

Modernization and adaptation of historical interiors

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Abstract

Modernization of the historical building's interior entails the need to take many decisions, often conflicting. Operational requirements, protection of the architectural heritage, fire-safety recommendations, construction regulations, all these aspects involve a whole set of problems that require a rational solution, respecting ambient architectural and historical value, as well as the needs arising from the planned transformation. Respecting complex spatial relationships, the introduction of the contemporary architectural means into the historic building requires custom design solutions. The method adopted to solve design problems rely on restoring the original technical solutions, based on an analysis of constructional elements of the original structure.

The paper describes methods and means used during the adaptation and renovation process of several interiors, both in design and construction domains. A tissue of a historical building required a special approach to these tasks, with special emphasis on good recognition of problems, careful planning and consistent implementing of proper solutions. An additional factor affecting the quality of the solutions is the planned building's function. Its occupancy and the complexity of the carried out processes substantially affect the ability of its adaptation. With several selected projects taken as examples, there is a description of problems which can be encountered in the design practice, and which would allow for the adoption of general and universal rules of conduct in the case of modernization, retrofitting, transformation or re-use of historical buildings.

Keywords: historical building refurbishment and modernization, technical equipment of historical building.



1 Introduction

The article contains a brief discussion of possible design methods related to the adaptation and modernization of historical buildings. The description applies to both architectural solutions as well as constructional and installation ones, and it is based on the Polish design practice dealing with these kinds of buildings. The examples given are used to illustrate the possible options and alternatives to some general solutions, and do not cover all activities.

The article discusses issues related to the adaptation of interiors only – conservation issues relating to repair and maintenance of the façades require a different approach and methodology; they do not usually interfere in the internal structure of the building. Adaptation and modernization of an interior, as opposed to purely preservation actions, often requires intervention in the very basic fabric of the construction of the building, its modification or, in extreme cases, its transformation. The effect of such conversions may extend from the complete retention of “external” cultural layer to the full transformation.

Considerations of work’s expediency stay beyond the scope of this paper. For this reason, the economic, cultural and social reasons of such refurbishments or restorations of the original appearance of the buildings are being completely ignored in this paper.

2 Design assumptions

The scope and complexity of the carried out modernization designs could make the basis for several general conclusions, which can be used with other works of this type. Of course, these cannot be any specific recommendations – a variety of construction techniques or spatial layouts and forms and functional requirements on the other hand, make restoration means an open question. Nevertheless, one may be tempted to find some common elements that can be used when implementing similar solutions.

The initial design settings include several elements determining the scope of permissible transformations or modifications. Some of them are the result of the investment assumptions (planned functional transformations); some come out of the provisions for the protection of cultural heritage, given as the state law or the conservation practice [1].

Methodological premises can be grouped as follows:

1. The dominant factors affecting the approach to the refurbishment:
 - a. Planned functional transformations.
 - b. Heritage protection determined by the acceptable level of interference in the structure and form of the building, indicating what elements can be under a complete or partial protection.
2. Functional (investment) assumptions:
 - a. Restoration or preservation and improvement of the function similar to the original one by adapting the building and its elements (structural, installation and equipment) to contemporary requirements (for example legal requirements, users’ comfort etc.).



- b. Implementation of a completely new function with a remodelling of the building's interior.
3. Scope of the use of technical means:
 - a. Maintaining the status quo of the building using techniques similar to the original, including the use of existing elements of the technical structure of the building.
 - b. The introduction of new technical and technological solutions, including internal installation systems.
4. Scale of intervention:
 - a. Use of existing building's substance at various levels to implement planned transformations.
 - b. Modification of the existing structure (with various degrees of interference, including the replacement of parts of an object).

Figure 1 shows these dependencies as a diagram. The design process concerning historical building differs a little from the “regular” course of architectural design, as the only significant difference is the introduction of heritage conservation requirements. The project cycle and the design process can be acclaimed as a kind of iteration and approaching the final optimal solutions. Conservation constraints arising from the structure of the building can be considered as the invariable and permanent factors and assumptions. The other elements are subordinated to these conditions and, to achieve the intended design goal, one has to pursue appropriate cycle's modifications.

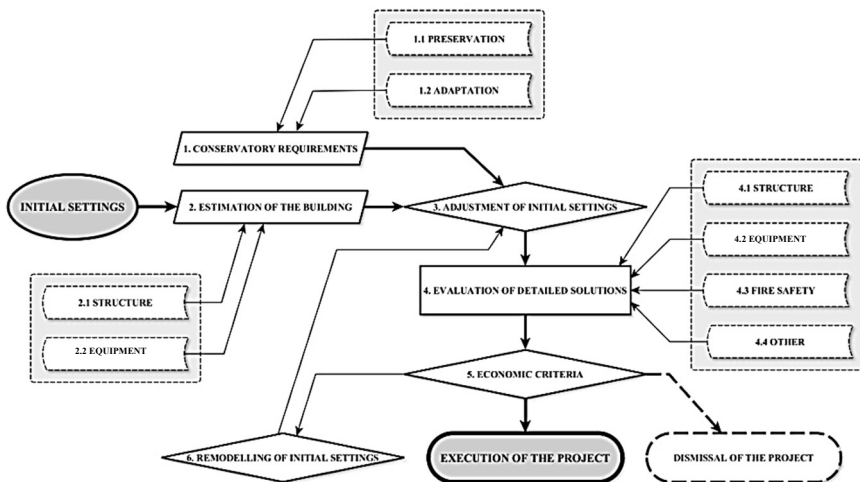


Figure 1: The methodology of the design process.

Building's elements being potentially subject to modification (Figure 2):

- a. The construction of the building (with a different range of interventions, from the maintenance to the complete change).

- b. The installation fittings (including large-scale ventilation and air conditioning systems, which have the greatest impact on the adopted solutions, demanding special space and installation shafts and ducts).
- c. The functional layout (internal communication, including stairways and elevators, the basic scheme or layout of the rooms).
- d. Others (fire-safety protection, day-lighting, special equipment).

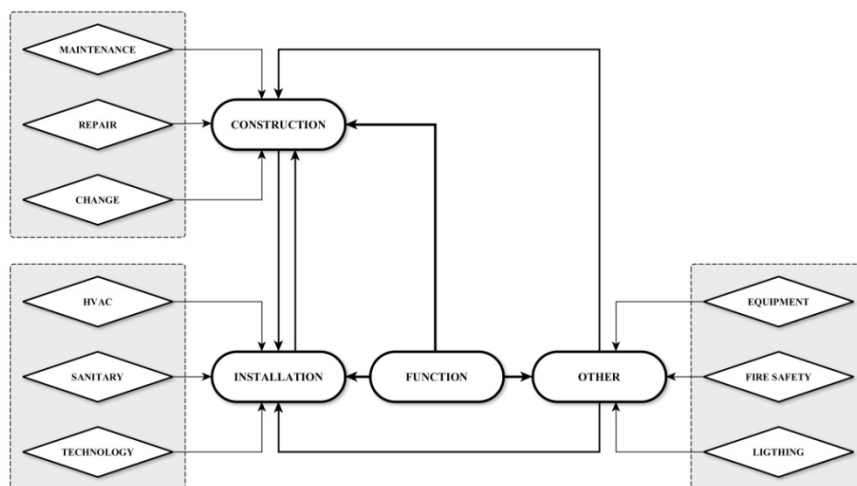


Figure 2: Relationships between the elements being subject to change.

Figure 3 shows that the function is the most demanding factor, interfering with almost all elements of the building. Virtually every alteration of the functional layout directly affects all other elements, proportionally to the extent and complexity of interference. Another key action is the change of installation equipment (Figure 4). This factor may vary regarding to initial functional settings, but also can be deduced from the need to adjust the building to current legal requirements or to increase a users' comfort without any functional transformation [2].

The choice of procedure path is determined mostly by the users' conditions, with a strong influence of heritage protection requirements. These factors define the scope of permissible activities and interference with the structure of the building, i.e. the range of acceptable transformations to the structure. Indirectly, the heritage protection thus decides how to make use of the object – any form of utilization entails the fulfilment of certain technical requirements and providing a technical space which is not always possible to meet the rigour imposed by heritage protection. While the introduction of relatively simple functions is feasible in virtually any building, a more complex functional layout implies more impractical or uneconomical outcomes. Heritage preservation and functional requirements often appear as two opposing (or even exclusive) aspirations.

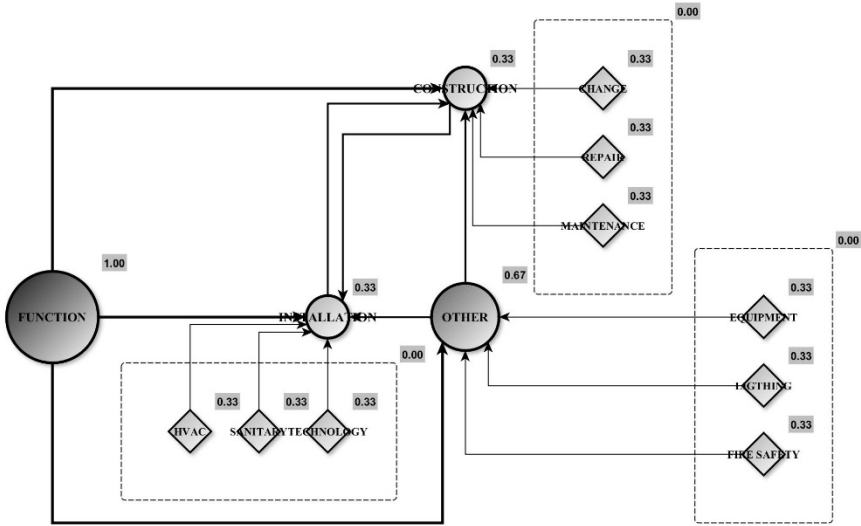


Figure 3: Weight of outgoing diagram's links. Function as the dominant setting.

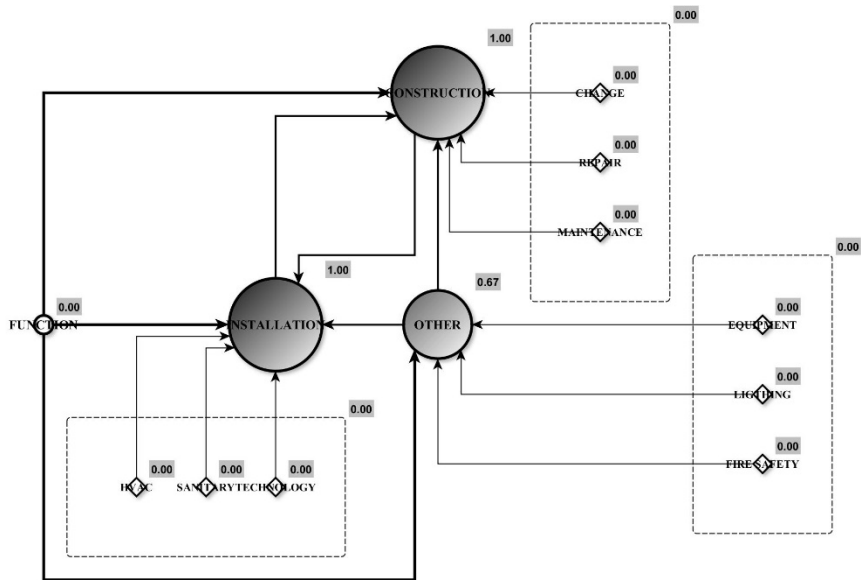


Figure 4: Weight of incoming diagram's links. Construction and installations as the most sensitive elements of a building.

3 Case studies

The examples of two design implementations show two different possible scenario transformations. For a sports hall, the limitations and requirements of conservation protection were relatively mild and not very restrictive, as opposed to the case of the main building of the University campus.

3.1 Bouldering gym at the stables' building of former military camp, Slowackiego Str., Gdansk. Authors: J. Bakowski and J. Poplatek. Design and realisation 2014.

The aim of the conversion was to adapt the building for a sports hall purposes, with several accompanying utility rooms. Based on admissible protection regulations, there has been a wide range of possible interferences in the building, including changes in the structural system. It has been one of the conditions and initial settings assumed by the investor to achieve the goal.



Figure 5: Bouldering gym, interior. Photo by J. Bakowski.

The aim has been achieved by removing one row of cast-iron pillars and replacing them with new steel structures, with a greater span allowing the assembly of the inner climbing wall.

The main problem was how to provide efficient mechanical ventilation for such a building, as there have been allowed indoor HVAC units only with one central machine room. The entire system has had therefore to proceed linearly along the halls. The interior design, with an industrial character, has allowed visibility of all elements of the technical infrastructure of the building.

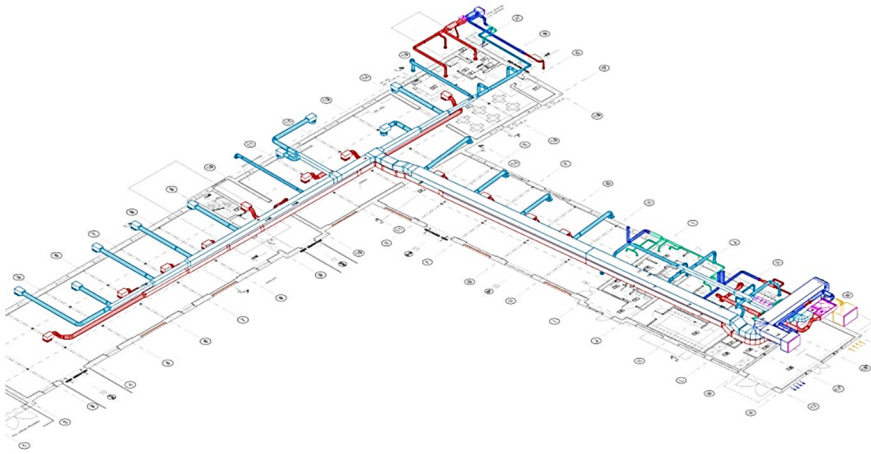


Figure 6: Bouldering gym, the HVAC layout.

3.2 Main building of Gdansk University of Technology, G. Narutowicza Str., Gdansk. Authors: W. Czabanski and J. Bakowski. Design and realisation: 2003–2012.

Over 10 years, the ongoing modernizations of the main building of the Gdansk University of Technology have made several substantial changes retrofitting it with a complete new system of mechanical ventilation and air-conditioning, two inner courtyards roofed and suitable for representative functions, the old clock tower reconstructed and a number of other solutions adapting it to modern requirements. Because of strict heritage protection and restrictions, all the elements have had to be checked and approved by the relevant heritage conservation department and the proposed solutions have had to be inscribed into the existing structure of the building.

For large-scale elements, mainly for mechanical ventilation or fire safety (fire water tank) there have been spaces created at the basement and at the attics. Additionally, some technical elements and equipment have been placed in the reconstructed architectural parts: the original chimneys and reconstructed clock tower have been used as air outlets and inlets. Also, the massive walls (with a thickness of up to 120 cm) have been used to contain new installation shafts.

4 Conclusions

From a technical point of view, structural solutions have been the most crucial (with strengthening or replacement of bearing elements) as well as installations (especially with implementing the large-scale equipment of HVAC system). In the case of retrofitting of the historical buildings, there is no comfort to choose as an option against the structure of the building. All the design actions must be placed



Figure 7: Inner courtyard and reconstructed clock tower of the main building of the Gdansk University of Technology. Photo: J. Bakowski.

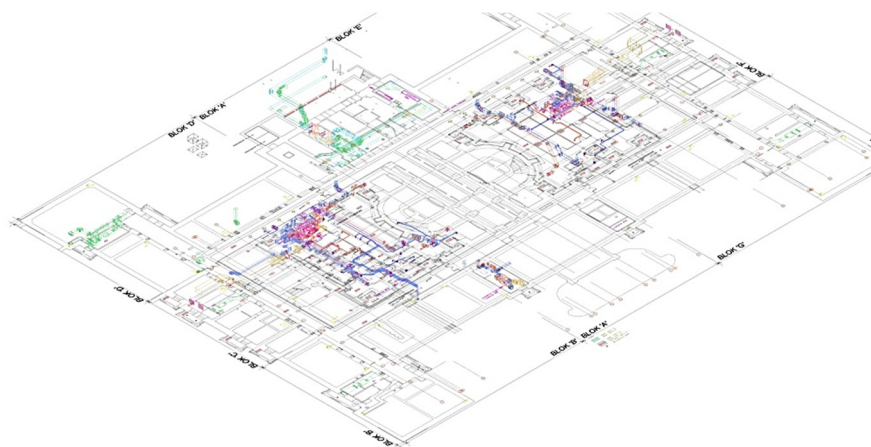


Figure 8: Basement of the main building, the HVAC layout.

in a ready system, where any changes and interventions are limited. By “structure” I do not mean only the design, but the whole set of equipment and technical means for the functioning of the object. So it can be any internal installations, technical or technological equipment.

The choice of adopted procedure path is determined primarily by functional prerequisites; also there is a strong influence of heritage protection requirements. They define the scope of permissible activities and interference in the structure of the building. Heritage conservation in this way can determine what the use of the building can be – because any form of functionality entails certain spatial and

technical requirements, and it is not always possible to meet these in a predetermined range of acceptable work.

Modernization of the building, especially the historical one, requires proper solutions to the problems characteristic and unique for this type of project. The construction of the new building allows one to resolve design issues freely; the designer decides how the spatial concept will meet the specific requirements – and if a parameter does not suit the concept, it could be freely transformed along with the building structure. In case of a contemporary designed buildings there is a multitude of possible solutions available, shaping not only the form of the building, but also its internal structure – construction, installations, system of functional relationships and much more.

Of course, still there is an pertinent question, how the newly designed building would be a subject of possible changes in the future – assuming the duration of the object and its use in accordance with the planned primary function, in the long run.

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