

EXPERIMENTS IN MUD-BRICK CONSERVATION

AT TAPPEH NUS-E JAN

In recent years archaeologists have become increasingly aware of the pressing need to protect the mud-brick monuments that they excavate. Nowhere is the urgency of the problem more apparent than in the Near and Middle East where many of the main monuments are composed almost entirely of mud-bricks.

In antiquity there was no difficulty in maintaining such constructions: numerous hands were always available to add fresh coats of mud-plaster to the walls and roofs, to repair structural damage and to keep vital drainage systems in working order. Today, however, when only a few custodians are available to take the place of dozens if not hundreds of local retainers new methods of conservation must be explored.

In recent excavations in western Iran various solutions - traditional and otherwise - have already been tried. At Hasanlu in southern Azarbaijan many of the thick mud-brick walls of the Period IV city were burnt in the attack that destroyed the settlement c. 800 B.C. As a result the walls frequently offer a hard baked surface - and a plain mud-plaster coat appears to offer sufficient extra protection. In many ways in fact the baked walls of Hasanlu would seem to suggest that one answer to the problem of conserving mud-brick building would be to find a safe, economic way of firing the exposed walls.

At Malayan, 46 km. north of Shiraz, William Sumner has made use of the local method that is used to protect mud-brick structures in the northern part of the Marv Dasht plain and has capped his excavated walls with a deep layer of brushwood and mud. Here, however, the walls are only burnt in a few places and they may well call for more frequent replasterings than the walls of Hasanlu.

Akbar Tajvidi has introduced thick coats of mud-plaster in order to preserve the newly excavated mud-brick fortifications of Persepolis while at Susa the surviving (and partly restored) walls of the Apadana are now provided with cambered cappings of mud-plaster. These last gently graded surfaces lead to a series of internal drains that carry all surface water directly down to the gravel foundations of Darius' palace.

Finally, Professor E. Negahban of the University of Tehran has

introduced a reinforced mud-plaster to protect a series of mud-brick surfaces that have been exposed at the new Elamite site of Haft Tappeh in central Khuzistan. Composed of a mixture of lime, cement and mud this hard covering is intended as a possible alternative to more expensive chemical treatments.

Tappeh Nush-i Jan

The Median settlement at Tappeh Nush-i Jan, where the British Institute of Persian Studies has been engaged in excavations for the past five years, was probably founded c. 750 B.C. and abandoned one hundred and fifty years later. During the life of the site three major mud-brick buildings - the Fire temple, the Fort and the Western Building - came to be erected on this natural rock outcrop which lies at the centre of the Malayer plain, 70 km. south of Hamadan.

In the tower-like Temple, which still stands to a height of 8 m., we were fortunate enough to recover a largely intact example of a unique type of Iranian mud-brick vault (Pl. Ia) that appears to have remained in vogue from the Median period down to at least Parthian times. This type of vault is made up of two opposed sets of curved mud-brick struts which spring from each of the long walls and meet in the middle of the room.

A shallow ledge holds the lower ends of each strut in position while the narrow "V" shaped gap between the ends of the opposed struts was filled with small pieces of shale. Such vaults were apparently capable of supporting the entire weight of a roof or upper floor without the aid of other structural members.

The exceptional height of the surviving walls at Tappeh Nush-i Jan also allows us to observe another aspect of early mud-brick construction: namely the universal rule that a first floor wall had to be at least slightly smaller and lighter than its ground floor counterpart. Long walls almost always show a "step back" at the level of the first floor (Pl. Ia) while short cross walls usually exhibit a gradual taper towards the top. (It is perhaps of interest that two or more internal "step backs" often occur in the upper mud-brick walls of the tall, cylindrical pigeon towers of Isfahan).

The remarkable extent to which the Medes themselves relied on mud-brick as a medium of construction may be illustrated in various ways. The excavated ante-chamber of the Temple moved to contain a low mud-brick bench (Pl. Ib); and, in the Fire Sanctuary, the excavations

revealed a series of blind windows and lesser recessed wall decorations (Pl. IIa) together with a plastered, mud-brick fire altar of monumental dimensions (Pl. IIb).

"Epikote" Lacquers

With such diverse and well preserved remains to contend with we have necessarily explored several separate methods of conservation. In 1967 our protective measures were limited to either the reburial of excavated structures or, where this solution was not practical, the addition of thick coats of mud-plaster. After the passage of only six months, however, it became clear that the winters of Hamadan were too severe to expect prolonged protection from mud-plaster alone. At this point we turned for help to the Egham Research Laboratories of Shell Research Limited, London, asking them if they would be interested in trying to develop a chemical application that could be used to protect mud-brick buildings.

Experiments at the Egham Research Laboratories started in the spring of 1970, a few months before we returned to Nush-i Jan for our second season. Working with several samples of mud-brick that had been sent from Iran the Laboratories developed two basic compositions: first, a two component "Epikote" lacquer for application by airless spray or brush and secondly, a two component trowelling composition in which mud-brick dust was used as a filler.

The first field trials of the new systems began in August 1970 when Mr. David Brooker brought out samples of both basic compositions. At the site it was found impractical to use an airless spray so that the first system had to be applied by brush alone. To start with the dark brown colour of the lacquer presented problems - until it was discovered that the treated area could be brought back to its original colour simply by dusting the surface with fine soil while the lacquer was still wet. This first composition was applied to small areas of both the Fort's southern (Pl. IIIa) and northern walls. As in the case of those areas that were treated with the heavier trowelling composition, the lacquered surfaces soon acquired a stone-like hardness.

After two winters these surface impregnation systems may be said to have successfully resisted ordinary wind and water erosion in most instances (Pl. IIIa). The problem, however, is whether such impregnated layers, which reach only 0.5 cm. in thickness, will continue to resist the effects of thermo expansion and contraction. With the wide range of temperatures to be found near Hamadan there is an obvious danger that

the hard surface will peel off, possibly carrying other parts of the wall with it. In short, the effects of a third cold winter on our selected surfaces will probably tell us much about the value of the two chemical preparations that have been tried so far.

Temporary Protective Measures

In seeking to protect the main walls of the Fort, which rise to 7 m. in height and cover a rectangle 25x22 m. in size, we decided to devote most attention to the tops of the walls. First stiff reed mats (Hasir) were placed on the tops of the walls and then a layer of guni - that is to say sacking soaked in bitumen - was laid over the mats. This temporary solution is perhaps not averly elegant but it is flexible enough to follow the contours of even the most uneven wall surfaces and has yielded satisfactory results so far.

Fortunately the main walls of the Temple stand to a more or less uniform height. As matter of deliberate policy most of them have been left unexcavated on the outside while the interior of the building now stands protected by a temporary roof (Pl. IIIb and IVa). Similar temporary roofs have also been used to protect the trenches of the 5 m. excavation grid that covers the western part of the site (Pl. IVb). Such roofs are simple in the extreme. They consist of standard village roofing materials i.e. long wooden poles and smaller cross struts, a layer of reed matting and a layer of mud. Our only refinements have included the addition of a sheet of polythene above a first layer of mud and below a second layer and the provision of a ventilation hole at the side of each trench.

By no means all excavators would agree that trenches alone deserve this kind of treatment, whatever else should be done to protect monumental structures. If different features at floor level and important vertical sections are to be preserved from one season to the next, however, we must continue a search for basic protective measures in this modest context as in others.

D. STRONACH

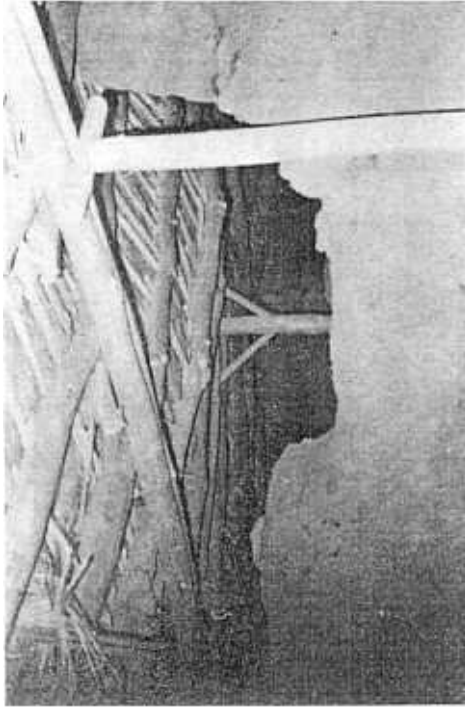
PLATE CAPTIONS

- Pl. Ia. Tappeh Nush-i Jan. A view of the mud-brick vaulting found above the shale filled ante-chamber of the Median Fire Temple. Similar curved mud-brick struts were also used for vaulting purposes in Achaemenian and Parthian Iran.
- Ib. Tappeh Nush-i Jan. The east end of the ante-chamber after excavation. A low mud-brick bench stands beneath a deep wall niche.
- IIa. Tappeh Nush-i Jan. The 8 m. high mud-brick walls of the fire sanctuary, showing recessed crosses and blind windows on two adjoining wall faces.
- IIb. Tappeh Nush-i Jan. The plastered, mud-brick fire altar in the course of excavation.
- IIIa. Tappeh Nush-i Jan. Part of the south wall of the Fort two years after being painted with the experimental "Epikote" lacquer developed by Shell Research Limited. The small arrow on the left marks the lower limit of the treated surface.
- IIIb. Tappeh Nush-i Jan. The temporary wooden roof built over the mud-brick walls of the Fire Temple.
- IVa. Tappeh Nush-i Jan. Workmen erecting a temporary wooden roof above a series of mud-brick features.
- IVb. Tappeh Nush-i Jan. Workmen cover the squares of the five meter grid at the western end of the mound at the close of the 1970 season.



Plate I a

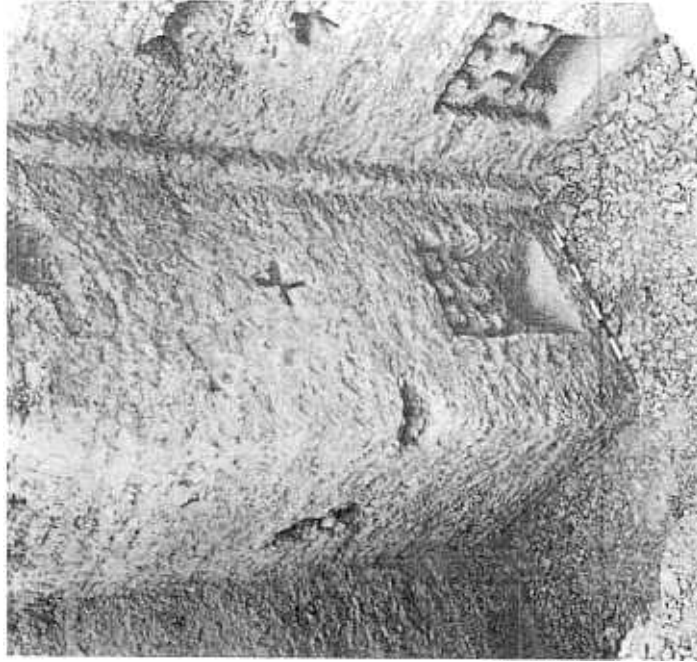




Plate



Plate .11



Plate

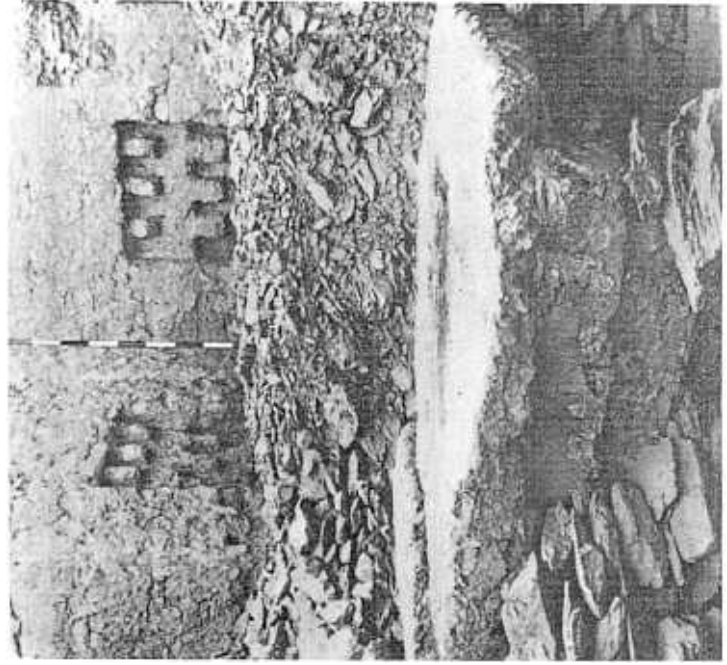
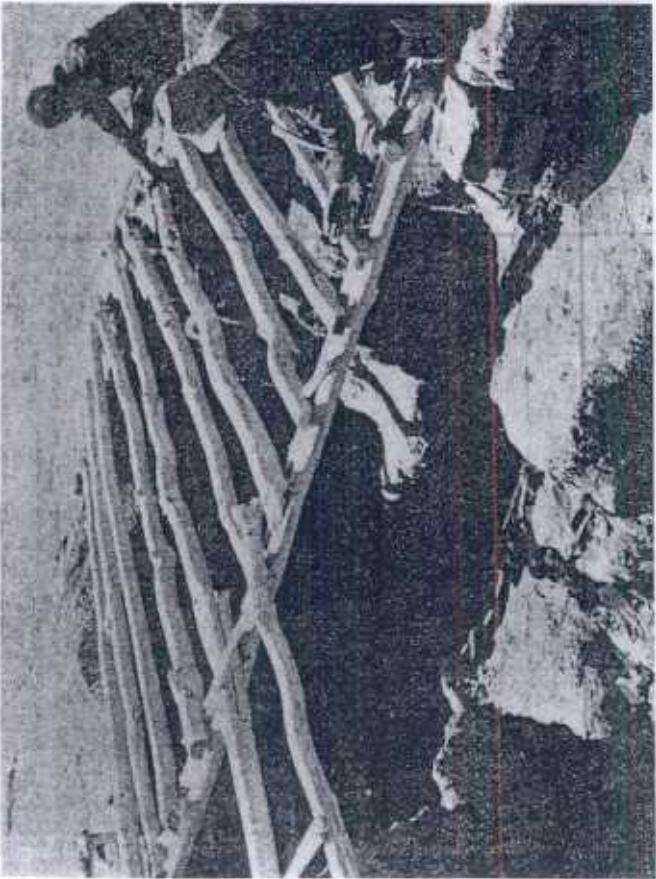


Plate b



Pla

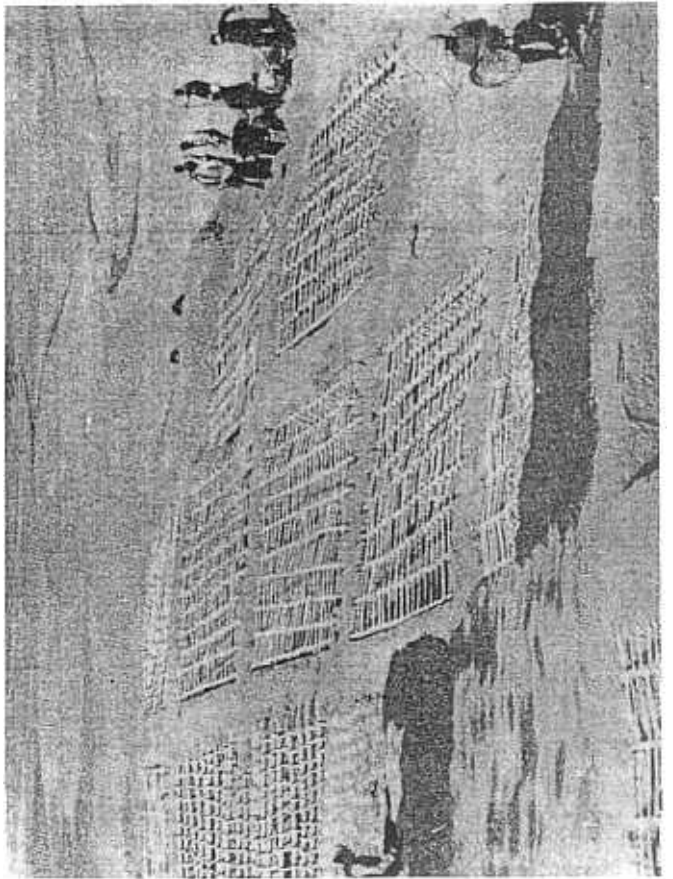


Plate IV b