LEGAL ANALYSIS OF CONCEPTS TO COMBINE BUILT HERITAGE PRESERVATION WITH ORGANIZATIONAL AND TECHNOLOGICAL FIRE PROTECTION

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Fire safety and built heritage preservation are significant topics in engineering and architecture. Meeting the requirements of both issues in a revaluation or reconstruction project often leads to conflicts that hardly can be resolved to the satisfaction of both interests. Thus, for example, on the one side, installation of fire exit signs or the placement of fire extinguishers affect the historical appearance of built heritage. On the other side, these installations are essential for fire safety. The authors inform about requirements from fire safety and built heritage preservation with a focus on German law. They discuss relevant recent research literature as well as rules and regulations. Furthermore, the authors analyze current court cases, focused on the conflict between organizational and technological fire safety installations and the historical appearance of built heritage. The conclusion is that organizational and technological fire protection installations may negatively affect the historical appearance of built heritage. Nevertheless, in acknowledging the importance of both issues for the society, solutions to balance these interests must and can be found.

Keywords: Safety aspects, Historical appearance, Protected buildings, Balance of interests.

1 INTRODUCTION

Historical buildings all over the world are damaged or destroyed by a high number of fires every year. Worldwide, in average, 3.5 million fires are recorded annually (International Association of Fire and Rescue Services 2023). Fires are costly in both human lives and resources. The irretrievable loss of historical structures and its interior is a tragedy for a society and futures generations. In April 2019, a fire broke out in the famous cathedral of Notre Dame in Paris and destroyed the wooden roof trusses. Only a detailed evacuation plan ensured the rescue of valuable art objects (Hussain 2019). Besides the direct damage, also indirect costs and damages must be calculated if built heritage is affected or destroyed by fire. As one example for these indirect costs, reduced tourism earnings can serve. For cities for which built heritage plays a major role in attracting tourists, fires can result in a relevant economic damage.

In Germany, around 1.3 million protected historical buildings, including 51 UNESCO World Heritage sites, exist. Thus, heritage protection strengthens both tourisms and economy and therefore enjoys a status of high importance (German Government 2023). The German
comprehensive fire safety legislation helps to keep historic structures operational and to preserve them and their interior for future generations.

Fire safety regulations must be complied for all structures - either for new or existing buildings. But, in built heritage, fire protection installations may negatively affect the historical appearance of the structure. The goal of heritage preservation normally is to retain the built heritage in its substance and its appearance, ideally unchanged and without damage (Vereinigung der Landesdenkmalpfleger in der Bundesrepublik Deutschland 2014). On the other side, historic buildings should be open for the public and useable. Thus, installation of fire protection systems will be necessary to ensure the safety of the users and to protect the historical structure including its interior. However, meeting fire protection regulations frequently results in conflicts between their requirements and heritage preservation goals. The authors examined if there is a way to combine the interests of fire safety and heritage protection.

2 METHODOLOGY

The authors analyzed requirements from fire safety and built heritage preservation with a focus on German law. In the research, the federal system of Germany must be acknowledged. Germany consists of 16 federal states with their own legislation power for several legal topics. For building safety, building design, and heritage preservation, each individual federal state enacted its own law with partly different requirements (Holschemacher and Quapp 2020).

Resulting from this federal system, there are 16 heritage protection acts and 16 building acts, one in each of the German Federal States. Heritage protection regulations can be found in the Federal States’ heritage Protection Acts, fire protection requirements in the Federal States’ building acts, accompanied by several technical rules and regulations. However, because of their orientation at the German Model Building Code (Building Ministers’ Conference 2002), fire protection regulations in the Federal States’ building acts are quite homogeneous. The authors carried out their investigations regarding the legal requirements at the example of the Federal State of Saxony. Saxony is an excellent example because it has more than 103,000 protected historical sites (Saxon State Office for Conservation of Monuments 2015). Due to the similarity of the Federal States’ regulations in building and heritage protection law, the research results can also be transferred to other German Federal States. Additionally, the authors analyzed relevant research literature and current court cases, focused on the conflict between organizational and technological fire safety installations and the historical appearance of built heritage.

3 FIRE SAFETY

Organizational and technological fire protection are measures of preventive fire safety (Quapp 2014). They focus on the prevention of the development of a fire. At the same time, preventive fire protection measures pursue the goal of averting the spread of fire and thus reducing fire damage (CWS International GmbH 2023). Technical fire protection uses various fire protection measures to detect fires at an early stage (e.g., by means of smoke detectors or a fire alarm systems) and to prevent their spread (e.g., by means of extinguishing systems). Organizational fire protection includes measures, such as fire safety instructions, fire protection plans, and escape route plans that supplement the technical fire protection measures. The aim is also to prevent fires as far as possible and to protect people and property in the event of a fire (CWS International GmbH 2023).

German fire protection regulations are quite detailed and have been developed over hundreds of years, since the 13th century (Holschemacher and Quapp 2020). In general, structures, not only in Germany, must be designed, constructed and revaluated with regard to public safety and good order (see as an example Federal State of Saxony 2016). Fire damage can be caused directly by
direct exposure to fire (flames) or indirectly by high heat. Further, outbreak of fire and the spreading of fire and smoke must be prevented (Federal State of Saxony 2016).

4 FIRE SAFETY IN BUILT HERITAGE

Building heritage in Germany is defined as buildings and constructions whose conservation and use are of public interest because of their historical, artistic, scientific, urban and landscaping importance (Federal State of Saxony 1993). Those protected structures document the human efforts, the world of ideas, and the value system and thus, in their regional diversity and character, contribute to the uniqueness of the built environment (Vereinigung der Landesdenkmalpfleger in der Bundesrepublik Deutschland 2014).

Users and owners of protected structures are required to care for the built heritage, to protect it from danger and to preserve it in line with the historic preservation principles (Federal State of Saxony 1993). On the other side, users and owners shall allow open access to the public, to the extent which is reasonable (Federal State of Saxony 1993). Nevertheless, with a more intensive use, the danger for fires increases, especially in structures which are constructed from historical building materials such as timber and straw or with former time’s construction methods (e.g., with ceiling openings or without minimum distances to other buildings). To guarantee the safety of visitors and a continued existence of the built heritage, also historical structures normally must comply with current fire safety requirements (Administrative Court Ansbach 2022). These requirements often lead to conflicts between users/owners’ interests, fire safety needs and building heritage preservation goals. Which consequences it may have, if there is a lack of fire safety in historical buildings, the fire in the Duchess Anna Amalia Library in Weimar showed. In 2004, in total 118,000 books of unique historical value from the 16th to the 18th century were damaged and 50,000 books were destroyed (Mitteldeutscher Rundfunk 2020).

5 CONFLICTS BETWEEN FIRE SAFETY AND HERITAGE PRESERVATION

Revaluation and modernization of built heritage contribute to its preservation for future generations. The tragedy is that precisely these construction works often lead to outbreak and spread of fire (Kabat 2017), as it happened 2019 in the cathedral of Notre Dame in Paris, where the fire probably resulted from reconstruction works. Furthermore, preservation interests often collide with fire safety requirements (e.g., in the case of wooden staircases) (Geburtig 2017). Fire safety measures may have a negative effect on the historical appearance of the structure itself and on its interior (see Figures 1 and 2). In German law, both interests are of equal importance without a priority of one of these interests. That means, in case of conflict, courts have to balance between the two objectives in the individual case (Quapp and Holschemacher 2020).

If it is not possible to comply with all of the up-to-date fire protection measures in the historic structure, because they affect the historical appearance and/or function of building heritage, building authorities may allow an individual fire safety concept, that ensures the best possible fire safety for users and the structure (Administrative Court Ansbach 2022).

6 TECHNICAL SOLUTIONS TO BALANCE THE INTERESTS

In Germany, state building authorities are responsible for allowing construction works in built heritage. Together with the state heritage preservation authorities, they are responsible to find a balance between fire safety and heritage protection interests (Administrative Court Berlin 2022). Often, individual fire safety concepts are the only solution to balance both fire safety standards and preservation interests.
It is important to raise construction workers’, planners’ and users’ awareness for the special characteristic of historic constructions. With respect to the age and specialties of protected structures regarding their construction systems and building materials, fire preservation measures developed for new constructed buildings often must be adapted to the historic structures.

Also, in building heritage, basic principles of fire safety must be obeyed as well to protect life health of the users. That means, before installing fire safety systems, a fire safety analysis of the built heritage has to be made. Finally, while planning individual fire safety concepts, an evaluation is necessary whether constructional fire protection requirements also could be met by technological or organizational fire protection measures, to avoid an effect on the historical appearance of the structure. At the end stands an integrated fire safety concept that contains synchronized structural, technological and organizational as well as defensive fire safety measures (Quapp and Holschemacher 2020). Ideally, it balances all the interests of heritage preservation and fire safety. For reaching this aim, owners, state building authorities, and state heritage protection authorities are required to work together in a solution-oriented way.

Technological fire protection measures normally used for new buildings can be unsuitable for building heritage, such as automatic water sprinkler systems. These water-based systems may destroy parts of the building which are not involved in the fire such as water sensible interior with culture historic importance, for example in archives, libraries, and theaters. The authors found some creative alternatives to the classical fire safety measures in literature (e.g., Geburtig 2014, Bernardini 2017, Geburtig 2017). As alternative solutions instead of automatic water sprinkler systems, water mist systems according to DIN EN 14972-1:2021 DE (CEN 2021) could be used, such as in the historical palace theatre Celle/Germany (17th century), where a water mist system was installed which uses a pressure of 200 bar (Kleindienst 2018). Some of these fire protection installations can be hidden, e.g., in columns and walls, to leave the historical appearance unchanged. The Anna Amalia Library is an example where such hidden devices are used.
Also, linear infrared fire detectors, fire alarms systems and smoke detectors can serve as examples for innovative fire safety measures that respect the historical appearance of protected structures. In the castle ‘Wartburg’ in Thuringia/Germany, a smoke extraction system included in historical windows in the staircases preserves the window glass in case of fire by enabling smoke extraction without breaking the glass (Kabat 2017).

In archives and libraries, or in other places not often frequented by people, such as storage for historic costumes or instruments and stage decorations, gas extinguisher systems or active fire prevention systems reducing the oxygen percentage in the air, could be suitable, according to DIN EN 16750:2020-11 (CEN 2020). As regards the latter, controlled supply of nitrogen reduces the risk of an open fire strongly while the areas basically stay accessible and usable.

Escape and rescue routes are a problem in many historical constructions. To preserve an old wooden staircase, escape and rescue routes could be via an external staircase (Stellhorn 2015).

7 CONCLUSIONS

Protection of historical structures from fires means active built heritage preservation. Fire safety with respect to heritage preservation can be achieved by using up-to-date fire protection methods and by an individualized fire safety concept. Thus, fire safety installations can be transferred to outside of the structures, such as external rescue routes or can be kept unseen to leave the historical appearance unchanged. It is possible to find creative and suitable solutions if building authorities, heritage protection authorities and owners cooperate. Therefore, meeting legal fire resistance requirements, acknowledging economic interests and contributing to heritage protection do not necessarily have to be a contradiction. Researchers shall work for more effective and sensitive fire safety systems that respect the special needs of historical buildings. The authors plan to re-evaluate the technical development on the fire safety field and its benefit for heritage protection every year.

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