EXPERIMENTAL INVESTIGATION OF I-BEAM MADE FROM UHPC

M. Vokáč [1], P. Bouška [2], J. Kolísko[3], P. Huňka[4], J. Tichý[5], M. Kostelecká[6]

Abstract

The experimental investigation on girder made from UHPC was provided. The results proved that the ultimate bending load depends on the casting technology, on the fibre distribution and the air pore distribution in the structure member.

Keywords: concrete, UHPC, ultimate load, fibre distribution

Introduction

Klokner Institute cooperates with SKANSKA CZ, BASF and PONTEX companies on investigation of UHPC material. The aim of research is application of UHPC material on real structures in the future. Therefore, the I-beam made from UHPC was investigated and the loading test should prove the technological possibilities of pre-cast plant. The cross section was 240 mm in height. The girder was cast without any longitudinal and stirrup steel reinforcement. We prepared 12 testing specimens with the length 2 m. The beam was tested in bending as cantilever. The distance between the force and the rigid fixing was 1,30 m.

Experimental results

The casting of testing specimens was provided by two different plants of the SKANSKA Company and by two different technologies. Nine specimens were cast in the I-position and three specimens were cast in the H-position.

The mechanical properties of UHPC material were determined on prepared accompanying specimens. The cube strength in compression reached 115 MPa, strength in bending was 21,3 MPa, Young's modulus 38,1 GPa and volume density 2400 kg/m^3.

[1] Miroslav Vokáč, CTU in Prague, Klokner Institute, Šolínova 7, Praha 6, miroslav.vokac@klok.cvut.cz

[2] Petr Bouška, CTU in Prague, Klokner Institute, Šolínova 7, Praha 6, petr.bouska@klok.cvut.cz

[3] Jiří Kolísko, CTU in Prague, Klokner Institute, Šolínova 7, Praha 6, jiri.kolisko@klok.cvut.cz

[4] Petr Huňka, CTU in Prague, Klokner Institute, Šolínova 7, Praha 6, petr.hunka@klok.cvut.cz

[5] Jan Tichý, SKANSKA CZ, a.s., Líbalova 1/2348, Praha 4, jan.tichy@skanska.cz

[6] Michaela Kostelecká, CTU in Prague, Klokner Institute, Šolínova 7, Praha 6, michaela.kostelecka@klok.cvut.cz

The obtained force-deflection diagrams are presented on Fig. 1. The fibre distribution and also the pore distribution were studied by optical microscope on several cut and polished cross-sections. The example of fibre distribution along the height of cross section is on Fig. 2. The content of air pores in the upper flange was about 50 % higher than in the lower flange.

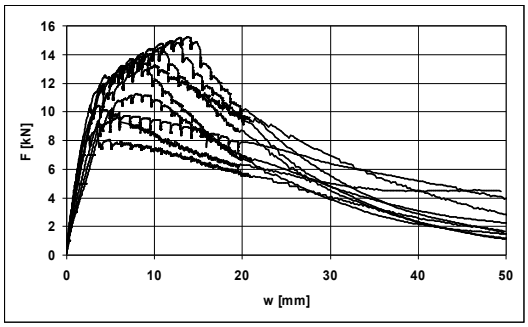

Fig. 1: The force-deflection diagram

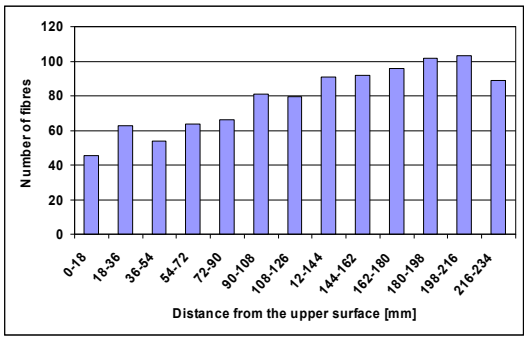

Fig. 2: Distribution of fibres along the height of cross-section

Conclusions

The ultimate loads in bending were significantly variable in dependence on direction of bending moment with respect to casting position of cross section. This is caused by non-homogeneity of UHPC material in the cross section, which was proved by fibre and air pore distributions.

Aknowledgements

This study was partially supported by the project GAČR P104/10/2359 and partially by the project TAČR TA01010269.

References

[1] J. Lataste, S. Barnett, T. Parry, M. Soutsos, Determination of fibres orientation in UHPFRC and evaluation of their effect on mechanical properties, *NDTCE'09 Non-Destructive Testing in Civil Engineering,* www.ndt.net.

[2] EN 480-11. Admixtures for concrete, mortar and grout - Test methods - Part 11: Determination of air void characteristics in hardened concrete.

[3] J. Tichý et al., Další zkušenosti s ultra vysokohodnotným betonem v prefabrikaci, *17. betonářské dny* (ČBS), pp. 219-225, 2010. *(In Czech language)*