PODLEŠÍN BRIDGE

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Abstract - The paper describes the survey of the stone five arch viaduct. The Podlesinsky Viaduct is a railway bridge in the Kladno district, in the Czech Republic. It spans the valley of the Knovízský Brook. It has been preserved in its original state without modifications. It is protected as a Czech Cultural Monument

Keywords - Stone Arch Viaduct, Survey, Restoration

I. INTRODUCTION

The Podlesinsky Viaduct is a railway bridge in the Kladno district, in the Czech Republic. It spans the valley of the Knovízský Brook. It has been preserved in its original state without modifications. It is protected as a Czech Cultural Monument



Fig.1Podlesin viaduct – current state of preservation

A detailed evaluation of the results obtained by the survey are described in this paper.

II. DESCRIPTION OF PODLESINSKY VIADUCT

The Podlešín viaduct is a five-arched stone railway bridge built between 1872 and 1873 from local sandstone, some parts are from granite.Its total span is 95 metres, the individual arches have a span of 10 metres

III. SURVEY OF THE PODLESINSKY VIADUCT

A. Survey methods used

The following testing methods were used in the survey

- Visual Inspection At The Place Of Sampling,
- Sampling For Destructive Compressive Strength Tests,
- Destructive Compressive Strength Tests Of Stone And Mortar, Determination Of Bulk Density,
- Non-Destructive In-Situ Mortar Compressive Strength Tests,
- Indicative Measurement Of The Moisture Content Of The Bricks With A Moisture Meter,
- Determination Of Stone Absorption, Determination Of Stone Softening Coefficient,
- Compressive Strength Of Masonry According To En,
- Sampling And Determination Of Water-Soluble Salts,



Fig.2 A look at the state of the core drill sample

B. Sampling site selection

Probe locations were chosen randomly within the structure area (depending on access). As part of the in situ work, sampling and a general visual inspection was carried out in the sampling areas.

C. Visual inspection of the current condition

During the visual inspection, several places were located where the stones are very significantly degraded. The depth of degradation (disintegration) reaches locally up to 150 or 200 mm. On the front walls, areas with a depth of degradation of up to 300 mm were found. Significant decay also occurs in the area of all the ledges of the sandstone arches. In field 5 above the road, degrading pieces of sandstone are falling off onto the shoulder of the bridged road. According to a cursory inspection, similar disintegration is occurring in the other fields of the viaduct (except field 1). The sandstone surface is degraded mainly by the effects of freezing and water. Cracks were also found in some points (e.g. field 2).

In field 3 there is a crack separating part of the headwall from the rest of the arch. Individual arches are covered with black crust in most of the area. In many places there is also leaching of connective tissue from the joints

D. Results of the survey

The masonry of the vaults is covered with black crust in most of the area. At the top, and especially from about ¼ of the vault towards the base of the vault, there is significant degradation of the sandstone surface effects of frost water. Locally, it is possible to measure a depth of up to 200 mm. The masonry is affected by high humidity, which has a negative effect on its strength. Moisture status of the structure is indicative of a completely non-functional waterproofing layer (if present at all).

Fields 2 to 5 are made up of sedimentary rocks (sandstones), field 1 is made up of granitoids (granite). The determined strength of the sandstone in the dried state is about 11.1 MPa, but in the saturated state it is only 6.9 MPa. The strength of granite in the dried state is 148.4 MPa and in the saturated state 131.6 MPa.

The strength of the mortar in the near-surface layers is about 1,66 MPa (determined non-destructively). The strength of the mortar on test cubes with an edge of 17 to 20 mm is approximately 6,1 MPa. On the basis of test drilling carried out over the bedding joints, a large part of the joints can be considered to be insufficiently filled.



Fig. 3 Look at the stones above the ledge, field 5, depth of degradation approx. 50 to 100 mm

For the static calculation, we recommend considering a mortar strength of approximately 3 MPa and a sandstone strength of approximately 10 MPa in case of at least partial drying of the masonry and prevention of further moisture penetration.

The strength of the masonry is calculated according to the EN methodology. In the current state of the structure, the design value of the compressive strength of the masonry (fields 2 to 5, i.e. sandstone fields) can be considered to be approximately 1.0 MPa. In the case of drying out the masonry and preventing the ingress of moisture other than air, a masonry strength of approximately 1.4MPa can be considered. In the case of Field 1 (i.e. granite field), the design value for the compressive strength of the masonry is approximately 7.5 to 8.0 MPa.



Fig. 4 Field 5, part of the falling surface layers on the adjacent road, on the roadside pieces weighing up to 1 kg are falling off

IV. CONCLUSION

A detailed survey of the historic bridge structure showed its deteriorated condition. Based on the survey, the following actions were recommended. The reconstruction of the bridge deck should be carried out, the detailed design of which will be elaborated in the following stages of the documentation, and the complete restoration of the stone elements of the viaduct should be carried out, taking into account the cultural and historical significance of the structure.



Fig. 5 Detail of the base of the granite arch on the sandstone masonry of the pillar

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[9] ČSN P 73 0610 Hydroizolace staveb. Sanace vlhkého zdiva. Základníustanovení.
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