R. SENGUPTA

CONSERVATION IN INDIA - SOME TYPICAL CASES

India is a land of rich cultural heritage with a vast range of monuments dating from about 2500 B. C. to the modern times comprising protohistoric remains, Buddhist remains, rock-cut monuments, Hindu and Jain temples, Islamic structures, forts, palaces and other secular structures. Among them are such world famous edifices as the Taj Mahal, Gol Gumbad, stupendous South Indian temples, rock-cut shrines at Ajanta, Ellora, etc. The monuments of national importance (about 4000 in number) receive the attention of the Archaeological Survey of India but there are still many under the care of the respective State Governments. With such a wide variety of monuments in a land of varying climatic conditions the problems of their preservation are as numerous as the monuments themselves.

Since the time available is rather restricted I shall confine myself to a few typical cases only. I shall first deal with the conservation of rock-cut monuments.

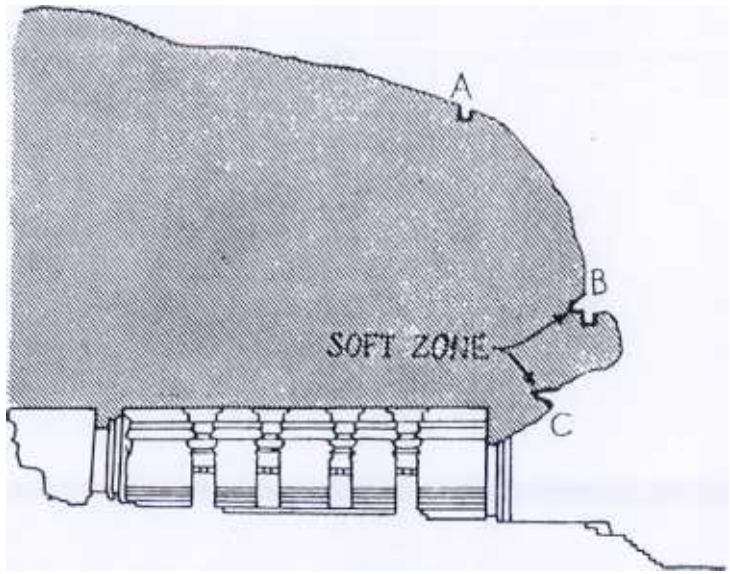
After investigation on the causes of decay, intensive repairs have recently been carried out to the groups of shrines at Ajanta (2nd cent. B. C. to 6th cent. A. D.). Ellora (6th-13th cent. A. D.) and Elephanta (7th cent. A.D.) renowned respectively for their beautiful paintings and sculptures.

All these groups are cut in the amigdaloid trap formed in terraces. Because of its comparatively soft nature, the rock weathers easily. Percolation of water through the formative layers along the surface have damaged the facades of most of the shrines. Accumulation of debris derived from fallen pieces in front of the shrines had caused stagnation of water inside and consequently the walls, pillars, door-jambs, etc. were weathered and paintings on them had disappeared.

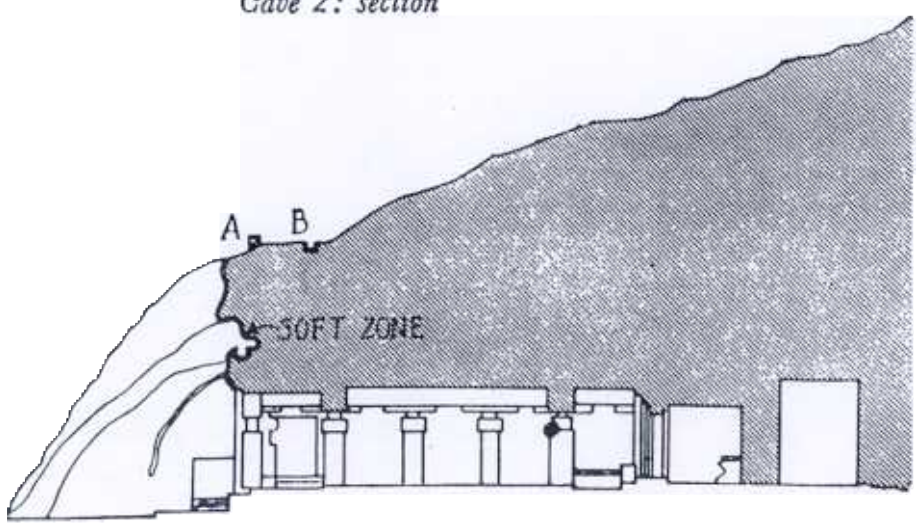
To stop the water from flowing inside the shrine, surface drains have been cut in the rock immediately below the percolating zones so that the oozing water can be drained properly. In addition, drip-lines are also cut in the rock ledges. The weathered members are repaired in cement concrete in preference to ashlar masonry as was done in the past. The choice is obviously dictated by the advisability to match the adjoining homogeneous mass of rock to simulate rock-architecture, for it can be moulded, tinted, chiselled and strengthened with reinforcement where pillars are required to take load. But except for a few rods for binding, and where it was necessary for moulding, no reinforcement is usually used as the 1 : 2 : 4 mix of the cement concrete is rich enough to take the moderate load. The treated surface is covered with a coat of tinted plaster mixed with graded sand and gravel and is later taken out to reproduce the « honeycomb » effect of the trap. The repaired patches are indicated by a line.

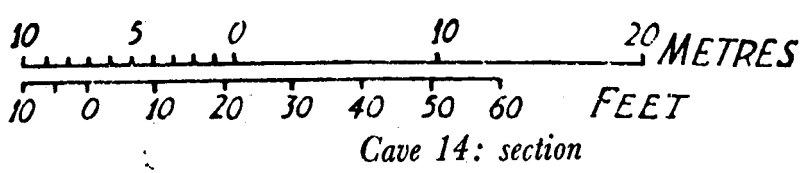
These are in general the problems and principles adopted in repairing the rock-architecture in traps.

Among the notable repairs effected is that of the cracked roof of the cell in



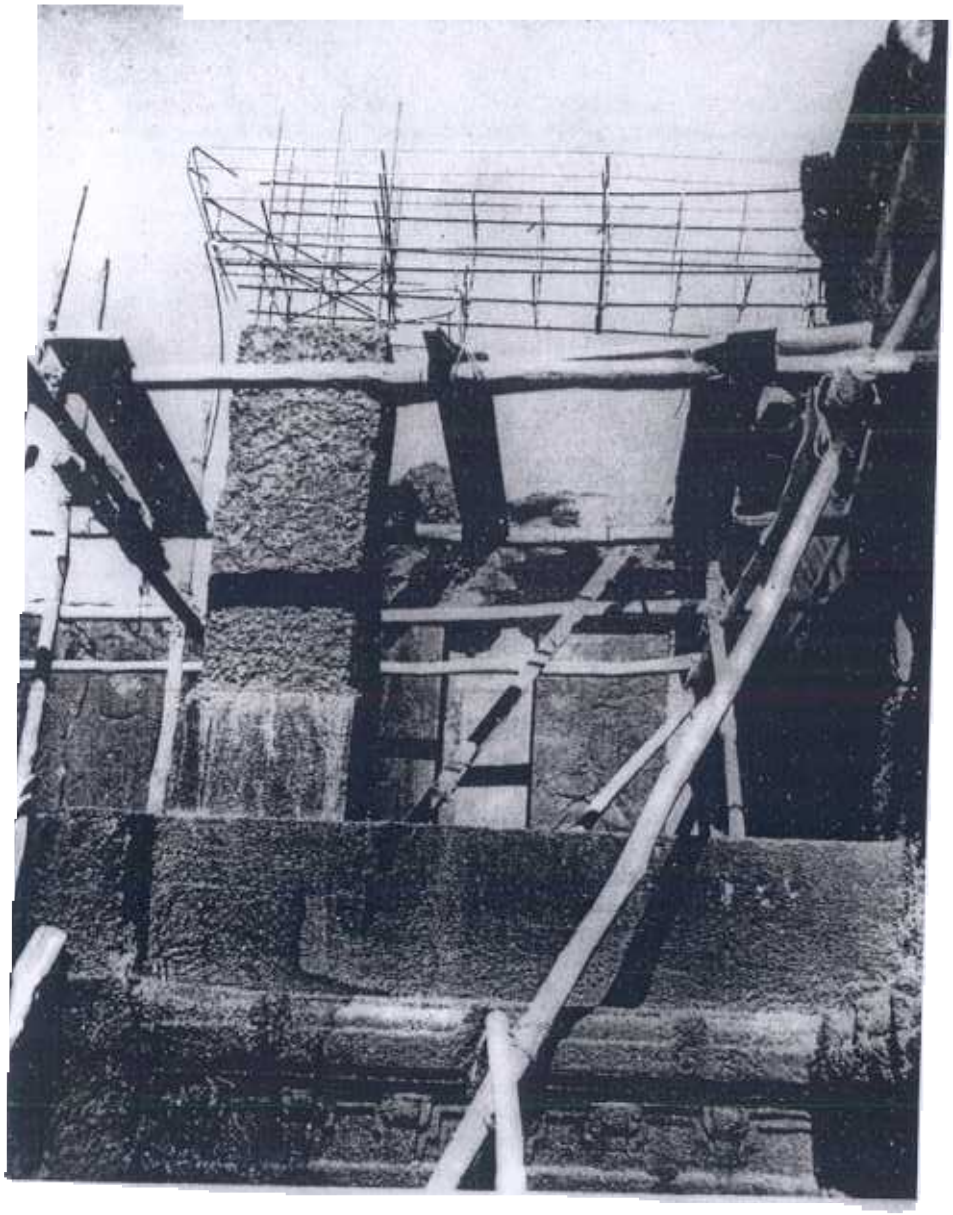
Cave 2: section





Cave 14: section

Pl. 1 *Ellora. Percolating zones and provision of drainage.*

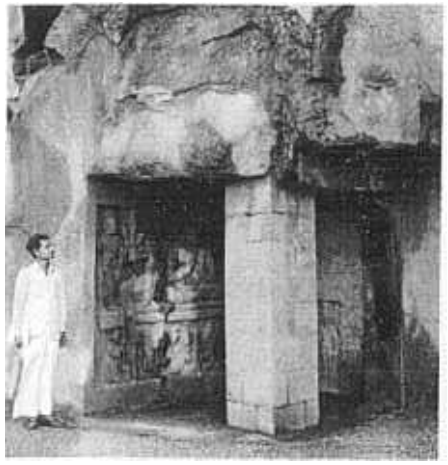


Pl. 2 *Ellora. Restoration of roof in progress.*

front of shrine 3 at Ellora. The roof was supported with an « L » shaped R.C.C. beam concealed in the ceiling with supports in the right and back walls in place of an ashlar masonry support that was obstructing the view of the sculptures on the walls. The crack at the top was completely sealed off through the insertion of iron clamps and grouting with cement mortar.

Pl. 3 *Ellora. The roof after restoration.*

Then there is the leakage in the ceiling of the corridor at the back of the hall of shrine 1 at Ajanta which was endangering the safety of the famous painting of Padmapani. The source of leakage could not be located and water continued to ooze out. But the problem has been tackled in the best possible manner under the circumstances. The oozing water is collected in an asbestos trough concealed in



Pl. 4 - *Ellora. Masonry pillar supporting the cracked roof of the cell in front of shrine 3.*

Pl. 5 - *Ellora. The cell after introduction of R.C.C. beam to support the roof and removal of the pillar.*

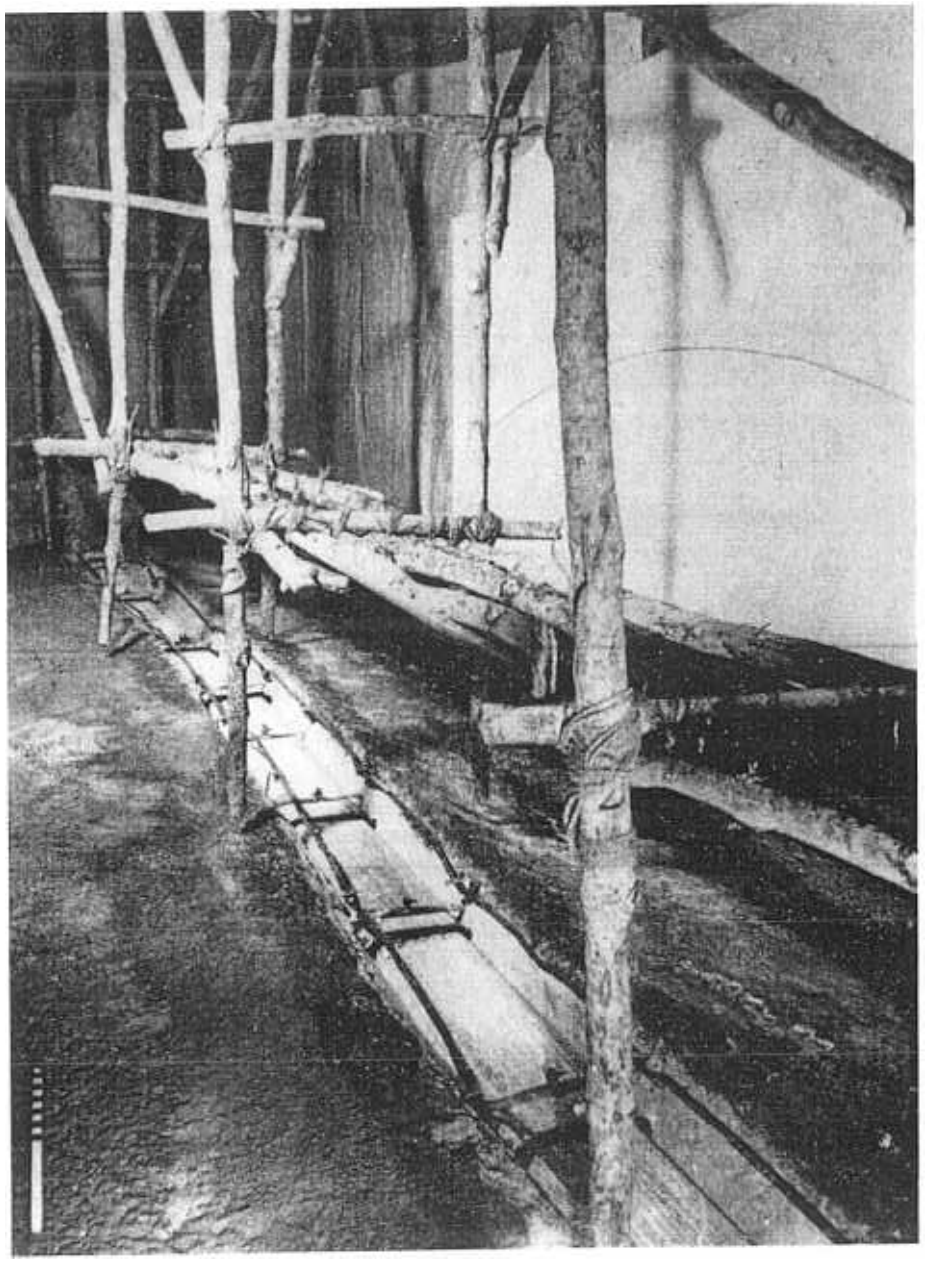
the ceiling along the length of the crack and connected to a channel in the side wall. The water is taken out through an underground drain built under the floor.

The ticklish problem of leakage in the roof of the main shrine at Elephanta near Bombay is also noteworthy. The soft material on the top of the roof which was harbouring moisture was first dug out to place a layer of shotcrete on the harder rock-roof, after grouting the roof through drilled holes. No improvement was registered and to make matters worse the coating of shotcrete showed buckling in places.

The situation was reviewed and it was decided to re-do the surfacing with R.C.C. duly anchored to the rock and to mix with it a water-proofing compound with kinked copper sheets in the expansion joints. Before the surfacing was done the rock-face was further chiselled free of all soft material and the rock-roof was subjected to extensive grounting with liquid cement mortar to plug the interstices. The concrete was covered with a layer of earth and turfed to prevent expansion and contraction. The leakage is reduced. Further grouting of the leaking points from below the ceiling having yielded encouraging results, the work is now kept in progress.

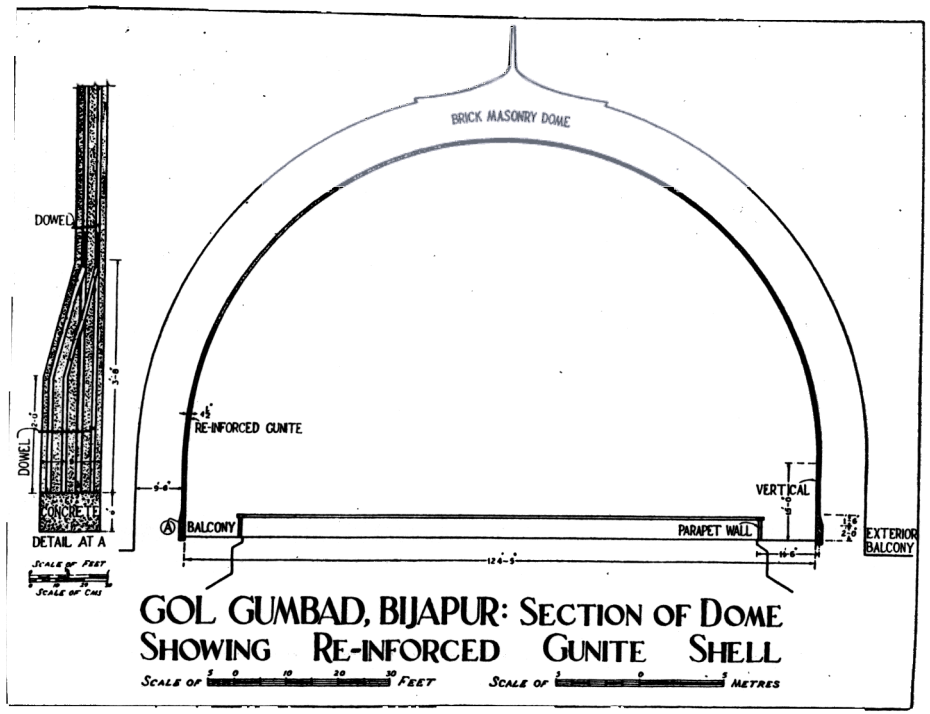
The 17th cent. Gol Gunbad, the mausoleum of Md. Adil Shah (1626-57) at Bijapur in Mysore State is a majestic and unique structure, being the largest domed roof in existence and having acoustic properties.

Plaster in the intrados of its 36-metre diameter dome was found loosened and wide transversal cracks developed in the brick shell, impairing the structural stability as well as affecting adversely the acoustic properties which constitute the chief attraction of the monument. In order to give proper support to the dome and to improve its acoustics a reinforced gunite shell 11.43 cm. thick was provided below and against the intrados of the dome — after grouting and repairing the wide cracks in the brick shell with fullsized bricks. The gunite was doubled at the base to a height of 60.96 cm. resting on a reinforced circular beam at the bottom.



Pl. 6 - *Ajanta. Groove in the ceiling for asbestos trough.*

The reinforcement was dovetailed with the brick core by means of stainless steel dowels, of about a metre either way, grouted in the masonry of the dome. The

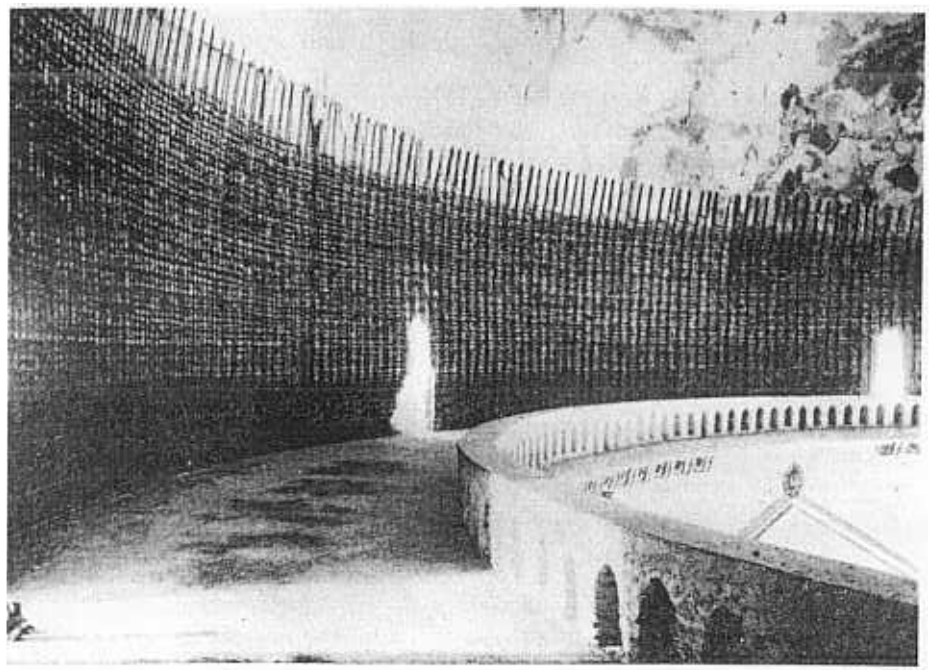


Pl. 7 *Bijapur. Mausoleum of Adil-Shah. Arrangement of the gunite-shell.*

gunite was composed of 1 part of cement to 3 ½ parts of sand. After guniting, the surface was ultimately covered with a coat of plaster, quite smooth and uniform, so that there was a definite improvement in the acoustics.

One of the structures in the palace complex in the fort of Chitogarh in Rajasthan was badly in need of repairs. The central portion of the three-storeyed building having disappeared, the 13 metres long wall rising about 12 metres from the floor with a hanging balcony attached to each floor was in danger of overturning and tearing off from its end supports. The overhanging dome was badly damaged during the fall of the floors which were supported by wooden beams and stone pillars. The weakness of the structure, as you see, was inherent to the construction itself. Conservation of the building here demanded partial restoration as has been done actually by rebuilding the front walls of the side room to complete the dome. The back wall of the central hall was then anchored to the lateral structures by means of R.C.C. beams and pillars provided at the different floor levels and behind the stone pillars embedded in the masonry.

Preservation of excavated remains *in situ* presents many problems; the difficulty increases if the structures lie below the ground level from where accumulating surface water cannot be easily drained off. The brick structure exposed near Dehra Dun of the 3rd cent. A. D. in the shape of an eagle with spread wings, being the altar for the horse-sacrifices performed by a king to proclaim his sovereignty over others, however, did not suffer from such a predicament as the



Pl. 8 - *Bijapur. Mausoleum of Adil-Shah. Reinforcement against the brick-shell for guniting.*

site itself was elevated by about 30 cm. from the surroundings. The structure, as exposed, showed the general shape with masonry walls intact at places otherwise disturbed. To preserve this very feature the different pieces were secured in their respective positions by stabilizing the base with mud mortar mixed with cement so that the pieces might not get dislodged as a result of erosion. The pockets in the structure were then filled up to prevent any stagnation of water, at the same time maintaining an outward slope for easy drainage.

At Nagarjunakonda, as in Nubia, the remains were to be submerged under the waters of a huge dam. The entire site was therefore excavated between 1954-60 and the remains of temples and monasteries, a bathing-place with steps and platforms, a stadium, etc. were exposed. These of them which are better preserved and more complete in form have been transplanted to the top of the nearby hill which will eventually become an island. The structures datable to the 2nd-3rd cent. A. D. were of brick in mud mortar; the bathing place had an encasing of lime stone slabs.

In the reconstructions the core was built in cement mortar 1 : 4 and the facing was laid in cement mortar mixed with brick powder. Although there was no foundation as such in the original construction, a cement concrete (1 : 4 : 8) bed was provided when reconstructing where rock bed was not encountered. Otherwise the original structures have been re-set in their minutest details on the basis of photographs and drawings.

Conservation of the protohistoric sites, one in the desert climate — Kalibangan in Rajastan — and another near the sea-shore — Lothal in Gujarat —

poses different problems. Although essentially the building material is the same viz. brick both unburnt and burnt, the climatic conditions differ. The Survey is working on the problem.

I have tried to expose to you in this short period a few cases only. But there are many others which, I am sure, would interest you. We can share our experiences and discuss problems to our mutual benefit only through an international journal. I fervently hope that when the proposed "International Council for the protection of Monuments and of the Landscape" comes into being, publication of such a journal will be possible. I can assure you of India's fullest co-operation in its preparation.

R. SENGUPTA

LA CONSERVATION EN INDE QUELQUES CAS CARACTÉRISTIQUES

RÉSUMÉ.

Dans le vaste territoire de l'Inde, sous des conditions climatiques variées, le grand nombre de monuments datant de 2.500 a. J. C. environ jusqu'à nos jours, pose de nombreux problèmes d'importance variée.

L'eau de pluie en coulant à l'intérieur et le long des superficies et en s'infiltrant à travers les veines a pénétré dans la roche et a endommagé les temples et les monastères, dépositaires des plus belles sculptures et peintures indiennes. Des canaux de drainage avec points d'issue ont été nettoyés et débarrassés de l'épaisse couche de matières molles qui le recouvrait en y entretenant l'humidité et le faîte a été rendu imperméable à l'aide d'un béton, après qu'on ait eu comblé les veines à travers les trous. La coupole de Gal Gumbad à Bijapur (37 m. 80), caracterisée par des proprietées acoustiques, était endommagée à cause de l'action de l'humidité qui pénétrait dans la structure. La gaine de briques de la coupole a été réparée et on a fait un support (gaine de gunite) au-dessus et contre l'intrados, puis la superficie a été recouverte avec du plâtre, ce qui d'ailleurs a amélioré l'acoustique. A Chritorgarh la haute paroi du fond, sans supports et avec balcons en saillie, de l'une des structures du palais qui menaçait de tomber a été renforcée par des poutres de ciment armé cochées à l'intérieur de la maçonnerie.

Les ruines provenant de fouilles retiennent aussi toute l'attention. L'autel de briques pour le sacrifice des chevaux, à Jagatgram, a été préservé dans sa forme originale, par stabilisation de la construction qui se dégradait avec du ciment teinté. A Nagarjunakonda, la « Nubie indienne », les ruines ont été sauvées et reconstruites dans leurs plus petits détails. La conservation des structures de briques protohistoriques découvertes récemment, soit un groupe dans le désert et un autre groupe près de la mer, est en cours actuellement.

En Inde, la restauration du Monument n'est favorisée que dans la mesure où la stabilité de la structure est en jeu.