

Establishments of conditions, limits and recommendations for the renovation of the Vyšehrad Railway Bridge – basis for discussion for the working group of the Director General of the National Heritage Institute

Definition of the object under consideration

The bridge in question is actually a complex of bridges. From east to west, it consists of:

- a stone railway viaduct with five arched openings (length 38.6 m),
- a single-span steel bridge over the Vratislavova – Vyšehradská road connection,
- a stone railway viaduct with eight arched openings (length 69.0 m),
- four single-span steel bridges (total length 77.5 m),
- three semi-parabolic truss bridge structures over the Vltava River (total length 261.1 m).

Both stone viaducts can be further divided into northern and southern parts. The northern sandstone parts are part of the original bridge opened in 1872, while the southern granite parts were completed in 1908, when the entire bridge was opened as a double-track bridge.

The existing semi-parabolic truss structures were built around 1901, and the steel four-span bridge on the Výtoň bank also dates from this time.

Heritage preservation

The bridge is, to the extent specified above, a cultural monument, r. no. ÚSKP 101315 (a set of railway bridges on the Prague hl. n. – Prague Smíchov line) declared by the decision of the Ministry of Culture, ref. no. 9417/2000, dated 8 December 2004.

Except for the completely western (Smíchov) abutment, the entire bridge complex is located within the Prague Heritage Reservation, declared by a Decree of the Government of the Czechoslovak Socialist Republic No. 66/1971 Coll., dated 21 July 1971 on the Prague Heritage Reservation.

The Historic centre of Prague was inscribed on the UNESCO World Heritage List in 1992.

To the extent of the Smíchov abutment, the bridge is part of the Prague Heritage Reservation buffer zone.

The operator made two attempts to remove the status protecting the bridge complex as a cultural monument, but the Ministry of Culture did not comply with either request.

Heritage values of the Vltava River bridge

1. Typological and structural

This is one of two Prague bridges with a lower bridge deck (the other is the highly modern Troja Bridge, carrying automobile and tram traffic). Furthermore, it is the only railway bridge in Prague arched over the Vltava River, which is made of a steel truss structure.

The truss riveted bridge structure is a typical structure for a relatively short historical era – the end of the 19th and the beginning of the 20th century. The structure is made of mild steel, i.e. steel produced with technology modern in its time, still used to this day. It is also one of the key works of a prominent Czech designer of that time – civil engineer František Prášil (who is also the author of the structural design of the Petřín Lookout Tower or the Industrial Palace).

2. Architectural and urban planning

It is the bridge's own architecture, which, although originally composed as strictly functional, has its own valued aesthetics, clearly referring to the time of its creation. The urbanism role is also significant, because its exposure above the Vltava River naturally traces the Vltava Valley in long- and medium-range views. Together with the Negrelli Viaduct, it is a feature in the Vltava Valley, symbolically closing the centuries-old and today historical centre of Prague, behind these bridges lies the urban sprawl of the industrial revolution. It is also a linear structure that significantly determines the character of the connected urban structure.

3. Value of authenticity of preservation and authenticity of function

The bridge has been preserved in almost its original, authentic state. In 1969, the bridge's traction line was modified and at the same time the fronts of the individual arches were modified to increase the underpass profile. In 1987, the bridge deck was reinforced. The bridge's continuous operational function is also an indispensable value - it is a living monument within the scope of its original purpose, not a thing used in a different, secondary way.

4. Iconic value

The bridge is not only a valuable part of the urban organism but is also inscribed in a number of other cultural areas. It is therefore a frequent subject for various artistic works, especially pictorial or photographic ones. It is very often part of various advertising activities.

Formulation of the conditions of monument care for the renovation of the bridge over the Vltava River

The renovation of the railway bridge under Vyšehrad must ensure safe railway, pedestrian and bicycle traffic, preserve the maximum of the original structural elements and the original appearance of the bridge. The service life of the bridge should be extended so that the requirement for the expected operational load for at least a hundred years is met.

In an effort to preserve the heritage values (see above) and to extend the functional service life of the bridge, the National Heritage Institute has previously agreed to compromise conditions for renovation, which, however, can be adjusted in relation to new circumstances, expert recommendations and also the conclusions of the working group.

The National Heritage Institute does not dispute the requirements resulting from the development of the city's transport needs. In the opinion of the National Heritage Institute, the conditions for ensuring a transport route for freight trains with heavy equipment can be met within the framework of the third-track bridge.

The conditions for the renovation formulated so far by the National Heritage Institute allowed for:

- 1. reinforcement of individual elements** (reinforcement plates/bars, or other technical solutions) in such a way that the overall appearance of the structure is not significantly changed;
- 2. replacement of out-of-date structural elements** (beams, joints, ...) provided that an objective and independent assessment of the necessity of replacement is made;
- 3. replacement of the bridge deck** provided that an objective and independent assessment of the necessity of replacement is made;
- 4. new structural solutions for the elements and the bridge deck** in the event that it is necessary to replace out-of-date and unusable types of elements, structural units or the bridge deck; then it would be possible to propose a contemporary solution that will improve

their static properties or extend their service life provided that they will not affect the overall appearance of the bridge;

5. **use of contemporary materials** (specifically carbon fibres and adhesives), on which the National Heritage Institute issued a one-time opinion and which should be the subject of a retrospective expert discussion.

Requirements from the operator

- **The requirement for a minimum service life of the reconstructed bridge for 100 years.** The requirement for the sustainability of operation was not formulated specifically, but in general terms with regard to the effectiveness of the funds spent.
- **Fulfilment of the ZG-C traffic profile.** The question is whether the profile needs to be fulfilled for all three tracks, or whether it is sufficient for the third track to fulfil it. If the condition concerns all three tracks, then it probably excludes the solution consisting in supplementing the existing structure and requires a more extensive intervention in the bridge deck.
- **Expected operational load of approximately 420 trains per day.** However, this load is considered for the overall solution of the bridging of the Connecting Line, with the expected addition of the third track, the load should then be one third lower.
- **Increase in speed to 70 km/h.** This requirement is apparently also connected with the considered bridging capacity (420 trains/day).
- **In the minimum mode, allow bicycle traffic to pass over the bridge,** pedestrian traffic is a given.

Current background and new circumstances

New circumstances are primarily future findings that might deviate from the previously considered solutions in various directions. Furthermore, the studies and assessments that Správa železnic has had prepared in the meantime, which provide a number of important information and guidelines for assessment in the working group.

- Architectural and historical survey
- Cultural heritage impact assessment HIA – Prof. Kloos
- Report of the Advisory Mission of the World Heritage Centre / ICOMOS to the World Heritage site "Historic Centre of Prague" (Czech Republic) 11–12 December 2024
- Measurement results – permanent electronic monitoring of the bridge.
- Letter from the General Director of Správa železnic Ing. Tomáš Tóth with ref. no. 41103/2026-SŽ-GŘ-06

The working group will focus on discussing and assessing the following topics and questions:

1. What structural reinforcements on the bridge are needed and how can they be implemented? The National Heritage Institute requires that their scope and design be adapted to the historical value of the Vyšehrad Railway Bridge, i.e. that they are as minimally intrusive as possible (while meeting the legitimate requirements for safety, load-bearing capacity and service life of the renovated structure)?
2. How can the scope of steel replacement be minimized to preserve as much of the original bridge material as possible?
3. Is it possible to keep (repair and strengthen) the existing bridge deck, or does it need to be replaced with a new structure, possibly a ballastless/slab track?

4. Can local element replacements be carried out on the bridge? Can damaged elements be replaced (for example, if only part of them is corroded - typically a joint at the lower connection point, where water is retained), or do they need to be replaced entirely?
5. Can all the connections on the bridge be made by riveting, or is this not possible or appropriate in certain places (for example, in places that are difficult to access)?
6. How can the structures be cleaned and their surface protected so that the measures taken have the highest possible durability while at the same time preserving the authenticity of the bridge?
7. What measures can be taken against water retention in the structure to extend its service life and lengthen the intervals between necessary repairs?
8. How can the noise of the bridge be reduced? Can a seamless rail be used on the bridge?
9. How does material fatigue and its residual service life relate to the requirements for replacing or strengthening elements? Why do the calculations of these parameters and the related requirements for replacing original elements differ so much in existing bridge assessments?
10. What effect will the implementation method have on the service life and quality of the repair of the steel structure? Is it possible to recommend on-site repair, or rather removal from the pillars and repair on the bank?
11. How should the bridge be maintained after its renovation in order to achieve its expected service life and prevent a recurrence of the current condition caused by long-term neglect of maintenance?

The task of the working group should be to discuss the conditions for the restoration of the bridge (the bridge over the Vltava) from the side of heritage preservation, their confirmation, specification, expansion or abandonment relating to professional discussion and expert opinions.

Long-standing practice in the former Czechoslovakia and then in the Czech Republic of neglecting regular maintenance of metal bridges, the inevitable end of the life of the structures and their replacement with new ones. This approach led to the fact that the public, including vocational and higher education, began to perceive the above procedure as “normal” and practically “the only possible” and completely senselessly as “more financially viable”. The result is the replacement of a significant part of the historical metal bridge structures with new ones, or the preservation of the original structures only in a reduced state, deprived of their original function. The dispute over the preservation of the Vyšehrad Railway Bridge can thus serve as a model example of a solution and contribute to changes in current procedures and public opinion.

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