Concrete architecture in Chitanya Jyothi: The Commemorative building at Puttaparthi

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Summary

This paper highlights how concrete was used innovatively to create an architectural marvel – The Chaitanya Jyothi. The building is located at Puttaparthi, Andra Pradesh, India. This unique structure is designed with a fusion of many cultures and architectural styles. A concrete Oriental roof of size 31.9m x 19.9m in plan, flanked by two Moorish domes, crowning semicircular ends adorned with Gothic arches, are the main features. The inside of the 27m high building has multi levels which house the exhibits explaining the life and mission of Bhagawan Sri Satya Sai Baba. The building has a central grand staircase flanked by two side stairways with a stupa in front of the building.

Keywords: Oriental roof, concrete, Timber, Polyurethane, Fibre reinforced plastic, Polycarbonate sheet, Granite, Titanium dome, construction.

1. Introduction

The Chaitanya Jyothi – Commemorative building was built at Prasanthi Nilayam, Puttaparthi, abode of Sri Sathya Sai Baba. Conceptualised by the Malaysian architect Late.S.T.Goh, the building functions as a museum, drawing Sai devotees from all over the world. Concrete was used as an alternative material for the construction of the Oriental roof, which in general is made out of timber.

2. The Site

The site (Fig.1), where the Chaitanya Jyothi is located, is the foothill of the hillock, Vidyagiri. The location was selected considering the ambience and grandeur of the structure. A plot of 65m frontage and 60m depth at 4m above the road level had to be created. This required 3m to 4m filling to an extent of one-third portion and about 5000 cum of rock removal on the remaining portion. Out of 5000 cum of rock cutting, 1800 cum was removed without blasting and 3200 cum of rock was removed by blasting under controlled conditions in order to preserve the sanctity of the place.

Fig.1 : View from the hillock

3. The Concept

The building symbolizes the "Unity of faiths." The five values, Satyam, Dharma, Shanthi, Prema and Ahimsa that Sri Sathya Sai Baba teaches together with symbols of the world's major faiths are characterized by a fusion of architectural styles. The ancient designs synergised with modern concepts are signifying Bhagawan Sri Sathya Sai Baba's embodiment "Love All Serve All". The building as a whole is conceptualized in Oriental architecture of "Qing" dynasty, with Moorish domes and other features like "Gazebos" depicting the faith of various religions.

4. The building

Fig.2: Front view

The building (Fig.2) has a covered built up area of 6000 sqm. The building rests on isolated footings placed at different levels depending on the profile of the terrain and multi-levels of the building. The super structure is a reinforced concrete framed structure. The column grids are planned in such a way that they are modular and will not affect the flexibility of the arrangement of exhibits in the museum. Ramps are provided for smooth movement of visitors from one level to another. The building is air-cooled to give comfort to the visitors.

4.1 The Oriental roof

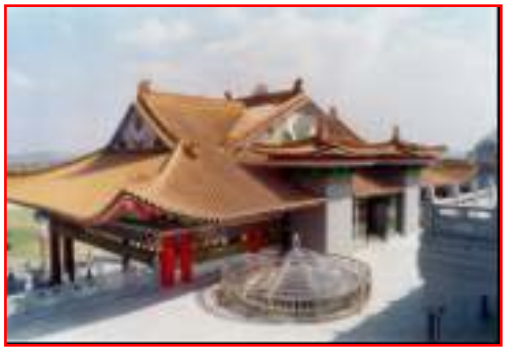

Fig.3: Close up of Oriental roof with sky light

The Oriental roof (Fig.3) of the building is of 31.9m x 19.9m in plan. This is made out of concrete slab supported on the inclined beams, which are planned to suit the profile of the roof. The roof is finished with various architectural features and ceramic tiles. The peripheral beams and the bottom of the ceiling are decorated using polyurethane based Oriental architectural features like "Dugong". The reflected ceiling of the roof is covered with beautiful false ceiling made out of polyurethane. Fibre optic lighting is provided in the false ceiling to add beauty to the reflected ceiling.

4.2 The Gazebos

Fig.4: The Gazebo

There are four Gazebos (Fig.4), two at fourth level and two at the sixth level. They primarily act as watchtowers. The roofs of the Gazebos are also made out of concrete and covered with decorative ceramic tile features.

4.3 The Titanium domes

On either side of the building, the semi-circular ends of the building are crowned with Titanium domes. These domes are 4.5m in diameter and of Moorish style.

4.4 The lift shafts

The building is provided with two lifts connecting all levels. The lift shafts are covered with curved roofs (Fig.5) made out of concrete.

4.5 The skylight

Fig.5: Rear view of roof

Skylights are provided in the building to draw natural lighting. The skylight at the open court level is made out of polycarbonate. The skylights in the fifth level are made out of glass supported by stainless steel members.

4.6 The entrance

The entry to the building comprises one grand central staircase and two side staircases. A driveway is also designed to enable vehicles to reach the ground level of the building, which is about 4.5m above the road level.

4.7 KOI pools

The building has a beautiful KOI pool on either side of the central grand staircase. The KOI pool is interconnected by means of semi-circular arches below the central grand staircase.

4.8. Stupa (Pillar)

In front of the building, at 2.5m above the road level, a stupa of 11m high is provided as the focal point of design. The concrete Stupa (Fig.6) is finished with polyurethane ornamental cladding, which itself served as shuttering during concreting.

Fig.6: Stupa

4.9. Rolling granite balls

At the entrance, on either side of the grand staircase, aesthetically designed, hydraulically balanced 600mm diameter red granite rolling stone balls (Fig.7) weighing 670 kg are provided.

Fig.7: Rolling ball

4.10. Finishes

Fig.8: Ornamental sliding glass door

The main entrance doors (Fig.8) are of sliding glass fitted with decorative brass motifs. A variety of materials like ceramic tiles, polished granite and marble tiles of different shades were used for flooring. The semicircular ends on either side of the building are finished with Gothic arches. The external surface is treated with textured paint and a pattern is created to simulate granite masonry.

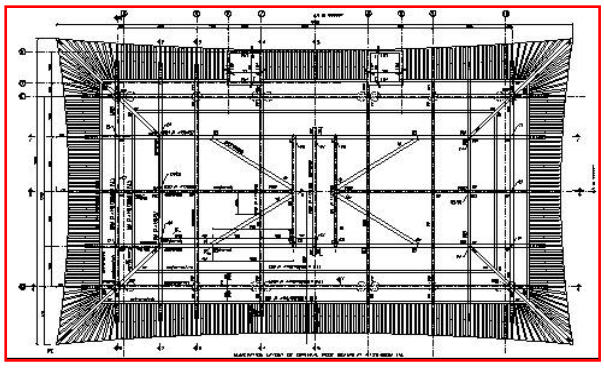

Fig.9: Plan showing the beam arrangement for Oriental roof Completed view

5. Analysis and design

The building modelled as a space frame structure was analysed for all possible load combinations with self-weight, super imposed loads, wind loads and seismic loads being the primary load cases. The floor slabs at all levels were designed for a superimposed load of 5 KN per sqm to cater for placement of exhibits and movement of visitors. The roof (Fig.9) is designed for a super imposed load of 750 N per sqm in addition to the tile load. All the concrete elements were designed as per the Limit state method.

6. Construction

Fig.10: Closer view of Oriental roof corner

Since the building is located at the foothill excessive rock cutting was to be done. Due to this and because of stringent time schedules, the structural construction did not proceed in the normal way but commenced wherever site clearance was made available. Thus on the right hand side, the columns and slabs were raised up to the roof level, leaving dowels for beams and slabs for continuity. All levels were tackled simultaneously and the whole building was constructed proceeding sideways from right to left. This radical departure for normal construction was adopted to meet stringent time frames. Anchoring of reinforcement bars of columns directly into the hard Granite rock was done wherever such rock was encountered. For the superstructure M30 grade concrete was used. The Oriental roof shuttering was supported by the suitable staging. For the intricate forms of the Oriental roof (Fig.10), expanded polystyrene, cut to sizes were used as part of shuttering. For maintaining the proper curvature for the Oriental roof and Gazebos, templates were used to prepare shuttering and the finished surfaces matched exactly with drawings.

Fig.11: Closer view of concrete ribs

The external and internal walls are of infill brickwork and maximum care was taken to maintain straight lines on the exterior finish. Extensive sthapathi (ornamental) work was done on flat surfaces to improve aesthetics. Stone handrails for a length of 965 m are placed on either side of the external staircases and along the periphery of the building at various levels. This architectural marvel had been designed and constructed by Larsen & Toubro limited, ECC division, Chennai, India.

7. Concrete as construction material for Oriental roof

Concrete is chosen as the construction material because it can be moulded to various shapes and sizes in order to create and support the intricate architectural forms in the Oriental roof and Gazebos, which otherwise were traditionally made out of timber in other parts of the world. Even the lightweight baffle wall partitions used in the filter chambers of the “KOI” pool were made of pre-cast concrete.

Concrete scored higher over timber on many structural design parameters such as shear stress (twice as that of timber), moment resistance (15% higher) and young's modulus (twice as that of timber). Hence it was possible to keep the size of the structural members small.

8. Techno-Economic indices

The Chaitanya Jyothi of area 6200 sqm created with the following structural quantities:

Table 1 Quantities

Item	Unit	Quantity
Concrete	Cum	3644
Shuttering	sqm	22700
Reinforcement	MT	425
Stone hand rail	RM	965

The cost per square metre of the structural works worked out to $105.

9. Conclusion

The Chitanya Jyothi brings to the fore the use of concrete as an alternative to other materials like timber in achieving intricate architectural forms effectively and thereby enhancing the aesthetics

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Fig.12: Completed view