5.8 meters Hemispherical Observatory dome Structure

Introduction:

This concept and design drawings are prepared for the 5.8 meters diameter dome structure to be housed at Jawaharlal Nehru Planetarium (JNP), High Grounds, Bangalore. This design work has been undertaken at the request of the Director, JNP, Bangalore – 560 001.

The above design work has been carried out by Manohar Modgekar, Retd. Sr. Engineer of Raman Research Institute, Bangalore – 560 080.

5.8 meters Hemispherical Observatory dome Structure:

This project involves designing, fabricating and commissioning of a 5.8 meter diameter Hemispherical Telescope Dome at the existing tower located at JNP, High Grounds, Bangalore. Planetarium has professional grade optical telescope of 6” Coude Refractor Telescope manufacture by Carl-Zeiss, Jena Germany. The telescope will be housed inside the dome.

Advantages of Enclosures (Dome)

- No need for the movement of telescope
- Permanent Polar Alignment
- Just roll the shutter back and you are observing in seconds
- Even in marginal weather you can observe with the comfort of knowing that you can close the dome in few seconds should rain seem likely.
- Inside the dome your telescope is protected from wind buffeting allowing more accurate tracking and higher precision astrophotography
- Telescope is also shielded from street and outdoor lights allowing you to observe in best possible conditions.

Design consideration:

The Dome structure shall be fabricated and finished in such a manner that

1. It shall survive wind velocities, including gusts to 120 kmph with shutter closed and in storage position
2. It shall be capable of normal operation with wind velocities of 30 kmph, including gusts from any direction with shutter open
3. It shall be capable of normal operation in temperature from 0 degree C to 45 degree C
4. It shall be fabricated of material so selected that it should not suffer solar exposure deterioration or corrosive deterioration.
5. It shall incorporate adequate expansion joints to prevent thermal distortion.
6. It shall be leak proof and water tight when subjected to rain as may be experienced in tropical downpour.
7. The rotating dome shall achieve complete continuous clockwise and counter-clockwise rotation by means of multiple adjustable rollers.
8. Positive hold down devices shall be fitted to the entire rotating dome assembly from blowing off the base wall or rising more than 3mm.

**Brief Structure Description**

The dome structure has a nominal outside diameter of 5.8 meters and opening of approximately 1.2 meters wide extending from the bottom to beyond the Zenith with a pair of horizontally actuated shutters. The dome is made up of radial sections and a structural frame consisting of MS rectangle tubes. The surface of the dome is made up of 1.2 mm thick Stainless Steel Sheet (SS 304 type).

The shutter halves are attached to the dome structure by linear drive (40 mm dia rod) and linear drive is rigidly fixed to dome structure at the top and bottom.

The Dome is supported on spring loaded vertical rollers and prevented from uplift and horizontal rollers translation by a horizontal rollers assembly. The vertical and horizontal rollers permit a full 360 degree rotation of the entire Dome Structure.
## DOME CONSTRUCTION COST ESTIMATION SUMMARY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Cost / Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Roller Assembly: Material, Fabrication, Machining</td>
<td>1,40,000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Fixture for Centring and Stopper for Lifting of Base Ring Material, Fabrication</td>
<td>60,000.00</td>
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<td>3.</td>
<td>Rotating Base Ring Material, Machining, Fabrication and Coating</td>
<td>3,00,000.00</td>
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<tr>
<td>4.</td>
<td>Dome Backup Structure with Shutters Material, Fabrication, Linear Drive, Shutter Drive</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>5.</td>
<td>Cladding Sheet (Dome Skin with Shutters S.S. type 304, 1.2 mm) Material, Forming, etc.</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>6.</td>
<td>Hardware, Hiring Crane, Scaffolding, Assembling Ladders and Observation Platform etc.</td>
<td>3,00,000.00</td>
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<tr>
<td>7.</td>
<td>Associated Civil Works</td>
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<tr>
<td><strong>GRAND TOTAL</strong></td>
<td></td>
<td><strong>15,00,000.00</strong></td>
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