

## Rehabilitation of Gurva Griha of Shree Jagannath Temple, Puri

Till very recently, for the treatment of structural cracks in concrete, the most extensively used material was Epoxy Resin. In our over enthusiasm, we, the practicing engineers, sometimes use Epoxy Resins rather indiscriminately.

Epoxy, no doubt, remains an excellent material to be used in repairs of concrete, but it definitely demands a thorough and extensive study of following aspects before choosing it for the rehabilitation measures :

- a) The difference in its co-efficient of thermal expansion in comparison to that of concrete (this requires restriction of the volume of epoxy inside a concrete structure);
- b) Its Heat Deflection Temperature (H.D.T) in comparison to the surrounding temperature;
- c) Its moisture insensitiveness for application in wet condition;
- d) Its creep property requiring proper filler and e) Its cost factor. Any alternate material to be developed should satisfy the following requirements.
  - The grout material should have physical characteristics as close as those of concrete itself
  - It should have sufficient flowability and low granule size to penetrate reasonably small cracks
  - It should be in-sensitive to the presence of moisture of water
  - It must have non shrink characteristics
  - It must have early strength gain characteristics and good bond with the substrate

A Polymer modified cementitious (P.M.C.) system was developed with specially formulated acrylic polymer admixed with finely ground high strength and non-shrink chemicals. The comparison of properties of epoxy and P.M.C. is provided in table 1 which is self explanatory.

### Renovation of the Gurva Griha of Shri Jagannath Temple

The Gurva Griha or the holy sanctum of Lord Jagannath of Puri is having cantiver stone corbels in all the three floors. The stones in the corbels are stitched together in plan by wrought iron dowels. These dowels over the years have got badly corroded and have cracked the existing corbel stones due to expansion resulting in progressive failure of these stones causing imminent danger to the deities and the pilgrims visiting the holy sanctum.

The basic conditions of the original stones also become suspect due to weathering effect of the marine atmosphere. An expert committee was formed to evaluate the condition of the structure and suggest remedial measures. The committee was formed consisting of specialist from archeological survey of India, noted historians specialising in Orissa temp,e architecture,

senior engineers from PWD Orissa, IIT Kharagpur, few selected specialized private organisation having experience and expertise in this field etc... The recommendation of the expert committee was in two parts that is on structural strengthening and on preservation. Details of structural strengthening are provided below.

### **Structural Strengthening**

The floors work as horizontal diaphragms in a vertical tower and are necessary for providing stiffness lateral forces that is earth quake, wind etc. In the ground floor at the base the inside dimensions are 8.85 m x 8.85 m, there are six rows of corbels each of 466mm high and 370 mm cantilever projection. On this, four wrought iron beams carry the floor stones with a total thickness of 950 mm. These beams are assumed to be going inside the main walls. The load transference, is through the beams, to corbels and finally to the main walls.

It was found necessary of strength the corbel action by strengthening the joints between the corbels by means of P.M.C. grouts and also to eliminate local failure by introducing a stainless steel truss to support the corbel stones.

The corbel stones were planned to be stitched together by means of threaded stainless steel bars inserted into the drilled holes and grouted with Epoxy Resins would be able to lock the corbels into the temple main walls and the pressure from the expanding rusting dowels would be neutralized.

For preservation of original stones, two phase strategy was formulated i.e., to provide a preservative coating on the outside stone surface to retard the process of ageing, in the second phase the phase 1 activities are completed and the P.M.C. grout formulation used on each batch, by Contract Division was :

Pagel	=	25 kg
Tapecrete P 151	=	6.0kg
Water	=	7 to 8 litres.

Total P.M.C. grout consumed in three floors of Gurva Griha is around 28 tonnes