Heritage Protection Regulations in Germany and their Relations to Fire Safety Demands

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Abstract. Historical constructions are an important value of the world’s cultural heritage. Nearly each day, newspapers inform about fire damages in protected buildings. One reason is that historical constructions often are very fire sensible due to ancient building methods and easily flammable building materials. Therefore, fire safety regulations contribute in an essential way to the countries’ heritage protection. Furthermore, they avoid personal injury, property loss and environmental damage. Heritage protection law tries to preserve historic buildings but, in Germany, it often collides with various safety requirements, such as on load-bearing capacity and fire safety. The paper analyzes recent German heritage protection regulations for preservation and reconstruction of historical buildings and shows the difficulties to balance the interests of heritage protection on the one side and safety aspects on the other side. The authors explain various concepts of fire safety in historical constructions as well as current German legal and technical fire protection regulations for historical buildings. On the example of fire safety demands, the authors show the difficult relationship between heritage protection and safety requirements. They conclude that safety regulations and historical structure protection should not be antagonists but rather collaborate in the interest of preservation of cultural heritage.

1. Introduction

At the end of March 2019, there was a fire in the Institute of Palatinate History and Cultural Anthropology in Kaiserlautern/Germany. By the fire not only the old building was damaged but also numerous historical documents, books and map material. And recently, in the cathedral of Notre Dame in Paris raged a fire and destroyed the wooden roof trusses. Only due to a detailed evacuation plan, valuable art objects were rescued.

Each year, in Germany and all over the world, historical constructions are damaged or destroyed by fire. Fire damages result in enormous direct and indirect cost, e.g. in Germany approximately 0.2% of the gross domestic product, which means around 2.5 to 3 billion Euro per year [1]. However, some damages cannot be compensated such as the loss of building heritage and other cultural heritage. Thus, German legislators have developed comprehensive fire safety and heritage protection regulations to keep historic constructions operational, to show their beauty and to preserve them and the interior for posterity. The difficulty is to link the conservation of architectural spaces to needs of people who use the spaces [2].
2. Heritage protection in Germany

2.1. Importance of heritage protection in Germany

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 [3]. Historical constructions become state protected when registered on the list of building heritage [3]. The listing is done by the state heritage protection authorities, on the suggestion of the owner or the municipality where the historical building is located in.

As the United Nations Educational, Scientific and Cultural Organization (UNESCO) stated, 47% of the protected historic constructions are located in Europe and North America and around 78% of the listed UNESCO-heritage are buildings [4]. In the year 2018, the federal budget of Germany for the support of heritage protection was more than 169 million Euro [5]. Additionally, the protection of building heritage is supported by legal requirements, approval procedures and taxes.

Beside the state also private organizations or persons are active in monument protection such as the German Foundation for Monument Protection (Deutsche Stiftung Denkmalschutz) or heritage protection volunteers.

2.2. Federal states law

Resulting from the federal system of Germany, there are 16 heritage protection acts, one in each of the German Federal States. Because of the fact that in the Federal State of Saxony 103.000 protected constructions are located [6], heritage protection enjoys a status of high importance in Saxony. But, the amount of historical buildings in Saxony are both a curse and a blessing at the same time. On the one hand, building heritage stimulates tourism but, on the other hand, it needs enormous efforts in preservation. That’s why the paper concentrates on the situation in Saxony.

The Saxon Heritage Protection Act (Sächsisches Denkmalschutzgesetz [3]), among others, defines protectable heritage, requirements for the treatment of monuments as well as the tasks and competences of the state heritage protection authorities. In other laws, such as the German federal state constitutions, an exceptional status of heritage protection is acknowledged [7].

Heritage protection has the task to protect and to maintain building heritage, especially to check its status and to ensure averting danger, Article 1 (1) Saxon Heritage Protection Act [3]. To realize this, state heritage protection authorities shall work together with owners and users of protected constructions. In all state planning and state measures, heritage protection must be considered in an appropriate way, Article 1 (3) Saxon Heritage Protection Act [3]. Furthermore, the interest of disabled people should play a role in heritage protection, Article 1 (4) Saxon Heritage Protection Act [3].

Owners and users of building heritage are required to treat the protected constructions with care, to preserve it in line with the historic preservation principles and to protect it from danger, Article 8 (1) Saxon Heritage Protection Act [3]. Additionally, the owners and/or users shall provide the public with access, to the extent which is reasonable, Article 9 (2) Saxon Heritage Protection Act [3].

To fulfil their tasks, state heritage protection authorities have the right to take reasonable measures. Thus, the authorities are responsible for granting authorization to reconstruct, to alter, to destroy or to remove the protected building. They are allowed to request information from owners and users regarding the building heritage, to enter and to visit the protected constructions, to exercise its pre-emptive right to buy the protected structure, to impose a fine on the owner or user up to 500.000 Euro if acting against heritage protection regulations or to expropriate the owners if they do not preserve the historical structure from danger [3]. Expropriation could be done if the building heritage owner for example is not able to prove sufficient fire safety in the protected building.
3. German fire safety regulations

3.1. Importance of fire safety
Fire and resulting emissions such as heat, smoke and fire gas may cause serious injuries and destruction of buildings [8]. Thus, fire protection contributes essentially to the prevention of death, injury, property loss and environmental damage [9]. Furthermore, fire protection requirements, especially for building heritage, help to preserve the state protected constructions and their interior for future generations.

Due to numerous fire safety regulations and continuous legal and technical development in fire protection, Germany could reduce the death by fire significantly [10]. That’s why the level of damages caused by fire is relatively low related to other western industrial nations [10]. However, there is still a significant number of fire disasters in historical buildings. To reduce fires and fire damages, the responsible state building authorities are checking carefully the compliance with fire safety regulations, especially in protected historical buildings. The legal basis for that are the federal states fire safety regulations.

3.2. Federal states law
Fire safety requirements are part of the German public construction law and can be found in legal building regulations which mainly serve the purpose of hazard prevention and regulate the implementation of buildings as well as structural works. Due to the fact that building regulations are legislation of the German Federal States, there are 16 federal states building acts, one in each of the German Federal States.

The federal states building acts require that constructions are to design, to construct, to maintain, to alter and to remove in a way that public safety and order, especially life, health and natural living resources will not be endangered [11]. The same applies for the removal of constructions and a change in usage. Requirements for fire resistance of building elements and flammability of building materials are a central part of the federal states building acts (e.g. Saxon Building Act 2018 [11]) and have been changed significantly over the years leading to comprehensive fire safety concepts for constructions nowadays. Additionally, fire safety regulations can be found in nationwide applicable technical standards such as German DIN Codes or Eurocodes (e.g. DIN 4102 [12], DIN EN 13501 [13] or Eurocode 2 [14]).

Normally, fire protection regulations are developed for new constructed buildings. But, additionally they contain schemes to deal with the specialties of existing constructions [15]. The difficulty in older or state protected historical constructions are the former times’ construction methods and a frequent use of easily flammable construction materials, e.g. timber or straw.

Fire safety requirements in Germany differentiate between preventive fire protection and defensive fire protection. In the paper, only preventive fire protection will be the topic.

Constructions in Germany are to design, to construct, to maintain and to alter in a way that incipient fire as well as spread of fire and smoke will be prevented. Furthermore, in case of fire, the rescue of humans and animals as well as an effective fire-fighting must be possible (e.g. Article 14 [11]). Dependent on the building class, federal states building acts contain requirements regarding building elements, building materials and construction methods. Thus, the fire resistance of building elements using fire resistance classes and the flammability of building materials using building material classes are defined. Additionally, there are rules regarding the structure’s division in fire compartments and provision of access routes for the fire service.

The design and construction of new buildings must be in compliance with all currently applicable fire protection standards. This will be checked by the responsible state building authority. If non-compliance with legal requirements has been found, the state building authority may stop the construction works, prohibit the usage of the building or may issue a removal or adjustment order.
4. Fire safety in historical constructions
As under 2.2 described, German heritage protection law requires the owner of monuments to care for the protected structure, to maintain and to protect it from damages, such as fire. That includes a sufficient fire safety in the protected structure. But, due to the characteristics of historical buildings, German fire protection regulations for new buildings often cannot be applied. Nevertheless, there are some basic principles of fire safety also building heritage must comply with. For existing constructions, local state building authorities can enforce the implementation of a modern fire protection if there will be a real danger for life or health of humans or animals (e.g. if there are no escape and/or rescue routes). But, while adjusting the fire safety concept of historic constructions to the current legal situation, heritage protection must be respected.

Because of the particular combination between various risk factors such as historical construction methods and easily flammable construction products, sufficient fire safety in protected constructions is challenging. Nevertheless, in historic buildings such as theatres, hotels, museums, churches or opera houses not every single current fire safety requirement is to meet. Only the fire protection objective must be reached [16]. It is the decision of the respective state building authority which extent fire safety measurements shall have and if legal and technical requirements for fire safety can be reduced (Article 3 (3) and 67 [11]). The state heritage protection authority must be involved in the decision to be able to ensure the preservation of historical constructions based on the respective heritage protection law of the Federal German States. Existing constructions must not be more affected than necessary by fire protection requirements.

Under certain circumstances, it is allowed to plan and build in non-compliance with fire safety requirements if standards will be met in an equivalent manner with a deviating technical solution (Article 3 (3) [11]). In this case, it is to proof that the planning is equivalent to the legal requirements – ideally within a fire safety concept. If the engineer is able to proof the equivalence of the deviating technical solution, the state building authority has to allow the deviating solution.

4.1. Conflict between heritage protection and fire safety
Preservation interests often collide with fire safety requirements (e.g. in the case of wooden staircases) while both are of equal importance [16]. To preserve the historical appearance and function of building heritage, not all of the modern fire protection measures are acceptable. Often, the structural status, existing preconditions as well as the desired usage of building heritage require special preventive fire protection measures. That’s why, individualized fire safety concepts are needed.

Furthermore, it is to acknowledge that refurbishment and modernization of historic buildings not always contribute to their preservation. The resulting construction works can lead to outbreak and spread of fire, as it can been seen at the example of the recent fire in the cathedral of Notre Dame in Paris, where the fire probably results from reconstruction works. For example by installation of modern technical systems, walls and ceilings will be opened which supports fire and smoke spread. Furthermore, a new building structure (e.g. by smaller units and conversion of attics) may affect and hamper the first and second escape route [17]. That’s why it is important to increase construction workers’, planners’ and monument users’ awareness regarding the special characteristics of historic constructions.

4.2. Solutions for balancing heritage protection and fire safety
For state protected historical buildings, the responsible state building authority has to find a balance between fire safety and heritage protection interests. Often, individual fire safety concepts are the solution for meeting fire protection standards in historic buildings. Usual fire safety measures for modern buildings can be unsuitable for building heritage, such as automatic sprinkler systems. These systems may water parts of the building which are not involved in the fire [17] and thus destroy water sensible interior with culture historic importance, such as in theatres, libraries or archives. An alternative are water mist systems, linear infrared fire detectors, fire alarms systems and smoke detectors.
There are some interesting examples available in literature where with creativity and in cooperation of state building authorities and owners, suitable solutions for building heritage could be found (see [2], [8], [16]). Thus, in the historical palace theatre Celle/Germany from the 17th century, a water mist systems was installed which uses a pressure of 200 bar [18]. In the ‘Schlaue Haus’, a protected historical building from the 16th century in Oldenburg/Germany, a fire control system including a water mist system prevents fire and smoke spread [19]. Smoke extraction systems included in historical windows in the staircases of the castle ‘Wartburg’ in Thuringia/Germany preserve the window glass in case of fire by enabling a smoke extraction without breaking the glass [17].

For areas not often frequented by people, such as archives or places where historic instruments, costumes, stage decorations or literature are stored, active fire prevention systems reducing the oxygen percentage in the air, are a solution. By controlled supply of nitrogen, the risk of an open fire will be strongly reduced and the areas stay accessible and usable [20]. Thus, active fire prevention systems protect valuable documents or interior from smoke and extinguishing agents.

Before fire protection modification of building heritage a fire safety analysis has to be made. Fire in historical buildings often will be caused by dilapitated technical installations, open fire or acts of arson [17]. Former time’s construction methods (such as close distance of buildings and ceiling openings) and the frequent use of easily flammable construction materials, e.g. timber or straw, supports spread of fire. This is aggravated by the missing of automatic systems for early recognition of fire as well as escape and rescue routes in many historical constructions. Due to the age and specialties of historic buildings, e.g. regarding construction system and building materials, requirements and fire protection systems developed for new constructed buildings only can be used with respect to the specialties of the existing structure. Nevertheless, some basic principles of fire safety also in building heritage must be obeyed.

The solution is an integrated fire safety concept which must include coordinated structural, technological and organizational as well as defensive fire safety measures to meet the specified protection objectives. Aim of such an integrated fire safety concept is to proof fire safety for one special building. It must balance the need for the safety of the user, damage prevention interests and heritage protection requirements. For reaching this goal, state building authorities, state heritage protection authorities and owners should cooperate solution-oriented and in the interest of preserving the protected structure.

5. Conclusions
Fire safety respecting heritage protection is possible by using modern preventive fire protection methods and by developing an integrated fire safety concept. Thus, fire protection can be hidden, e.g. in columns and walls to leave the historical appearance unchanged. Because it is possible to find creative solutions in cooperation with state building authorities, state heritage protection authorities and owners, meeting legal fire resistance requirements, economic considerations and heritage protection do not have to be contradictions.

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