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The chain bridge of Francis I as an archaeological find. Discovery of the entrance ramp to the bridge on the Vltava river side at Malá Strana

ANNOTATION

Around the mid-19th century three chain bridges were built over River Vltava in Prague. The earliest of these, the bridge of Francis I by the constructor Bedřich Schnirch, was replaced in 1899 by a new stone bridge, today the Legion bridge. During a standard archaeological rescue excavation, the entrance ramp of the bridge was revealed in a trench for the reconstruction of a water pipe in Vítězná street, Malá Strana. This article also mentions other archaeological excavations of Prague industrial buildings.

SUMMARY

Numerous chain bridges have been built around the world, with the development of new technologies, during the first half of the 19th century however very few have survived to the present day. In Prague three bridges of this type were built in the 19th century (Fig. 1). First the bridge of Francis I built in 1839–1841, 25 years later followed by the bridge of Franz Joseph I (1865–1868) and immediately afterwards a chain footbridge between Rudolfinum and Klárov, completed in 1869. This article concerns the remains of the earliest Prague chain bridge with its entrance ramp revealed in 2013 during the archaeological excavation in Vítězná street, Malá Strana (Fig. 2).

The earliest chain bridge in our country and in the continental part of Europe was built in 1823–1824 in Strážnice by Bedřich Schnirch, the author of most of the chain bridges built in Bohemia, including the Prague bridge of Francis I.

The site for building of the chain bridge in Prague was selected at a suitable place where Vltava river is divided by Střelecký island, similarly as Kampa at Charles bridge, which shortens the distance to be spanned. The chain bridge of Francis I is composed of two separate bridges of the same length, which met on the anchoring pillar in the middle of Střelecký island (Fig. 7). The anchoring pillar was 20,66 m long and 15,54 m wide, flanked by two multi-storey buildings. The main bridge pillars with pylons (gateways open to traffic) were 132 m apart from each other (Fig. 8). The access to the bridge was enabled by entrance ramps, which also functioned as the anchoring body. The total length of the chain bridge was 412, 74 m, the width between the railing was 9 m (6 m of the road and 1,5 m of the pavements at each side). The 5,9 m thick bridge pillars together with the semi-circular finish spanned over 18,79 m. They were founded on a timber base underpinned by 156 timber piles. On top of the pillars stood the pylons – the gateways opened to traffic. The bridge construction was hanging on eight chains (two bunches of four on each side) leading through the pylon tops in the height of 10,5 m. The main chain section between the pylons had the loadbearing function; the chains behind the pylons were for tensioning, and the anchoring chains were embedded in the anchoring parts of the entrance ramps and in the central pillar on Střelecký island.

The bridge deck was hanging on both sides on a bunch of four chains in two rows above each other. The construction took around 3 years (1838–1841). The bridge eventually did not meet rising traffic requirements, and it was determined to be demolished. In 1898 traffic was moved from the chain bridge to the provisional construction next to it in order to allow its demolition the following year. A new bridge, later called of Legions, built 1898–1901, serves to the present day.

A standard archaeological rescue excavation revealed the remains of the well-preserved entrance ramp of Francis's I chain bridge. The vault of one of the entrance ramp chambers was recorded in a shaft on the corner of Šeříková and Vítězná street (Fig. 14: S12). More remains were discovered in a shaft on the corner of Vítězná and Všehrdova street, in particular the northern outer face of the bridge lined with granite blocks and the cast walling of the bridge core. Altogether four chambers have been documented, vaulted by a segment, which were reducing the load of the western narrower part of the ramp. The first three have longer span (10,5 – 9,5 – 9,5 m), the fourth one furthest to the east shortens to 4,6 m. The front of the ramp, where the tensioning ropes were anchored, was of monolithic construction with a chamber lower down in the centre. The 1,7–2 m thick walls between the chambers were built of quarried stone (marlstone and slate). The wall faces including the brick vault are roughly plastered by lime mortar.

The western part with the chambers is 12,4 m wide and ca 44 m long, including the thickness of the outer walls. In the second chamber S21b there is on the inner face of the front wall an inscription PF 1888, probably commemorating the introduction of the water pipe, which commenced in the area of Smíchov and Malá Strana in 1885. The outer appearance of the ramp is depicted on a panorama of Prague from 1865 (Fig. 25), but not on any photographs of the period. The function of the bottom, most western chamber, cannot be interpreted; we know neither its shape nor its size.

Chain bridges were one of the most common forms of traffic structures in their period, but we must admit how little we know about them today. They deserve more detailed studies not only from a technical point of view, but of the esthetical one also. The chain bridge of Francis I in particular deserves further investigations of its project documentation, which could answer many outstanding questions.

Fig. 1. Plan of Prague with the position of the three chain bridges built over Vltava in 1840s–1860s (depiction S. Babušková, 2016).

Fig. 2. František Fridrich, 1865: A photo of Prague from Petřín, from the garden of Kinský. In the front there is part of the Malá Strana defences with the Újezd gate, a block of houses by the Chotkova (Vítězná) street, leading to the chain bridge of the Emperor Francis I running over the Střelecký island to Ferdinand's, today Národní avenue. The space by the Malá Strana bank is not yet fully built on (copied from Bečková 2000, 166).

Fig. 3. Prague 1-Malá Strana, Vítězná ulice. General situation with the revealed parts of the chain bridge (**blue**) with the reconstruction based on the manuscript plan from 1885 (**blue hatch**). The Baroque fortification in **light brown** (drawing K. Žďárský and J. Hlavatý, editing S. Babušková, 2016).

Fig. 4. Josef Kriehuber, 1860: Portrait of the constructor Bedřich Schnirch from 1860 (copied from <<http://www.payne.cz/3xS43787/SchnirchBedrich.htm>>).

Fig. 5. J. D. Huber 1769: Panoramic plan of Prague, ink drawing – section with the position of the chain bridge of Francis I.

Fig. 6. A section of the Imperial compulsory print of the stable cadastre 1842 – a section. The plan originated shortly after the completion of the bridge of Francis I and depicts the original situation prior to the demolition of the Baroque ramparts, in particular the two bastions, between which the bridge passes. The newly built Chotkova avenue followed the completion of the bridge around 1840. Original in The Central Archive of Land Surveying and Cadastre ČÚZK, Cadastre funds, signature B2/a/6, 6068-1 (Č). Accessible on <http://wgp.urm.cz/app/tms/aplk/arcgis_api/ck_1842/index.html?view=6068-1>.

Fig. 7. Karel Würbst, 1841: The bridge of Francis I from northeast (copied from <<http://www.patriksimon.cz/vystava/21-v-zajeti-prahy/>>).

Fig. 8. Prague 1-Malá Strana, Vítězná street. Longitudinal section of the bridge, view to the north. Reconstruction based on the depiction of the bridge on the stable cadastre map, with projection of the section of the revealed entrance ramp documented during the archaeological excavation in 2013. The ground surface in the period of the construction and function of the bridge in **deep green**, **light green** the built up for the ramp on the west (depiction S. Babušková, 2016).

Fig. 9. Samuel Friedberg-Mírohorský, 1855: The end of the chain bridge in Chotkova street, watercolour. Low houses on the bank at Malá Strana with the fortification behind. The house No. 445 to the left and completely on the left the corner of the church of St. John Baptist Na prádle. Also significant elevation difference between the surface of the chain bridge and the surrounding ground is apparent (copied from Bečková 2000, 163).

Fig. 10. Eastern end of the bridge on the Old Town bank in front of the National theatre, with collectors' houses with the tension parts of the anchoring chains below. In the background to the north from the bridge a provisional timber bridge is being built as the replacement of Francis's I bridge, demolished shortly afterwards, and later replaced by current Legion bridge (photoarchive NPÚ GnŘ, N039121).

Fig. 11. Karel Würbst, 1840: Construction of a chain bridge of Francis I, oil painting. View from the east from the right bank. The pair of pylons between Ferdinand's street and Střelecký island is being completed. The flag flying behind Střelecký island indicates that the following two pillars with pylons are also being completed. The building of the anchoring pillar in the middle of Střelecký island has not been started yet. The embankment is covered with building stones from the demolished buildings or stones for building the outer face of the pylons (copied from Míka 2007, 50).

Fig. 12. Jindřich Eckert, 1899: Demolition of the old bridge of the Emperor Francis I and the building of the new arc-shaped one in its place, photo. View into the Harrach square, today the eastern part of Vítězná street (copied from Bečková 2015).

Fig. 13. Prague 1-Malá Strana, Vítězná street. View from the west towards the Legion bridge. Below the surface of the road the entrance ramp to the bridge spreads further from the crossroad towards the river. On the left side of the road there are trenches for the replacement of a water pipe (photo J. Havrda, 2013).

Fig. 14. Prague 1-Malá Strana, Vítězná street. The trench signed as S12 in the archaeological documentation, view to the southwest. In the front there is the inner face of the western outside wall of the chamber S21c (photo K. Žďárský, 2013).

Fig. 15. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge with the chambers S21a–S21d and trenches S02, S09, S12 and S25 archaeologically documented by NPÚ in Prague in 2013 (Havrda 2015a). In the trench S09 there is the north face of the anchoring part; in the trench S25 the channel for stretching the anchoring chains. In the chambers S21a and S21c there are the openings of the revision shafts embedded into the northern outside wall of the chambers; eastwards from the chamber S21a an entrance leads into the lower chamber, which was inaccessible during the excavation. Key: **1** – revealed walling; **2** – reconstructed walling; **3** – trench extent; **4** – archaeological section; **5** – current buildings; **6** – infill of the chambers during the construction of the new bridge (drawing K. Žďárský and J. Hlavatý, editing S. Babušková, 2016).

Fig. 16. Prague 1-Malá Strana, Vítězná street. The northern face of the widened anchoring part of the entrance ramp of the chain bridge, built of granite blocks, damaged by a trench for a water pipe. View to the south (photo K. Žďárský, 2013).

Fig. 17. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge, chamber S21a, view to the north. The front wall is cut by a later opening of a revision shaft, recent water pipe in the front (photo K. Žďárský, 2013).

Fig. 18. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge, chamber S21b, view to the northwest. There are two slit windows in the front outside wall, in the far corner to the left from the slit window there is an inscription PF 1888 (photo K. Žďárský, 2013).

Fig. 19. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge, chamber S21c. View to the northwest, partly infilled vault front contains the exit hatch from the second secondary revision shaft (photo M. Semerád, 2013).

Fig. 20. Prague 1-Malá Strana, Vítězná street. The cone of the infill of the eastern chamber S21a in the place of the dismantled outside wall of the entrance ramp, view to the south (photo K. Žďárský, 2013).

Fig. 21. Anonymous, 1885: the western end of the chain bridge, manuscript plan, with the layout of the boundaries between Smíchov and Malá Strana in the Újezd area. The entrance ramp of the bridge passes through the curtain wall of the Baroque rampart, with the bridge pylon on the river bank to the south from the bastion I (copied from Chodějovská 2013, map sheet 21, map 36).

Fig. 22. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge. The western part of the northern outside wall of the third chamber S21c is cut by a slit ventilating window. To the left from it there are capitals PF and 1888, which may refer to the introduction of the water pipe to Malá Strana and Smíchov in 1885. In 1888 the cast iron water pipe was probably drawn through the chambers of the entrance ramp of the chain bridge of Francis I. (photo K. Žďárský, 2013).

Fig. 23. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge with an exit hatch of a later revision shaft by the chamber S21c. The shaft is narrowing from an oblong to a square section; the access is on the steel steps set in the wall. Its steel lid is built into the kerb in front of the house No. 550/III (photo K. Žďárský, 2013).

Fig. 24. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge. A break through the cross wall between the infilled chambers S21d and S21c for the cast iron water pipe. In summer 2013 this pipe was replaced by plastic. The break is rebuilt to the face of the infilled western chamber S21d (photo K. Žďárský, 2013).

Fig. 25. Prague 1-Malá Strana, Vítězná street. The entrance ramp of the chain bridge. The infilled entrance from the chamber S21a to the front, lower anchoring part of the entrance ramp (photo M. Semerád, 2013).

Fig. 26. Prague 1-Malá Strana, Vítězná street. Work in the technological shaft signed as trench S25 on the south side of the street, before the entering of Zborovská street, view from the west. Situation during the dismantling of the cast wall of the anchoring part of the entrance ramp of the chain bridge. On the bottom right below asphalt and

levelling layers there is a brick vaulted channel sloping to the west for drawing the anchoring chains of the bridge down into the core of the anchoring part of the ramp (photo K. Žďárský, 2013).

Fig. 27. Prague 1-Malá Strana, Vítězná street. Model of the chain bridge projected into the present situation. The entrance ramp in the front is depicted without the side walls of the chambers. Yellow are the revision shafts, constructed after the filling of the ramp to the current state. View from the northwest (visualisation by M. Šimůnek, 2016).

Fig. 28. Bedřich Havránek around 1865: Panoramic view of Prague – a section. The part of the bridge at Malá Strana from the southwest including the entrance ramp passing through the curtain wall of the Baroque rampart (copied from Wirth 1941).

Fig. 29. Prague 1-Malá Strana, Vítězná street. Model of the chain bridge projected into the present situation. Top view from the southwest (visualisation by M. Šimůnek, 2016).

Fig. 30. Model of the Malá Strana part of Francis's I chain bridge including the entrance ramp, hidden below the surface of current Vítězná street. Top view from the northwest (visualisation by M. Šimůnek, 2016).

Translation by Linda and Patrick Foster