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# Large-span structures for purposes of heritage sites

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**Abstract:**

**The object of research** is large-span structures for the presentation of archaeological sites in situ - construction of roofs, shelters, and bridges with the aim to provide support in the decision-making process for architects and engineers. **Method.** We examined existing practices and analyzed their engineering classification looking for a pattern in their application. Contemporary engineering structures at built heritage sites create a sharp contrast between old and new. A presentation of cultural heritage in situ requires an understanding of heritage theory and internationally accepted doctrine, which exceeds common engineering education. Nevertheless, the application of large-span structures, which often takes advantage of state-of-art construction technologies nowadays, is also an aesthetical statement that affects the appearance of the site. Therefore, we gave an overview of the theoretical background of aesthetical issues and the overall ethics of the decision-making process in such sensitive cases. **Results**. Within the framework of heritage presentation, engineering and architectural issues, and selected case studies, we concluded in favor of the application of large-span structures under certain conditions.

## 1 Introduction

Archaeological excavations have been made for several centuries, yet new archaeological sites constantly emerge, and some require presentation in situ while others need to be transported to museums. In both cases, built-heritage sites, often require the construction of large-span structures as roofs, shelters and bridges for presentation purposes. Archaeological sites are most numerous among heritage sites that require an application of large-span structures, however, other heritage site may also require construction of such structures. This research was primarily but not exclusively focused on steel structures for noted purposes.

Special structures for presentation of heritage sites are considered common nowadays and, therefore, a substantial number of scientific papers have been written about them so far. For some of them, the focus was on a specific category of heritage e.g. protective structures for mosaics [1] or underwater heritage [2]. Sometimes, the articles contain geographical determination [3-5]. In other cases, focus is on a particular aspect of materialization e.g. transparency in design [6, 7] or innovative technological solutions [8]. Although the topic has been researched for several decades, the interest remains. Some articles deal with case studies e.g. [9-13], while others focus on method itself, as in [14-16], or presence in scientific publications [17] and on wider context, as e.g. capacity of protective buildings to serve future urban development [18] etc. For the research on large-span structures for heritage sites as the one that follows, we did not find previously published example in scientific literature.

# 2 A look into the past

There is a long tradition of setting shelters and roofs above the archaeological finds, both when they are presented *in situ* and when not. Since the beginning of the 20th century, built heritage was exhibited in museums especially built for that purpose (Fig. 1) shows the roof construction above the Pergamon Altar in Berlin), while in other cases, roofs and shelters were built above archaeological finds *in situ*, in both cases as protection from precipitation, releasing weathering and similar. In both groups of cases, the purpose is essentially the same, though demands may vary.

Many case studies of protective buildings for archaeological sites presented *in situ* have been published by now. Therefore, the following chapter gives only an overview of possible structural designs of roofs and shelters. Another type of structure – bridges also find application at heritage sites, however, for slightly different purposes and, applied less frequently than the previous.

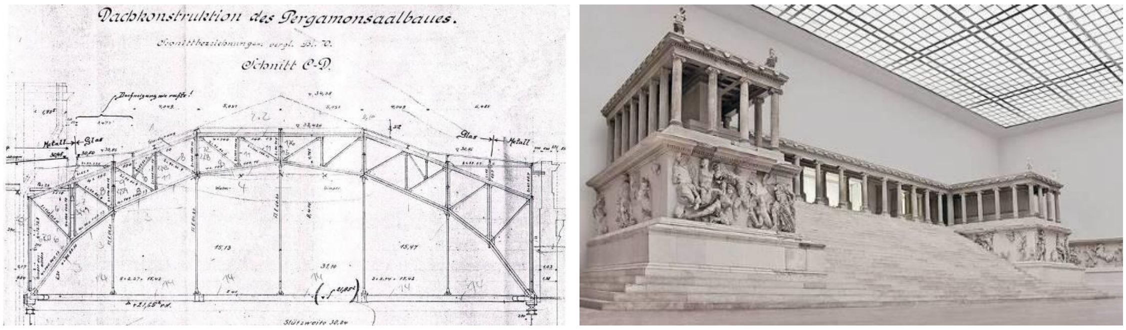


**Fig. 1 Roof above the Pergamon Altar, Berlin, Germany; the museum was erected between 1910 and 1930, and it has a ca. 30 m wide span steel truss covered by glass with a false ceiling which lets in natural light [19]**

# 3 Subjects of roofing, sheltering and bridging

Roofing and sheltering come from a need for the protection of archaeological finds and architectural and other structures in situ from a variety of influences (e.g. precipitation, UV, pollution etc.). A need for bridges emerges in an attempt to avoid collision of opposing spatial requests (in other words – as a way to cross over, typically, an archaeological site by linear infrastructure instead of going around), or as a instrument for a presentation or another stage of heritage protection. In the second case, pedestrian bridges are typically used to provide a better view of a heritage site, avoiding, at the same time, the danger of destroying surfaces of historical structures by walking on them or in their immediate surroundings. These are the cases that we identified. However, other circumstances are possible.

Relation between the architectural period and span is difficult to find, and there are two main reasons for it. Firstly, throughout history, there exists an urge for making world records in construction (in length, height, volume etc.), and in practice, there are no "standard" spans for a particular period. Historical "periods" in Eurocentric architecture naturally come out of the prevailing use of materials, construction techniques and their aesthetics. The constraints of construction techniques can be used as an indicator of expectable spans in some cases. However, natural materials have been used through centuries for large spans with great success. Only later, in the Industrial age, new materials and new possibilities emerged.

The old construction techniques were surprisingly efficient in resolving large spans using stone, brick, wood, small amounts of scarce and expensive iron, traditional concrete and mortars. For facilitating an overview, we remind a reader of a few sets of otherwise commonly known data (see Table 1).

Later use of artificial materials with greater potential did not fundamentally affect spans for construction of buildings, as one might expect, simply because human ergonomic needs remained the same. Quite the opposite, the other factors such as demographic growth and need for time/resource/energy efficiency encouraged optimization of spans in habilitations, and they became even smaller than before.

**Table 1: Examples of common and maximum spans for iconic buildings from Renaissance to early Industrial age**

| Type of structure | Common span | Biggest known span | Note of location/author | Year/cent. |
|---|---|---|---|---|
| Trusses | 20-26m | 30.5m | Triangulated trusses for bridges by Andrea Palladio (5 times 13m) | 16$^{th}$ c |
| Nave of Gothic churches | 13-16m | 23m | Girona Cathedral - the widest nave | 1015-1038 |
| Dome | | 42m | in Florence by Brunelleschi | 15$^{th}$ c |
| | | 42m | in Rome St. Peter's Basilica | 1506-1626 |
| | | 34.2m | St. Paul's Cathedral in London | 1675-1710 |
| Girders-wooden roof | 6-13m | 20m | Uffizi by Vasari | 1560-1581 |
| Cast iron | | 30,6m | Bridge over the River Severn | 1779 |
| Wrought-iron roof trusses | | 28m | Theatre Française | 1786 |

Secondly, a subject of protection may be a single building or part of it, as well as, e.g. agglomeration of buildings. In some cases – if the agglomeration is considered the most valuable, required spans must be tens of times bigger than spans used in the construction of a single unit (Fig. 2).

**Fig. 2 Santorini, Greece, Archaeological site - prehistoric town of Akrotiri preserved due to volcano eruption – single units, agglomeration, aerial view of the roof [20]**

# 4 Structural design possibilities

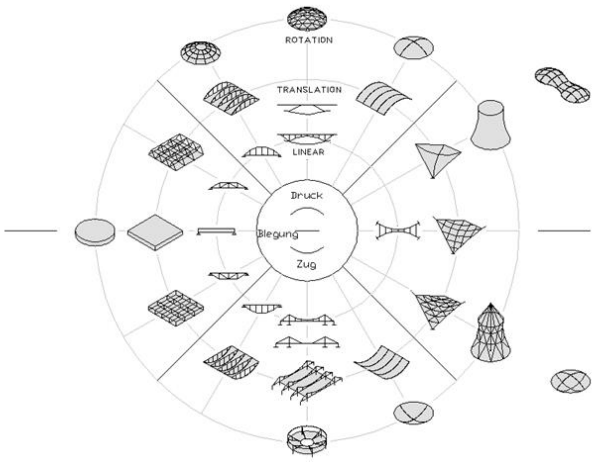


**Fig. 3 Types of structure (By SschlaichBergermannund Partner (SBP))**

In general, there is a great variety of possible constructions, as shown in Fig. 3. The main structural members are subjected to either compression or bending, or tension. The possible scope of solutions narrows when required spans are taken into account. Spans can be frequently used as eliminating criteria in an early phase of decision-making.

**Girders:** The Pallas of the castle (from around 1250) in Vlotho was reconstructed before WWII. A contemporary designed shelter from steel was added, along with works on reconstruction of the castle after 2000, giving an idea of how the original building looked (Fig. 4). The optimum span for hot-rolled girders is up to 9m.

**Fig. 4 Medieval Pallas in Vlotho, North-Rhine Westphalia, Germany [21]**

**Fig. 5 Acropolis, Athens, Greece (By authors)**

**Strut trussed girders** consist of hot-rolled profiles and round steel and have the optimal field of application between 9 m and 20 m. The advantage of those girders lies in smaller internal forces and deflections under uniform loading than for simple girders. This results in slimmer steel construction of the roof, which combines well with glass as applied in the Acropolis of Athens (Fig. 5). A solution with a slim beam was used behind the House of Martin Luther (1483-1546), the Initiator of the Reformation. One strut runs over the beam, the other under it (Fig.6). The roof (constructed in 2010) over the ruins has a span of 22m and applies a combination of steel and PTFE foils.

**Fig. 6 Roof over the ruins behind the house of Luther, Wittenberg, Germany [22]**

**Frames** Find from the Byzantine time, situated near the Ohrid Lake, were sheltered with traditional members (Fig.7). This frame consists of hot-rolled hollow sections and has a span range of up to 15m.

**Fig. 7 Shelter in Plaosnik, near Lake Ohrid, Macedonia (By authors)**

**Fig. 8 Heritage agriculture building with preserved walls frames in Lucklum, Lower Saxony, Germany (left [23] right: By authors)**

In the following example, the masonry walls have been too weak for the construction of a new roof on it, in an agriculture building in a manor from the $17^{th}$ c (Fig.8). Therefore, the steel frame is set inside to preserve the outer historical view. In the case of welded sections, spans of as many as 80 m are possible.

**Trusses** (with a single upper and lower chord) have a span optimum between 15 m and 30 m. They are convenient for combining with glass or translucent membranes. Figure 9 shows the roof near the center of Athens, which covers a Roman Bath.

**Fig. 9 Truss roof, near the Syntagma square in Athens, Greece (By authors)**

Another example, houses in Ephesus are shown in Fig 10. In this archaeological site of ca. 4000m$^2$, there is a large insula with seven residential units from 1st century BC, designed according to the terrain on terraces. The buildings were damaged by big series of the earthquake in 262 AC. Nowadays, they are protected by a roof made of stainless steel and a translucent textile membrane.

Fig. 10 Ephesus, Turkey [24]

The Hamar Cathedral (Fig. 11), which is located 100km north of Oslo in Norway, was built before 1152 and destroyed by the Swedish army in 1567. What was left of it (mostly remains of arches) is now protected by a truss construction.

Fig.11 Hamar, Norway [25]

Generally, **arches** allow the widest spans. Fig. 12 shows a two-hinged steel truss arch above the middle-stone-age and Neolithic site in Lepenski Vir, which is situated outside of the urban area by the River Danube.

Fig. 12 Lepenski Vir, Serbia [26]

Fig. 13. Hagar Qim, Prehistoric temples in Malta [27]

Prehistoric temples in Malta, a World Heritage site, are well preserved and later sheltered by a structure with arches.

**Metal shells** Pig iron first flowed from the blast furnace of the St. Antony ironworks in 1758. Today, this first ironworks in the Ruhr region is part of an industrial archaeological park. The 900m$^2$

shell roof has 323 similar panels overlapping each other like shingles. Due to their double-curved shape and rigidity, the shell is self-supporting and does not need any welding (Fig.14).

**Fig. 14 Oberhausen, Germany [28]**

**Fig. 15 Tent above archaeological site in Rhodes, Greece (By authors)**

**Tent and ETFE structures** When the climatic conditions allow it, a simple awning may be satisfactory (Fig. 15). A more demanding example has been the case of the Kufstein Fortress (Fig. 16). For high-quality events, protection from the rain was required. It happened a few times that concerts literally fell into the water in bad weather, while other events never happened because of financial risks. Thus, the idea arose to make the largest possible part of the fortress weatherproof by a temporary retractable protective roof.

Strict requirements of the monument protection had to be considered, which did not allow anchoring in the historic structure. The appearance of the fortress was not to be affected much by the new construction. In order to meet these conditions, the planners developed a filigree, centric cable structure from which a membrane can be stretched. This convertible canopy allows covering 2000m$^2$ over the entire fortress yard and part of the casemates in 4 minutes. In good weather, the membrane is situated in the centre.

**Fig. 16 Fortress Kufstein, Austria [29]**

Another recent example is the roof over a heritage site, a market in Poznan, Poland [30]. The cushion roof covers an area of approx. 2400m$^2$. The supporting structure is a steel girder grid with an outer, middle and inner ring (Fig. 17a). The grid is formed by rectangular profiles running orthogonally. Large cushions attached to the three rings form the pneumatic roof. The span of the outer cushion is approximately 13.5m; the inner cushion has a maximum span of 17m. With ETFE foils, limited spans can be realized due to the material properties. With large pillows, this restriction can be circumvented with the help of ropes on both sides of the pillow. The internal pressure pre-stresses the ropes over the internal ETFE foils, which guide the external loads safely into the edge girders.

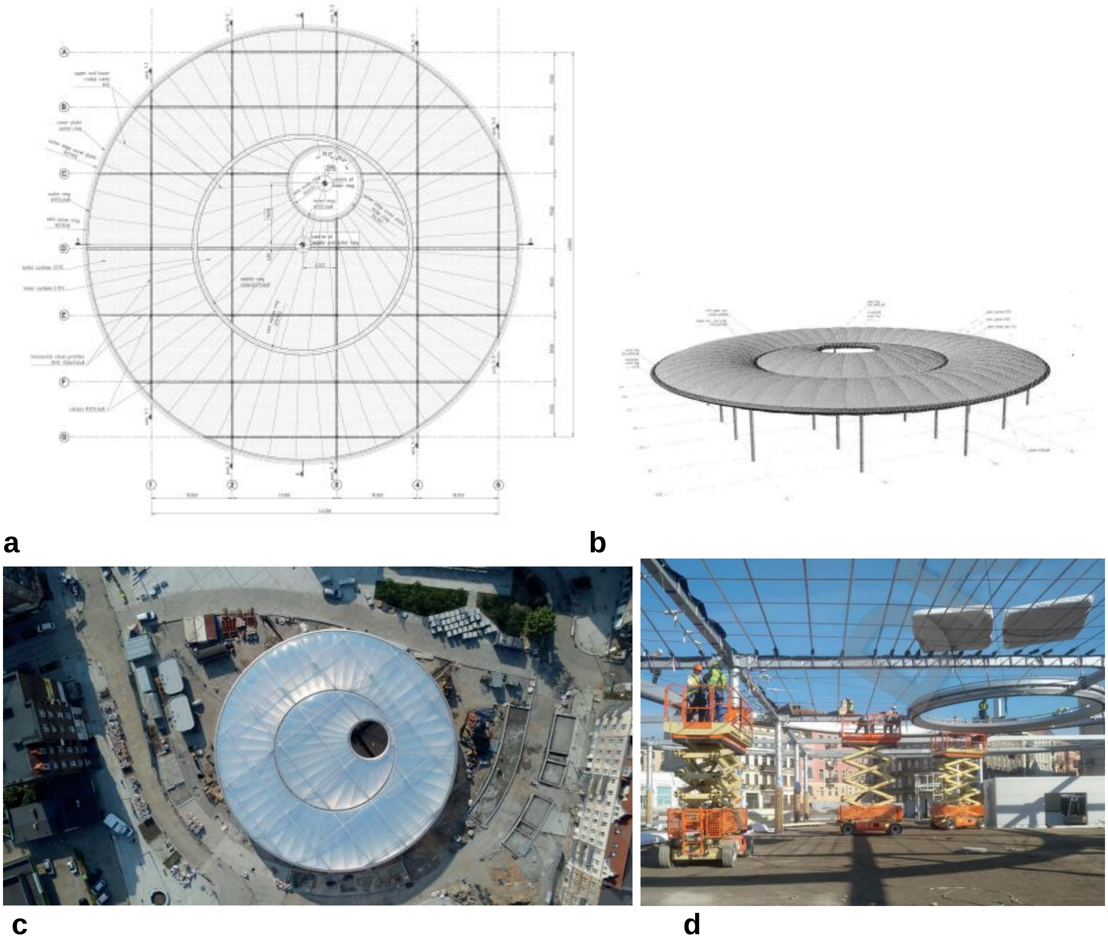


**Fig. 17 ETFE roof. a -Plan view, b - Perspective view, c- Aerial view, d Grid and lower ropes [30]**

**Bridges** are clearly distinctive from those previously mentioned structures. The example in Fig.18 shows pedestrian bridges which serve to allow safe access for visitors of the archaeological site of Roosenberg Abbey from the 13$^{th}$ century (Belgium).

**Fig.18: Ruins of Roosenberg (from the private archive, by Prof. Philippe van Bogaert)**

**Fig.19. Brug Kipdrop [31]**

The other example of the bridge over archaeological sites (Fig. 19) shows the importance of useful coverings. Under the bridge, there are parts of Spanish ramparts around Antwerp from 16th c. [32].

## 5 Heritage and ethics of intervention for engineers

Intervention is never neutral, and therefore we should be aware of the ethical meaning that interventions carry concerning heritage sites. Underneath a simple statement, “ICOMOS allows new structures at archaeological sites if they are clearly distinctive”, there is a lot of work of heritage theoreticians and practitioners and a set of unspoken rules of thumb.

By many engineers, heritage rules (and in particular those regarding aesthetics of intervention) are perceived as “terra incognita” or “a minefield”. This comes essentially from two characteristics of heritage protection as a discipline. It relies both on theory and doctrine – which is a phenomenon typical for social sciences, and that could be confusing for practitioners from a purely technical background. Moreover, the theory had early progress roughly at the end of the 19th c and beginning of the 20th c; then it was established well in the middle of the 20th c, followed by the period of fragmentation in the second half of the century, like other disciplines in social sciences, without a clear streamline and without univocal acceptance. Its development led to the first integrated general theory in the early 1970s, which, nevertheless, left many issues undefined, in particular regarding architectural problems, which typically happen to be an exceptional case, unlike any other art or science. On the other hand, heritage doctrine has experienced profusion since the second part of the 20th c resulting in an enormous number of resolutions, declarations and other documents generated by numerous international and national stakeholders, which may sometimes be (if not often) difficult to trace and interpret.

Ethics of intervention consists of two elements: questioning the morality of intervention and if it is aesthetically acceptable. The first part may reveal questions as: does intervention change the nature of the subject of presentation, are the author's rights (known or unknown) violated by intervention and alike. The answer is sometimes obvious and sometimes can be proved through symbolic analysis. Such an approach can be briefly summed up by the following saying (paraphrased): it is not possible to build a highway to the top of Mont Blanc without causing it to become something completely different [33]. Applied to cultural heritage, this rule refers to the problem if intervention reveals understanding and respect for the heritage at stake according to the reasons for protection. Fig. 20 illustrates an example of a pedestrian path across the fortress, for a fast connection between the city center and the technical university, across the area of the fortress, which is very rich in archaeology and that has been resolved by the bridge across rampart. Any fortress is defined by its walls and gates. Although this communication could have been provided through the gate located 50m further away, it was resolved by the bridge across the rampart – a concept which was in the Middle Ages seen only in times of war and usually punished by death, and which aesthetically and symbolically violates the spatial integrity of the fortress (if the fortress is perceived as an obstacle, it should be demolished, e.g. as Viennese ramparts, and not preserved with hypocrisy) [34, 35[i]].

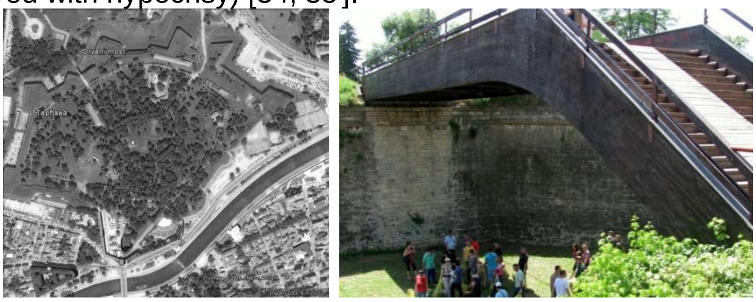

**Fig.20: The Fortress of Nish, Serbia – Arial view (Google maps) and the wooden bridge over the north-western rampart [36]**

Furthermore, at a more theoretical level, every time when we present an architectural object as an artefact, we change its nature from a functional structure with practical use into something else – an exhibited item. We do not object that shelters and roofs should be applied if that is necessary for preserving endangered heritage for further generations, but we consider it fair to clearly state what such action implicates in the ethical sense. Although all documents of international heritage doctrine “touch” ethics of intervention, some deal with it more than the others:

- Venice Charter (1964)
- Convention Concerning the Protection of World Cultural and Natural Heritage (UNESCO 1972)
- The Burra Charter (1979-2013)
- Nara Document on Authenticity (1994),

(this one, the authors, usually see as the crucial, e.g. [37-39])

and in there are also two important documents that refer to information technology and 3D-visualisation as tools of restoration:

- The Charter of Krakow (2000);
- The London Charter (International charter for the computer-based visualization of Cultural Heritage) (2009);

Authenticity is closely related to the morality of intervention, as one element of the problem, while aesthetics of intervention is the other. Creating shelters and roofs changes the visual perception of a heritage site. The problems of visual perception as such have already been examined by Gestalt psychology in the early 20th c. The results were known and integrated into the general theory of restoration that emerged in a circle of Italian theoreticians in the middle of the 20th c. This theory is considered an aesthetic theory essentially, according to which, a new structure on a heritage site is acceptable if it is clearly distinctive and **if it is a work of art** [9]. The first criterion is related to the issue of authenticity and plagiarism, and it is not a big challenge in the case of contemporary large-span structures (they are naturally clearly distinctive compared to heritage). The second one was once a demanding criterion, but not since the development of proper software for visualization. The software allows creating many models until the right one is chosen. Such software, especially those which allows sculptural shapes (e.g. Revit, Grasshopper, Blender etc.), also guarantee that the object will remain clearly distinctive. Theories of architectural aesthetics can be studied from Homer's epics and origins of Western civilization until the middle of the 20th c, through the war between Aestheticians and the Avant-garde, and beyond. However, this route takes time. For practical purposes, there are rules of thumb that are generally well known: e.g. interventions which can be described as mimesis of historical structures, copy-paste or imitation of other buildings or scholarly examples, do not lead to good results while honesty, authenticity, originality, creativity, and sensitivity to unique characteristics of location generally do, and it proves practically that either way it is all about ethics. However, according to the same theory [40], it is not possible to create a work of art intentionally; therefore, no rule should be taken literally and out of context. It is not an easy task, and every intervention may have an ambivalent outcome. The following example illustrates one of the iconic interventions on heritage building (Fig. 21). The castle, which was the residence of Saxon electors and kings, was damaged in a bombing by the allies on February 13, 1945, and later it was rebuilt. In 2009 a steel grid shell with foil cushions was added. The structural model shows a framework dome, which consists of a grid shell and surrounding edge truss girders at the dome base [41]. The design of a new structure is fully contemporary and resolves a real problem in the present time. However, the cumulative effect of numerous interventions in Dresden led to it losing the World Heritage status in 2009, which was particularly based on the impact of the new bridge (Waldschlösschenbrücke) on the River Elbe on its landscape with heritage values. Twists in the case of Dresden illustrate well the complexity of interventions on heritage.

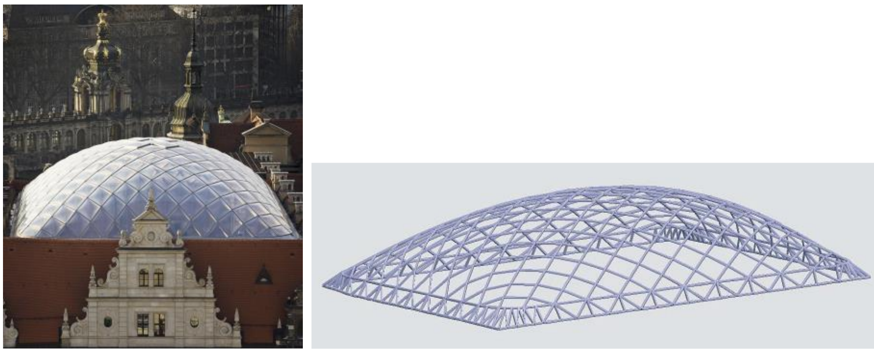

**Fig. 21: The roof above the small yard of Dresden Castle, a Renaissance building in the centre of the city, demonstrates the application of shells [41]**

Finally, we want to point out the distinction between the aesthetics of existing heritage buildings and the aesthetic of new structures. The existing building may be preserved for various reasons, including historical and scientific or documentary, and for such reason, its aesthetic may also be aesthetic of ugliness (e.g. memorials of war crimes), coming from any historical period, and yet be acceptable and appropriate. On the other hand, the aesthetics of the new structure cannot be such, and its design has to belong to the present.

# 6 Methodology and decision-making process

One of the approaches for supporting decision-making in the process is to follow a code. The most popular choices are the Code of Ethics and Guidelines for Practice by the American Institute for Conservation [42], and Engineering heritage and conservation guidelines by Engineering Heritage Australia [43]. However, using codes without proper understanding also may be misleading.

All relevant characteristics and circumstances regarding cultural heritage sites under protection need to be known to all parties involved in an intervention. In the ideal case, it means that there is a reliable document – nominally, a cultural management plan which explains the values which are under protection and provides accurate and relevant information. If such a document does not exist, it should be ordered, if possible, before any work on intervention starts. A heritage management plan is not simply a formal document, although it is obligatory in some countries and in all cases of WH sites. It is a useful method that, when applied, leads to different, better and scientifically-founded solutions (for more information on a heritage management plan, see, e.g. [44] or [45]).

For every decision, in theory, there are only three areas of moral thought – options, duties of special relation and constraints according to [46]. In the case of large-span structures, it means the following:

**Options**: Examining all choices of structures that fit the requirements, looking after optimal solutions for heritage. Table 2 sums up case studies from previous chapters.

**Table 2. Optimal use of different types of structure**

| Type of structure | Common span/area | Notes |
|---|---|---|
| Girders | <9m | A simple solution |
| Strut trussed girders | 9-20m | Optimal for intermediate spans |
| Frames | 12-50m | Recommendable when walls are preserved but too weak for a new structure of the roof |
| Trusses | 15-50m | Widely used |
| Arches | 40-100m | Suitable for very large spans |
| Metal shells | to 1000m$^2$ | Considered an elegant solution covering a great area |
| Tent structures | to 2000m$^2$ | Light, convenient for a reduced number of foundations and large area covered |

**Duties of special relation:** include all the obligations which come out of particular circumstances and stated preferences. Among numerous equal possibilities, in architecture, it is possible to choose the particular according to personal preferences, and that is fully acceptable as long as one truly understands one 's own choices and the reasons beneath. In this case, among duties of special relation belong designers` preferences, previous experience, and all preferences regarding special characteristics of a particular heritage site.

**Constraints:** examine all constraints regarding the scope of intervention, respect for the monument, views, jeopardizing existing values, acceptable number and position of foundations etc. Cost-benefit analyses may provide additional constraints. As a result, after this stage, there should be only a few versions of the solution, which should be developed in detail with visualization.

Visualization (with a fully free choice of software) enables evaluation based on symbolic and aesthetic analyses.

# 7 Discussion

**Heritage interventions between "needs to be done", "can be done", and "appropriate".** The precondition of any success in the structural design is a good understanding of what needs to be done. In cases of heritage, it is normally described in a Heritage management plan which should start with an accurate and thorough explanation of values – what is protected, why, and what is the aim of the intervention. In the context of this paper, there is an obvious distinction between the structures that originate in actions for presentation, that are important primarily for architects, and those emerging as an outcome of the conflict in land use between built heritage and entirely different purposes, usually infrastructural, which are more relevant for urban planners and infrastructural engineers.

Although the current state of construction technologies creates the general opinion that “anything can be built”, one should not underestimate the difficulty of the task to resolve the presentation of a highly sensitive heritage site with unique and irreplaceable values. We want to point out that the previous case studies reveal that a variety of additional requests may emerge. The list of technical requirements starts with high standards in safety, serviceability and durability, which significantly narrow the scope of possibilities. That may include load/weather conditions, span, exterior and interior climate, restrictions for anchoring and size of foundations. In addition, there could be more complex demands like extensive load due to requests for walkable roofs or another layering of space to provide high land efficiency through multi-functionality etc.

Each of such requests narrows possible choices for the optimal type of structure.

Heritage presentation can be an occasion for “the best of” contemporary architecture. In that manner, heritage keeps a role that we have all been aware of for a long time – it serves as the catalyst for socio-economic development [47]. The consumption generated by a restoration of a heritage site is economically and socially desirable, representing the type of public works that keep a community going forward. Heritage buildings have the privilege to be considered a priori “the right concept”, similar to planting a tree: even if choices, when, where or which type of tree, can be wrong, it is still generally beneficial. Heritage projects are similar. Defining “**appropriate”** within an intervention is a kind of fine-tuning that makes a good heritage project become a great one, and it is largely based on the ethical values integrated into the design.

**Fig.22 a) (left) Fredericton-Moncton highway (Canada)[48] b) (middle) Tall Ulmeiri (east), Jordan [49] c) (right) Kladensce-Crnokliste (Serbia)**

**The unexpected outcome of the research.** We want to point out the outcome of the search e.g. of bridges in cases of the collision of archaeological sites and infrastructural works, for which we originally believed to be common. It is known that many archaeological sites are discovered during infrastructural works. However, we did not find many examples when bridges were used for resolving such spatial conflict. Instead, we have found examples where bridges would have been natural solutions, but they were not applied – instead, either the infrastructure route was changed, or the archaeological site was earthed. Fig 22a shows the change of road alignment for consideration of the archaeological site of Maliseet First Nation (2000 years old) in New Brunswick, Canada. Fig. 22b shows a highway with the changed route, fully independent from the archaeological site which it by-passes. Fig.22c shows one of the tens of archaeological sites which were discovered along highway route between Nish (Serbia) and Bulgarian border (towards the capital, Sofia) in recent years, which overlapped with a wider area of the route of one of most important Ancient Roman roads - VIA MILITARIS. That illustration shows a huge basilica discovered in the axis of the highway (the aerial picture was taken before the site was earthed). The arguments for changing a route of infrastructure in collision with heritage sites are several: it is a faster solution, a cost of construction and the maintenance of a bridge compared to the cost of the new route on the ground is much lower, risks are high (disaster at a bridge can cause a disaster at the archaeological site), public opinion demanding a change of route etc. [47].

**The hidden potential of large-span structures.** The huge impact of large-span structures on landscape, for obvious reasons, does not have to be wrong and overwhelming. Because of the size, such structures have potential, which can be most welcome nowadays. Their huge surfaces may be engaged for meeting additional requests as generating energy or enabling vertical structuring of space in dense areas, reducing carbon emission in combination with greenery etc. The size can be a weakness or an obstacle as well as an advantage, and one should not underestimate multiple ways in which such structure may serve the community.

## 8 Conclusions

The examples used above speak in favor of the rule of thumb of construction: we (humankind) build what we need more often than we can. However, while resolving our necessities, which could be functional, economical, emotional, inspirational, educational etc., we preserve our heritage and protect it the best we can which often means – using protective buildings and sometimes constructing bridges over the site or its parts, which is widely accepted if they are designed and constructed with certain characteristics which are relevant for a particular site. These structures, with some additional effort, may become works of art and even part of future World heritage, as it eventually happened in the worldwide known case of the dome for the Temple of Abu Simbel.

## 9 Acknowledgement

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