

FABRICATION AND ELEMENTAL CHARACTERIZATION OF MULTIPURPOSE DISMOUNTABLE BAMBOO GEODESIC DOME

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Introduction:

- The world's rapid shift towards urbanization has brought numerous unfortunate consequences such as the depletion of natural resources and climate change. One of the ways we can combat this issue is by using sustainable materials in construction.
- Eco-friendly building materials have increased in demand for the past few decades. More and more projects are switching to these materials because they offer better quality at a lower price. On top of that, sustainable building materials have lower carbon emissions during production and use.
- Bamboo is one of nature's most valuable gifts to mankind. It is a fast-growing wood-like grass which is found in many parts of the world. It is a versatile, strong, lightweight, easy to handle, renewable and environment-friendly material. Bamboo has remarkable properties as a construction material, being both light weight and extremely strength and durable.

Geodesic dome

A geodesic dome is a spherical or partial-spherical shell structure or lattice shell based on a network of great circles lying on the surface of a sphere. The geodesics intersect to form triangular elements that have local triangular rigidity and also distribute the stress across the entire structure. When completed to form a complete sphere, it is known as a geodesic sphere.

History of Geodesic dome

The first dome that can be considered as geodesic was designed by Walter Bars Feld and it was to accommodate a planetarium projector, that this design was conducted as Zeiss factory roof by Wydman & Dykerhoff in Germany it opened in 1922. Almost 30 years later, in 1954, Buckminster Fuller¹, American geological materialist proposed the seemingly independent idea of the domes and called it "Geodesic Dome".

Objectives:

The scope of this study is the consumption of building materials changes both quantitatively and qualitatively in various stages of building construction. Accordingly, the cost of construction also changes between the conventional and cost-effective technologies.

- To construct a geodesic dome using bamboo struts.
- To test the compressive strength and tensile strength of the bamboo.
- To cover larger area with less materials.
- Assembling the bamboo struts and joints to build a geodesic dome.

Methodology:

➤ Procuring of raw materials. (Bamboo, 3 Mild-steel U Strip, Nuts, Bolts etc).

- Bamboo: The Bamboo used for the construction of geodesic dome is “Assam Bamboo”.



- Joint: 8mm dia Bolt, 3 Nuts, 1-Bolt, 3 Circular Strip, 2 U-strip of 3mm thickness.



- Connectors: The connectors are used to connect the bamboo struts to fabricate the dome.



➤ The compression test and tension test were conducted on the bamboo struts.

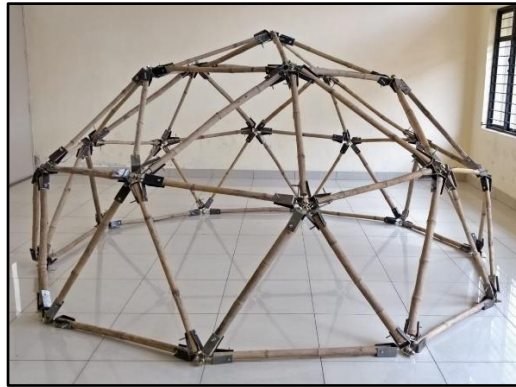
- Compressive stress: 53 MPa.
- Tensile stress: 110 MPa.

➤ The Dome was constructed with the following structural details:

- Frequency: 2V
- Polyhedron type: Icosahedron
- Dome dia: 3m
- Supports: 10
- Total struts: 65
 - ◆ Strut A- 35, Length- 0.93m.
 - ◆ Strut B- 30, Length- 0.82m.
- Hubs: 26
- Joints: 130.

Results:

- A multipurpose dismountable Geodesic dome was constructed by the project members in a span of 3 hours.



- The structural analysis of the dome is to be done using SAP2000 software.

Conclusions:

- Using bamboo as a structural material may reduce the cost of construction by 40%.
- Geodesic domes promote more efficient air circulation and keep temperatures even throughout the structure.
- The geodesic design combines the strength of the arch with the rigidity of the triangle, resulting in incredibly strong dome dwellings. They can survive high winds, earthquakes, and snowfall, making them perfect constructions for any location, especially in today's environment.
- Since the joints are factory made, the speed and accuracy of construction dome is more.
- The maintenance as well as the maintenance cost of the dome is low.
- The dome constructed using bamboo has greater resistance to corrosion.
- Compared to other forms of structures, a dome covers larger spans with minimum materials and distributes the loads evenly throughout the structure.

Scope for future work:

- Since the dome is multipurpose, it can be used for plant nursery, floriculture, horticulture and also by the rural community for various purposes like housing.
- The dome being dismountable, it can be carried to various places.
- The dome is constructed of only bamboo struts which make it affordable to everyone.
- It can be used as gazebo in parks, zoo, hotels, etc.
- A Geodesic dome can be used as Sport stadiums, exhibition halls and children's playgrounds.
- As the dome is dismountable and is easy to construct in a short period of time, it can be used as Military camps and emergency shelters.