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Libušín – Historical Building Fire

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Case Study

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Abstract

The case study deals with the analysis of the all-wooden object Libušín in Pustevny in the village of Prostřední Bečva in context: the architect and his work - fire - restoration of monument relationship. The Libušín was designed by Slovak architect Dušan Samuel Jurkovič. It was destroyed by fire in 2014 and subsequent this object was reconstructed. This case study is a good example of scientific reconstruction. For all repairs they have been complied with traditional handcraft techniques, using the original materials and technology. Also, the modern extinguishing technology based on a special inert gas and using a water fog low-pressure spray have been integrated for its fire protection into the future.

Keywords: Dušan Samuel Jurkovič; fire; Libušín; reconstruction

1 Introduction

Fires wooden historic buildings often represent an irreplaceable loss for our cultural heritage. When a historical object burns down, society loses not only material values, but also cultural values, i.e. a spiritual legacy that should be passed down from generation to generation. When future generations will no longer be able to admire rare murals or paintings, they will lose an important part of cultural identity. The protection of historical monuments is also specific in terms of the complexity of the intervention, due to the limited possibilities of arrival and access. Another problem is the protection of movable monuments inside these buildings, which must be evacuated in time in case of danger.

In recent years, there have been several devastating fires of wooden historic buildings in the Czech Republic, for example in 2002 the Church of St. Catherine's from the 16th century in Ostrava-Hrabová, in 2007 a bell tower from the 18th century in Železný Brod, in 2014 the tourist hostel Libušín in Pustevny, and also in 2017 the Church of the Corpus Christi from the 16th century in Třinec-Guty (Generální ředitelství HZS ČR, 2021; Otrusina et al., 2014; Nedělníková, 2017). Regardless of the cause of the fire, none of these buildings was able to be extinguished in time so that their historic structures and decoration remained undamaged.

Despite the destruction of the historic building, on the other hand, we could also perceive the effort to restore the buildings destroyed by fire. To this day, in the form of a replica of their original building, the church of St. Catherine in Ostrava-Hrabová (in the years 2002-2004), the cottage Libušín in Pustevny (2016-2018), and also the Church of the Corpus Christi in Třinec-Guty (2020-2021) was built.

In this case study, we will point to a good example of the reconstruction of a building destroyed by fire, in the view of the architect and his work - fire - restoration of a monument with the aspect to the concept of spark (impulse) and its significance for the origin, damage and restoration of the historic building Libušín in Pustevny in the Czech Republic.

2 Methods

Methodology of work consists of the following analysis of the available books, magazines and internet resources:

a) an analysis of an all-wooden object of a tourist canteen Libušín, which projected Dušan Samuel Jurkovič,
b) an analysis of the fire of that object
c) an analysis of the reconstruction process and its future fire protection.

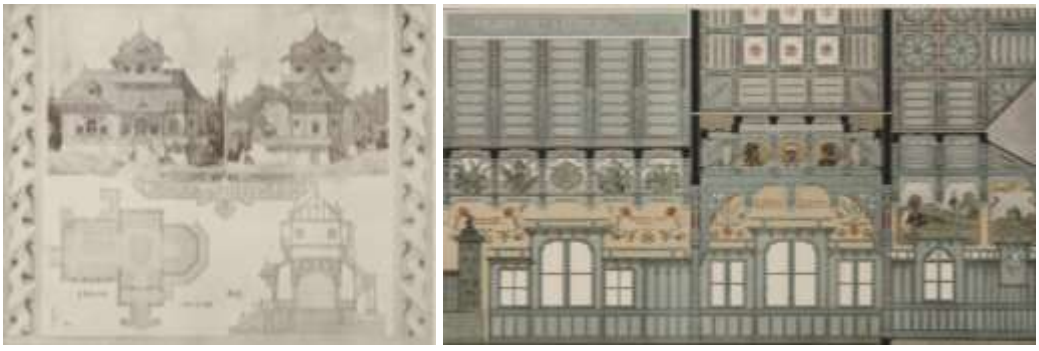
3 Results and Discussion

3.1 An architect Dušan Samuel Jurkovič and his Libušín

The first symbolic spark in the form of interest for wooden buildings appeared at a young age architect Dušan Samuel Jurkovič. He came from a very nationally aware family. He was born on August 23, 1868 in Turá Lúka and grew up in Brezová pod Bradlom. His father was a strong patriot and his mother was an expert in folk art. During his studies, he discovered the magnificence of folk wooden architecture in north-western Slovakia and the Moravian-Slovak border. He was especially interested in the wooden architecture of folk buildings in the Slovak unique village of Čičmany.

Already during his university studies at the State School of Crafts in Vienna, he became interested in wood working - carpentry work. In 1889, after a short stay in the Atelier of architect Blažej Bulla, he started practice in project office of architect Michal Urbánek in Vsetín, where he stayed for 6 years. In that time, he received a proposal for the hostel and dining room (Fig. 1, Tab. 1) on the Radhošť hill in the village of Prostřední Bečva. Jurkovič accepted this offer. These two buildings are considered to be Jurkovič´s most important works and thanks to them he earned the nickname Poet of Wood (Bořutová, 2009). He worked as an architect in three countries - in the Czech Republic, in Slovakia and in Poland. He was a prominent representative of Art Nouveau architecture. Unlike other Art Nouveau architects, he integrated many elements of folk wooden architecture into his projects. With the buildings in Pustevny – Maměnka and Libušín (opened on August 6, 1899), an architect Jurkovič shocked art theorists and also tourists.

The Libušín (Fig. 1) was built as a wooden log construction in the style of Folk Art Nouveau with a rich decor, which is typical for folk buildings in individual areas of Moravian Wallachia and Slovakia. The building had a stylish restaurant dining room with a capacity of 200 guests, which was built in the years 1897-1899 and named in honor of the Princess Libuše. There was also a kitchen, including food warehouses and facilities for staff, sanitary facilities for guests and a bar. The original building was followed by a separate technical background, which had brick perimeter walls with wooden cladding. The most valuable part of the dining room was the hall with richly decorated frescoes and sgraffitoes. They depicted motifs of Wallachian and Slavic legends, designed by the artist Mikoláš Aleš and painted by Karel Štapfer. An apartment was set up in the attic above the hall on the second floor, which in the time before the fire only served to store unused equipment. Above it was a lookout tower. The interior of the dining room was designed by the architect Jurkovič himself and consisted of three chandeliers, a sideboard, a greenhouse, a clock and 100 carved chairs (Hasalík, 2009).



(a) (b)

Fig. 1 (a) Original designs of Libušín, (b) Libušín's interior decoration (Jurkovič 1900).

The all Pustevny complex as a unique architectural and urban complex including log buildings in folk style (tourist hostels Maměnka, Libušín, Stará krčma, bell tower and chalet) designed by important architect Dušan Jurkovič. In 1958, it was inscribed as a cultural monument in the Central List of Cultural Monuments of the Czech Republic (LCM CZ) under No. 22962/8-295. Since 1995, it protected as a national cultural monument under No. 230 in the LCM CZ (Národní památkový ústav, 2021).

Among the significant changes during its use, we can mention changes in its colour. The original colour of the wooden elements designed by the architect Jurkovič in the interior as well as in the exterior was preserved until approximately the period of the First World War. A clear degradation of wooden surface finish was visible in photographs from Pustevny's visit with President T. G. Masaryk in 1928. Also the surface finish of wood of exterior elements (log beams, balconies, railings, columns, consoles, ceilings, painting of gables, etc.) based on oil paints was significantly damaged mainly by long-term weathering (Dvořák, 2019). Other significant damage of wooden elements by wood-destroying fungi led to an extensive renovation of the building, which was personally agreed upon after 1947 by the almost 80-year-old architect Jurkovič, who visited Libušín for the last time (Hasalík, 2009). Large reconstructions in object Libušín were in 1960 and from 1996 to 1999. Also in 2004, a complete remediation and sterilization of wooden elements infested with dangerous wood-destroying fungus (*Serpula lacrymans*) was carried out (Cultural Service s.r.o., 2007).

3.2 Fire of Libušín

The second spark was literally a spark, and it led to the active fire. At night of March 2-3, 2014, the fire of this building started. Firefighters from 13 professional and volunteer units took part (Tab. 1). However, the building was destroyed by a massive fire. The height of the ash locally reached a height of about 70 cm (Otrusina et al., 2014; Otrusina, 2015).

Tab. 1 Characteristics of fire of Libušín (Otrusina et al., 2014; Otrusina, 2015).

	Libušín
City	Prostřední Bečva
District	Vsetín
Country	Czech Republic
Description of the object	Tourist cottage with a dining room on the top of the hill Radhosť, detached building with an irregular floor plan with an area of 492 m^2, has one underground and three above-ground floors
Construction description	Wooden log construction in Art Nouveau style with many decorative elements
Fire brigade	Voluntary Fire Department (VFD) Prostřední Bečva, Fire Rescue Corps (FRC) Rožnov pod Radhoštěm, FRC Valašské Meziříčí, VFD Horní Bečva, VFD Horní Bečva, VFD Hutisko-Solanec, VFD Zubří, VFD Zašová, VFD Velké Karlovice, VFD Valašská Bystřice, VFD Frenštát pod Radhoštěm, VFD Trojanovice, VFD Karolinka
Time of declaration of intervention	00:17 03.03.2014
Time of arrival for the intervention	00:45 03.03.2014
End of intervention	12:40 03.03.2014
Total intervention time	12 h 23 min.
Intervening technique	Water tender
Number of firefighters	96
Affected area [m^2]	600
Used fire extinguisher	Water
Quantity [l]	20 000
Damage caused	80.5 million (approx. 3.1 million €)

In the time before the fire, the building was equipped with an Electric Fire Alarm Systems (EFAS) with outputs to the Integrated Security Centre of the Moravian-Silesian Region. Early intervention by fire brigades prevented the fire from spreading to Maměnka. According to the overall evaluation of the intervention (Otrusina et al., 2014; Otrusina, 2015), the negative specifics of this intervention were several facts such as strong wind, which supported the rapid development and spread of fire, long distances of fire brigades, elevation, which significantly limited the speed of older SDH units from the surrounding villages, the later arrival of altitude technology, the nearest underground hydrant malfunctioning, the high temperature in the attic of the building, and finally the information about the fire from the EPS to the Central Protection Desk was not transferred.

The fire was caused due to the unsatisfactory design of the chimney and the installation of the flue from the heating element. The air pocket in the chimney body was not insulated from the wooden structure. The contractor issued an inspection report on the lined chimney, stating that "the smoke ways are without obvious defects and safe". No appliance was connected to the chimney at the time of the inspection. Even though the chimney was not in accordance with the standards, a tiled stove was subsequently connected to it. No flue gas path revision was performed after the appliance was connected (Jiřík, 2014 cited in Otrusina, 2015).

3.3. The main principles for Libušín restoration

The restoration of Libušín as a national cultural monument was guided by the methodological procedure valid for museums in nature in the form of scientific reconstruction (Bryol et al., 2020). Its aim is to preserve as much as possible the original form of the building, including the originally used material and traditional technologies. The scientific copy is designed on the basis of survival and detailed documentation of the *in situ* original (focus, description, drawings and photographic documentations), material analysis, archival research and historical-ethnological research. The principles of the reconstruction of the Libušín building included:

- restoration of the original disposition of the building,
- removal of inappropriate interventions in the building and changes in color during the existence of the building,
- ensuring fire protection of the building according to the requirements of currently valid legal and technical regulations in the field of fire protection.

The fire protection of the Libušín building was based on the need to achieve the resistance of the wooden structure for 45 minutes, based on a properly selected type and location of a stable fire extinguishing system, or a combination of extinguishing agents (Masák, 2019). It was necessary to decide the function of the original tiled stove – with its original or only decorative function. An equally important decision was to determine the function of the restored building.

3.4. Comprehensive restoration of Libušín

Another spark in the analysis of the architect and his work - fire – restoration relationship was the impulse of people to restore Libušín. The speed, ingenuity and effort of people to support the public collection for its restoration clearly showed the remarkable value of this Jurkovič building. 9,926,175 CZK was collected during the public collection (from March 4, 2014 till March 3, 2017) (Koželuhová, 2018). The director of the Wallachian Open-Air Museum appointed a working group for the supervision of the professional restoration of the monument constituted by specialists from the Wallachian Open-Air Museum, the National Heritage Institute, the Monument Care Department at Zlín Regional Office, Fire Rescue Service of Zlín Region and from the Construction Department at Municipal office in Rožnov pod Radhoštěm. All members of working group were agreed on the restored building would correspond to the form of 1925 and that all works would comply with the rules of exemplary scientific reconstruction (Bryol et al., 2020).

The digital focus and processing of pre-project documentation was performed by the company Transat Architekti from Brno, which prepared a construction-historical survey of Libušín in the period 1886-2014. In 2016, architectural studio Masák & Partner from Prague as a winner of the tender was prepared project documentation for construction of the new Libušín and necessary technologies (Masák, 2019).

Initially, the foundations and torsion of Libušín were precisely focused, and subsequently was created 3D model using BIM software (Masák, 2019). The advantage of this software is the accurate visualization and placement of every single element in the object. This helped in the design of the fire protection system and engineering networks, their most suitable locations and at the same time hiding in the structures so that they do not interfere with the aesthetic elements of the structure. Based on the tender, the company Archatt from Brno was selected as the build contractor (Prudík, 2019). The reconstruction of the building began with the gentle dismantling and passportization of the preserved elements. Each wooden element was assessed in terms of fire damage, previous rot damage as well as in terms of the quality of its craftsmanship in previous reconstructions.

Only 12% of the original wooden structures and elements and approximately 83% of the original masonry parts of local sandstone have been preserved (Prudík, 2019). After cleaning the fire-affected place and during research and design work, the torso of the building was briefly covered with a steel structure.

During the construction of the new Libušín, traditional woodcraft techniques were followed, and the original materials and technologies were used (Bryol et al., 2020; Kloiber, 2020). One of them is that timber must be logging in the winter during the latent period, when there is a minimum of water and tissue in the tree trunk. This contributes to increasing resistance to wood durability. Therefore, the logging was in winter after a full month from November 2016. All wooden components in wet state were hand-worked, as was done at the time of the original construction. Hand-worked wood was used for the dining room building, the surface of which is smoothed by planing and not sanded. It affects not only the appearance of the surface but also its quality. In accordance with dendrological purposes, fir wood was used for parts of the dining room and spruce wood for other parts. The threshold beams in contact with the foundations were made of oak wood. The external staircase was made of spruce wood and the decorative elements in the windows were made of aspen wood (Prudík, 2019). Surface charred original wooden elements had to be cleaned to sound wood and their state was either used on its original place, or as material for another suitable place (Fig. 2a).

An important feature of Jurkovič's buildings is the color of the exterior cladding and interiors. Restoration surveys, laboratory analyses, photo surveys and, in close collaboration with conservationists and conservators, identified and selected nine color shades for surface coating of exterior elements such as perimeter cladding, brackets, railings, columns and for painting plant parts and geometric elements. Seven shades of the top color and three types of underpainting were identified, which were then applied in the interior. The color of Libušín returned to 1899. A manufacturer with a corresponding recipe for oil paints was found at Ottoson in Sweden (Matulíková et al., 2014; Dvořák, 2019). The interior decoration of the dining room, painting the walls with frescoes and sgraffitoes, was successfully restored to its original condition (Fig. 2b). According to the preserved drawings of the artist Mikoláš Aleš, their contemporary artists reproduced them.

(a) (b)

Fig. 2 (a) Log cabin wall with built-in original beams (Novák, 2018); (b) Paintings and frescoes in the new dining room, the vapour barrier is also visible in the lower part (Masák & Partner s.r.o., 2021).

Also, during excavation work was found shard from the original tiled stove in the dining room. According to its color and the rest of the floral pattern, the original lining of the new fully functional furnace was made. During the dismantling of the torso in the toilet, hidden original ceiling beams appeared under the plasterboard ceiling, flatly polychrome with plant motifs and dated 1891. These beams were preserved in original form and returned to the building in its original place. During the reconstruction, a private person offered to buy an original wooden cartouche with the emblem of the Pohorská Jednota Radhošť, which was planted in one of the beams (Novák, 2018).

According to Jurkovič's original designs and historical photographs, details were realized in the interior of the building that were not there before the fire, for example a glass ceiling in a dining room with colorful painted motifs, now made of fire-resistant glass 4 cm thick, a chandelier in the apside, which Jurkovič designed but never created (Prudík, 2019; Novák, 2018).

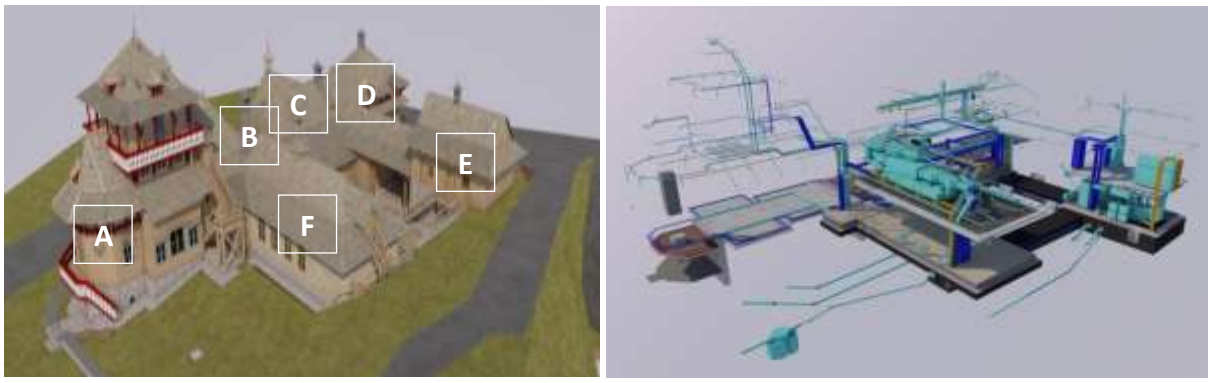
3.5. Fire protection of Libušín

A large concentration of people in Libušín puts special requirements on the timely and reliable detection of a fire, so that a similar scenario from 2014 never has to be repeated. Fire protection is important from the point of view of personal safety and protection of property.

Combined EFAS detectors containing optical-smoke sensors with a temperature differential system and a thermal sensor are installed in the entire building. A flame detector is located on the observation tower. Stable fire extinguishing equipment (SFEE) for volume and local fire extinguishing was placed in the building (Otrusina, 2017).

In the dining room as the most valuable room (Fig. 3), EFAS is installed with double suction for smoke detection. In the event of a fire, its protection is ensured by gas extinguishing, due to the complex division of the ceiling structure, the unique appearance of the dining room interior and its equipment. Gas stable fire extinguishers use a mixture of gases INERGEN as an extinguishing agent. It is a mixture of nitrogen 52%, argon 40% and carbon dioxide 8% (Otrusina, 2017). The extinguishing effect is achieved by reducing the oxygen content in the protected room to less than 15%, thereby extinguishing the fire. The gas supply, as well as all technical equipment, including the generator, transformer station, and technical room, is located in Pustevenka (Fig. 3a, b).

Here it is necessary to mention that in the process of designing the layout of SFEE and fire alarm, there was also a requirement not to disturb the aesthetic impression of the room, it means to be seen by firefighters and not by visitors (Masák, 2019).



(a) (b)

Fig. 3 (a) The Libušín areal: A) dining room with lookout tower, B) neck, C) pub, D) Parma extension, E) Pustevenka, F) kitchen; (b) Design of SFEE layout and fire alarm system in BIM (Masák & Partner, s.r.o., 2021).

As mentioned above, transparent fire glass 4 cm thick was placed on the coffered ceilings (Fig. 4).

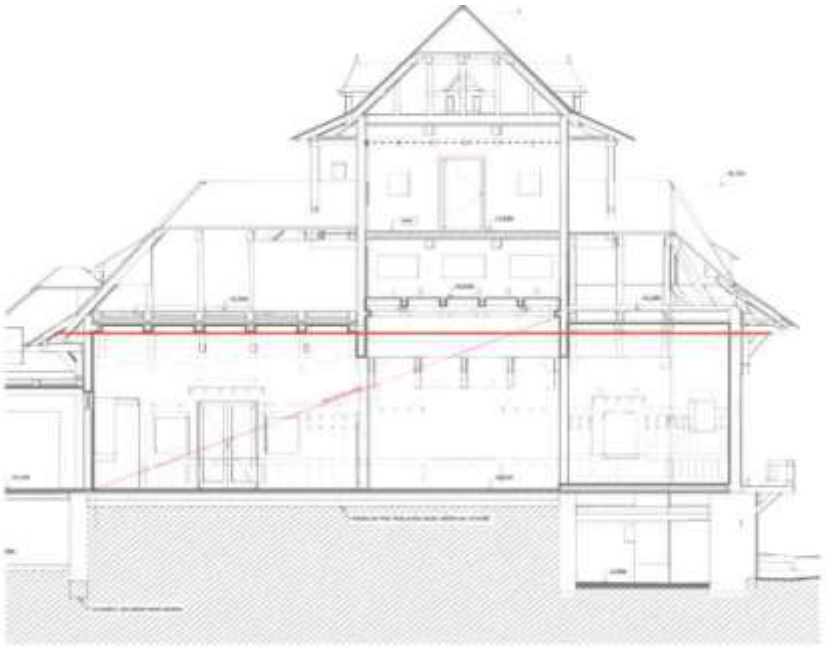


Fig. 4 Location of fire glass (red line) as protection of coffered ceiling (Masák, 2019).

It is a demanding and at the same time unique way of solving fire protection of buildings, which is used in server rooms, computer centres, electrical substations, in warehouses of hazardous and rare substances, but also in museum archives and expositions with archives and everywhere where it is not possible to extinguish with foam or water. This type of extinguishing is activated automatically by EFAS, detectors, but also manually. However, it requires hermetic sealing of the room and gas-tightness of the walls, so that during extinguishing the extinguishing gas does not leak into the outside environment and that the extinguishing concentration is maintained for 10 minutes. For this reason, a special vapor barrier reinforced with a mesh and provided with aluminium foil was inserted under the plaster (Fig. 2b). When using an air conditioner, the EFAS system stops the air exchange in the room. The door has automatic closing controlled by EFAS. Window closing is also connected to the EFAS system. The tiled stove door is also gas-tight.

In the interior of other parts of the building are built-in sprinkler SFEE, where the extinguishing agent is water (Otrusina, 2017). Sprinklers are activated autonomously, selectively, always those that are heated to the so-called opening temperature. In the ceiling of the pub, sprinkler SFEE with retractable heads are used, which have the advantage that they do not interfere visually, as they are hidden under plastic covers in the color of the ceiling and are extended by the water pressure when activated.

On the outside of the roof cladding, there are also built-in SFEE sprays with fixed heads that form a water mist. The extinguishing effect is based on the rapid evaporation and absorption of the heat of the fire by small drops of water mist. This provides total cooling of the protected object. On the side of Maměnka, it is supplemented by a sensor that reacts to a possible fire by Maměnka and starts sprinkling Libušín (Otrusina, 2017).

An underground tank with a volume of 200 m^3 was built in front of the building as a fire water tank. The whole building is secured by voice announcement and alarm sirens. All EFAS sensors are connected to the Central Protection Desk of Fire Rescue Service of Zlín region.

All extinguishing technologies, including electrical installations, are centralized in Pustevenka, from where the distribution lines lead through underground collectors to Libušín (Fig. 3b). The protection of this building is ensured by gas extinguishing. The technologies in the building are so complex that constant checks of their operability will be performed; some will be done once every six months and others even daily.

A similar integration of modern fire-fighting technologies based on extinguishing with a special inert gas occurs in the all-wood Orthodox Church of St. Nicholas in Hradec Králové (transported from Malá Polana from Slovakia in 1935), where there are rare murals on the log walls (Kostel sv. Mikuláše, 2020).

Low-pressure water mist is used for the external protection of listed buildings, such as all-wood churches in Norway and Poland. Of course, they are equipped with EFAS and many of them are connected to the workplaces of the fire brigade. They form a unified system of fire protection and security against theft, burglary and vandalism. The buildings are also equipped with motion sensors and camera systems as well as cameras with thermal imaging. The camera system, including other systems, is installed in indoor and outdoor areas on monuments, but also on columns in the vicinity of the monument. Churches are often located in places where there is not enough fire water, so large fire tanks or non-flooded fire pipes have been built near them in combination with smaller fire tanks, which will be used in the intervention of firefighters. The given technologies are controlled from technical rooms, which are built into the ground near the buildings (Palotová, 2018).

It is exemplary how protected monuments are in Norway, Poland and the Czech Republic, and what sophisticated fire protection solutions these buildings use to preserve them.

4 Conclusions

After the successful renovation of the Libušín building, which was destroyed by fire, and which was one of the largest and most important reconstructions of this type in the Czech Republic, we can say that the integration of modern technology into historic buildings is possible while maintaining their historic character. The newly built Libušín is in all respects closer to the Libušín, which the architect Jurkovič, our Poet of Wood, originally wanted to preserve here, than the one that was here before it burned down.

The modern technologies used do not deprive this building of its unique atmosphere; on the contrary, they are a great contribution to the fact that we can enjoy this atmosphere for future periods.

Thanks to what happened, other wooden buildings are gradually being equipped with fire-fighting elements. In this area we can observe a shift for the better and the figurative spark (impulse) continues.

Acknowledgments

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