

PAPER • OPEN ACCESS

## Construction-technical inspection of cemetery church of St. Peter and Paul in Želiv

To cite this article: J Daková *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **549** 012007

View the [article online](#) for updates and enhancements.



**IOP | ebooks™**

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the collection - download the first chapter of every title for free.

# Construction-technical inspection of cemetery church of St. Peter and Paul in Želiv

J Daňková<sup>1</sup>, P Mec<sup>1</sup>, T Majstříková<sup>1</sup> and M Škopcová<sup>1</sup>

<sup>1</sup> Department of Building Materials and Diagnostics of buildings, VSB – Technical University of Ostrava, 17. listopadu 2172/15, 708 00 Ostrava – Poruba, Czech Republic

E-mail: jana.dankova@vsb.cz

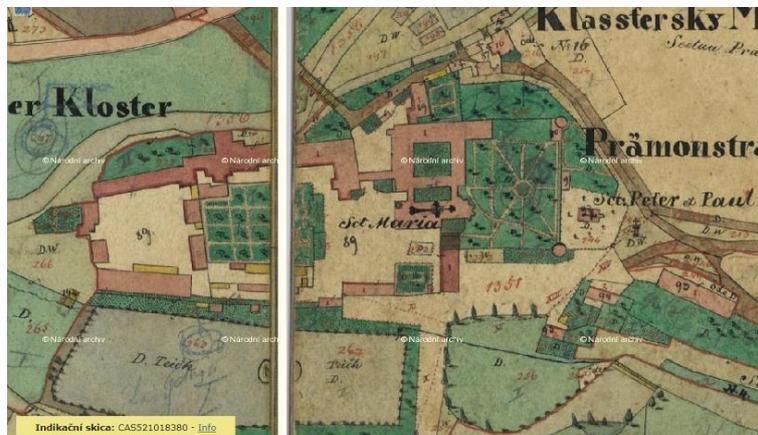
**Abstract.** This article deals with the construction-technical inspection of Cemetery Church of St. Peter and Paul in Želiv. The church is a cultural heritage and its history dates back almost for 900 years. The construction-technical inspection was performed with the goals to survey construction structures and define their major defects and failures before the commencement of constructional renovation. The survey also included measuring humidity of masonry and wooden parts of the structure.

## 1. Introduction

The Želiv Monastery is situated at the border of Bohemia and Moravia, at the junction of the Želivka and Trnávka Rivers, eleven kilometres westwards of Pelhřimov. The Cemetery Church of St. Peter and Paul is situated at the edge of the eastern part of the monastery premises and continues partly preserved remains of a historical fortification of the monastery (Figure 1). It is an oriented church of western, Latin rite.

The history of the Church of St. Peter and a Paul in Želiv has not been scientifically studies yet. However, it can be expected that it is closely related to the beginnings of history of the Premonstratensian Monastery in Želiv, or even to the beginning of the settlement in that location [1,2]. Although the Cemetery Church of St. Peter and Paul is often presented as “Roman”, it is very likely that it is a Baroque structure from the period of a large monastery refurbishment performed approximately in the 2nd half of the 17th and at the beginning of the 18th century (Figure 2). The last larger constructional modifications of the Church of St. Peter and Paul were implemented in the 20th century. The “Roman” designation may refer to an older, Roman foundation of the church. The goal of the construction-technical inspection was to survey the existing constructional structures and identify major defects and failures of structures.





**Figure 1.** The Church of St. Peter and Paul in Želiv: historical map of 1838 [3].



**Figure 2.** A picture of the church in the historical veduta of 1736 [4].  
(note: the church is circled in the figure)

## 2. Materials and methods

### 2.1. Constructional history of the church

Historians currently tend to believe that the monastery in Želiv was founded in 1139 and its founder was the Premyslid prince Soběslav I, however, the year of 1144 is also mentioned as a year of monastery foundation [2]. As admitted by some interpretations of historical sources [2], the first monastery in Želiv had already been finished in the stage of a wooden temporary structure in 1139. The first written mention of the monastery is from 1226 [2]. The constructional history of the church is bound to the history of settlement or the history of the monastery. The monastery was destroyed by wars and fires many times to be subsequently renewed as to the construction and spirituality. The Roman architecture of the monastery disappeared even before the period of Hussite wars as in 1278 the monastery was pillaged in relation to the battle on the Moravian Field and in 1375 the monastery was burnt, including the monastery Roman basilica [5].

At the beginning of the 14th century during Hussite wars the monastery was highly destroyed and in 1467 – 1468 the assets of the monastery was pledged to the noble man Burian Trčka of Lípa [6]. Burian Trčka of Lípa belonged among leading noble men in the country. He recognised the church reformation and he did not belong in his religious belief to the Catholic church as presented at that

times by the Pope. This fact may relate to the Cemetery Church of St. Peter and Paul as the symbol of the Holy Trinity, situated in the west face wall of the church gable can indicate that the church was Protestant in the era of the Trček family reign.

At the end of the 16th century the monastery was gradually renewed. In 1644 the monastery and the whole region were attacked and pillaged by the Swedes and Premonstratians returned to the monastery only in 1653. The war events left the monastery highly dilapidated but in about 1655 a large Baroque renovation of the monastery was commenced, more or less preserved until the present days. In 1712 the monastery convent as well as the church burnt down. In April 1714 the monastery was visited by the recognised architect Jan Blažej Santini who designed a refurbishment of the monastery church in the spirit of Baroque Gothic. Repairs of the church were finished in 1720, but the works on monastery buildings and the interior of the church continued. There is currently a hypothesis that Santini also designed and implemented constructional modifications to the Church of St. Peter and Paul [7].

The third and the last fire in the monastery broken down on 12 August 1907. The Trčka's castle, the office building and other buildings were damaged by the fire. The convent and the church were only preserved from fire. One of the larger front towers of the church was damaged by fire. During the World War I a temporary military hospital was situated in the monastery. In 1939 – 1945 the monastery buildings were occupied by German Nazis. After 1950 a forced work concentration camp was established in the Želiv monastery. Since 1954 the monastery buildings were used for the operation of a mental hospital.

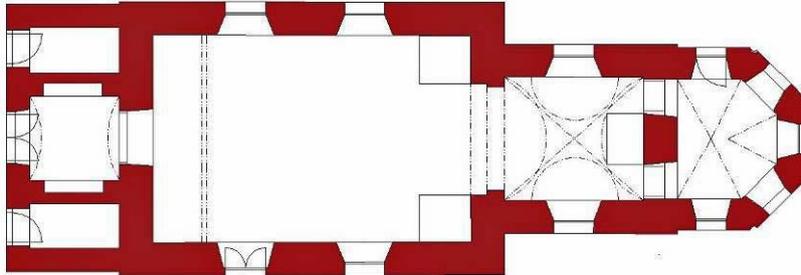
The monastery premises did not see any major constructional modifications in the period of 1933 – 1991. The technical condition of buildings was bad after the return of Premonstratians to the monastery in 1991. The famous Baroque monastery gardens disappeared completely, the valuable Baroque inventory, the library and interior of historical buildings especially suffered from irreplaceable losses. On the other hand, this situation of a neglected constructional maintenance and renovation caused that the artistic and material authenticity of constructions and materials from the Baroque monastery refurbishment have been preserved to a large extent.

## *2.2. Description of the construction*

Geographically, Želiv is situated at the border of Bohemia and Moravia, at the junction of the Želivka and Trnávka Rivers, at the latitude of 406 m. Geologically, the territory of the monastery premises and its surrounding is situated in the system of the Bohemian massif. Crystalline and prevaris paleozoic prevail, capping masses and postvaris magmatites partly occur in the location [8].

The Cemetery Church of St. Peter and Paul in Želiv is a single aisle, oriented construction with an offset presbytery. A younger polygonal apse continues the presbytery in its end. A narthex is built to the western face wall. The building has a double sloping roof, the roofs of presbytery and apse end with a hip in the eastern side. Above the presbytery there is a spirelet. The aisle ground plan has dimensions of 8.3 m x 11.49 m. The presbytery ground plan including apse has dimensions of 5.6 m x 7.2 m (Figure 3). No archaeological surveys have been performed in the Church of St. Peter and Paul that would identify hidden structure under the terrain level. The load-bearing circumferential walls of the church aisle and the presbytery consist of rocky masonry with the treatment of gaps evoking Roman masonry (Figure 4, 5). The secondary use of the building material from an older constructional stage of the church cannot be excluded (Figure 5). On the periphery of the masonry on its outer side there is an open ditch as a measure against higher masonry humidity. The thickness of the rocky masonry is 1 meter and the masonry is ended with a string course. The headway of the triumph arch is 7.060 m above the church aisle floor. The masonry of later structures (polygonal apse) is made of bricks or of mixed bricks with stones, the thickness of this masonry is 0.700 – 0.950 m. The church aisle has a flat wooden cassette ceiling and it originates from the latest refurbishment in the 1930s. The narthex, presbytery and apse are arched. The ceiling in the presbytery consists of an arched cross vault with stripped vaults, sacristy situated in the apse is arched with a concha with stripped vaults (Figure 6). The building is not heated, the ventilation is ensured through the doors and windows and venting

holes in the rocky masonry (Figure 4, 5). During the survey the temperature and average air humidity in the interior was 8°C, 60-65 %. The daily temperature and average humidity in the outdoor environment was 20 – 26°C, 55% at the time of measurement.



**Figure 3.** The ground plan of the church.



**Figure 4.** An eastern view of the church.



**Figure 5.** A detail of the rocky masonry with a venting hole.



**Figure 6.** The vault in the apse.

### 2.3. Defects and failures of the construction

The most significant failures are the ones in the roof cladding. During the inspection leaks in the roofing in the whole area of the roof cladding have been identified, and defects in the details of the gutter, corner and roof valley. Failures which resulted from the leakage of the roof cladding can be seen in constructional structures and materials in the interior and exterior. They especially include the degradation of plasters and cracks in the load-bearing structures, especially vaults (Figure 7).

A major problem is dampness of masonry, plasters as well as other materials. The dampness is manifested in dampness maps, complete degradation can be seen locally as well as blooming of salts in stones and bricks. Plaster, masonry and stone moisture by weight has been determined for the purposes of sanitation proposal. Results of plaster moisture determination are given in Table 1. Moisture plaster and masonry was determined in the laboratory by the gravimetric test.

The wood moisture measurement was carried out in structural elements in the interior. Non-destructive measurement with resistance moisture meters was used to determine the moisture content. The resulting wood moisture ranged in 13.9 – 31.7 % by weight. A large range of wood moisture values is caused by various wood surface treatments (e.g. polychromy), potential occurrence of metallic joining elements in the wood etc.



**Figure 7.** Cracks in the vault of the triumphal arch.

**Table 1.** Plaster moisture determination.

Sample	Humidity (% wt.)	Degree of moisture according to ČSN P 73 0610
<b>S1</b>	3.18	low
<b>S2</b>	3.34	low
<b>S3</b>	3.19	low
<b>S4</b>	3.85	low
<b>S5</b>	7.15	increased
<b>S6</b>	0.94	very low
<b>S7</b>	2.52	very low
<b>S8</b>	2.91	very low
<b>S9</b>	1.11	very low
<b>S10</b>	1.90	very low

### 3. Conclusion

The Church of St. Peter and Paul in Želiv is a cultural heritage with extensively reserved authentic form and material composition from the Baroque refurbishment in the 17th – 18th centuries. The defects and failures identified by the construction-technical inspection are not serious and do not present acute risks to the use of the structure. The reconstruction of the roof structures should be carried out simultaneously with securing the stability of vaults. The occurrence of manifestations of higher moisture in masonry, plasters and wooden structures can be efficiently managed by an adjustment of the interior climate to ensure a suitable temperature and indoor air humidity. In this case it is not recommended to control moisture in masonry and plasters by grouting or other radical methods, e.g. by insertion of waterproofing layers. Grouting would damage authentic historical constructional structures and grouting of the rocky and mixed masonry with a thickness of 1 m is difficult and provides little reliable effect.

### Acknowledgements

The work was supported from financial funds of the Conceptual Development of Science, Research and Innovations for 2019, allocated to VSB – TU Ostrava by the Ministry of Education, Youth and Sport in the Czech Republic

### References

- [1] Hejhal P 2010 *Zaměřeno na středověk* (Praha: Nakladatelství Lidové noviny) pp 581–585
- [2] Hejhal P and Šrámek J 2014 *Sborník k poctě J. Kalfersta* (Hradec Králové: Muzeum východních Čech v Hradci Králové) pp. 32–54
- [3] *Mapa kláštera v Želivi* (online, cit. 2019-04-16) available: <http://archivnimapy.cuzk.cz>
- [4] *Veduta* (online, cit. 2019-04-11) available: <http://www.wikiwand.com>
- [5] Petřů V 1898 *Klášter Želiv* (Praha: Cyrillo-Methodějská knihtiskárna a nakladatelství) p. 32
- [6] Charouz O Praem and Jindřich Z 1995 *Oživené dědictví – Premonstrátský Želiv včera a dnes* (Želiv: Opatství Želiv) p. 30
- [7] HORYNA M 1998 *JB Santini-Aichel–Život a dílo* (Praha: Karolinum)
- [8] *Geologická mapa* (online, cit. 2019-04-07) available: <http://www.geologicke-mapy.cz>