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TIME-DEPENDENT BEHAVIOR OF MASONRY SUBJECTED TO VARIABLE LOAD – EXPERIMENTAL STUDY

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Introduction

Nowadays many masonry arch bridges are in use on the roads in the Czech Republic. Average age of these bridges is about 70 years and many are rather in bad condition. With regard to its number it is impossible to replace these bridges with new structures. Therefore much attention is paid to development of new methods for load-bearing evaluation of masonry arch bridges. The important part of this research is investigation of time-dependent behavior of structural material – masonry – subjected to variable (fatigue) loading.

Methods

For investigation of time-dependent behavior of masonry subjected to fatigue loading was used the masonry column made of bricks and weak mortar. For dimensions of specimen see Fig. 1.

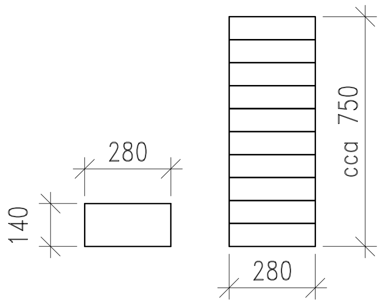

Fig. 1: Dimensions of specimen

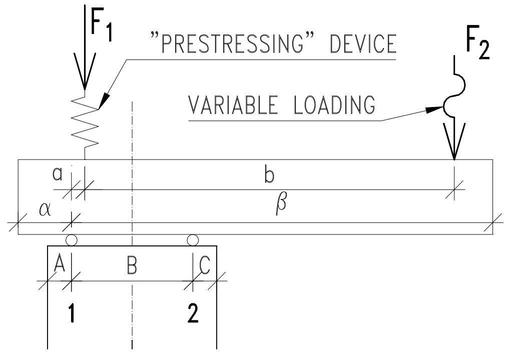

Fig. 2: Test arrangement

The specimen was subjected to loading according the Fig. 2. Dimensions of loading device (a, b, A, B, C, α, β – see Fig. 2) and forces (F_1, F_2 – see Fig. 2) was chosen depending on desired state of stress (maximum stresses in material) and depth of tension area of cross-section. Maximum compressive stresses in material were designed according to Europian

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standards. Number of cycles *n* was 2.10^5. The loading of specimen causing variables stresses in cross-section. These stresses vary from tension to compression in time and their magnitudes depend on test arrangement and used forces F_1 and F_2.

While the specimen was loading, acceleration and vertical deformation in points *1* and *2* (see Fig. 2) were measured. Because used inductive pickup device fails in higher frequencies, deformations were calculated from acceleration too. For analytical evaluation of deformations the Fourier transformation was used. Measured data were compared in time and masonry time-dependent behavior was assigned.

Results

Results of the one specimen experimental test are shown in Fig. 3 and Fig. 4. Because all noted measuring devices were set at 85000 cycles, figures 3 and 4 are drawn from this value of *n*. Maximal compressive stress was $0,6\sigma_{max}$, depth of tension area was 0,5 of cross-section high.

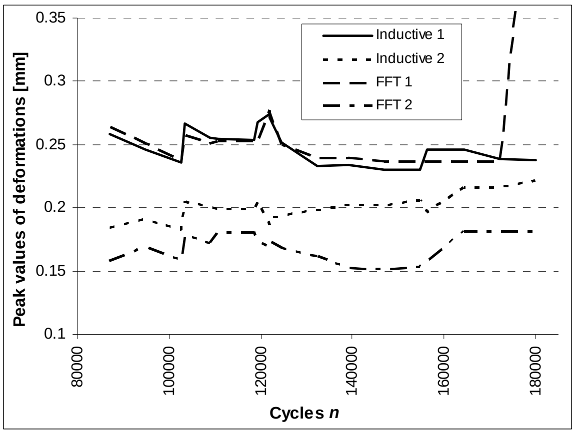

Fig. 3: Deformation alternation depending on number cycles *n* (measured data)

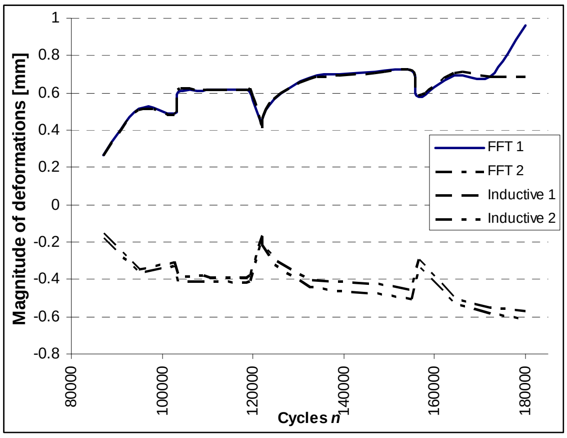

Fig. 4: Magnitudes of deformations depending on number cycles *n* (measured data)

Conclusions

While the deformation alternation (see Fig. 3) corresponds with instant (short-time) stiffness, the course of deformations magnitudes (see Fig. 4) corresponds with long-time stiffness of the masonry specimen. While instant stiffness of the masonry in time is relatively same (see Fig. 3), increasing of deformations magnitudes (see Fig. 4) signify decreasing of the masonry long-time stiffness in time (up to 3 times from initial values).

Relation between maximal stresses in cross-section and course of deformations magnitudes is the objective of the further research.

Acknowledgement

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References

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