

Hyperboloid Parabolic Shell Roof using Bamboo as Reinforcement

Rathan Raj PB¹, Pramod V¹, Umesha PK²

¹UG Students, ²Professor, Department of Civil Engineering
Vidyavardhaka College of Engineering, Mysuru, India
drumeshapk@vvce.ac.in

ABSTRACT

Designers have been progressively investigating shells and space constructions built of guadua bamboo while looking for innovative ways to build economical and appealing shells. Guadua bamboo poles are promising linear building components for curved grid systems because of their low mass, high strength, and excellent axial and bending stiffness. Guadua is also a renewable building material that can be easily harvested and deployed to create cost-effective, aesthetically pleasing, and long-lasting broad span roofs. However, in fact, rigorous numerical structural analyses of bamboo are uncommon. As a result, we describe the structural study of two roofs made up of a collection of hyperboloid parabola (hypars) that are being built in Cali, an area known for its abundance of the enormous bamboo species Guadua Angustifolia. More broadly, our research aims to show how an environmentally friendly, widely used, and low-cost material like bamboo may be used in a variety of applications. The relationship between the structural behaviour of hypar grids and their most essential bamboo junction is investigated in this work. To evaluate how the overall hypar effects the internal loads in the bamboo, a simple analysis as well as a finite element analysis are performed. Following that, laboratory testing is performed on the most crucial junctions that link the bamboo strips. The ‘fish mouth’ connection, both with and without mortar inserts, is given special care. A better knowledge of the flow of forces in the hypar grid, as well as a precise quantification of the behaviour of the ‘fish mouth’ joint, enables a more informed and effective use of the bamboo material utilized in these constructions. More broadly, our research aims to show how an environmentally friendly, widely available, and low-cost material like bamboo is utilized to its maximum structural capability in the design and construction of hypar roofs. A model of hyperboloid parabolic shell roof element is casted using cement mortar and after curing it has been tested for different loads. The results are compared with finite element analysis.

Keywords: *hyperboloid parabolic shell, roof structure, bamboo reinforcement*