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Design Proposal for a Protective Shelter to be Used in the Archaeological Excavation and Exhibition Phases of Housing Settlement and Mosaics of Myrleia

Myrleia Antik Kenti Konut Yerleşimi ve Mozaikleri'nin Arkeolojik Kazı ve Sergilenme Aşamalarında Kullanılmak Üzere Bir Koruyucu Üst Örtü Önerisi

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Abstract

Information about the ancient city of Myrleia, which is of great importance for the history of Bithynia and Mudanya, is minimal since the ancient ruins are buried under olive groves and the written sources about its construction in the ancient period are scarce. However, along with the ruins unearthed in 2015 and 2016, information about the ancient period of the city began to emerge. Therefore, it is essential to preserve the unearthed remains and their information and transfer them to the future in-situ, within the architectural and cultural context.

Within the scope of the study, a protective shelter design proposal is developed on the residential settlement discovered in Ömerbey District in 2016 and the mosaics discovered in the settlement. The designed shelter aims to protect the remains from various adverse effects, provide the team's comfort carrying out the study (thermal, security, etc.), and fulfill the functions of providing ideal conditions for the visitors. In addition, the sustainability of the top shelter and its flexibility to expand to include new finds discovered around the excavation area also played a significant role in the shelter design.

Keywords: *Myrleia, protective shelter design, sustainable design, in-situ protection, urban arcaheological sites.*

Öz

Bithynia ve Mudanya tarihi açısından büyük önem taşıyan Myrleia antik kenti ile ilgili bilgiler antik kalıntıların zeytinlikler altında gömülü olması ve antik dönemdeki yapılanmasına dair yazılı kaynakların azlığı nedeniyle oldukça kısıtlıdır. 2015 ve 2016 yıllarında ortaya çıkan kalıntılar ile birlikte kentin antik dönemine yönelik bilgiler de ortaya çıkmaya başlamıştır. Ortaya çıkan kalıntıları ve bu kalıntıların içerdikleri bilginin korunması ve geleceğe bulundukları yerde, içinde bulundukları mimari ve kültürel bağlam içerisinde aktarılması büyük önem taşımaktadır.

Çalışma kapsamında 2016 yılında Ömerbey Mahallesinde keşfedilmiş olan konut yerleşimi ve yerleşim içerisinde keşfedilmiş olan mozaiklerin üzerine koruyucu bir üst örtü tasarımı önerisi geliştirilmiştir. Tasarlanan üst örtünün; devam eden arkeolojik kazılar sırasında kalıntıların olumsuz çeşitli etkilerden korunması, çalışmayı yürüten ekibin konforunun (ısıl, güvenlik, vb.) sağlanması ve ziyaretçiler için ideal şartların sağlanması işlevlerini yerine getirmesi amaçlanmıştır. Üst örtünün sürdürülebilir olması ve kazı alanı çevresinde ortaya çıkan yeni buluntuları da kapsayacak şekilde genişleyebilmesine olanak sağlayacak esneklikte olması da örtünün tasarımında büyük rol oynamıştır.

Anahtar Kelimeler: *Myrleia, koruyucu üst örtü tasarımı, sürdürülebilir tasarım, yerinde koruma, kentsel arkeolojik bölgeler.*

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Introduction

The ruins of the ancient settlement of Myrleia were unearthed in 2015 at Mudanya. Following these excavations, in 2016, the remains, which are thought to be part of the ancient period residence settlement, were discovered in the south of the same region. After the evaluations, the first group of ruins were opened to structuring. The parcel in which the second group of remains was found, was included in the 3rd degree protected area. As it was determined that the structures discovered during the trenches continued in the surrounding parcels, the legal process was initiated to include these parcels in the conservation area. When the expropriation process is expected to be completed, excavation works are planned to continue in the protected area.

During the excavations carried out in the settlement area, it became clear that the remains that have been underground for a long time and have now been unearthed need to be protected to maintain their integrity. In addition, it is among the priorities of the excavation to work on using new information about this region and its ruins within the scope of research. Another important point about these ruins is to reveal this area's heritage value and ensure its reflection on the urban identity. In order to ensure this reflection, it is of great importance that the region is open to visitors and the service of researchers from different fields. In addition to all these, providing optimum comfort conditions for archaeologists, researchers, experts and workers who will participate in the archaeological excavations planned to continue here is among the priorities. As a result; it has become necessary to develop a conservation method that will meet the needs of uncovering, protecting the unearthed, obtaining information on this subject and experiencing the region while meeting these needs, which will cause minimal damage to the ruins while making the area more attractive and not disrupting the urban context.

It is possible that cultural assets such as building ruins, wall paintings, mosaics, which are suitable and necessary to be preserved and exhibited in situ, may be damaged by adverse weather conditions and the physical effects of humans, despite the conservation efforts (Zeren - Uyar 2010: 55-64). Protective shelters and structures designed -in different qualities according to the need- to preserve these works are frequently used as protection tools. In almost all excavations where archaeological artifacts are unearthed, a cover is needed to protect the easily affected and deteriorated material from moisture, sudden drying, mechanical damage and human influence (Schmidt 1988: 121). Protective structures can be considered one of the tools that allow the presentation of the ruins while providing control over the deterioration factors. The design criteria of the protective shelters to protect the immovable archaeological heritage vary according to each country and region in terms of legal obligations, the use of technological opportunities to be used and the economy.

Within the scope of the study, a protective shelter design proposal is developed to preserve and display the building remains and mosaics unearthed during the excavation of the ancient city of Myrleia. In order to develop this proposal, first of all, the design criteria of the protective shelters are determined. After these determinations, samples applied in different countries and climates are evaluated according to these criteria. After the research and examinations are completed, the historical and physical features of the ruins are examined, and the climatic features of Mudanya are evaluated. Based on all these research and evaluations, a shelter and sightseeing area proposal is developed to protect the building remains and mosaics during the ongoing excavations, to facilitate the studies

and research, and to prevent the people who will visit the site from damaging the remains while experiencing the entire excavation area.

The Design Criteria of Protective Shelters at an Archeological Site

A shelter at an archaeological site has to be multi-functional. Therefore, there are various factors affecting the design of a protective shelter. Each of these factors is important in determining the protective structure's success. During the design of a shelter at an archaeological site, many aspects have to be taken into consideration, including technical aspects (construction systems, durability of the materials, costs), conservation aspects (effectiveness of protection, new microclimate induced by the shelter), aesthetic aspects (the choice of materials, forms, overall effect of the new structure), the impact on the site as a whole, interpretation and presentation aspects in which the collaboration of the architects and the archaeologists is essential (Rizzi 2018: 51-57).

The primary function of a shelter is to protect the site and findings from climatic effects and vandalistic damages. As most archaeological sites are actively used in summer, the shelter has to supply climatic comfort for the workers and visitors. Therefore, the natural ventilation of the space created under the shelter is an important issue. On the other hand, protecting the findings buried under soil for many centuries from atmospheric conditions is also essential (Vasic-Petrovic - Momcilovic-Petronijevic 2015: 113-121). The climatic conditions of every archaeological site and location are unique. Therefore, the design criteria of each site might differ in terms of creating optimal comfort (Büyüköztürk - Oral 2020: 679-691). Draining the rainwater and snow is another problem the shelter has to cope with. The water itself might damage the excavated remains, whereas the chemical reaction between the construction material and water (such as corrosion and oxidation) might cause irreversible damages. Therefore, the microclimatic condition created under the shelter should be considered for all seasons. The humidity level also affects the archaeological remains and the climatic comfort level of the visitors and people working on the site.

The structure of the shelter ought to be attractive besides its functionality. It should neither be over designed nor underqualified. Because in both ways, it would affect the visitor's interaction with the findings and the overall perception of the site. The shelter should highlight the qualities of the archaeological site and the structures found in the area. Also, it needs to have the potential to present the qualities of the remains displayed in situ. The shelter's structure should not limit the vision and holistic perception of the site.

Meanwhile, it should not have a dominant design surpassing the archaeological findings (Ahunbay 1999: 106). The main reason for a shelter structure at an archaeological site is to attract visitors' attention to the findings. So, the differences between the remains and the protective shelter period should be perceived clearly in terms of building techniques and materials.

Most of the archaeological excavations long for many years. The parts discovered and the areas excavated enlarge through years. Therefore, the shelter structure should have the potential of expanding and need to be adaptable to the process. On the other hand, it should not create a barrier against the development of the excavation area. All new structures in the archaeological site, including the ticket offices, storage units, toilets, walking platforms, must be designed as temporary units (Zeren - Uyar 2010: 55-64). Meanwhile, most of these structures become permanent (Balderrama - Chiari 1995; 101-112), especially when those sites are open to cultural tourism. Therefore, both parameters should be kept in mind

during the design process of a protective shelter at an archaeological site. It should be flexible, reproducible, easily removable and light enough; on the other hand, it should be durable enough to resist all kinds of effects caused by natural and human sources.

The materials used and the design principles should be sustainable and cause non or minimal damage to the site and environment. The materials chosen for the shelter design is also vital in terms of the supply process. If local materials are chosen, the sustainability of the shelter will increase. This would also be beneficial for keeping the budget reasonable and accelerating the construction process. Pesarasi and Stewart (2018; 58-82) state that designing a cost-effective and low-maintenance shelter can present a challenge to archaeological sites, which often suffer from a systematic shortage of financial and technical resources. Zeren - Uyar (2010: 55-64) claim that shelter materials should have a long-life span. They should be resistant to corrosion and structurally stable enough to cope with seismic loads. Timber and steel are frequently used for protective shelters and walking platforms in archaeological sites. The critical thing is to make these materials resistant to atmospheric conditions by applying various processes such as lamination. The main principle is to use durable materials and require low maintenance time and costs.

Also, the budget is another crucial factor for the shelter's design. In most cases, the construction of a protective shelter is financed by state agencies which must stay within a limited budget. However, considering that archaeological remains belong to world cultural heritage, international contributors might be included in the process (Thompson - Abed 2018: 13-39). Also, some sponsorship agreements can be made. This would increase the budget's limits and allow realizing more effective designs. The maintenance costs are as high as the initial construction costs. Therefore, a long-term plan should be made to maintain shelter structure while choosing the materials according to their durability under local conditions and supply chain management issues.

The structural elements carrying the shelter load should attach to the ground with minimal connections to avoid damaging the archaeological remains. Furthermore, the minimal number of vertical constructional elements widens the field of view. Also, the adaptability of the structural schema to the ancient plan is vital for strengthening the visual perception (Zeren - Uyar 2010: 55-64).

Pesarasi - Stewart (2018: 58-82) states that protective shelters at an archaeological site should be monitored periodically. In this way, the effectiveness of the shelter in protecting ancient remains over time might be determined, and its performance might ultimately be improved as required. Also, the changes in the condition of the ancient fabric and the shelter might be detected, and its performance during heavy storms and other atmospheric conditions might be determined. All those periodic audits should be done by specialists, and necessary precautions should be taken before causing irreversible damage to archaeological remains. These audits become crucially important, especially during the winter season while the site is being used and visited by a few people or non.

Besides all the mentioned aspects; full enclosure with roof and wall insulation with highly reflective external materials, good controllable artificial lighting where necessary, controllable ventilation, access to archaeological features for routine cleaning and conservation, screens in ventilation points to prevent rodents or insects, ensuring that fragile archaeological material is out of reach of the visitor access route are also important factors that ought to be kept on mind during design (Ha'obsh 2018: 112-126).

The Protective Shelters Built in Archeological Sites

There is a wide range of construction methods of protective shelters built in archaeological sites to protect the remains and constitute an ideal display for the findings, providing optimal conditions for the visitors and the team members working on-site while creating tourist attractions. To present various approaches of designing protection shelters in archaeological sites, four examples are examined, two of which are in Turkey, one in Greece and the other one in Spain. However, having approximately similar climatic conditions, the design approach, the materials used, the constructional systems, the characteristics of the location differ.

In examining each case, a table mentioning identical features of the projects is presented. Also, the project's design approach, the interaction with the existing site, and the construction principles are explained.

Cartagena Archaeological Site Shelter

The Roman remains, including thermal baths, forum and domus, are located in the urban area of Cartagena (Table 1). The protection shelter over the archaeological site was designed as a single canopy covering the whole area. The design of the canopy differs from the existing urban texture. In this way, the design distinguishes structures built in different periods, respecting the antic remains while existing as an aesthetic landmark, creating tourist attraction. The main principle in the design process is to create a light holistic structure enabling visitors to perceive the site continuously while supporting the sculptural roofing with a minimum number of vertical constructional elements. The nature of the materials used for roofing (perforated steel panels and corrugated translucent polycarbonate sheets) enables it to take controlled daylight beneath the structure for natural lighting while protecting the remains from rain. This semi-transparent texture also brings out the lightness of the structure. The floating elevated walkway creates a route for the visitors, including disabled people, to wander around the archaeological site (Michler 2012).

Table 1
Cartagena Archaeological Site Shelter details.

Location	Cartagena / Molinete / Spain	**Area**	1847 m2
Designer	Amann,Canavas, Maruri Architects	**Climatic Cond.**	Tropical and Subtropical Steppe Climate (BSk)
Opening Date	2011	**Budget**	$ 977,719
Material	Steel, perforated steel panels & corrugated polycarbonate		

The zig-zag hollow wall structure defines a frontier between the antic city and urban area while presenting a blurry silhouette of the archaeological park for the visitors (Figs. 1-3). The artificial lighting of the canopy and the separating walls reveal an appealing image, especially at nighttime. In addition, the void between the linear modules constituting the outer separation wall and the openness under the roof cover lets the air in, generating natural ventilation in the area (Fig. 4). This creates a thermal comfort zone in the archaeological site.

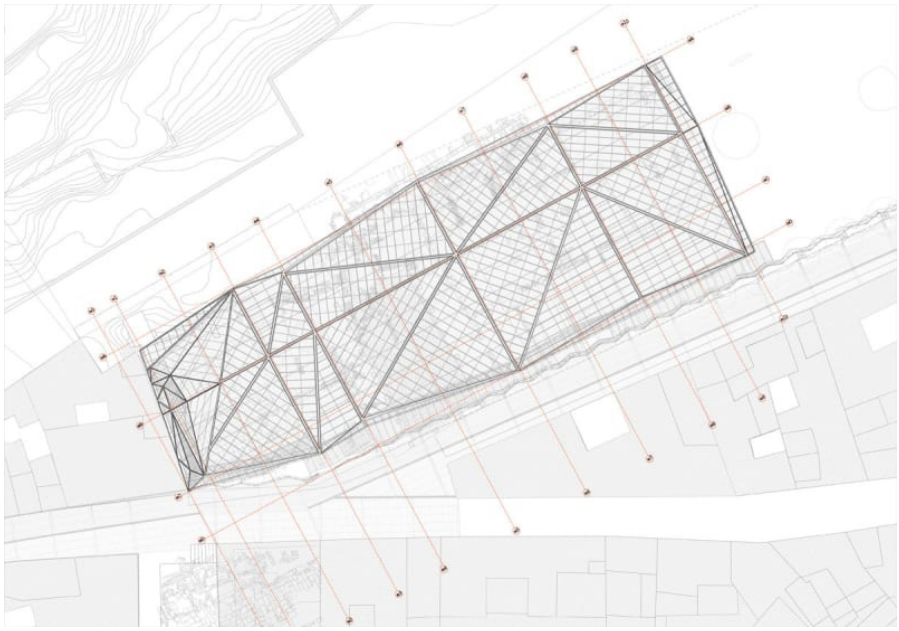


Figure 1
The plan drawing of the Cartagena shelter.
https://divisare.com/projects/217930-amann-canovas-maruri-david-frutos-bis-images-deck-over-a-roman-site-in-cartagena-spain
(Access Date: 29.01.2022).

Figures 2-3
The interaction between the Cartagena shelter and the urban texture.
https://divisare.com/projects/217930-amann-canovas-maruri-david-frutos-bis-images-deck-over-a-roman-site-in-cartagena-spain
(Access Date: 29.01.2022).

Figure 4
The space beneath the Cartagena shelter.
https://divisare.com/projects/217930-amann-canovas-maruri-david-frutos-bis-images-deck-over-a-roman-site-in-cartagena-spain
(Access Date: 29.01.2022).

Akrotiri Archaeological Site Shelter

The protective shelter covering the whole archaeological site of Akrotiri ancient city has a base area of 13000 m2 (Table 2). The excavations started in 1967, and the site was covered by a single shelter made from a metal construction system with corrugated asbestos cement sheets. However, as this structure has had corrosion damage through the years, a new protective shelter was designed by Nikos Fintikakis.

Table 2
Akrotiri Archaeological Site Shelter details.

Location	Akrotiri / Santorini / Greece	**Area**	13000 m2
Designer	Nikos Fintikakis	**Climatic Cond.**	Mediterranean Climate (Csa)
Opening Date	2012	**Budget**	$ 80,000,000
Material	Steel, glass, timber, natural volcanic materials		

The design approach is creating a shelter that introduces natural ventilation and lighting to the archaeological site and comfortable temperature for those who move inside it without any energy-consuming mechanical support. The landscape and the location's climatic conditions are determinant factors in the design. The volcanic land surface is used as a roof covering which absorbs the different seasons' greening and, at the same time, is a natural protector for the remains of the ancient city (Fig. 5). Another feature of the roof is collecting

Figure 5
Bird Eye view of the Akrotiri Shelter structure. https://worldarchitecture.org/articles/cghfz/nikos_fintikakis_creates_a_bioclimatic_shelter_for_akrotiri_archaeological_site_in_greece.html (Access Date: 30.01.2022).

rainwater which supplies the freshwater reserve needed for the excavation. Natural ventilation generates the renewal and cooling of the air inside for users' thermal comfort. The massive shelter preserves prehistoric city and creates room for additional functions of the excavation team (Fig. 6). These functions include storage facilities, safe-keeping and easy access for study and maintenance, the excavation archives (notebooks, inventories, drawings, photographs), library and computer room. Other facilities concerning the public function are toilet facilities, a refreshment counter, first aid medical station (Doumas 2013: 109-120). Besides creating comfortable accommodations for the visitors and the staff, the shelter attracts tourists with the sustainable character of its unique structure (Fig. 7).

Figure 6
The inner space of the Akrotiri Shelter. https://worldarchitecture.org/articles/cghfz/nikos_fintikakis_creates_a_bioclimatic_shelter_for_akrotiri_archaeological_site_in_greece.html (Access Date: 30.01.2022).

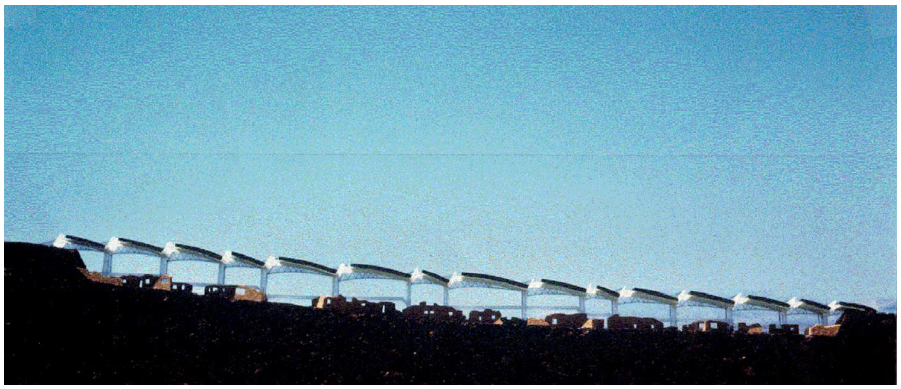


Figure 7
The section drawing of the Akrotiri shelter. https://worldarchitecture.org/articles/cghfz/nikos_fintikakis_creates_a_bioclimatic_shelter_for_akrotiri_archaeological_site_in_greece.html (Access Date: 30.01.2022).

Çatalhöyük 4040 Area Archaeological Site Shelter

This shelter was built on the northern part of the East mound of Çatalhöyük (4040 Area), lying in the south-north direction (Table 3).

Location	Çatalhöyük / Konya / Turkey	**Area**	1300 m2
Designer	Sinan Omacan, Rıdvan Övünç	**Climatic Cond.**	Mediterranean Climate (Csa)
Opening Date	2008	**Budget**	$105,000
Material	Laminated timber, polycarbonate panels, concrete foundation		

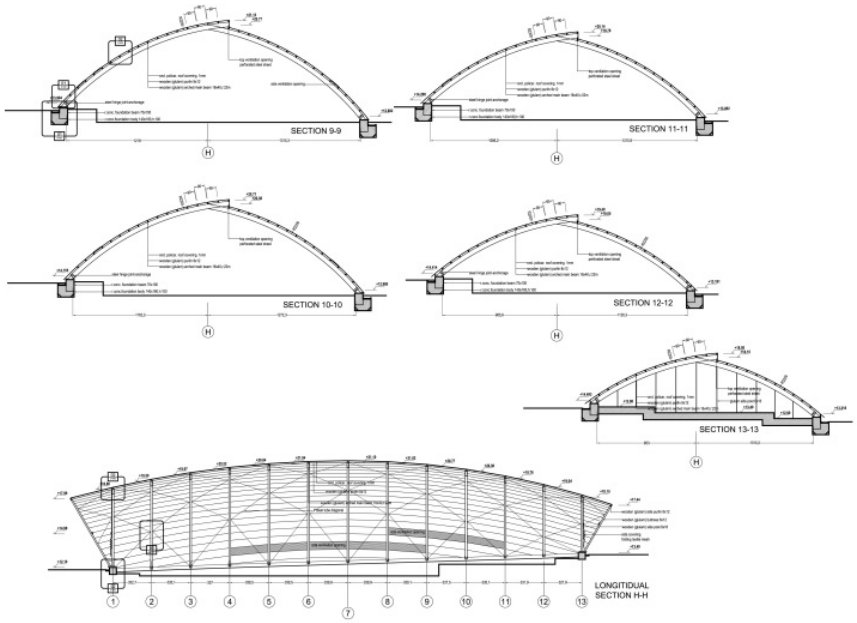
Table 3
Çatalhöyük 4040 Area Archaeological Site Shelter details.

The shelter's primary purpose was to protect the discovered earthen architecture, paintings, relieves and undergoing excavations. The initial construction process started with implementing a one-meter-wide continuous plinth that would carry the timber structure's load. This type of foundation was chosen as it required minimal excavation on the archaeological site. The following year, the main body of the protective shelter, which consisted of 14 laminated timber arches with various heights having the same diameter, was built. As far as it is located on the top of the mound, the shelter's design has a softer form, which can blend in with the natural topography while having an aesthetic character (Figs. 8-9). The timber skeleton is covered with polycarbonate panels which let the daylight in and support the visual comfort beneath the shelter (Fig. 10). The higher parts of the shelter provide natural ventilation (with folding side panels), while the lower sections create a slope for an effective drainage system (a channel made of pre-cast cement). This structure is also beneficial for making the shelter durable against the heavy wind in winter (Ertosun 2012: 104-109, 160-163; Çamurcuoğlu Cleer 2008). Although the shape of the shelter is in harmony with the existing

Figure 8
The shell structure of Çatalhöyük 4040 Area Shelter. https://archaeologicalshelters.wordpress.com/2012/06/24/catalhoyuk-site-north-shelter-atolye-mimarlik/ (Access Date: 05.02.2022)

Figure 9
The inner space beneath the Çatalhöyük 4040 Area Shelter. https://archaeologicalshelters.wordpress.com/2012/06/24/catalhoyuk-site-north-shelter-atolye-mimarlik/ (Access Date: 05.02.2022)

Figure 10
The technical drawings of Çatalhöyük 4040 Area Shelter. https://archaeologicalshelters.wordpress.com/2012/06/24/catalhoyuk-site-north-shelter-atolye-mimarlik/ (Access Date: 05.02.2022)



landscape, the relative humidity beneath the shelter causes a regular action of drying/wetting, which activates the soluble salts through the groundwater, causing mudbrick and plaster layers to erode, delaminate and detach constantly. These impracticalities might reveal a need to change the 4040 shelter in the long term (Çamurcuoğlu Cleer 2010).

Göbeklitepe GT1 Area Archaeological Site Shelter

The Göbeklitepe ruins dating back 12,000 years are located on the highest hills of the Germuş Mountains. The location is surrounded by the silhouette of Toros, Nemrut and Karacadağ Mountains. The remains in the site have a vast spread. The shelter mentioned in this paper covers the GT1 Area, where the excavations are completed, and the bedrock has been descended. The GT1 Area is also open to visitors; therefore, there is a steel and timber walkway following the borders of the elliptic roof structure (Fig. 11). The main principle of the design is to carry the loads of the roof construction by using the minimum number of fixing points to the ground. The steel skeleton of the roofing structure has a hyperbolic paraboloid form covered with a membrane to present both an attractive and functional cover (Fig. 12). All the vertical constructional elements are located on the outer side of the structural frame. In this way, the column-free inner space is wide open without any visual disturbance. The form of the structure is resistant to the local solid winds while creating natural ventilation beneath the shelter and

providing thermal comfort (Fig. 13). The membrane is semi-transparent, letting the daylight in, in order to increase the visitors' visual comfort (Fig. 14). The rainwater is drained with pipes hidden inside the steel structure (İrepoğlu 2019: 20-23) (Table 4).

Location	Göbeklitepe /Şanlıurfa / Turkey	**Area**	1750 m2
Designer	Kleyer – Koblitz –Letzel -Freivogel Architects	**Climatic Cond.**	Hot-summer Mediterranean climate (Csa)
Opening Date	2018	**Budget**	€ 4,800,000
Material	Steel construction, PTFE Mesh membrane roofing, timber		

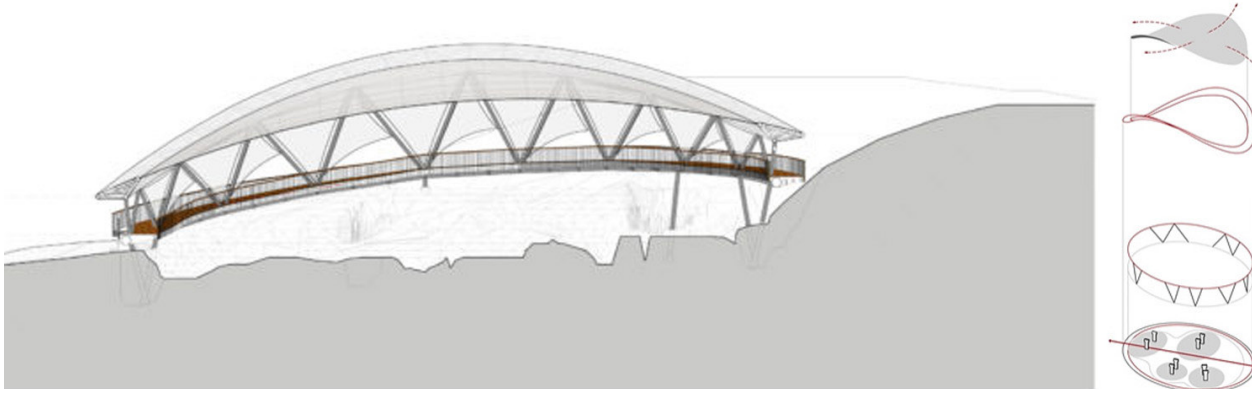
Table 4
Göbeklitepe GT1 Area Archaeological Site Shelter details.

Figure 11
The interaction between Göbeklitepe GT1 Area shelter and the landscape. https://www.kklf.de/schutzdach-goebekli-tepe-tuerkei (Access Date: 05.02.2022).

Figure 12
The hyperbolic paraboloid structure of the roofing. https://www.kklf.de/schutzdach-goebekli-tepe-tuerkei (Access Date:

Figure 13
The inner space beneath the shelter. https://www.kklf.de/schutzdach-goebekli-tepe-tuerkei (Access Date: 05.02.2022).

Figure 14
The technical drawings of Göbeklitepe GT1 Area shelter (İrepoğlu 2019).



Project Area – Myrleia Apameia

Myrleia/Apameia BC It is a colonial city founded by the people of Kolophon in the Cius Bay, which is the region where Mudanya district was located in Inner Bithynia in the 8th century (Doğancı 2007: 14-21; Şahin 2013: 101). The Macedonian King Philip V (221-179 BC) gave Myrleia to Prusias I for his support in the war with Pergamon and King Prusias I, and he changed the name of the city to Apameia in honour of his wife. The city, located within the borders of Bithynia, was founded in BC. In 74, King of Bithynia IV. After the death of Nicomedes, it was transferred to the Roman Empire by inheritance (Arıcı 2021: 227-245). The city joined the Byzantine lands after the division of the Roman Empire. (Güner 2014: 7). Apameia was used as a logistics support base of Byzantium during the Crusades, and in this period, it started to be called 'Moutagnac/Montaniac', which indicates its topographic nature and means 'mountainous region' (Akkılıç 2002: 1181). The city, which left the Byzantine domination for a short time between 1081-1097 and came under the rule of the Seljuks, was added to the Ottoman lands by Orhangazi in 1321 (Aydoğan 1994: 13).

The city is important because it was the first colony of the Roman Empire in the Anatolian geography and the commercial port city of Prusa Ad Olympium (Bursa), located in the southwest of Kent Kios (Gemlik) Bay (Gündüz 2015: 105-146; Arıcı 2021: 227-245). Although Bursa had many ports during the Ottoman Period, the region, which was used as the main port of the raw silk trade, continued to maintain its importance (Çiftçi 2004: 153-171).

The ancient city of Myrleia is in the Mudanya district of Bursa, 1 km southwest of the town center. Information on the history and structures of the city of Myrleia and its construction in the ancient period is minimal due to the scarcity of written sources on the archaeological excavations carried out in the city. More information about the history of the city has begun to emerge in the light of the ruins with a shopping center on it today, which were unearthed during the excavations carried out by the Bursa Museum Directorate at the request of the property owners in 2015, and the ruins unearthed during the work carried out for a residential building nearby (Fig. 15).

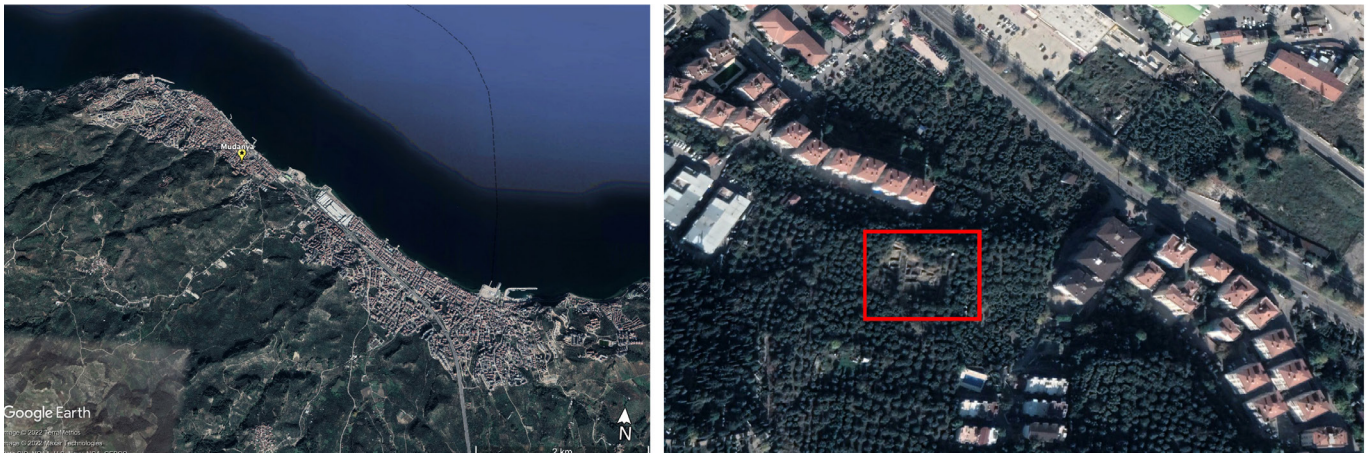


Figure 15
Location of the excavation area relative to Mudanya.
Google Earth Coordinates: 40°22'3.45"N, 28°53'38.18"E / 13.02.2022.

The area (Fig. 16) where the structures belonging to the residential ancient settlement was revealed during the foundation excavations carried out during the planning studies of a residential site built in Mudanya Ömerbey Mahallesi in 2016. The privately-owned land has been included in the 3rd degree archaeological site with the studies carried out by the Bursa Museum Directorate.

Figure 16
Residential settlement findings (Aerial photography was provided by Derya Şahin and Hazal Çıtakoğlu from Bursa Uludağ University Department of Archaeology Archive).

Based on the unearthed structures, it is thought that the structures in this area are residential structures with a columned entrance reached by steps (Fig. 16-A) and rooms located around the porticoes (Fig. 16-B). A mosaic with geometric patterns was unearthed in one of the building rooms (Figs. 16-C, 17), and a

Figure 17
The mosaic with geometric patterns (Photography was provided by Derya Şahin and Hazal Çıtakoğlu from Bursa Uludağ University Department of Archaeology Archive).

mosaic with a different pattern was found in another part of the building (Figs. 16-D, 18), but not all of it could be uncovered because the rest of it remained in the neighboring parcel. Again, a drainage system thought to be connected to the toilets was determined around the building (Fig. 16-E). The portico typology of the building and the nature of the mosaic are thought to be property belonging to the upper economic class. Again, the location of the building and the sea view it has, are found to support this idea (Şahin - Çıtakoğlu 2016: 85-94). Due to the private ownership of the lands around the excavation area, all the structures

Figure 18
The mosaic with blue pattern (Photography was provided by Derya Şahin and Hazal Çıtakoğlu from Bursa Uludağ University Department of Archaeology Archive).

found could not be revealed. Due to the lack of an archaeological context, this residential settlement cannot be dated precisely, but it is thought to belong to the late antique period (Şahin - Çıtakoğlu 2016: 85-94). These finds are of great importance both for the history of Mudanya and Bursa and for future scientific studies, as they provide data on the architectural structure of the city of Myrleia, of which there is minimal information, in the late antique period. This importance necessitates preserving the finds and opening them to visitors for both touristic and academic studies.

Bursa's Mudanya district is located between 28º32' - 28º58' east longitudes and 40º16' - 40º24' north latitudes (Fig. 19). It is surrounded by Karacabey in the west, Osmangazi and Nilüfer in the south, Gemlik in the east, and stretches along the southern shores of the Gemlik Gulf in the north. Covering the south face of the Gemlik Bay and separating the Bursa Plain from the sea, the Mudanya Mountains extend in the east-west direction. The highest peak, extending from the west to the point where the Susurluk Stream empties into the sea, reaches up to Karatepe, 600 meters high. The land has a rough structure[1].

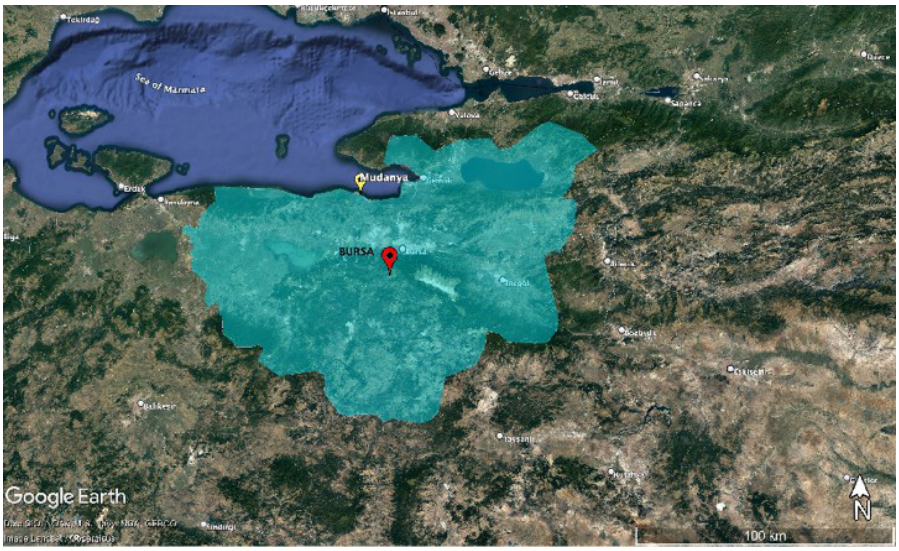
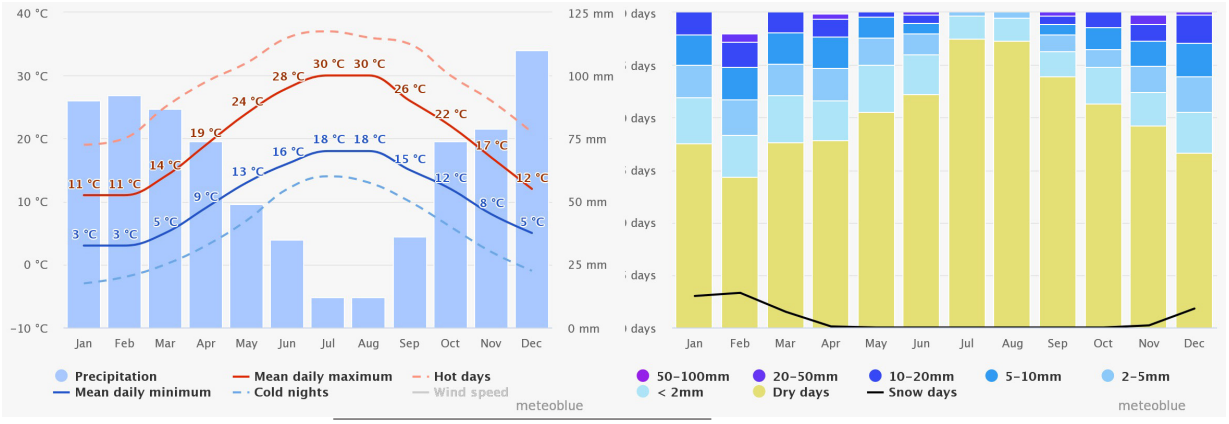


Figure 19
Location of Mudanya relative to Bursa. Google Earth Coordinates: 40° 5'47.75"N, 29° 1'2.70"E and 40°22'17.19"N, 28°53'15.57"E / 13.02.2022.

The Marmara Sea borders the district in the north and the Nilüfer Stream in the south. Therefore, the district has a transitional climate between the Black Sea and the Mediterranean. While the winters are warm and rainy due to the sea in the north, the surrounding hills from the south and the height, the summers are at an average temperature (30 ºC) and dry (Güner 2014: 6). Therefore, while the most precipitation falls in the district in December, July and August have the least precipitation (Fig. 20).

Figure 20
Tables of annual average temperatures and precipitation in Mudanya. https://www.meteoblue.com/tr/hava/historyclimate/climatemodelled/mudanya_türkiye_741487 14.02.2022 (Access Date: 14.02.2022).



1 https://mudanya.bel.tr/hakkinda 14.02.2022 /14.02.2022 (Access Date: 14.02.2022)

West and north winds (Summerwind, southwestern, sea breeze, northwest wind, northeastern winds) dominate the city. While the effect of the İmbat wind blowing from the north is felt between June and September, it enters the effect of Summerwind and Northwest wind winds at the end of September. With the effect of these winds, the temperature begins to decrease. In the winter months, the district, mainly under the influence of southeastern winds, starts to receive heavy rains (Yalman 2013: 29) (Fig. 21). In Mudanya, the climate is warm and temperate. This location is classified as Csa by Köppen and Geiger.

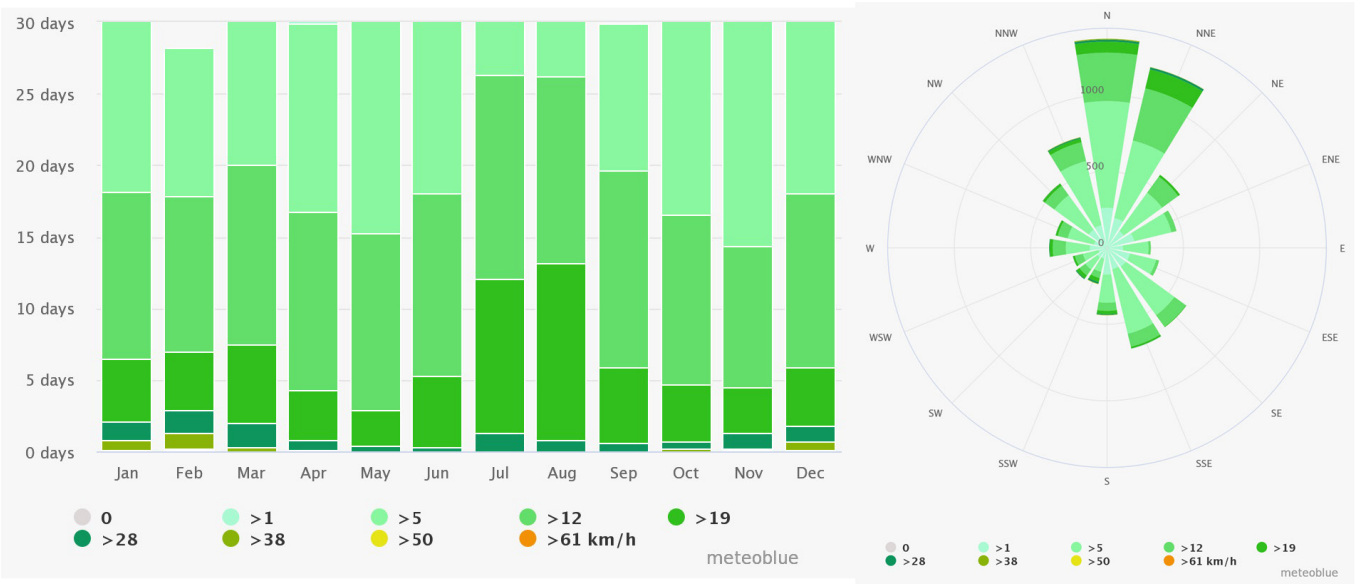


Figure 21
Annual wind direction and speed tables of Mudanya.
https://www.meteoblue.com/tr/hava/historyclimate/climatemodelled/mudanya_türkiye_741487 14.02.2022 (Access Date: 14.02.2022)

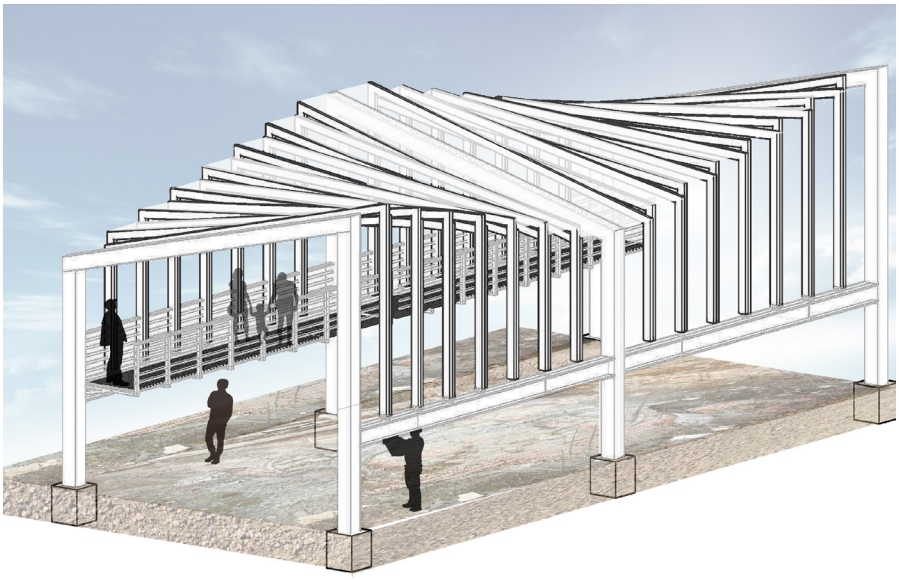
Protective Shelter Design Proposal for Myrelia Archeological Site

Several criteria are taken into account in the design proposal of Myrelia Archeological Site. The shelter aims to present:

- comfortable working space for the excavation team and the academic staff
- comfortable and secure path along the whole site for the visitors
- constructional system corresponding to the unearthed remains
- characteristic design which is appealing for the visitors while being easily distinguished from the ancient remains
- sustainable design approach

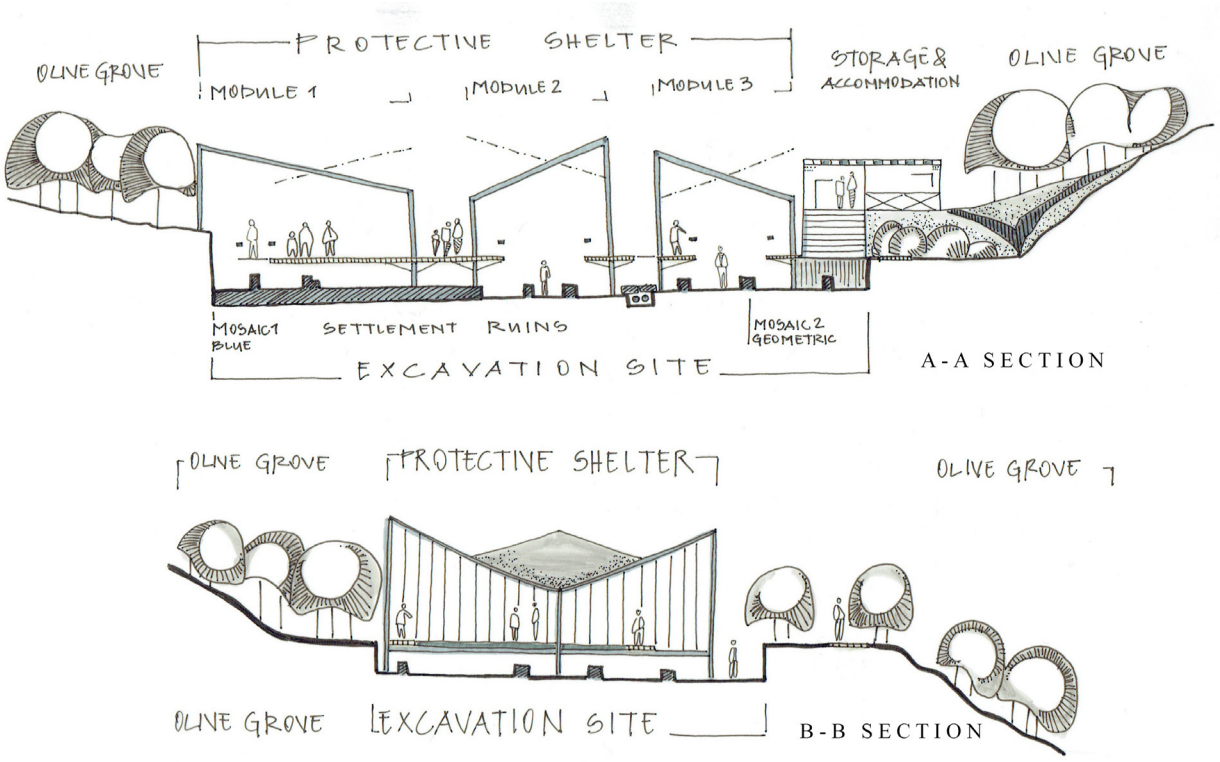
The main concern is to locate the constructional system with minimal number of fixing points to the ground. The primary load bearing elements are steel while secondary elements are laminated timber. The primary steel columns are connected to each other by I shaped steel-beam profiles. The constructional elements of the walking path are also connected to the mentioned beams. The primary steel columns are located on concrete footing elements which constitute the connection points of the structural system to the ground. These footing elements are positioned precisely on the points where the excavation is finished and no remaining structures are found. Each steel column has a box section and the void inside the column is used for draining rainwater. The rainwater is collected and saved for posterior use. The secondary timber load bearing elements are equally spaced with varying heights differing parametrically. This repetition system generates a rectangular shredded pattern. Each shred is covered with textile membrane. The translucent texture of the membrane provides a controlled level of natural lighting beneath the shelter. Some of the rectangular inclined shreds are covered with solar panels which help to meet the energy need of the excavation site (Fig. 22).

Figure 22
Perspective of protective shelter Module 2.



There is also a suspended walking path sharing the same constructional system with the shelter. The timber path, which expands and forms viewing platforms at several points, circuits the whole excavation area and enables visitors to wander around the site, observe unearthed mosaics and other remains. As far as the walking path is elevated, the excavation team may continue working on the ground level under the path. At the entrance of the site, there is a small info-unit which is repeating the design language of the shelter. In this reception area, the visitors may get information about the site, observe some of the remains excavated from this site and the posters presenting the excavation process, use the rest-rooms and slot machines, enjoy the scenery at the deck area in front of the unit. The ground level of the excavated site on the north side is approximately 3 meters under the entrance level, whereas the walking path is elevated 2 meters from the ground level (Fig. 23).

Figure 23
Sections of protective shelter.



The walking path starts from the info-unit and reaches to the excavation area by ramp with a mild slope. There is also a shortcut which connects the entrance to the excavation area with a few steps. Inside the site, the path enlarges at some points for resting and observing (Fig. 24).

Figure 24
Plans (layout and platform) of protective shelter design.

The sheltering system is divided into three parts which cover the main zones where the remains are located, two of which embody the mosaics found. These zones are connected to each other by the continuity of the walking path. The

sides of the shelter are designed as open surfaces in order to support natural ventilation. Anyhow, if it would be necessary, the gaps between the vertical structural timber elements which repeat at regular intervals might be closed by textile membranes. By this way, it might be possible to protect the site from both climatic factors and vandalism, especially during the off-season.

The excavation house is planned to be located on the south part of the site. Currently, this is the highest elevation of the site, therefore a simple stairs and a ramp connect the excavation house to the walking path and ground level. This unit involves accommodation, catering, working, WC, storage facilities for the staff and also designed in the similar design language with the shelter. If needed, the structural elements forming this unit might be disassembled and transferred to a new location.

It is aimed to construct the protective shelter as a system that is largely self-sufficient and sustainable by the use of energy obtained from solar energy panels, the accumulation of rainwater collected by the drainage system and the use of passive air conditioning methods. The repetitive character of the protective shelter's design approach has the potential to enlarge in case of the emergence of a new demand.

Conclusion

The criteria to be considered in the design processes of protective shelters for the remains and artifacts to be preserved in-situ can be evaluated within the framework of the concepts of (1) identity, (2) comfort, (3) sustainability and (4) flexibility (Table 5). The protective shelter to be designed should be attractive while preserving the holistic perception of the area without breaking its relationship with its surroundings. The diversity of material used and the construction system between the existing remains and the new structure, the minimum contact with the ground while meeting these criteria are of great importance for preserving the area's identity and transferring its heritage value. Furthermore, the shelter should provide suitable thermal and lighting conditions for people who work for different purposes (excavation, research, protection, documentation, etc.) and those who visit the site while providing optimal comfort conditions by providing comfortable movement. Another essential criterion for the protective shelter is its flexibility to be expanded and reshaped in line with new finds and information. The shelter should provide the necessary comfort conditions and have a flexible design while preserving the area's identity. Also, it is important to design with the responsibility of current economic conditions and the climatic crisis.

Table 5
Design Criteria for Protective Shelters.

Identity	Attractiveness, Distinguishability, Minimum contact
Comfort	Climatization, Lightning, Movement comfort
Flexibility	Adaptability
Sustainability	Materials and structure systems, Periodical monitoring, Affordability

Depending on all of these criteria a proposal for the design of a protective shelter for Myrelia archeological site is presented in this paper. In the scope of "identity" criterion, the proposed design has a parametric pattern which can easily be distinguished from the current condition of the site and the ancient ruins found. The appealing design of the structure has the potential to attract the visitors. Also the construction system is designed with a minimum number of connection points to the ground in order not to harm the excavated remains. In the scope of "comfort" criterion, the cover material of the shelter is chosen as

textile membrane whose translucency enables controlled daylight beneath. Also the form of the design creates natural ventilation. The continuity of the walking path makes the visitors wander around the whole site starting from the entrance unit. The connection between different elevations is established with ramps and security measures are taken, therefore the site is also suitable with universal design principles. There are some enlarged resting and observing platforms on the walking path in order to increase the comfort level of the visitors. The info-unit and the excavation house are designed to provide facilities both for the visitors and the staff working on the site. In the scope of "flexibility" criterion, the structural system is composed of steel and laminated timber elements connected with dismountable fixings. By this way the structure might be transferred to a new location if needed. Also the parametric design approach enables to enlarge the shelter area if new sections are excavated and a need to cover these parts occurs. In the scope of "sustainability" criterion, the system is designed to be self-sufficient. Solar panels are used in order to supply energy for the site, rainwater is collected and passive air conditioning methods are used.

Bibliography – Kaynaklar

Ahunbay 1999 — Z. Ahunbay, Tarihi Çevre Koruma ve Restorasyon, İstanbul.

Akkılıç 2002 — Y. Akkılıç, "Mudanya", Bursa Ansiklopedisi Cilt 3, Bursa, 1181.

Arıcı 2021 — S. Arıcı, "Myrleia/Apameia'dan (Bursa/Mudanya) Bir Bronz Çocuk Heykeli", OLBA XXIX, 227-245.

Aydoğan 1994 — G. Aydoğan, Mudanya Girit Mahallesi Geleneksel Konutlarının Mimarlık Özellikleri Üzerine bir Araştırma, Yayınlanmamış Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.

Balderrama - Chiari 1995 — A. A. Balderrama - G. Chiari, "Protection and conservation of excavated structures of mudbrick", N. S. Price (ed.), Conservation on Archaeological Excavations with Particular Reference to the Mediterranean Area, Rome: ICCROM, 101-112.

Büyüköztürk - Oral 2020 — E. Büyüköztürk - M. Oral, "Arkeolojik alanlarda üst örtü tasarım kriterleri", Journal of Social and Humanities Sciences Research 7(51), 679-691.

Çamurcuoğlu Cleer 2008 — D. Çamurcuoğlu Cleer, "Construction of the New Shelter", Çatalhöyük 2007 Archieve Report, 336-337, Retrieved: February 26, 2022, from http://www.catalhoyuk.com/sites/default/files/media/pdf/Archive_Report_2007.pdf

Çamurcuoğlu Cleer 2010 — D. Çamurcuoğlu Cleer, "Conservation", Çatalhöyük 2009 Archive Report, 139-143, Retrieved: February 26, 2022, from http://www.catalhoyuk.com/downloads/Archive_Report_2009.pdf

Çiftçi 2004 — C. Çiftçi, "Osmanlı Dönemi'nde İstanbul'un İaşesinde Bursa'nın Rolü", Ankara Üniversitesi Osmanlı Tarihi Araştırma ve Uygulama Merkezi Dergisi 16, 153–171.

Doğancı 2007 — K. Doğancı, "Antik Dönemde Mudanya (Myrleia-Apamea)", Y. Oğuzoğlu (ed.), Ulusal Zaferimizi Taçlandıran Kent: Mudanya, 14-19.

Doumas 2013 — C. G. Doumas, "Managing the Archaeological Heritage: The Case of Akrotiri, Thera (Santorini)", Conservation and Management of Archaeological Sites 15, 1, 109-120.

Ertosun 2012 — A. I. Ertosun, Evaluation of Protective Structures In Archaeological Sites For In Situ Conservation Of Architectural Remains And Artifacts, Unpublished Master's Thesis, METU, Ankara.

Gündüz 2015 — S. Gündüz, "Bursa'nın Antik Deniz Limanları", U.Ü. International Journal of Social Inquiry 8/1, 105-146.

Güner 2014 — E. Güner, Mudanya Tarihi Kent Dokusunun 1994-2013 Arasındaki Değişiminin İncelenmesi ve Değerlendirilmesi, Yayınlanmamış Yüksek Lisans Tezi, İstanbul Kültür Üniversitesi, Fen Bilimleri Enstitüsü ,İstanbul,

Ha'obsh 2018 — M. Ha'obsh, "The process of designing a new protective shelter at Um er-Rasas, Jordan", Z. Aslan - S. Court - J. M. Teutonico - J. Thompson (eds.), Protective Shelters for Archaeological Sites: proceedings of a symposium, Herculaneum, Italy, 112-126.

İrepoğlu 2019 — Y. İrepoğlu, "Şanlıurfa Göbeklitepe Arkeolojik Alanı Koruma Çatıları", Çelik Yapılar 59, 20-23.

Michler 2012	A. Michler, "ACM Arquitectura's Contemporary Canopy Protects Ancient Roman Ruins in Cartagena, Spain", Inhabitat, Retrieved: February 2022, https://inhabitat.com/acm-arquitecturas-contemporary-canopy-protects-ancient-roman-ruins-in-cartagena-spain/
Pesaresi - Stewart 2018	P. Pesaresi - J. Stewart, "Shelters evaluation, monitoring and maintenance in the context of archaeological site management", Z. Aslan - S. Court - J. M. Teutonico - J. Thompson (eds.), Protective Shelters for Archaeological Sites: proceedings of a symposium, Herculaneum, Italy, 58-82.
Rizzi 2018	G. Rizzi, "Considerations on archaeological shelters: a practitioner's viewpoint" Z. Aslan - S. Court - J. M. Teutonico - J. Thompson (eds.), Protective Shelters for Archaeological Sites: proceedings of a symposium, Herculaneum, Italy, 51-57.
Schmidt 1988	H. Schmidt, Schutzbauten, Stuttgart.
Şahin 2013	M. Şahin, "Bursa İli Yüzey Araştırması 2011 Mudanya-Harmancık", 30. AST, 1, 101-114.
Şahin - Çıtakoğlu 2016	D. Şahin - H. Çıtakoğlu, "A Newly Discovered Mosaic from Myrleia / Myrleia'dan Yeni Keşfedilen Bir Mozaik", JMR 9, 85-94.
Thompson - Abed 2018	J. Thompson - A. B. Abed, "Deciding to shelter: values and the management context" Z. Aslan - S. Court - J. M. Teutonico - J. Thompson (eds.), Protective Shelters for Archaeological Sites: proceedings of a symposium, Herculaneum, Italy, 13-39.
Vasic-Petrovic et al. 2015	E. Vasic-Petrovic - A. Momcilovic- Petronijevic, "Shelters For Archaeological Sites In Serbia: A Research Aiming To Develop Guidelines For Future Design And Construction", Architecture and Civil Engineering 13/2, 113-121.
Yalman 2013	B. Yalman, Mudanya: Marmara'nın incisi, Bursa.
Zeren - Uyar 2010	M. Zeren - T. Uyar, "Arkeolojik Alanlarda Koruma Çatıları ve Gezi Platformlarının Düzenlenmesi Kriterleri", DEÜ Mühendislik Fakültesi Mühendislik Bilimleri Dergisi 12, 2, 55-64.