Innovative Building Technologies for Sustainable Architecture in Heritage Sites:
The Revitalization Project of the Ancient Greek Colony of Megara Hyblaea in Sicily

The present research aims at revitalizing the archaeological park of Megara Hyblaea through innovative strategies developed within the PON project entitled "An early warning system for cultural heritage / e-WAS". In this national funded project, Sicilian research institutions, universities and companies work together with the common goal of developing new technologies for the protection and enhancement of historical and cultural heritage. They also aim to improve its strategic management and protect it from risks. The ancient Greek colony of Megara Hyblaea is immersed in an industrial landscape that stretches along the coast of eastern Sicily from Augusta to Syracuse. The sense of the original place has been erased by an indiscriminate occupation of the land by industries which has left, here and there, an archipelago of "heritage relics" of various kinds, which are equally close to the smelly chimneys and the horizon of the sea. This landscape of contrasts, dominated by petrochemical industries, has over time hindered a cultural tourism appropriate to the representativeness and importance of the findings, despite the efforts made by the authorities responsible for its protection. With a view to pursuing the primary objectives of the e-WAS project (i.e., guaranteeing safety and damage prevention with timely interventions to protect against risks), it was planned to install on site some prototypes of lightweight shelters and architectural facilities. They have reduced environmental impact and are responsive and designed to protect the sensitive areas of the excavations and at the same time to facilitate the use of the archaeological site.

Introduction

The eWAS project aims to promote and stimulate a policy of protection from degradation and prevention at the level of historic settlements which are conceived, in their morphological and functional whole, as a vital component of urban centers in line with the strategies defined by the recent UNESCO Recommendation on "Historic Urban Landscape" and "urban conservation"1. Environmental Safety and Structural Safety are among the essential requirements that historic settlements and historic buildings, containers of cultural assets and activities, must ensure for their protection and preservation. However, meeting these needs, it takes a combination of different knowledge and techniques that pose a number of significant technological challenges.

Therefore, the aim of the eWAS project is to obtain an innovative platform for the monitoring of cultural heritage based on the latest technological solutions, capable of fast and on-demand diagnostics following critical situations through the implementation of a continuous monitoring system over time, multisensory, multi-scale (control of the structure and surrounding area and detailed diagnostics), multiresolution, with low or no invasiveness on monuments and surrounding areas. This is achieved through advanced systems based on wireless networks and sensors supported by the most modern diagnostic methodologies, allowing to produce in a Smart City actions on issues related to natural and man-made hazards and to security (Smart Environment and Smart Living) for the protection and the valorization of cultural heritage at the urban scale.

In order to pursue these objectives, the project makes use of the following studies, investigations, technological and industrial developments and technical tools:
- Evaluation and diagnosis of the state of deterioration and safety (danger, vulnerability and risk) of historic-monumental buildings and artifacts in archaeological test-site areas.
- Development, realization and production of a new low-cost Smart Wireless urban environmental monitoring system and of a telecommunication network realized ad hoc for the continuous and multiparametric environmental control of structures and artifacts. This control will take place through the prevalent use of Smart stations and microsensors with a proactive approach that allows preventive and conservative interventions and actions or automatisms in situations of exceptional events.
- Verifications and evaluations on vibrating table of the characteristics and performances of the devices that will be used for the SHM with examples of applications to prototypes representative of structural parts, works of art or museum works.
- Installation at the selected test sites of an innovative wireless hybrid monitoring system (static and dynamic) with the purpose of verification of structural safety (SHM) and identification of crisis conditions such as to generate preventive alarms. Particular attention is paid to the preservation of cultural heritage and the activation of automatic protection for the population involved.
- Installation in the selected study cases of a prototype of a low-cost Smart, deformation and seismic-accelerometric monitoring network, integrated with a satellite monitoring system. This network will allow the necessary mitigation and prevention actions (early warnings) in case of natural event (eg. earthquake, changes in water table level for exceptional rainfall, etc..) or anthropogenic interventions (eg. deep excavations).
- Design and implementation of a continuous monitoring system on a limited number of museum objects (statues, works of art of high cultural value) for the immediate activation of damage protection devices in case of seismic events.
- Design of an innovative protection system for findings in archaeological areas, consisting of a lightweight shelter controlled by a sensor network.
- Design of an innovative system for the enhancement of archaeological sites, based on a multifunctional and sustainable architectural module for the reception of visitors and the support to the visit of the site.
- Realization of a prototype “Early Warning” system for the mitigation of environmental risks, which would allow, in certain cases, to use the information also for the automatic interruption of service of equipment and plants in case of earthquake, flood, heavy rain, etc. 
- Realization of an information system, based on GIS logic, which will contain the geometries and all the data acquired during the project, including those of monitoring, necessary to accurately represent the built environment being monitored and will ensure a constant updating of data derived from monitoring and the sharing of information at various levels.

eWAS has important implications in the enhancement of the Cultural Heritage of Historical Centers, especially those falling within the UNESCO heritage. In fact, the project aims to strengthen the specific skills in an approach of "structured collaboration" on issues of protection, security and enhancement of historical buildings. Moreover, the definition of standards, methodologies and tools for data acquisition, analysis and sharing favors the optimization of building interventions of redevelopment, restoration and renovation.

As to the protection and the support of archaeological areas, the traditional systems are invasive and not very flexible. In order to respond to these problems, eWAS plans to experiment with innovative architectural components that are highly performing thanks to their integration with a monitoring system. The aim is to reduce the disturbance on the site and to adapt the behavior of the components to the needs of users. For this goal, the area of Megara Hyblaea has been chosen as test-site for studies and technological developments of a lightweight shelter and of a multifunctional and sustainable architectural module for the support to the visit of the site.

In the following paper, the authors will show part of the result of this focus. For the valorisation of the areas, eWAS proposes an innovative architectural module, called Experience Pavilion (EP) and developed as a prototipe of the experimental technology called ICARO. For the protection of the archaeological findings, eWAS develops a kinetic responsive envelope, based on the origami art, called KREO. Both of them will be prototyped in real scale and tested in the archaeological site of Megara Hyblaea, one of the most important of the southern part of Italy.

State of Art: Value of Archaeological Sites and Project Issues

The enhancement of an archaeological area responds, according with Militello, to the following needs:

- the preservation of the material remains;
- the arrangement of the site for users;
- the valorisation and promotion of the site.

The realization of a protective shelter for archaeological findings is often one of the main responses to the first requirement\(^3\). This element is, in some cases, necessary for the protection of goods from material decay, due to weathering.

The use of a removable shelter could solve the problem of invasiveness that protective shelters made in the past have often shown. In some cases, they can also be harmful, profoundly altering the visual spatial perception of places.\(^4\)

To realize this kind of shelter, an easily controllable material, such as a sheet of paper, should be used. It could be easily moved by folding it. The fold would also make the surface corrugated, giving it an extra strength by shape.

The valorisation of the site could be achieved by introducing in it some architectural multipurpose modules, which can useful to illustrate the site and to introduce other facilities for the visitors (i.e. ticket office, kids laboratory, coffee-corner, multimedia information boxes, etc.). In the traditional layout of the sites, these services are concentrated in one point, generally near the entrance. The use of this innovative modules, make possible to spread them in the area and introduce a new concept of visit, in which the visitors are accompanied along their walk.

There are several examples in which this approach has led to very appreciated solution\(^5\)\(^6\). Generally, the modules are less invasive and easily removable.

Layout design must be driven by a reconfiguration of the entire area. The final goal is to improve the comfort of the places for touristic purposes and to facilitate the interpretation of the remains by users (through the creation of new spatiality, paths, lighting and so on). In the lack of this step, the introduction of architectonic elements could be a risk, because it could introduce a relevant disturbance in the site.

This is not the case if the architectural design is put in tension with a landscape approach. As Jean Nouvel recently stated in his *Manifesto* inaugurating his year as Guest Editor of the historic Italian journal *Domus*, architecture has to foster characterisation and belonging, bearing in mind the

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depth of recollection, the milestone of the time, the geography, the natural
landscape, the materialisation of responses to the climate. In resonance with
this approach, architectural interventions was conceived in relation to
topographical aspects (relationship between ruins and landscape) and visual
aspects (relationship between the aesthetics of the ruins and the morphology of
the landscape), and not only to the control of the architectural elements
themselves.8

So the architectural project was carried out in parallel with an inter-scale
Strategic Landscape Design, inspired by the principles of European Landscape
Convention9 and the idea of Territorial Heritage developed in the research of
the Italian Scuola Territorialista founded by Alberto Magnaghi10.

From the technological point of view, some important measures can be put
in relation with this cultural posture, even at the design level of the individual
building, to reduce the impact not only on archaeological assets but also on the
general environmental context. The main ones are as follows:

* use of building materials with high levels of environmental
sustainability;
* use of building components that can be dry-assembled;
* use of lightweight structure and shallow foundations.

Research Methodology

Responsive Shelter

In recent time, the use of the so-called textile architecture11 or fabric
structure12 has improving. Generally, the base material is a composite with a
reinforcement in natural or synthetic woven and the matrix is a polymeric
material that increase mechanical properties and durability, as shown by
Houtman13.

8 Calvagna S. Miliello P. M., Reale F.A., Rodonò G., Tornabene A., “From the landscape of
contrasts to the landscape of invisible cities: a strategic landscape design for the revitalization
of the Ancient Greek colony of Megara Hyblaea in Sicily”, Athens Journal of Architecture
2022, 8: 1-33 https://doi.org/10.30958/aja.X-Y-Z
9 Council of Europe (2000), European Landscape Convention,
10 Magnaghi, A., Il progetto locale. Verso la coscienza di luogo, Bollati Boringhieri, Torino,
2010.
11 Maurin, B.; Motro, R. Textile Architecture. In Motro, R., Flexible Composites Matererials
in Architecture Construction and Interiors; Birkhauser, Germany, pp. 26–38, 2013.
By folding the composite, it is possible to strengthen it, thanks to the form resistance. It is also possible to move the sheet, because each fold is a hinge. This configuration can be achieved through a thermoforming process using a mould with the assigned pattern. So, the folded composite material could be used to realize a lightweight kinematic shelter (Figure 1).

![Figure 1. Composed material used for eWAS Project](image)

The eWAS project has been focused on the optimization of this innovative material, i.e. choice of the raw materials, stratification, mechanical characterization and post-production thermoforming process. Through the numeric modelling, it has been fixed a suitable workflow to optimize the physical parameters of the shelter. The design of the shelter is based on the analysis of the folding geometries, for which the reference is the Japanese art of Origami and the folding patterns already used in the engineering and architectural field, as discussed by Casale and Valenti. For this reason, the experimented technology has been called KREO, which means: Kinetic Responsive Envelope by Origami.

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18 Casale, A., Valenti, G., M. Architettura delle superfici piegate: Le geometrie che muovono gli origami; Kappa, Italy, 2013.
To test this innovative technology, it has been developed a prototyping phase, in real scale. Before this, it has been realized a virtual model to analyse the thermos-physic and the mechanical behaviour. The test has been addressed to several focus, i.e., to define of a mechanical system to move the folded sheet, easy and light and to automatize the prototype, with a suitable an informatics code. The testing phase in real scale will be also finalized to fix the climatic parameters for the opening and the closing of the shelter.

**Multipurpose Architectural Module: The Experience Pavilion**

According with the project requirements, the building materials for the construction of the architectural module must have the following features: easy availability, low economic price, lightness, low environmental impact. They must also come from recycled and recyclable raw materials. Moreover, in order to reduce the activity in the building site, and so the risks for the archeological finds, prefabrication has been adopted as the main construction technology, by focusing on the realization of a modular panel for the vertical building envelope. According with these purposes, it has been chosen multilayer wood and corrugated cardboard as building materials. The first one is used to realize the frame of the modular panel; corrugated cardboard is arranged in box shape to infill space between the frame components. In this way the panel assumes both the role of structural element to support the roof, and the role of main component of the envelope, which is then completed with a second outer skin. To increase the panel’s structural performance, a pre-stress procedure is adopted. So, the cardboard boxes are not only complementary elements, but their presence makes stronger the element. This innovative technology is called ICARO (Innovative Cardboard Architectural Responsive Object).

The gap inside the boxes can be fill in different materials to improve the thermo-acoustic comfort (Distefano et al, 2016). The panel is completed with a ventilated façade, to improve the indoor comfort conditions and also to improve the protection of the cardboard from the rainwater. A number of materials has been tested as finishing, both for their technological features and
their compatibility with the high assets value of the context. *Shou Sugi Ban* wood (burned wood) has been chosen for its high durability\(^\text{19}\) and visual and sensory qualities. The southern façade will be used to fix a set of photovoltaic cells to assure the off-grid operation of the module. They have been embodied in a composite fabric, the same tested in KREO, to have lightness and flexibility and to mitigate the visual impact by eliminating the reflective effect of ordinary photovoltaic panels.

The base of the module is a grating in steel elements. The base is settled with telescopic legs, in plastic material, to arrange the horizontal layout; a sheet of nunwoven fabric has been set below, as interposition with the archaeological ground.

The prototyping of ICARO technology has been carried out in two phases. In the first one, some panels have been realized, in reduced scale, with different modality of pre-stress. By analyzing them, the best solution has been chosen and it has been realized a panel in real dimension. This is called Panel ZERO.

In the second phase of the research, the suitable number of panels and the other elements will be the realized, in order to build the real scale architectural module called Experience Pavilion in the test-site. The test phase will conclude the experimentation.

**Valorisation Project of the Archaeological Site**

The archaeological site of Megara Hyblaea has been chosen as test-site for the testing phase of ICARO and KREO, for a series of conditions that make it optimal for this aim.

This is one of the sites with the highest historical and archaeological significance in Sicily, since, apart from the oldest traces of an entrenched Neolithic village, in it the remains of a Greek colony dating back to the VIII-VII sec. BC. (founded in the 727 a.C. from colonists coming from Megara Nisea) are conserved. The city of archaic period (VI sec. a.C.) and that of smaller dimensions of Hellenistic period (end IV-III sec. a.C.) are then superimposed on it. After its final destruction in 214 BC, at the hands of the Romans, the city was not rebuilt. For these characteristics is therefore configured as one of the most important centers of the entire Magna Grecia.

In spite of this, Megara is practically neglected by tourist routes. The reason of this, perhaps stays in the location of the site, that is very closed with the industrial complex of Augusta-Priolo, from whose expansion it was saved thanks to the intercession of the Superintendence in the early 1960s.

The architectural and technological project has been framed in a wide-ranging and inter-scalar strategic landscape design. Starting with the analysis of the landscape features of the site, the purpose was to rediscover a new narrative centered on the system of local values, as to put the experimentation of

innovative construction technologies in harmony with the archaeological landscape.

The Strategic Landscape Design process was intertwined with a dialogue with stakeholders (local authorities, superintendence, association of the tourist guides, cultural associations, associations for the environmental protection, and so on), in order to understand if the local community identifies with its territorial heritage, and re-weave a network of physical and immaterial relations between archaeological heritage, place and community.

After this phase, it has been defined a masterplan of the site, in order to define:

* the new viability, both pedestrian and vehicular;
* the most fragile areas, to protect them with the responsive shelters;
* the most sensible areas, to equip them with multipurpose architectural module.

**Discussion and Results**

**The Test-Site of Megara**

Megara Hyblaea was a prosperous city, especially in the archaic age, and was full of rich monuments. Mostly of them are located near the large Agora, in which the main axes of the city cross each other. A Stoa closes the north side of the agora. In the north west corner, there was the Heeron (a sacred area). The Zeus Temple was along the north side, it remains several entablatures and other decorated elements of it; in the south part of the city it was the Prytaneum, a public building for the distinguished guests. The south temple of the archaic age has a central line of columns, in Doric style; it is overlapped by the Hellenistic structures. Near the corner south west there is a Hellenistic Bath, which is very particular for its circular plan. A part of these monuments, there are many other interesting buildings, as the House 13,22 (Figure 3), which its marvelous pavement in opus signinum (mosaic), or the metal workshop. Due to the subsequent destruction, it survives only foundations and masonry bases of mostly of them (Figure 4).

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To set the prototypes of EP-ICARO and of KREO, a new layout of the site has been designed (Figure 5). In it, the entrance of the archaeological area is located near the west gate of the archaic city. So, the visitors have the opportunity of a walk through the large area surrounding the historical city in which it will be recovered the autochthonous agricultural crops. Thought this path people reaches up to the coast line. Here there is the “Faro Cantera”, a lighthouse, and a masseria, that is partly nineteenth-century but the building of the baglio dates from the eighteenth century. The first one is a guesthouse for the archaeologists, the second one is the Antiquarium. The new gate is just outside the archaeological area, thanks to this, it is possible to realize there a parking and other facilities. The current entrance of the site, maintains its functionality only for the workers and for people with disabilities.
When the path arrives in the ancient city, it is overlapped on its main axes, west-east; it crosses the second axes of the city, with north-south direction, in the agora. They are highlighted with an elevated walkway and form the main visit route. Along these two axes some protection and valorization structures are dislocated.

There are three protection shelters:

A. on the area on the North Temple;
B. on the Hellenistic Bath;
C. on the House 13,22.

There are also nine multipurpose architectural modules, three in strategical paths point and six located as following:

1. near the touristic entrance;
2. near the North Temple;
3. near the Heeron;
4. near the Metal Workshop
5. near the Hellenistic Bath;
6. between the Prytaneum and the South Temple.

The project eWAS finances the realization of the responsive shelter C (on the House 13,22 - Figure 6) and the module number 6 (between the prytaneum and the south temple - Figure 11 b) named Experience Pavilion (EP).
In order to test KREO technology a prototype in real scale has been realized, which measures 4.00 x 5.00 meters. The loadbearing structure is in steel and it is made up by four cruciform pillars (Figure 8). The concept of the design is to reduce the disturbance in the site. To get this achievement, the structure is lack of beams and foundations.
The pillars are connected at the top by a series of steel tie rods (Figure 8). The horizontal ones are used for the movement of the covering surface, using a trolley system with triple pulleys (Figure 9). Trolleys are able to slide in both directions, allowing to open and close the shelter.

Figure 8. The cruciform pillar

Figure 9. The connection between pillar and steel tie rods

At the base of each pillar there is a welded mesh boxes that is full of concrete bricks, to for a ballast to stabilize the pillar (Figure 10). Other six ballasts, with similar shape, are located in the corners, along the diagonals of the shelter, to get the necessary weight for the stability. In this way, it is not
necessary to provide foundations and so it avoids excavation works or other invasive actions on the archaeological site. To link the pillars to the ballast boxes, steel cables are used, id est stays.

Figure 10. The connection between pillar and the welded mesh box.

The realization of the prototype of the shelter KREO has shown several criticalities. They will be correct in view of the realization in the site.

The steel structure has two functions: on one hand it is the load bearing structure, on the other hand, it is the guide for trolleys. It means that in the assembling it is necessary the perfect alignment of the pillars to allow the sliding of the trolleys. It is also necessary to control the mid-span deflection for the movement of the pulleys. So, the ballast boxes must be improved. According with the high dimensions, the foldable material must be stiffened and strong sucked to the trolley.

The composite material for the covering surface is formed with the following stratification (from the top to the bottom): EVA (Ethylene Vinyl Acetate), PTF (polyvinyl fluoride used as back sheet), EVA, Biotex Flax and EVA. The flax tissue is the reinforcement; the back sheet improves the rigidity of the material; the EVA is the matrix and it sticks the various layers. The folds are obtained with a secondary working process of thermoforming. The chosen folding pattern consists in bellows with rectangular tassels. Thanks to its simplicity, the mold consists in plates of aluminum. In the first step the composite is stratified; all components are arranged in flat in a laminator, in the correct order. In the second step the composite is folded; the semi-finished product is folded around the plates and tight and put in an oven for fifteen minutes, at 120°.

The control system of the shelter is still under development. It will be realized by a series of sensors (for rain, wind, solar radiation and so on) connected with Arduino. According with the climatic conditions, the control system will open the shelter, making it smart. To prevent different location of the two side, the engines are equipped with encoders. A limit switch sensor will allow the automatic shutdown of the system.
Design of the Multipurpose Module Prototype EP with the ICARO Technology

The panel ZERO of ICARO technology (Figure 11) is formed by ten modules and it is 2.80 m high, 1 m large ad 0.30 m deep. It has been realized by using the following materials:

- the triple wave cardboard, type of the “Cartonificio Fiorentino” (called Euro 22-24/14);
- * spruce laminated panel, 20 mm tick, technical class SWP/2 S L3

The finishing is realized by five panels of composite material, supported by a wooden frame. They realize a sort of ventilated façade, thanks to the air gap between them and the cardboard.

The pre-stress is realized by using two threaded rods that run median in the boxes. They are tightened at the ends with bolts. As to the choice of the type of the cardboard, the double-wave one has a not sufficient strengthen and the it tends to collapse to the inside part, during the pre-stress. So, the triple-wave one is more preferable, even if it has higher costs.

After the construction of Panel Zero the design of the multipurpose module Experience Pavilion EP has been defined in detail.

EP is a mini-architecture located within the archaeological excavation site. It aims to allow a deeper reading of the remains. Its shape is generated by the
projections of the footprints of some representative buildings along the main routes of the ancient colony.\textsuperscript{22}

EP is a parallelepiped eleven meters long, two meters wide and four and half meters high (Figure 12). It has two doors, to make easy a linear flow of visitors, from one part to the other one and it has two levels. The ground floor is a closed rectangular space. The upper floor of EP is a terrace that is accessible with an external stair, to have a panoramic view of the archaeological site.

Considering the feedback of the structural analysis, 42 mm thick wooden elements were adopted. The depth of the wooden uprights is 40 cm, while the depth of the beams is 24 cm, to leave sufficient gap for the ventilation, between them and the finishing. The fixing between uprights and beams is realized through slotted holes, to allow shifting during the pre-stress phase.

\textbf{Figure 12. The EP constructive section}

The base of the module is a grid in steel, each element is a couple of C profiles in galvanized steel S275. The profiles will be bolted in site to reduce

\textsuperscript{22} For further details about the architectural project see the already mentioned article: Calvagna S. Militello P. M., Reale F.A., Rodonò G., Tornabene A., “From the landscape of contrasts to the landscape of invisible cities: a strategic landscape design for the revitalization of the Ancient Greek colony of Megara Hyblaea in Sicily”, Athens Journal of Architecture 2022, 8: 1-33 https://doi.org/10.30958/aja.X-Y-Z also: Calvagna et Al., ....
the weight of the beams, because the transportation inside the archaeological site will be manual. In the gap between them, the uprights of the panels are fixed, with a steel plate to improve the contact area. Their weight is not sufficient to contrast the action of the wind, so the basement will be ballasted with concrete brick. According with the usage of the module and the short permanence in it, the filling in insulating material can be avoided.

The covering is formed by a wooden grid of beams, connected to the uprights. The connection is guarantee by nine through bolts M10 strength class 8.8. On the top, there is an x-lam floor. The thrust of the wind, which is the highest horizontal stress, is countered by the knee beams of the stair, that are fixed on each wooden uprights, with a steel element.

In the internal side, the finishing is missed and cardboard and wood are exposed. In the external side, the finishing is formed by burned wooden slats, which has been preferred over composite for its high durability. For fire protection of the cardboard, the use of a treatment with a two-component, water-based, transparent and colourless fireproof bottom coat has been planned. A prefabrication procedure has been defined also for them. The slats are connected with two shaped steel bars, to realize a matchboarded. Similar bars are looked on the panel, to stuck the matchboarded, with the so called Fitlock system\(^\text{23}\). The high of the panel is covered by three elements, which leave free an air gap, for the ventilation of the facade.

The module will be equipped with digital and analogical informative materials. For the first type, there is a multimedia device with the virtual reconstruction of the Stoà, which is the most important monument of Megara. For the second type, there is a tridimensional model of the area of Megara, obtained from a cellular lightweight concrete block thanks a subtractive prototyping procedure.

The electricity for the devices and for the lighting will be supplied by the photovoltaic panels embodied in the finishing of the south elevation. Each panel is realized with fifteen solar cells in monocrystalline silicon with high efficiency (realized by SunPower Maxeon) 125 mm x 125 mm (Figure 13). The system is patented\(^\text{24}\). The unit of production is formed by two panels and it has the following datasheet.

According to the hypothesized scenario of use, it is necessary to use three couples of photovoltaic panels. It is also necessary to provide the module with a backup battery, for the cloudy days.

\(^{23}\) https://www.fitlock.it/ (accessed on April 2021).

Figure 13. The photovoltaic panels embodied in the finishing layer of the south elevation

Conclusions

In the valorisation of the archaeological site, there are three actions that are showed in the literature as efficient: the preservation of the remains; the communication to promote the site; the arrangement of the site.

In the e-WAS project these three actions are implemented with the KREO and ICARO technologies.

The realization of a shelter is one of the most efficient systems for the preservation of the archaeological area; the possibility to remove it, when it is unnecessary, could be a good strategy to reduce the disturbance on the site.

This achievement is reached by using a pre-folded composite material. To be sure about its performance, a campaign test on real scale prototype is useful.

As to the communication, a relevant strategy is to introduce in the area some architectural multipurpose modules, which can be useful to illustrate the site and to provide facilities for the visitors. This aim could be obtained through lightweight material, as corrugated cardboard and wood. The prefabrication of the envelope can reduce the disturbance on the site. The campaign test on real scale prototype is useful to verify technology issue and comfort performance.

Shelters and architectural modules can contribute, together with the study of a system of paths, to redefine the arrangement of an archaeological site with the aim of improving the reading of the complex system of stratifications that characterizes it. The set of linear and small punctual elements can promote an approach of widespread and non-invasive reception to the archaeological heritage.

Bibliography


