# Reconstructing Bhumija Temple Architecture: A Computational Revival


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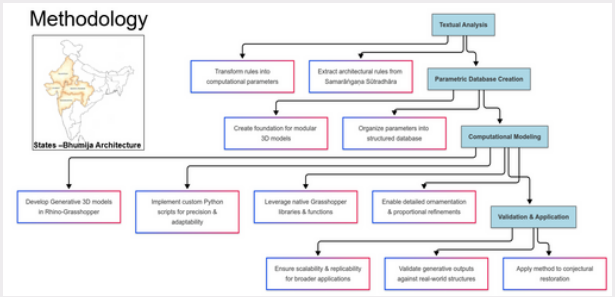
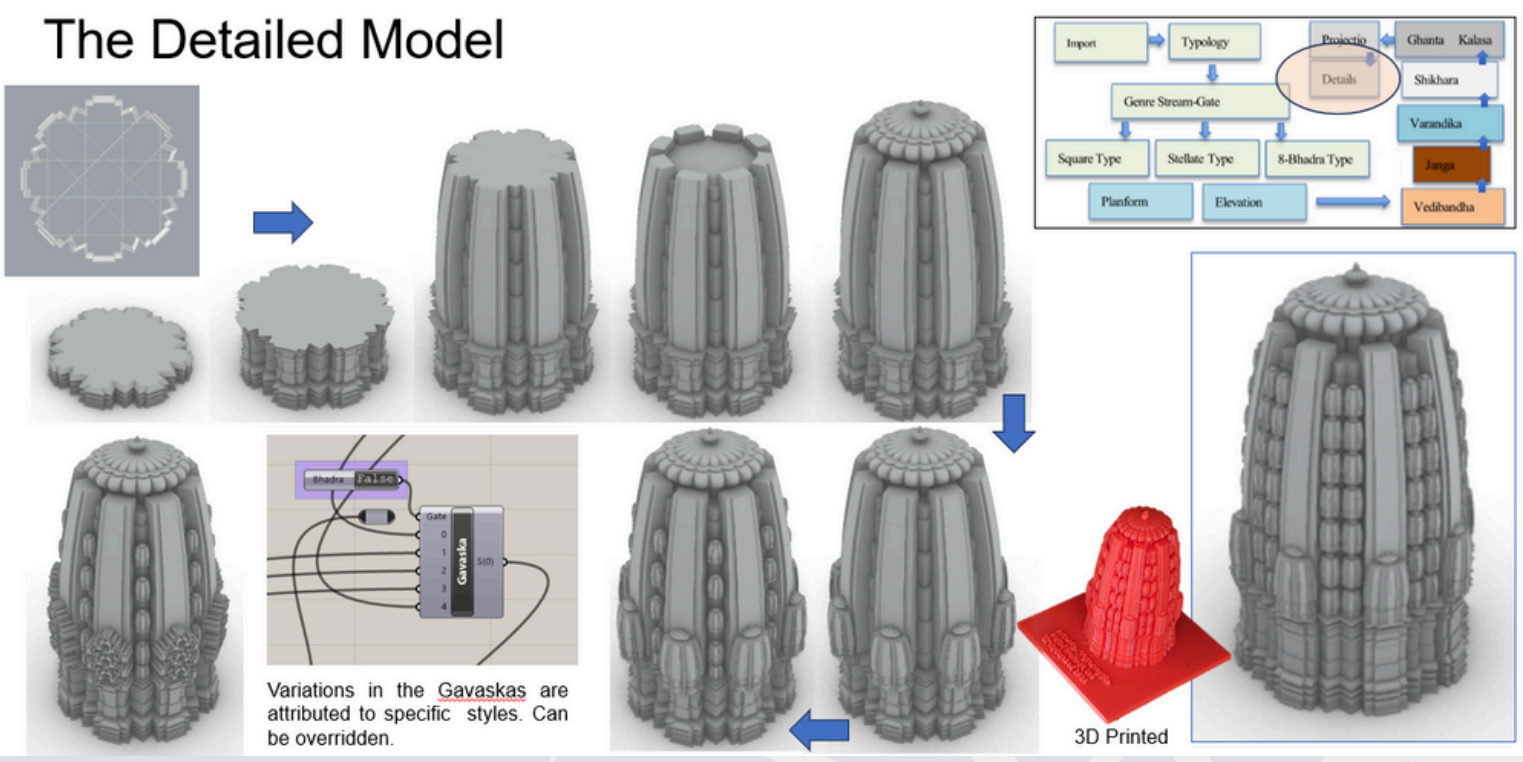
The splendour of Indian temple architecture, known for its symbolic intricacies and geometrical precision, is vividly captured in the Bhumija style. A subgenre of the larger Nagara architecture, Bhumija temples are marked by their multi-tiered structures (bhūmis) and star-shaped planforms, as elaborated in the 11th-century treatise, Samarāṅgaṇa Sūtradhāra. Despite its architectural brilliance, Bhumija remains largely underutilized in modern restoration practices, prompting a need for innovative computational approaches to preserve and reinterpret its forms.


The methodology begins with the extraction of geometrical and proportional principles from the Samarāṅgaṇa Sūtradhāra. Key verses were interpreted into computational parameters, defining star patterns, bhāga divisions, and elevation profiles. These parameters are imported into Grasshopper to create base geometries that reflect traditional construction methods. The Parivartana—a transformational rotation technique—is employed to form multi-point stars and complex planforms that characterize Bhumija temples.

Our research presented at CAADRIA 2025 in Tokyo introduces a novel, generative computational model aimed at reconstructing Bhumija temples by translating the treatise's textual guidelines into parametric design workflows. Using Rhino-Grasshopper, we developed a parametric database with 57 fields encapsulating essential parameters such as plan proportions, tier distributions (bhūmis), and ornamental elements. This structured data forms the backbone for generating precise 3D models of 16 Bhumija typologies, categorized into square, stellate, and 8-bhadra genres.




The computational models were further validated through a photogrammetry survey of the Ramalingeshwara Temple in Nandikandi, Telangana. A dense point cloud was generated from 11,000 images, allowing for a precise digital reconstruction. Comparative analysis with our generative models revealed alignment with the Kumuda typology, highlighting both congruences and regional adaptations. These findings not only confirm the model's accuracy but also its potential for conjectural restoration of damaged or incomplete structures.



The generative approach unlocks possibilities for digital preservation, exploration of design variations, and scalable restoration techniques, marking a significant step in the conservation of Indian temple architecture. Future research aims to expand this computational framework to other temple styles, reinforcing the importance of integrating traditional knowledge with modern technology.

This article is based on the paper 'Reconstructing Bhumija Temple Architecture: Computational Model Based on the Samarāṅgaṇa Sūtradhāra,' presented at CAADRIA 2025, Tokyo, Japan.

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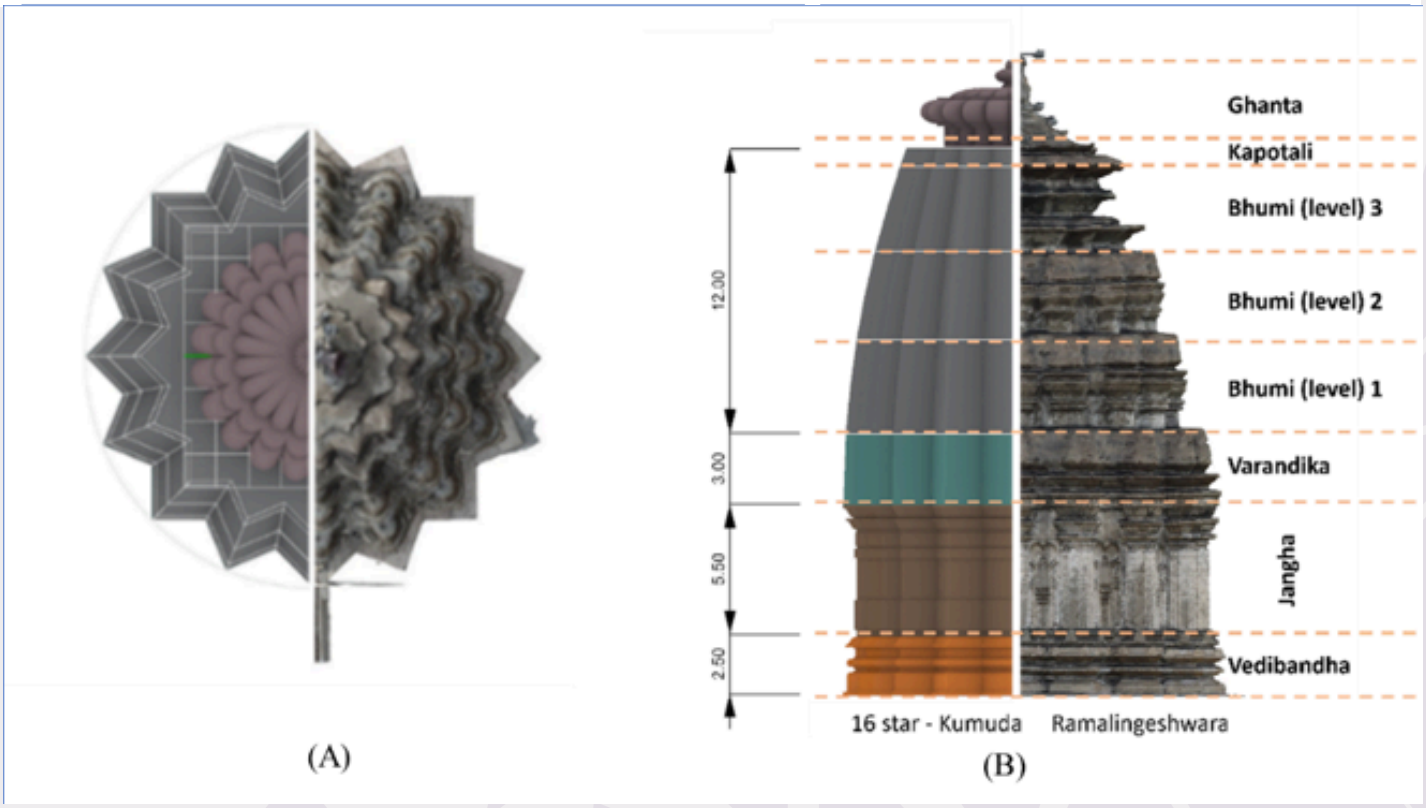
# Comparative Analysis

Comparative Analysis between Computational Model and Photogrammetry Model




**Objective:** Compare Grasshopper-generated models (Kumuda & Kamala typologies) with the **photogrammetric model** of the **Ramalingeshwara Temple** to assess morphological alignment.

**1. Planform Analysis**

- **Kumuda Typology → 8-star planform** (as per *Samarāṅgaṇa Sūtradhāra*).
- **Kamala Typology → 16-star planform** with **bhadras (projections) at cardinal directions**.

**Observation:**

- **Ramalingeshwara Temple follows a 16-star planform** but lacks **bhadras**, deviating from the Kamala typology.
- **It aligns more closely with the Kumuda typology** when transformed into a **16-point star**

**2. Elevational Profile**

- **Ramalingeshwara Temple is a Tri-bhūmi structure** (three-tiered).
- **Observed Deviations:**
  - Elevation begins from the **janga (walls)** instead of the **varandika (balcony)** as per traditional rules.
  - **Topmost bhūmi (level 3) does not follow traditional scaled-down tiering**.
  - Instead, it **merges with the ghanta (bell/crown)**, forming a **complex multi-layered crown**

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