

# **The History has a Future**

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## **ABSTRACT**

The application of new materials and technologies in the projects regarding the protection of cultural monuments is unavoidable and may render excellent results under the condition that a whole spectrum of experts are included, from art historians, curators and architects to producers and work performers.

The paper is dealing with the general issues concerning the protection of cultural heritage with a special emphasis on the role of quality carpentry. Examined were cases of individual cultural heritage objects as well as undertakings in the protected city areas.

High quality windows made of new materials are for a good reason no longer a taboo in this field: they are characterised by high quality thermal insulation, longevity, by being economical and easily maintained, and the design does not disturb the original style of historical buildings, thus significantly contributing to the preservation of the facility and its content.

Keywords: cultural, heritage, protection, materials, technologies, sustainable, windows

## **INTRODUCTION**

Traditionally, 'cultural heritage' has for a long time been defined through architectural, archeological or moving objects. With the modern redefinition of the term, the 'heritage' today includes buildings, monuments, landscapes, urban and rural areas, maritime sites, underground remnants and objects. „Historical surroundings“ or „site“ have become common terms. These trends are shifting the understanding of the world heritage protection from specific categories towards integrated protection of cultural surroundings.

The legislature and philosophy pertaining to cultural heritage mainly lean on the basic definition of cultural importance (or value), whereby this definition has been changing as well. Heritage has always been valued with regard to its age and beauty or it was a work of art by a great artist; today we are adding new values and understand that the heritage can also be painful, dramatic or inconvenient. It may reflect cultural diversity more than national unity. Namely, a large part of the legislature emphasised national values; at present local and regional values are becoming ever more

important. As values become more complex, managing the heritage becomes more of a philosophical question, beside being a technical one.

In the past several decades we have witnessed great changes in the renovation and protection of buildings representing objects of cultural heritage in Europe: up until the end of the 1970s the restoration and protection of old buildings and cultural monuments was in the hands of a very few experts, mainly motivated and concentrated by the historical aspect of the buildings, who were oriented towards traditional techniques and materials in their work. Since then, the interest in protection and restoration “exploded” up to unbelievable proportions, which caused a demand for a new approach, new materials and new techniques. For example, the number of protected objects has increased several hundred times (!) and among the numerous changes caused by this, so to say, inflation in the number of monuments and incomparably higher diversity of the subjects included in their protection, one of the most important is certainly the introduction of applied sciences and advanced technologies and materials in this otherwise very traditional discipline.

## **SUSTAINABLE DEVELOPMENT AND CULTURAL HERITAGE PROTECTION**

The philosophy of sustainable development requests that the development and protection be reconciled in a way that is appropriate to the needs of future generations. Those needs include the ‘quality of life’ – resources, clean air and water, ecology, but must take into consideration the economic aspect as well.

Sustainability is generally divided in three mutually overlapping aspects covering the environmental, economic and social demands. All of them are relevant for the cultural heritage objects as well and need to be harmonised, but for the needs of this paper and the conference topic the emphasis should be put on the environmental aspect, to be more precise, on the reduction of fossil fuel consumption, which again is closely linked to the reduction of carbon dioxide emissions, both in the production and adaptation, and in the regular use of such objects.

Therefore, how is the sustainability in the protection of cultural heritage to be achieved? Sustainable development is based on the set of basic principles which may be applied to this area, such as:

- Understanding resources as the basis for decision making
- bottom-up as well s top-down approach to protection
- continuous monitoring and exchange of experience as a basis for informed decisions
- reconciling the principles of development and protection instead of their confrontation
- respecting economic, social and cultural goals as a whole, not separately

The subjects of sustainable development and cultural heritage will be in conflict unless joint action takes place from the very start of planning. For that reason, the economic subjects must participate in the interdisciplinary teams with institutes, universities, investors and professional restorers in preserving cultural heritage. Only

in this way will the knowledge gained by the fundamental science find a way to the end users such as industry, authorities in the field of cultural heritage and architects/restorers.

Historical cities, places and buildings, in their territorial surroundings, represent the essential part of the universal heritage and must therefore be viewed as a whole with the facilities, area and the human factor, and, of course, in the process of permanent evolution and change. Certain buildings which compose a certain historic area may not always have a special architectural value in themselves, but must be protected because of the organic whole, their distinctive dimensions, cultural identity and their technological, spatial, decorative and other characteristics as binding elements.

## **ENERGY EFFICIENCY AND OLD BUILDINGS**

The construction practice in the past as a rule does not correspond with the modern requirements. The standards of energy efficiency for new buildings imply central heating and maintaining a constant room temperature of e.g. 20°C. This strategy of heating has become the norm in the past 50 years and hardly anyone questions it. The level of insulation of new buildings is conditioned by such a strategy and is mainly able to meet the requirements. Older buildings were as a rule raised before central heating and their form and details were designed for a totally different regime of use. The earlier energy systems and construction solutions were created at a time when the use of fossil fuels was not considered a problem and when the awareness of the need to save energy was not realised and did not even exist. As a result of research in the area of cultural heritage protection and ecological management of the heritage, scientists and end users nowadays have a clearer picture of protection and ecology needs of historical buildings and of what is acceptable to be done in the sense of modification of their infrastructure and service. A clear differentiation has been established between the construction requirements of residential, commercial and industrial facilities and of those of cultural monument protection. A new generation of professionals has advanced with a better understanding of conservation processes as well as ecological, social and political factors, which will work together with the construction sector in creating sustainable solutions that will respect the cultural heritage and its ecological and energy aspects.

A historical building in its urban or rural surroundings, together with the interior design and decoration, can be understood as a composition of a work of art and a historical testimony. Historical buildings greatly differ in the degree in which it is acceptable to make changes i.e. the measure in which this is possible without having a significant impact on their character. Some are extremely sensitive to the smallest change, especially of the exterior, while others may bear significant undertakings and are of a smaller sensitivity. This should certainly be taken into consideration when making decisions on which interventions are acceptable with the goal of energy efficiency increase.

However, in effect, the reconciliation of the requests for energy efficiency and preservation of the protected buildings often represents a huge technological and economic problem. The possibility to improve the thermal characteristics of old buildings is almost always limited by the influence which the outside insulation would have on the general appearance of the building – on proportions and most of the

facade details, which is often not acceptable from the cultural heritage preservation viewpoint. From a clearly technical viewpoint, as much as the outside insulation of the building is desirable, it is too often connected with insurmountable difficulties that need to be taken into account before any intervention. Concerning walls, simple injection of the insulation material into rifts and cleavages without the appropriate steam barrier and certain ventilation may be devastating. Insulation changes colour, loses its insulation qualities and actually, in the end, it increases the thermal loss of the wall itself. Furthermore, the surplus of moisture may condense and cause serious deterioration of certain facade elements, e.g. window frames. There are also types of insulation which may in no way be used (e.g. urea formaldehyde foam or cellulose whereby aluminium or aluminium sulphate is used as a firefighting retardant and which in connection with the moisture from the air creates an acid causing metal corrosion and causes the stone to fall apart). The situation is similar with floors, roofs and other parts of the buildings.

Antiquated installations and equipment represent an even bigger challenge. Existing buildings are very often too expensive in the sense of using them in an ecologically and energy-wise acceptable manner and are often facing the serious problem of the internal microclimate quality (this is a very important element when considering the preservation of the content of those buildings – be they exhibits, furniture, construction elements etc. This is often a consequence of an inadequate original installation design. There is a need for research whereby infrastructural modifications in that sense would be acceptable and necessary. Demolition is often chosen because, when old buildings are in question, the investment in material resources and human skill would be enormous, which for private and public investments in the construction sector is often unacceptable.

Modern materials such as cement epoxy resins, polymers etc., if used without adequate efficiency and compatibility analysis, certainly pose a problem. However, the use of traditional materials, if done without proper know-how and if original techniques are tried to be simulated, also results in a black box so to speak, which in no way guarantees a positive final result and often leads to a malfunction.

## **WINDOWS: BEAUTY AND PROBLEMS**

Old window frames and doors have the reputation of the “main gateway” for letting air pass uncontrollably (draft). Originally, they were made with utter care in the measure which the then technology and craftsmanship of the master carpenter permitted, while plasterers ensured that water at joints flew outside. Conservative reparation which demands that the materials and technology be as close as possible to the original ones will certainly in a larger or smaller measure contribute to the improvement of the building's characteristics and longevity, even though the level of the up-to-date energy efficiency standards will not be reached. However, though overrating the importance of traditional windows is difficult in preserving their authenticity for the character of the building, it has to be taken into consideration that they can never be flawlessly



replicated with all their proportions and details because they are the product of a unique, individual effort.

Most historic windows are made of wood. Oak carpentry, mainly fixed openings, were dominant until the end of the 17<sup>th</sup> century when, with the development of winged windows, soft wood was started to be used. Slowly growing, high quality and naturally resilient wood was mainly used and this was the practice until the beginning of the 20<sup>th</sup> century. After that, woods of lesser qualities started to be used which needed some kind of a chemical treatment in order to ensure a certain degree of longevity. Historic wood for windows is, therefore, not a renewable source and today it is extremely difficult, almost impossible, to get materials of such quality and longevity. Furthermore, old glass, as used at the time of construction of historic buildings, has become extremely rare. Its value lies not only in its age; characteristics of reflection and letting through light in such glass is significantly different from the uniform one of today's flat glass.

Energy efficiency improvement in existing traditional windows on protected objects may be carried out in several more or less efficient ways. Because of everything already stated, it is by far best to renew the existing windows, but this is unfortunately often not possible: all modern research is extremely pessimistic concerning the condition of traditional windows and the possibility of their restoration. Additional interventions may, for example, be putting double glazing, but in most cases this again means changing the windows, especially when original elements have very narrow crossbars which are not capable of accommodating double glazing. Sometimes it is possible to do this with narrower double glazing, especially when the wings are metal, but in that case as well all this is possible if the existing elements can accommodate additional weight, which is often not the case. Based on research carried out for

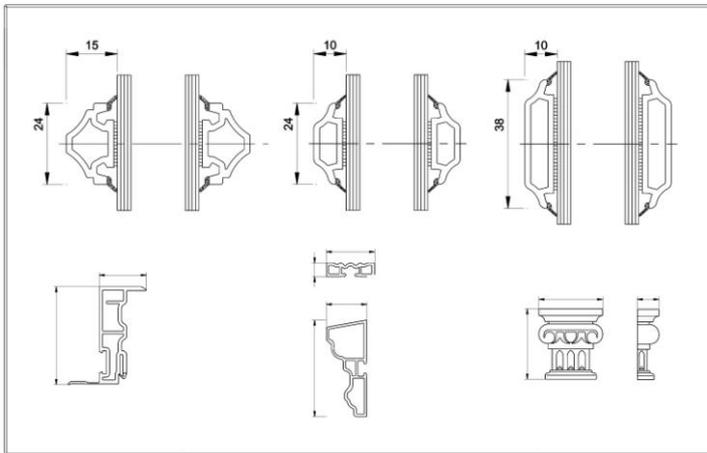


the English Heritage, an organisation officially known as the Historic Buildings and Monuments Commission for England, it was established that correct and functional historic windows (including the frame and the wing) have an U-factor of approximately  $U_w=4.3$ , being left in such a condition means to bring into question the energy efficiency of the whole building – simply, the losses are too great. Thus, the windows should be replaced and when the elements are replaced in their entirety – one should also think about alternative solutions and new materials, where appropriate of course, in accordance with an all-encompassing analysis and elaboration by the already mentioned interdisciplinary teams. Here we will examine in more detail one of the alternatives – the PVC windows.

The share of PVC windows in the restoration of old buildings is on the increase. With more than 55% market share in the total German market of window frames it has been constantly on the rise for several years. Mounting high quality PVC windows is

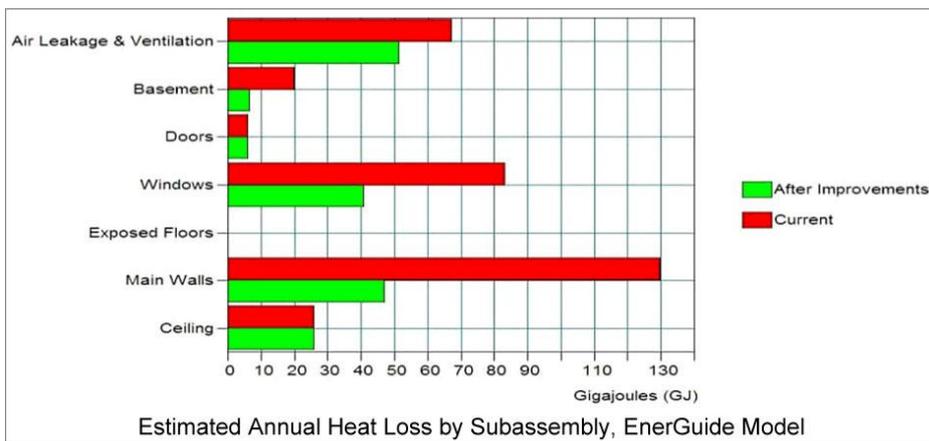
no longer a taboo even in buildings that are protected monuments or cultural heritage objects.

As a rule, as was already said, the cultural heritage institutions and also architects, investors, owners of houses and companies producing windows should consult with each other and make an evaluation on the importance of the object to be restored. The cultural and historic importance and the expected use play thereby an important role. Nevertheless, ecological and economic aspects are rational criteria when making the decision for or against PVC windows. This easily brings us to the conclusion that monasteries or mediaeval castles and a Gothic cathedral should forsake PVC windows, while for the majority of other buildings, from the inflationary increasing number of such buildings as mentioned in the first part, it should first be thought about the many advantages of PVC windows.



The modern PVC systems of major producers with their manifold profile and equipment programme allow for a restoration in style in almost all old and historic buildings. All requests are met with various crossbar profile sections, pillars, vertical bars and crossbars as well as decorative profiles.

Of course, examples of unsuccessful window restoration where the window surfaces were not divided well and the glass surfaces and profiles were inaccurately dimensioned are known as well. Many historic windows, wings and glazings, have fallen victim to improper craftsmanship in the past decades, which has significantly reduced the value of the buildings. However, those negative examples are not only



about PVC windows, but also about wooden ones. This is, unfortunately, of the one part the result of harsh market conditions and competition where the bottom line of every decision making is the price, and

often it is the result of poor empathy when architecture and the facade design are treated with little understanding and sometimes they are even brutally ignored.

Time appropriate use is important. When rational thinking about costs meets with high quality profile system and the know-how of the craftsmen, then there are no

hindrances to perfect restoration with PVC windows. Precisely when old buildings need to be “prepared” for modern use, it is unconditionally necessary to build in modern materials according to the latest technical knowledge. Faithfully according to the principle of modern architecture: drafts with love for detail, careful selection of materials according to the technique.

Therefrom other rational solutions of the modern restoration problems ensue: concrete covers instead of wooden ones, central heating instead of a coal stove, insulation glass instead of a simple one, electrical lighting instead of candles, water supply line instead of a well, and, yes, PVC windows. The changed use of historic buildings and higher demands of later users should intertwine the loyalty to the design, beauty and functionality. Construction demands such as thermal insulation, sound insulation, sealing, ventilation possibilities, easy operation, theft protection, but also easier maintenance, as well as their cost-effectiveness are important arguments in favour of PVC windows.

## **PREJUDICES AND STEREOTYPES**

Of course, every new product has besides its advantages also some disadvantages. In case of PVC windows the objections are well known and they are, mostly, outdated. Today, what is generally not taken into consideration is the fact that things change and that the production of PVC profiles advanced impressively during the past decades. Global changes in the attitude towards the environment have not bypassed this segment of the economy either and they had a significant impact on the legislation in most countries. PVC profiles of today are not what they used to be twenty or more years ago, and environmentally friendly production has become a standard in most parts of this industry branch. Actually, this is one of the extremely rare examples where the practice preceded the legislation: The Association of European PVC Producers started as early as late 80s and early 90s of the last century the initiative Vinyl 2010 ([www.vinyl2010.org](http://www.vinyl2010.org)) which in later years gathered an until then inconceivable number of companies associated in the joint effort to make their production sustainable. In the year 2000, all this resulted in activating the Voluntary Commitment and implementing its obligations whose goals and deadlines are in accordance with the recommendations of the EU Environmental Committee and often even surpass them.

In the document of the Special EU environmental commission titled „Life Cycle Assessment of PVC and of principal competing materials“, made under the auspices of the European Commission and in whose creation PE Europe Life cycle engineering, Institut für Kunststoffkunde und Kunststoffprüfung from Stuttgart, Institutet for Produktudvikling Denmark and RANDA GROUP, Barcelona participated, it is clearly emphasised that from the sustainability and ecological acceptability viewpoint there are no pronounced advantages of other materials compared with PVC. Far back in the year 2000 the international non-governmental organisation for environmental protection The Natural Step declared that PVC can be accepted as a sustainable material and in 2002 the Johannesburg Declaration on Sustainable Development of the UN emphasised the important role that this industry has in the effort to create a more just and sustainable society.

## CASE STUDY: PVC WINDOWS AND ACQUIRING LEGAL STATUS

In the recent years neither individuals dealing with monument protection nor judges could be disinterested regarding the advantages of PVC windows due to their optical and technical qualities, as well as ecological and economic advantages. "The case of a window from Offenbach", as it is called in the literature, reported as early as 1992 of a house owner against whom a suit was filed by persons responsible for monument protection and who under the threat of a high fine was supposed to replace the already built in PVC windows with wooden ones. The first instance judge objected to the persons for monument protection saying that they lost touch with reality and confirmed to the house owner „that the PVC windows are far more practical, that they have a longer life and that their price is more favourable than similar elements made of other materials and that they do not disturb the general appearance of the building and the surroundings“. The competent ministry for the reconstruction of villages in the German province Schleswig-Holstein warned the all too zealous mayors that „... of course, within the framework of renovating villages the window selection is completely up to the individual. This is an issue of cost-effectiveness. No one is forbidden anything and no one is forced to use a certain material and no one is forbidden to use a certain material. We do in no way wish to discriminate against a whole group of products or even PVC as a material in general“.

The higher administrative court in Münster passed in 1992 the verdict in the concrete case of restoring the building/monument which partially stems from the 15<sup>th</sup> century „... that it is not true that PVC as a modern construction material may as a rule not be used in the necessary restoration work and replacements on old buildings. Thus, an owner of a damaged building cannot be directed to exclusively use such construction materials which were known at the time the building was constructed. Monuments, in the end, need to be in function. Of importance is not only the historic but also the modern use. In order for an old house to be used in accordance with the present time it is as a rule necessary to equip the building with modern technical attainments.“ (7 A 936/90).



Administrative Court in Braunschweig allowed to build in 64 PVC windows with crossbars (2 A 2101/92).

As a restoration example in accordance with the character of cultural monuments the Rodheim complex in Frankfurt am Main is often quoted. It was built in 1907 in the Wilhelminian ("Gründerzeit") style (style from the last third of the 19<sup>th</sup> century) the building was in 1989 declared a cultural monument and was eventually completely restored. As many as 695 TROCAL windows were thereby built in, all of which were individually measured and made in nine different basic forms. The system of TROCAL profiles and the craftsmanship of the company for the window production

provided a perfect solution whose esthetics and conformity with the style met the criteria of the persons responsible for the protection of monuments in Frankfurt. PVC windows with 1.2 million marks were the largest individual item in the restoration of the building. The construction authority had similar offers for frames made of different materials, however, they were about 50% costlier than the PVC windows.

Taking into consideration all documented advantages of PVC windows in restoring old buildings and monuments, this alternative material is in most cases the only proper solution. If, for example, one is aware of the extremely high need for restoration on the territories of the Eastern European countries in transition due to their being in poor condition, and if one knows the poor financial situation of municipalities and provinces, it is not possible in view of this huge need for restoration and repair not to discuss PVC windows. The protection of monuments is not an end in itself.



## THE NEW LIFE OF OLD BUILDINGS

The European society counts on the construction sector to ensure better living and working conditions in their social surroundings. For the construction industry this represents a dramatic shift: from an industry stimulated by technology to a sector stimulated by the needs of the society. The new key aspect of the development is sustainability and cultural heritage becomes the basis for acquiring a new, cultural dimension which is added to the three basic pillars of sustainability: ecological, social and economic. Changes and continuity will be the guiding theme of construction and conservation activities related to the cultural heritage. Maintenance, redesign, use and adaptation of historic buildings for a new function will be the focal point of architects, experts and construction industry. The ambition for the future is to respond to challenges, find balance between new demands on one and conserving authenticity/compatibility on the other side.

Very few historic buildings and sites have been conserved in the form in which they were erected. Most of them are actually a mixture of works from different periods, founded on differing values. When simple changes and modification on individual elements such as walls, windows, doors or the roof are necessary, the basic characteristics are usually clearly visible and the solution should not be too complicated. In certain circumstances it is necessary to replace the windows with those that are historically not authentic. As in any other intervention, such an undertaking must be fully documented in order not to cause perturbation between the original and the replacement elements. In such cases the new window must be, as far as it is at all possible, compatible with the historic character of the



building. Actually, the earlier replacement of old wooden windows with those of metal frames was a kind of a trade-off between aesthetics and functionality. Nowadays we regard those windows as cultural heritage.

## CONCLUSION

It is necessary to find ways to protect cultural heritage which in the best way coincide with the modern economic, social and cultural circumstances, as well as use the possibilities provided by new materials and technologies. In accordance with the sustainability principles, it makes sense more than ever before to adapt old buildings for a new purpose. There are even suggestions and opinions that restoration should be given advantage over new building because of the functional quality and durability of old buildings. In any case, new buildings are sustainable, energy efficient and ecologically friendly thanks to scientific innovations and the application of new materials and technologies, and this experience must be used also in restoration. Adaptive change of purpose (i.e. change of the object's function with improvements) of the existing old buildings may represent an opportunity for economically justified transformation measures to make them ecologically acceptable and energy efficient, at the same time increasing their value.

## REFERENCES

1. European Construction Technology Platform (ECTP), *Vision 2030 & Strategic Research Agend: Focus Area Cultural Heritage*, Strasbourg, March 2008
2. Council of Europe, *Convention for the Protection of the Architectural Heritage of Europe*, Grenada 3.X.1985
3. André de Naeyer, *New Materials for Safeguarding Cultural Heritage*, Antwerpen, Belgium 2003
4. London Group, *Forward Planning: The Functions of Cultural Heritage in a Changing Europe*, Discussion Paper, London 2000
5. The Group of Authors, Commissioned by European Commission, *Life Cycle Assessment of PVC and of principal competing materials*, July 2004
6. Dian Ross, University of Victoria / Faculty of Engineering, *Operating Energy Reduction in Heritage Buildings*, Victoria BC, 2007
7. English Heritage Publication, *Energy Efficiency and Historic Buildings*, London, November 2010
8. European Heritage Network, <http://www.european-heritage.net/>, January 2011
9. European Commission Website, *Research – Heritage – Environment*, [http://ec.europa.eu/research/environment/index\\_en.cfm?pg=cultural](http://ec.europa.eu/research/environment/index_en.cfm?pg=cultural), January 2011
10. *Constructive Conservation in Practice*, Web Site <http://www.english-heritage.org.uk/professional/advice/conservation-principles/constructive-conservation/constructive-conservation-in-practice/>, January 2011