

# Protective shelters at the archaeological sites of Mallia (Crete) and Kalavassos-Tenta (Cyprus)

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## ABSTRACT

Three protective shelters, composed of glulam (laminated wooden beam) structures forming arches covered by polycarbonate sheets, were built in 1990–1 at the Minoan Bronze Age site of Mallia in Crete, within the context of development and presentation of the site, including conservation and the building of facilities (tourist pavilion and parking area). In Cyprus, at Kalavassos-Tenta, since 1995 the Neolithic settlement has been covered by a new shelter in the form of a 12-faceted conical tent consisting of PVC fixed on glulam beams; it has the striking appearance of a landmark.

## PROTECTIVE SHELTERS AT THE MINOAN SITE OF MALLIA

*The site* The Bronze Age site of Mallia is located in the plains between the mountains and the sea on the north coast of Crete, 35km east of the town of Iraklion. After the discovery in 1915 of part of the Minoan Palace by the Greek archaeologist J. Hazzidakis, from 1921 the French School at Athens continued to excavate the Palace, part of the town with its streets, and a necropolis.

*Topography* The most important ancient buildings are located near the Palace (see Fig. 1) within an area of around 45,000m<sup>2</sup> surrounded by a fence and, along its southern border, by a thick natural barrier of carob trees which separate the site from the road, the parking area and the tourist pavilion. Around the Palace are located the different administrative and housing quarters such as D, K, L, Z, M, the crypt and the *agora* (see Fig. 2).

*Planning* Having been the architect at the site since 1970, in 1985 I worked out a conceptual master plan, with the aim of protecting the monuments.

The plan included restoration of the ruins, building protective shelters, planning pathways with signposting, erecting orientation panels, repairing the old excavation house for the exhibition of drawings, photographs and models, and the construction of the tourist pavilion and parking areas.

*Construction* Three new shelters, implemented to my designs by the Greek research body DIEKAT (now called METRON), were constructed in 1990–1 [1]: one over the east magazines of the Palace, another over the crypt, and the third (the largest) over quarter M (see Fig. 2). These replaced existing protective shelters in areas where the archaeological remains – walls made of mudbricks, stucco-covered floors – were particularly vulnerable, and where there are rooms located in basements.

These new shelters are constructed of glulam (laminated wooden beams), supplied by Avex of Patras, Greece. They stand on reinforced concrete foundations that are situated outside the ancient buildings, or in courtyards, in order to avoid any destruction of the monument itself. The laminated wood not only matches the environment – its reddish-brown colour is that of the



Figure 1. Mallia: aerial view from northwest, before construction of new shelters.

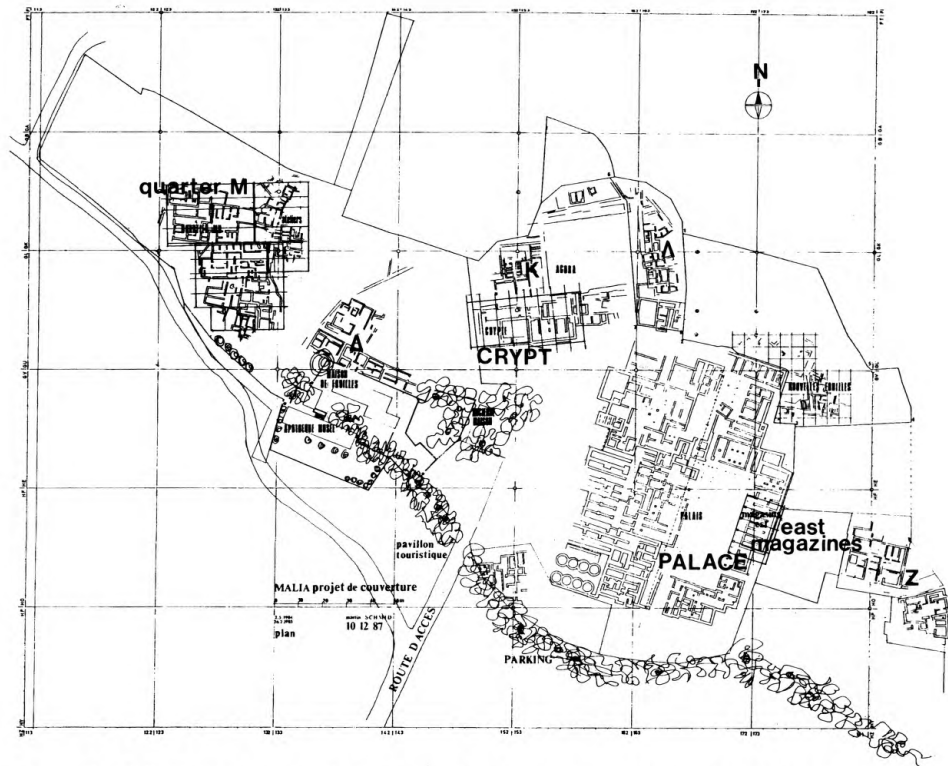
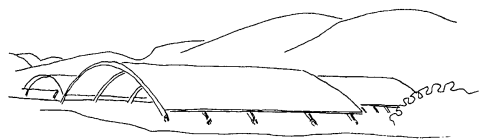


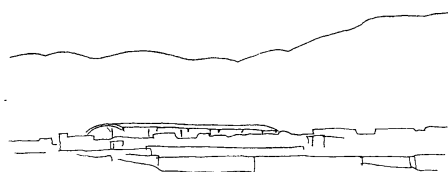
Figure 2. Mallia: Plan showing shelters covering the east magazines of the Palace, the crypt and quarter M.



Quarter M



The crypt



The east magazines of the Palace

Figure 3. Mallia: the three new shelters in their environment.

earth and the mudbrick walls – it is also resistant to marine air and, above all, it offers cover that is wide in span yet with supports external to the ruins.

*Appearance* The shapes of the structures are curvilinear, to harmonize with the sweep of the surrounding mountains (Fig. 3) and also to reduce their height optically. The main beams are in the form of arches following the direction of the ancient walls, their design adapted to each particular case: in the shelter covering the east magazines of the Palace they are supported by vertical wooden posts; at the crypt and at quarter M they are mainly self-supporting, i.e. reach to the foundations.

The roof of each shelter, fixed on smaller transverse and horizontal beams, is made of double-face, tinted, translucent polycarbonate sheets (a material long in use in industrial buildings). Dust settling on the roof is of no consequence, either for aesthetics or for translucence, as it is removed by rain. The rain water is collected at the lower edges of the roofs in gutters, from where it is conducted through drainpipes outside the excavated area. The shel-

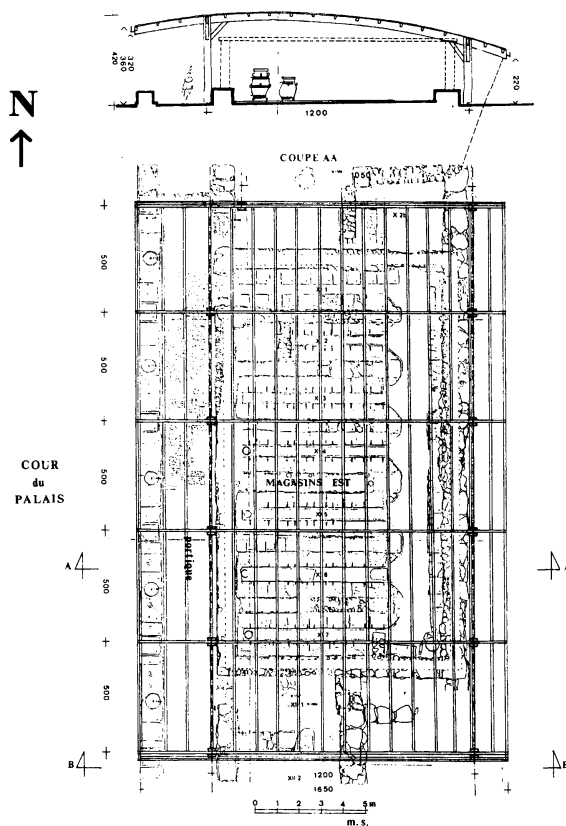


Figure 4. Mallia: section (above) and plan (below) of the shelter covering the east magazines of the Palace.

ters are more extensive than the ruins they protect, to ensure good protection against the rain, and the volume created has nothing in common with Minoan architecture.

#### EAST MAGAZINES OF THE PALACE

*History* These series of magazines (stores), belonging to the Protopalatial period (1900–1700 BC), are equipped with low stuccoed benches which held the storage jars [2]. They are still in a good state of preservation as since 1931 they have been protected by a building constructed directly over them on the ancient walls. However, the corroded iron of the concrete roof of this building needed replacement.

*Construction* As these magazines were not accessible to visitors, the building was dismantled and replaced by an open shelter that additionally covers the portico along their west side (Fig. 4).



Figure 5. Mallia: the shelter covering the east magazines of the Palace.

The new shelter covers an area of 413m<sup>2</sup>. The six main beams, each 16.5m long in the shape of an aeroplane wing, are supported by wooden posts placed outside the magazines at the ends, on the axis of the portico pillars on the west side, and outside the exterior wall of the Palace on the east side. The foundations are not visible: they are covered by earth or by the flagstones of the portico. The rainwater from the roof runs away through pipes to the east outside the Palace.

*Appearance* Because the magazines are a part of the Palace, the shelter was designed as an open

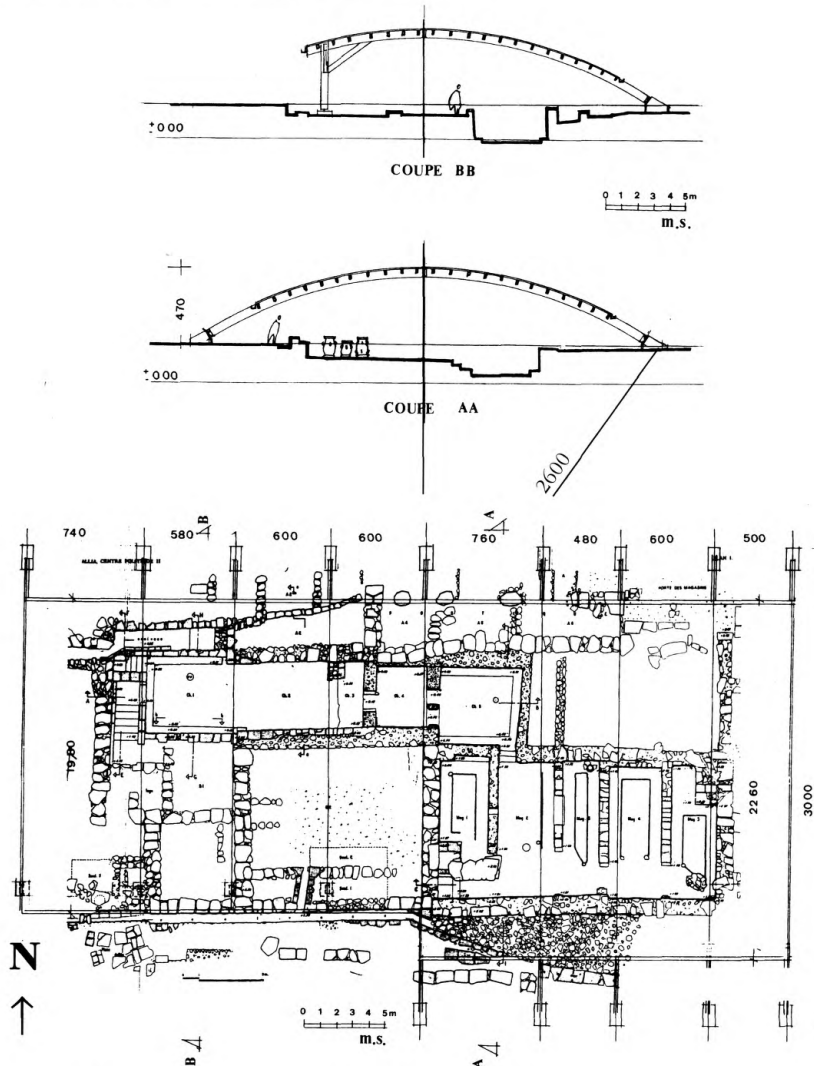


Figure 6. Mallia: sections (above) and plan (below) of the shelter covering the crypt.

Figure 7. Mallia: the crypt, under the new shelter.



structure, so that it does not block the view of other areas and of the surrounding countryside (Fig. 5).

#### THE CRYPT AND ADJACENT MAGAZINES

*History* These rooms, the floors and walls of which are stuccoed, are situated below entrance level, the crypt entirely in the basement and the magazines partially so [3]. For this reason they had been covered immediately after their excavation in 1961 by a shelter made of metallic posts and beams supporting a roof made of plastic material. As it was in an advanced state of deterioration, the whole structure was dismantled.

*Construction* The crypt and the magazines have been covered by a new shelter of 978m<sup>2</sup>, whose main beams consist of nine arches set on the foundations to the north (Figs 6–8). Arches 1–4 are interrupted at the vertical line of the ancient gutter bordering the south side of the building, and are supported there by wooden posts. Arches 5–9, with a span of 30m, cover the whole area of the magazines, and are directly supported at each end on foundations. A few structures of earlier periods had to be removed to build these foundations, of which only the small upper section is visible, the greater part having been covered by earth or flagstones. The rainwater is led away at the south side through an ancient drain.

Figure 8. Mallia: the shelter covering the crypt, seen from the east.



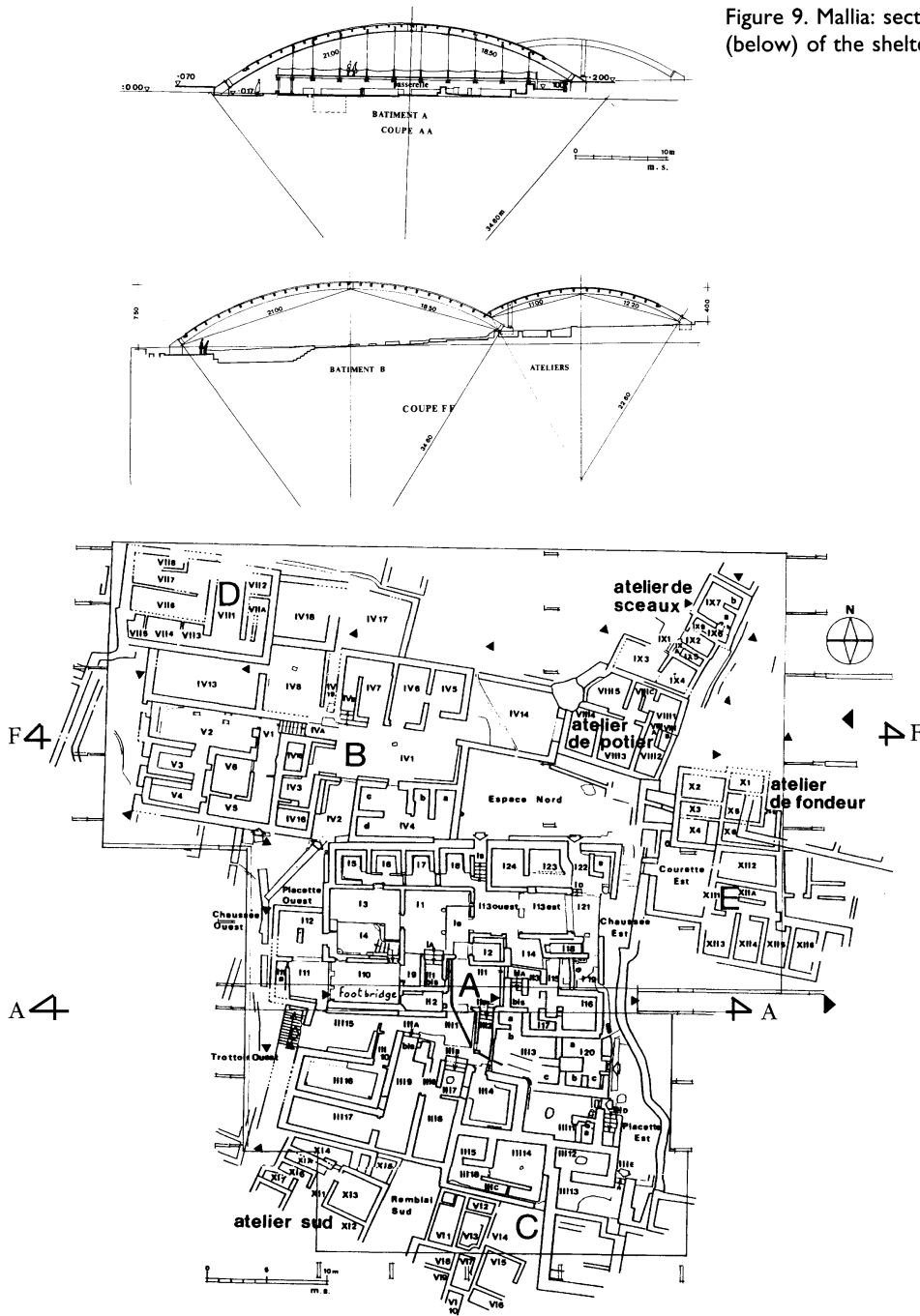


Figure 9. Mallia: sections (above) and plan (below) of the shelter covering quarter M.

*Appearance* As the northwest side of the site does not have spectacular ancient remains and is also the dominant weather side, the view has been blocked in that direction. Instead, the view is open towards the *agora*, the Palace and the site entrance.

**QUARTER M**

*History* Excavated by Professor J.Cl. Poursat between 1965 and 1984, this quarter represents the most important ensemble known in Crete, and the best-preserved architectural remains, of



Figure 10. Mallia: the main rooms of quarter M, under the shelter and the suspended footbridge.

the Protopalatial period [3]. Prototypes of the characteristic Minoan architectural features – polythyron, lightwell, portico and lustral basin – are found here. Painted stucco still covers the walls, floors and numerous staircases of the five buildings, surrounded by workshops. The basement rooms are preserved to their whole height. To ensure the protection of these buildings, after their discovery a temporary roof made of plastic sheets fixed on a metallic frame was placed just above the walls.

*Construction* As this low roof did not allow visitors access, a permanent shelter with an area of 2710m<sup>2</sup> was installed (Fig. 9). The major buildings in this quarter are covered by two large shelters, the arches of which have a span of 38m

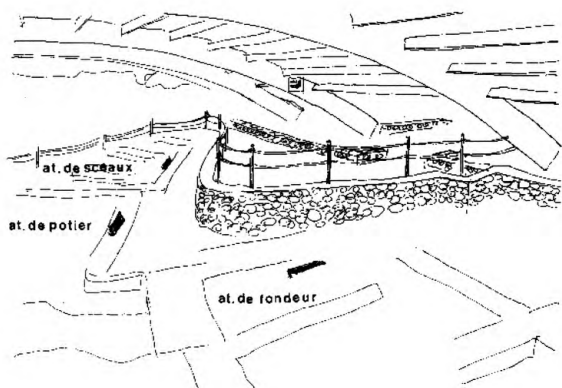


Figure 11. Mallia: the entrance of the quarter M shelter, from the south, near the workshops.



Figure 12. Mallia: openings on the south side of the quarter M shelter.

– one covering building A, the second buildings B and D – with smaller arches extending over the workshops and building E. Two of the six arches over building A support a suspended footbridge, from which visitors have an elevated view over the main rooms (Fig. 10). In the southern section of building A the structure is perpendicular to these latter arches, which lean against it (Fig. 12).

The foundations supporting the arches were placed mainly external to the building in areas with no architectural remains, in fill deposit to the east or in the northern courtyards. To the west we had to sacrifice sections of walls belonging to another building. Rainwater is directed to an existing ditch.

Visitors are to enter the shelter at the northeast near the workshops, then follow a one-way route delimited by ropes and low stone walls (Fig. 11), which prevent tourists from walking through the ancient rooms. The route will be completed by explanatory panels and plans of the ruins. As it forms a whole unit, quarter M is covered by protective structures that are more or less closed on the east and west sides, leaving openings for ventilation on the north side, and also, forming a link to the natural environment, to the south, which faces the mountains (Fig. 12).

#### POSSIBLE FUTURE EXPANSION OF THE EXCAVATED AREA

As most of the sheltered areas have already been excavated, protecting future excavations nearby, if this proves necessary, will not be a major problem. In the cases of the east magazines and

the crypt, three of the four sides have been excavated and they do not need any protection. In the unexcavated areas we know only of the existence of one other building west of the crypt but not how extensive it is. If this building were to have the same width as the crypt, it could be protected, if necessary, by an extension of the existing shelter; if not, a suitable new design would have to be developed.

In quarter M, the south section has already been destroyed by the thalweg path, the east section was excavated after the shelter was built and reburied, and, to the north, a new site was excavated but does not need protection. For any future extension of excavations to the west, a solution appropriate to the discoveries would have to be applied: if the site were to prove to be of great interest and to need protection, a new design would be required; otherwise, the best option would be to rebury the remains.

#### COST OF THE SHELTERS

The cost was fixed at the start of the project at 118 million drachmas but by the end the total amount had risen to around 150 million drachmas (£325,000 or US\$510,000 at current exchange rates).

#### CONCLUSION

For the most part, the plan's schedule has been implemented, as described, under the control of TAPA (the accounting office for archaeological revenue and expropriations of the Ministry of Culture of Greece). Other elements – pathways, orientation panels and signposts – were finished in 1997. The next phase of the plan will be the development of an archaeological park over the whole site, an area of more than 1.5km<sup>2</sup>.

#### PROTECTIVE SHELTER AT THE NEOLITHIC SITE OF KALAVASOS-TENTA

*The site* Excavated by Dr Ian A. Todd [4], this is situated on a small hill near the Vasilikos river, in the southern part of Cyprus. From here there is a panoramic view of the Troodos mountains to the north, of the nearby Late Bronze Age site of Ayios-Dhimitrios, and of the modern highway and the sea to the south.



Figure 13. Kalavastos-Tenta: the site, the old shelter and the foundations for the new one.

A substantial wall, preserved on the east and south sides, surrounds the settlement, which consists of small, circular houses constructed of stones and mud. The largest house is situated at the very top of the hill.

*Specification* As part of a plan to develop the site for visitors, I was asked to design a new roof to replace the previous metallic one, which covered the site only partially (Fig. 13). The specifications for the design were: to cover a larger area than the previous shelter, mainly the area at the top of the hill but not the whole settlement; to plan a pathway, with the entrance and exit close together on the southern side near the access road; and to facilitate a good view of the whole valley from the site.

*Topography* The hill is oval-shaped, with steeper slopes on the west and north sides, so the hilltop is off-centre. The position of the surrounding wall in relation to the hilltop produces a geometric shape resembling a spiral (Fig. 14). The layout of the site inspired the plan's outline, which has been designed as a spiral irrationalis (a spiral whose rays, starting at 1, progress to  $\sqrt{2}$ ,  $\sqrt{3}$ ... $\sqrt{13}$ ).

*Construction* The new shelter was constructed in 1994–5 by the Department of Antiquities of Cyprus. The tent-like structure (Figs 15–17) comprises 14 straight glulam beams (supplied by Avex, of Patras, Greece), with lengths varying between 16 and 30m, standing on reinforced concrete blocks and joined at the top by a steel ring. These main beams are connected together

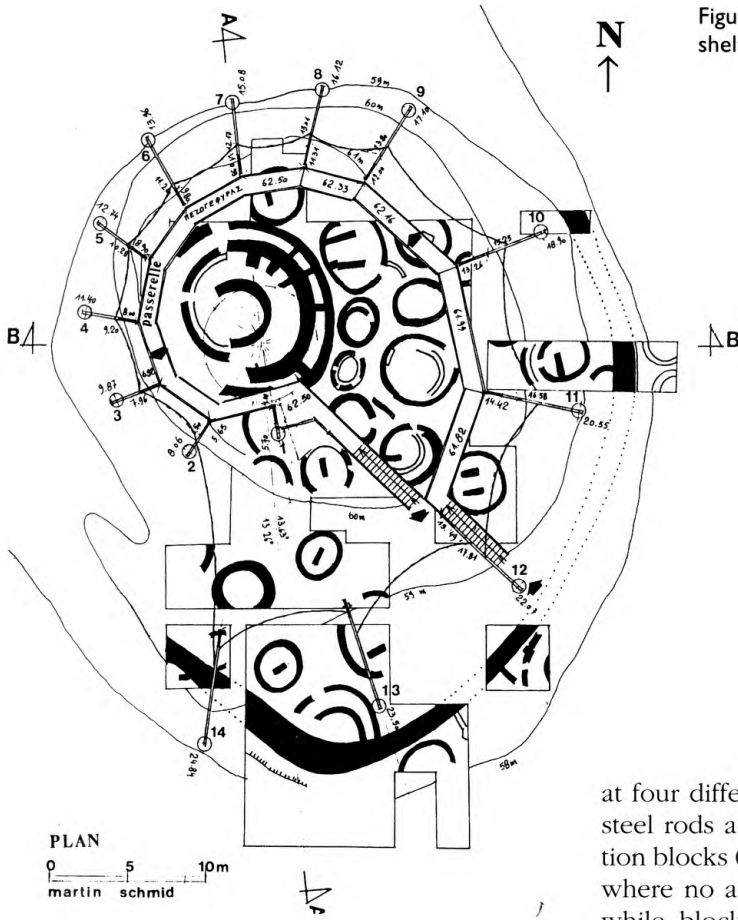


Figure 14. Kalavassos-Tenta: plan of the new shelter.

at four different levels by horizontal beams and steel rods acting as braces. Most of the foundation blocks (2–9; see Fig. 14) are situated in areas where no ancient houses have been preserved, while blocks 10–13 are inside the main wall, between houses. Block 14 is placed outside the wall and only block 1 is inside a house. The foundations are 6m deep.

A footbridge suspended from the beams enables visitors to see the Neolithic houses from

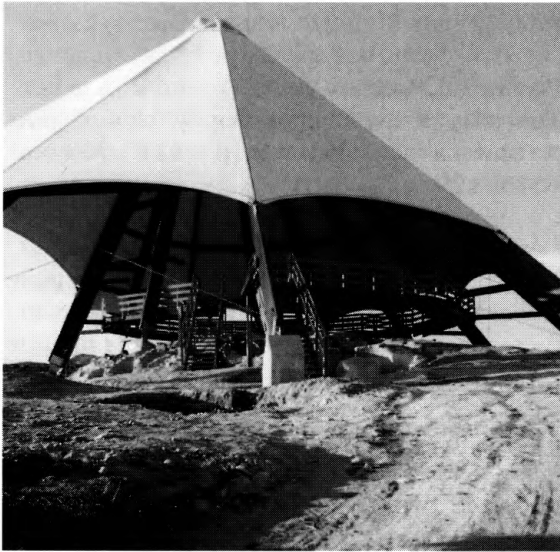


Figure 15. Kalavassos-Tenta: view from the entrance side of the new shelter.

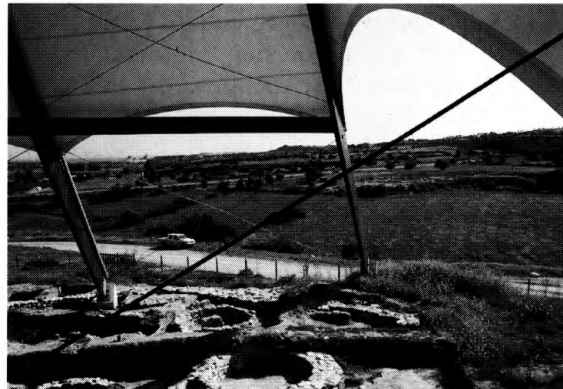


Figure 16. Kalavassos-Tenta: view to the south from the inside of the new shelter.



Figure 17. Kalavassos-Tenta: view of the new shelter from the north.

above and also to have a view of the valley, the sea and the Late Bronze Age site in the vicinity.

The roofing material is a stressed, coated PVC membrane (supplied by Landrell Fabric Engineering, UK), which provides consistent daylight. The space between the bottom of the PVC cover and the site's ruins provides natural ventilation.

*Appearance* The new shelter, looking like a 12-faceted conical tent, has the striking appearance of a landmark. The PVC is a slightly greenish yellow, a shade that shines in the sun and harmonizes with the colours of the environment, which change according to the season.

#### COST OF THE SHELTER

The cost of the shelter was 170,000 Cyprus pounds (approximately £212,000 or US\$340,000).

#### CONCLUSION

The shelter at Kalavassos-Tenta is part of a more extensive project involving the conservation and presentation of the larger site, taking in the Late Bronze Age remains, and perhaps also the Christian basilica excavated nearby, to include pathways, an access road, a parking area and an entrance pavilion. To date only a preliminary outline of this project has been made.

## GENERAL CONCLUSIONS

The shelters described here have been designed as part of plans for the conservation and presentation of the sites, taking into account their topography and environment.

The main features of the designs were:

- clear differentiation between the ancient monuments and the shelters with regard to material, shape, volume and appearance
- suspension of walkways from the structures to prevent visitors stepping on the fragile remains and to offer them an elevated view
- use of glulam beams for the structures because of their specific qualities: aesthetically pleasing appearance, low maintenance requirements, resistance to marine air, ability to cover large spans
- shape appropriate to each site: curved lines at Mallia, conical shape at Kalavassos-Tenta
- different roofing materials: polycarbonate at Mallia and PVC at Kalavassos-Tenta
- design of openings so that, from inside the shelter, visual contact with the external environment can be enjoyed.

**Martin Schmid** has been an architect at the French School in Athens since 1970. He has carried out architectural studies of ancient monuments at Lato, Mallia, Delos and Delphi in Greece and at Amathus in Cyprus. At Mallia, Delphi and Amathus he was responsible for conservation, reconstruction and presentation of ancient monuments.

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The photographs, drawings and plans are by the author.

## SHELTER PROJECT DETAILS

### *Mallia*

The site plan was authorized by the Anastylis Service of the Greek Ministry of Culture, directed by Jordan Dimacopoulos, and the Eastern Crete Archaeological Service, directed successively by C. Davaras and N. Papadakis. Thanks to the efforts of the latter service, and particularly those of S. Apostolakou, the construction of the protective shelters received financial aid from the European development programme for the Mediterranean area.

Designers on the project were:

- shelters – M. Schmid and G. Lambrou, engineer
- parking areas – I. Patsarouchas, engineer
- tourist pavilions – X. Yannakis, architect.

### *Kalavassos-Tenta*

The new shelter was commissioned by Dr Vassos Karageorghis, the former Director of the Department of Antiquities of Cyprus, with the financial support of the Anastasios G. Leventis Foundation.

Contributors to the shelter project included:

- design by M. Schmid
- plans prepared by Hyperstatic Engineering Design, Limassol (A. Achilleos, engineer)
- work carried out by Dynacon Ltd, building and civil engineering contractors, Limassol, Cyprus.

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