co.uk](http://www.pinescalyx.co.uk)

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