## I.2: Renovation of Sukhniwas Palace

Sukhniwas Palace in Indore was constructed in the year 1883 by Shivaji Rao Holkar, the famous ruler of the Holkar dynasty. Presently, it is a heritage structure of archeological and historical importance. Figure I.2.1 is a photograph of the Sukhniwas Palace taken in the year 1907. The Palace is leased to RRCAT since its inception in 1984. The Palace building was initially utilized as the office of Director, RRCAT and thereafter as workplace for Laser Target Laboratory. RRCAT has made enormous efforts to preserve the structure as per the archaeological guidelines. Further, to take care of aging of this old structure, intensive renovation work was taken up and completed recently. The Palace was made ready to set up the "Accelerator and Laser Science Museum". Following is a brief description of the old state of the building prior to renovation, challenges faced in renovation and the various civil design principles applied for renovation.

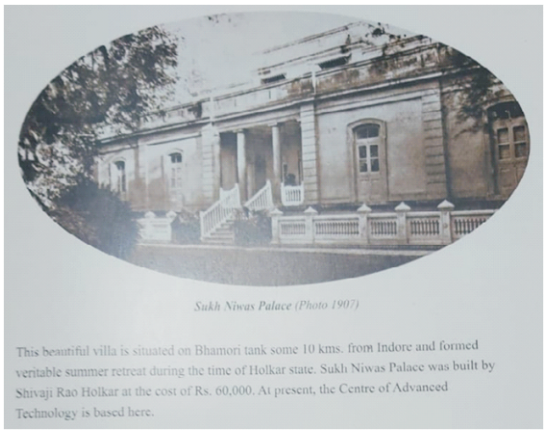


*Fig. I.2.1: Sukhniwas Palace (1907).*

*About the palace:* This is a two storied structure having basement floor and ground floor. The structure is supported on stone masonry wall foundation. The building is located on the northern bank of the magnificent Sukhniwas Lake spread over an area of 40 hectares. For investigation and retrofitting purpose, the building was dealt in following three parts:

A) Old Palace building having basement and ground floor.
B) Reinforced Cement Concrete (RCC) annex block which was subsequently constructed.
C) Entrance stairs, lobby and retaining wall.

Following is a brief description of the work carried out in each of the three parts:

*A) Old Palace:* It was a load bearing structure constructed on low lying area. The trial pits near the site indicated the existence of weathered rock layer over hard strata. The load bearing wall of thickness 600 mm did not show any sign of distress, indicating its sound structural health. However the basement floor indicated significant settlement at many places. The trial pits indicated black cotton soil and hollow space below the floor. Thus, it was concluded that black cotton subsoil was subjected to volume changes. The fluctuation of water level in the adjoining lake led to the moisture movement and consequent expansion and contraction of sub base. Due to intense seepage of lake water in the building, the floor started settling, posing great threat to stability of the structure. Figure I.2.2 shows the damaged hollow floor as proof of settling of the floor. In order to arrest seepage, RCC cut off wall is constructed up to the depth necessary for stability of foundation. Incidentally the deepest point of lake is close to the palace, hence the construction of cut off wall under water was challenging. Coffer dam was built to restrict the water flow. Construction and dismantling of coffer dam was also a challenging task.

*Fig. I.2.2: Damaged hollow floor.*

The floor sub base is reconstructed with designed sub base in layers, considering the moisture movement. The reconstruction of basement floor includes provision of box type RCC slab designed to withstand upward soil pressure. Red stone flooring is provided over the RCC slab. Figure I.2.3, is a cross sectional view of the box type slab and the floor after renovation.

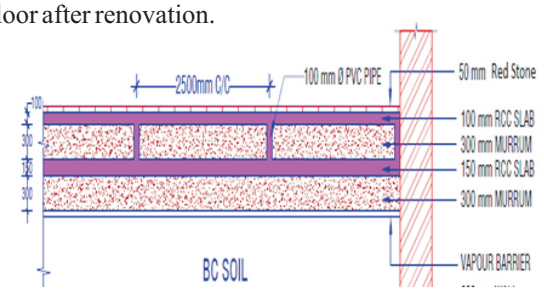


*Fig. I.2.3: Cross-section of box type slab and floor.*

It was also observed that there is a deflection of the wooden beams as shown in Figure I.2.4. In view of the deteriorated wooden beams, scantlings etc., old available structural steel frame work with old weld mesh is provided on the soffit of roof to increase its stability. Further, in order to restrict the entry of rain water, low height metallic roof is also provided.

*Fig. I.2.4: Deflection of wooden beams.*

*B) RCC annex block:* This is a RCC framed structure having basement and ground floor. This portion of the block is not structurally connected to the old palace building and the structure was not in healthy condition when renovation work was taken up. The basement and ground floor walls had significant cracks at many places due to subsoil being black cotton soil. Hence, as advised by Madhya Pradesh State Government authorities, the same is dismantled and this block was not renovated.

*C) Entrance stairs, lobby and retaining wall:* The entrance stairs were supported on RCC structure exhibiting signs of cracks and distress due to settlement of the building foundation. Also, the cracks were noticed in the retaining wall along with de-bonding of plaster. The paved space in between basement wall and retaining wall was also settled at some places and showed uneven surface joints. This is shown in Figure I.2.5.

*Fig. I.2.5: Side view of entrance staircase.*

Entire structural work of retaining wall and waist slab is retrofitted by providing cantilever waist slab supported on newly constructed RCC retaining wall. Figure I.2.6 shows a view of the retaining wall after renovation. The retaining wall is also provided with weep holes to drain out sub soil water from the embankment of road. RCC retaining wall with marble railing similar to the existing pattern is also provided for better aesthetics. Internal electrification work along with lightening arrester have also been carried out in consultation with the State Government authorities.

*Fig. I.2.6: Retaining wall after renovation.*

*Fig. I.2.7: Palace after complete renovation.*

Figure I.2.7 shows the front view of Sukhniwas Palace, after complete renovation. After the completion of renovation work, the authorities of Archeology, Records & Museum Government of Madhya Pradesh have issued a certificate indicating satisfactory completion of the work and asserting its fitness for intended use.

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