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Protective Structures on Archaeological Sites in Greece

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Abstract: This paper discusses a list of important architectural criteria for the design of protective structures on archaeological sites. Moreover, it describes a way of categorizing protective structures and presents one example of an existing protective structure on an archaeological site in Greece for every proposed category. Every documented example is accompanied by an evaluation, based on the criteria list. Finally, concluding remarks are derived from the examples' comparison and evaluation.

Key-Words: Protection, Structure, Architecture, Archaeological Site, Design and Evaluation Criteria, Greece

1 Introduction

The topic of protective structures becomes more and more important nowadays, especially if one takes a look on recent events (as is for instance the collapse of an enormous part of the pioneering bio-climatic protective structure over the excavations in Akrotiri, Santorini, on 22nd September of this year).

The aim of this paper is the presentation of constructional and aesthetic criteria, which should always be considered when designing an in-situ protective structure. The implementation of these criteria is then examined with the aid of existing examples derived from archaeological sites in Greece. As innumerable excavations lead by Greek and foreign archaeologists do exist in this country, an outstanding amount of internationally representative design proposals and examples of protective structures can be found. In consequence, the analyzed constructions are evaluated and general conclusions are extracted.

This research is based on the excessive work of the author: "Schutzbauten über archäologischen Stätten in Griechenland" [1], which was elaborated for the Department of Architecture of the Vienna University of Technology.

2 Criteria for the architectural design and evaluation of a protective structure

The following architectural design and evaluation criteria for a protective structure are based on results of numerous discussions with archaeologists that are working in Greece and related building professionals, mostly architects. Besides this source of information, some issues for the list of the 10 most significant design criteria derived from a design proposal of P. Jerome [2]. In conclusion, the criteria every protective structure has to consider are as follows:

- The protective structure has to be completely reversible, causing no damage to the site ruins.
- It ought to be low-tech, low cost and low maintenance.
- It has to consider potential microclimatic effects.
- It ought to give an impression regarding the original form and volume, without being a reconstruction.
- It has to be aesthetically compatible with the surrounding site, environment and landscape.
- Building materials should support the aesthetic impact in a positive way and never alienate the whole impression.
- It ought to contribute to the visitor's educational experience, as well as to the overall interpretation and presentation of the archaeological site.
- It has to integrate accessible informative aids, such as plans, details, figures, texts, etc. (also in Braille or audio-texted) in order to support every visitor's understanding and comprehension of the site and its surroundings.
- Additional night lighting, and if necessary even day lighting, should be integrated in the design.
- Last, but not least, the site's visit (from the (dis-) embarkation area to the (protected) historic remains and back) ought to be designed with the aid of an accessible, comfortable and safe guidance path.

3 Categories of protective structures

3.1 Short description of categorizing criteria for protective structures

About 15 years ago, H. Schmidt [3] proposed to categorize protective structures according to their form. Thus, the categories more or less refer to: a) temporary protections, b) protection roofs, c) partly enclosing protective structures and d) all-side closed constructions (buildings). However, researches show, that it is more convenient to base the categorizing on building materials used. Therefore, the following four categories are proposed: protective structures with:

a) metallic construction elements,
b) with wooden construction elements,
c) with concrete and/or brick and
d) with membrane or textile.

3.2 Categorized examples of protective structures on archaeological sites in Greece

Due to the richness of excavations in Greece, numerous in-situ protective structures can be found on archaeological sites. Only to name some examples according to the pre-defined categories:

a) protective structures with metallic construction elements: e.g. Pellana (Peloponnese): roof for the Mycenaean Tomb; Lefkanti (Evia): Megaron protection; Palekastro (Crete): temporary protective roof for “Building 5”; Knossos (Crete): design proposal for the expansion of the museum and storage rooms; and many more,
b) protective structures with wooden construction elements: e.g. Malia (Crete): constructions for the Minoan settlement; Klausi (Central Greece): roof construction for the Leonida’s Basilica; Knossos (Crete): roofing for the Dionyso’s Villa; and many more,
c) protective constructions with concrete and/or brick: e.g. Vergina (Northern Greece): Macedonian Crypta; Eretria (Evia): House for the mosaics; Palekastro (Crete): Alternative A for “Building 5”; and many more, and
d) protective structures with membrane / textile: e.g. Bassae Figalias (Peloponnese): temporary shelter for Apollo’s temple; Palekastro (Crete): Alternative B for Building 5, and some more.

In the following, one representative example for each of the above-mentioned categories is presented and evaluated.

4 Example of a protective structure with metallic construction elements: Pellana - Mycenaean Tomb

4.1 Presentation

The Mycenaean tomb found in Pellana, Peloponnese, comprises of an oval central chamber and an entrance corridor. During the excavation, an opening in the tombs ceiling was found, which allowed the removal of ancient material due to entering water. As this grave is the biggest and best-conserved Mycenaean Tomb in this specific region, the responsible State authority decided to have a protection roof constructed in order to maintain it in the long term.

The logic of this design lies in the alienation of an anastylosis (fig. 1). The tomb’s tholos becomes a decagon, while the original volume of the vaulting is maintained. In conclusion, the visitor’s impression inside the tomb resembles to the ancient one.

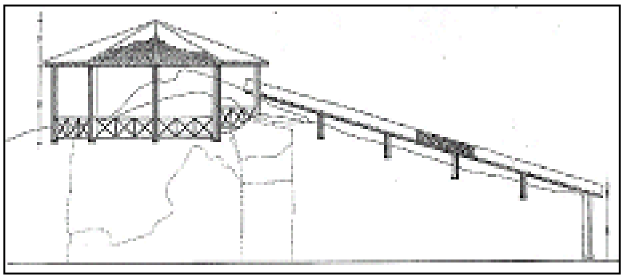

Fig.1: View of the protection roof over the Mycenaean tomb at Pellana showing also the originally planned roofing of the entrance corridor

The finally built protective structure in Pellana consists of a single roof over the main chamber ceiling without the planned roofing of the entrance corridor (fig. 2).

Fig. 2: The protection roof over the Mycenaean tomb in Pellana seen from the entrance corridor

Its metallic pylons are fixed on rock and only in few cases, foundations of concrete blocks had to be filled into the rock. All pylons consist of I-beams, which are decorated with wooden arbors in the indentations. Their heights vary depending on the surrounding site level. The roof itself consists of wooden racks and overtops the grave's opening due to reasons of drainage. It was laid with copper sheets, which explains also the existence of the gable due to technical reasons.

4.2 Evaluation

The combination of creating the impression of a tholos inside the tomb together with the outside alienation of the original volume by forming a decagon seems to be a suitable design idea. A reconstruction is avoided, but the impression of the tomb's original volume is given. Thus, the educational process of visitors is facilitated.

As regards construction elements, all contacts with antic remains are avoided. The concrete foundations do not interfere with historic substance and are completely reversible. Besides that, the construction does not limit the overview of the wider landscape in any way.

The protective roof's maintenance is kept low, as it is a low-tech construction, which only needs anti-corrosive methods from time to time. Natural lightening from all sides among the pylons is guaranteed, without allowing total illumination of the tomb's main chamber. This fact supports the ambience of a tomb and the visitor's experience.

No microclimatic effects can occur, as the roof allows fully air circulation. The chosen materials support a positive aesthetic effect and a harmonious embedding in the surrounding landscape is achieved. Moreover, time will contribute in a positive way to the roof's aesthetic, as copper sheets will turn into green, toning in perfectly with the surrounding vegetation and reducing its attraction even more.

Although the design for the protective roof in Pellana has not foreseen any supplementary information and presentation material in-situ, it can be said that it represents a positive example of a protective structure with metallic construction elements in Greece.

5 Example of a protective structure with wooden construction elements: Malia – Minoan Settlement

5.1 Presentation

The excavation of the Minoan settlement of Malia, Crete, covers an area of about 45.000m^2 today. In 1985, a master plan was elaborated for the totality of the archaeological site including the construction of three protective structures (over the remains of the quarter "M", the crypt and the East magazines), a tourist pavilion and a visitor's parking area, as well as the creation of signed paths, the positioning of explanatory and information panels, pictures and models.

All three protective roofs have been designed with similar criteria and only little variations distinguish the one construction from the other, according to its proper needs. Their surges consist of bows of gluelam, as this material is very resistant and allows immense wingspans. In conclusion, the antic remains could be completely roofed without any in-between piers (fig. 3). In all three solutions the main bows run parallel to the antic mural remains.

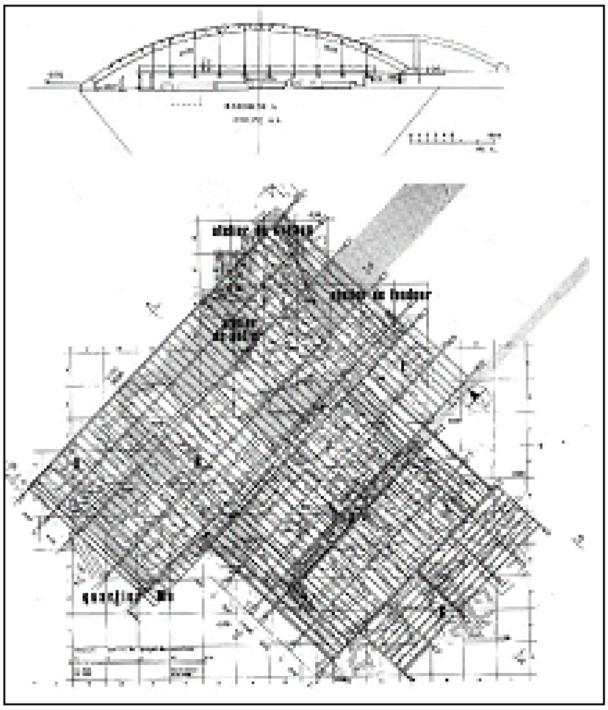

Fig. 3: Section and plan of the protection roof over the quarter "M" at the archaeological site of Malia

The wooden bows are founded in reinforced concrete blocks, which are placed outside the antic buildings or if not otherwise possible, in original courtyards in order not to contact any historic substance. They exceed the antic remains and if necessary even lie directly on the foundations so as to protect also against side rain. The roofing material consists of sheets of double-faced milky tinted polycarbonate. The drainage system leads rainwater to the lowest points of each roof, at some points even into antic gutters, and is set free through pipes in the wider surroundings.

5.2 Evaluation

The examples of Malia represent a dared modern solution as regards protective structures. The design adapts the lining of the surrounding mountains (fig. 4, 5, 6 and 7) and only gives a very general impression of the extension of the buildings' original volumes. As these constructions are totally new elements in the excavation area, the attempt to optically reduce the structures' heights was made. In addition, all construction elements are reversible, visible and identifiable.

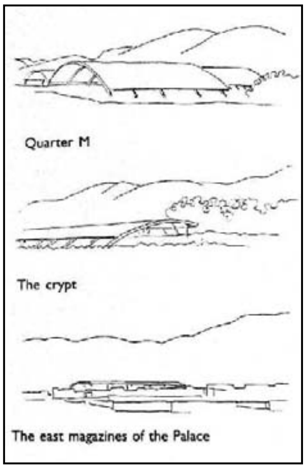

Fig. 4 and fig.5, 6, 7: Embedding of the protection structures into the surrounding landscape of Malia

Maintenance is limited to protection against the highly salty climate of the area. Air circulation is possible under all protective structures hindering the development of any microclimatic effects. Sufficient natural lighting is possible through all open sides, as well as through the translucent roof covering.

The embedding in the surrounding landscape is highly aesthetical, as the red-brown tinting of the gluelam arches harmonizes perfectly with the earth and the adobe vestiges. In all three solutions limitations to the wider view on the archaeological site and the surrounding landscape have been avoided. So, the architectural entity does not interfere with the archaeological unity and a harmonious and aesthetic assimilation with these new shapes is achieved. In conclusion, the three examples on the archaeological site of Malia are positive designs for protective structures with wooden construction elements.

Furthermore, the case of Malia is one of the rare examples in Greece, where a master plan was elaborated, which included paths and information points for the whole archaeological site. However, as far as these matters are regarded, still a lot needs to be done.

6 Example of a protective structure with concrete and/or brick: Vergina – Macedonian Crypta

6.1 Presentation

In Vergina, Northern Greece, a complex of Macedonian tombs was found, which consists of five graves differing in size and in their today's conditions (from almost intact tombs to completely destroyed vaults and chambers).

The idea for the protective structure's design was the adaptation of the outside shape of an enormous hill, like the one the tomb's complex used to be. Thus, the interference with the surrounding landscape is minimal.

The new entrance leads to a rectangular room, which gives access to a corridor and to the grave-rooms. This central room also serves as an exhibition area providing supplementary information about the tombs and the treasures that were found in them. Around it, four similar hexangular rooms are arranged in the shape of a circle. Their pyramidal ceilings include a light depressant cupola, which also allows direct air supply from the outside.

All rooms are constructed with prefabricated reinforced concrete elements (fig. 8) in order to be reversible. The outside covering of the cage with earth provides a natural insulation and protects the monuments. Furthermore, maintenance is kept low, as almost all construction elements are buried into the earth. Lighting is artificial. Sliding doors serve as separation elements between these rooms.

Fig. 8: Aerial view of the erection of the protective construction over the tombs' in Vergina

6.2 Evaluation
The idea to separate the grave rooms one from the other is a positive aspect, as they origin from different periods of time and their archaeological correlation is not explicit. However, it is not evident, why the shape of hexagons has been chosen. The choice of the pyramidal ceiling seems to be more logical, as in some way it adopts the hill shape inside. Besides that, the aesthetic of the landscape is not severely disturbed, as the outside shape of the earth hill integrates well into the surrounding area.

The protective structure is reversible and low maintenance and potential microclimatic effects seem to have been taken into account during the design.

However, the major problem of this construction seems to be the artificial lighting, resulting in the fact that the somber underground atmosphere of a tomb complex gets completely lost. In addition, the choice of polished materials seems rather inappropriate, as they reflect light even more (fig. 9).

Fig. 9: Fully lightened exhibition room and access to tombs

The example of the protective structure for the Macedonian tombs at Vergina tried to meet the requirements of a new aesthetic perception and to combine it with the seminal execution of this complex project. But it seems that due to this effort, the important aspects of its aesthetic and of the creation of a proper atmosphere got completely lost! The expectation of a visitor entering the tomb complex is definitely not met.

In the case of Vergina, maybe the removal of the exhibition room to some other place on the outside archaeological park area (perhaps next to the museum's shop and the sanitary block) would have been more appropriate.

7 Example of a protective structure with membrane: Bassae – Apollo's temple

7.1 Presentation
The last example that is presented is the temporary protection for the Apollo's temple at Bassae Figalias, Peloponnese. This example has been chosen, as on numerous archaeological excavations visitors have to face provisional solutions. However, the protective coating at Bassae gives proof, that there do exist other solutions than the ones usually found (e.g. barrels filled with concrete and steel columns that support unaesthetic wavy carbon-fibred sheets).

The aim of this temporary synthetic membrane coating was to securely protect the antic remains against extreme climatic conditions during restoration works. The construction's erection had to be easy and all new elements had to reveal their temporary character at one glance to visitors (fig. 10).

Fig. 10: Temporary coating around the Apollo's temple at Bassae

7.2 Evaluation
Although the temporary character of the temple's coating is evident to visitors (renewals and restoration works take place), this solution remains questionable. The main problem is the invisibility of the temple itself and thus the reduction of its cultural value. The aesthetic devaluation of the temple is dramatic, mostly due to the diminution and deformation of the temple's plasticity (fig. 11).

Fig. 11: View of the temple after the renovation works in 1987

As the coating has now been standing for many years, its temporary character has gotten lost, as well as its harmonious embedding in the surrounding landscape. On the one hand, visitors entering the mantled temple area will not forget the improper atmosphere under the membrane, but on the other hand the question arises, if this really should be the goal, when erecting temporary protective structures, that end up to be standing for a couple of decades!

8 Concluding remarks

In conclusion of the presented examples, it can be stated, that in general most of the pre-defined design criteria are incorporated in permanent or temporary protective structures, regardless their construction materials. From the constructional point of view it can be said that in all cases foundations are chosen and constructed in such ways that reversibility is guaranteed and that no damage to historic substance is caused. Most examples represent a low-tech construction, which does not need extensive maintenance. Microclimatic effects seem to be considered in every design.

On the contrary, the aesthetic issue seems to be more delicate. In most cases, an impression of the original building's form is achieved, either using an alienation of the original shape or solely defining the antic volume with new forms. Both ways support the educational process of the visitor as her/his understanding of the original constructional form and volume is achieved. The aesthetic integration in the surrounding landscape is well considered, with few exceptions. Only in few cases the in-situ protection attracts more attention than the site itself. However, the most problematic issue seems to remain the creation of a proper atmosphere inside protective structures according to the initial ambience.

Besides that, it has to be emphasized, that protective structures on archaeological sites should integrate more carefully explanatory aids in order to support the visitors' understanding. Even the positive example of Malia, where the master plan integrated visitors' paths and information panels, this issue has been finally neglected during the site renewal.

Finally, the most important issue, which needs immediate treatment on all archaeological sites, is the one of accessibility. Almost none of the excavations in Greece and only few of the protective structures are accessible e.g. for visitors with a mobility impairment or visitors with a visual impairment. As it is a fact, that mobility is worldwide augmenting (especially in the case of senior citizens) the tourist sector and all relevant fields (not only in Greece) urgently need to meet requirements of accessibility. This means, that archaeological sites and their protective structures have to be adapted and designed in accessible, safe and friendly ways, in order to guarantee an autonomous and independent use for every future visitor!

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[Fig. 1, 2] by courtesy of Mr. Vasilis Papadimitriou of the Greek Ministry of Culture

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[Fig. 5, 6, 7] author's archive

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[Fig. 10] Θεωδόρα Καραγιώργα-Σταθακοπούλου, *Η συντήρηση του ναού του Απόλλωνος στις Βάσσες Φιγαλείας. Χρονικό μιας προσπάθειας,* Greek Ministry of Culture, Athens, 1994, p.18

[Fig. 11] Θεωδόρα Καραγιώργα-Σταθακοπούλου, *Η συντήρηση του ναού του Απόλλωνος στις Βάσσες Φιγαλείας. Χρονικό μιας προσπάθειας,* Greek Ministry of Culture, Athens, 1994, p.16

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