CONCRETE
Innovations in Materials, Design and Structures

Book of Abstracts for the 2019 *fib* International Symposium
May 27-29, 2019, Kraków, Poland

Edited by: Wit Derkowski et al.

fib CEB-FIP
PK

Concrete – Innovations in Materials, Design and Structures
Book of Abstracts for the 2019 *fib* Symposium,
held in Kraków, Poland,
May 27-29, 2019.
Edited by: Wit Derkowski, Piotr Gwoździewicz, Łukasz Hojdys, Piotr Krajewski, Marek Pańtak

Every effort has been made to ensure that all published information has been reviewed by suitably qualified professionals and that all information submitted is original, has not been published previously and is not being considered for publication elsewhere. Further, the *fib* has made every effort to ensure that any and all permissions to quote from other sources has been obtained. The editor and the publisher are not responsible for the statements or opinions expressed in this publication.

fib Books of Abstracts are not able to, nor intended to, supplant individual training, responsibility or judgement of the user, or the supplier, of the information presented. Although the Scientific Committee did its best to ensure that all the information presented in this publication is accurate, no liability or responsibility of any kind, including liability for negligence, is accepted in this respect by the organization, its members, employees or agents.

ISSN 2617-4820
ISBN 978-2-940643-01-1

Printed in Poland.

CONTENTS

CHAPTER 9: PROJECT PRESENTATIONS

THE PROBLEM OF IMPROVING THE METHODS FOR ESTIMATION THE BEARING CAPACITY OF PRECAST CONCRETE BEAMS BY SLOPING SECTIONS ON THE EXAMPLE OF THE BRIDGE RECONSTRUCTION IN VINNYTSIA

Voitsehivskiy Olexandr[1], Baida Denis[1] and Romanenko Andrii[2]

[1] Vinnytsia National Technical University (VNTU), Vinnytsia, Ukraine
[2] LLC "Gervin" Vinnytsia, Ukraine

Corresponding author email: voicehvinn@gmail.com

Authors in 2016-2017 years were engaged in the design development for the reconstruction of the bridge across the river Pivdennyi Bug in Vinnytsia. This bridge is a four-span reinforced concrete arched structure with a total length of 200 m and total width of 17.2 m. It was built in 1962 and hasn't been repaired till now. According to the probing results in 2016, the bridge was declared to be in alarm and alert condition (Figure 1).

Figure 1. The general condition of the arched span structure of the bridge in Chornovol street before the reconstruction.

The improvement of the technical condition, adaptation to the modern requirements for load-carrying capacity and increasing the pavement dimensions of the bridge was foreseen by the reconstruction project.

One of the important and problematic issues during the reconstruction was the necessity to ensure the beams' strength of the traffic area when lateral forces are applied. T-shaped bridge beams with a span of 7,5 m, based on the spandrel structures, needed to be strengthened by sloping sections according to the calculations in accordance with the current design standards.

In the reconstruction project, two options of technical solutions for strengthening were developed. The first option had to provide reinforcement with the installation of partially stressed cross-rods. The reinforcement of beams with composite carbon fiber material Sika Wrap was proposed in the second option.

It is known that the existing methods of calculating the effect of lateral forces have overestimated reliability compared to other calculations. Software systems don't allow in full to consider the actual redistribution of efforts in real cross-sections. The Customer decided to conduct in-place tests of bridge beams applying lateral forces and according to results to determine finally the necessity for their reinforcement.

The specialists of VNTU together with the employees of the university's scientific research laboratory of effective building structures developed a scheme and methodology for conducting in-place tests. The external load was applied with the help of eight-wheeled lorries with a total weight of 45 tons each. During research, the deflection of different beams' sections in the crosswise and lengthwise directions was controlled, as well as the nature and the process of cracking in the support and span areas.

Analysis of the obtained results allowed to clarify the stress-strain condition of the beams, depending on the scheme of the applied load. Corrected initial data made it possible to recalculate from checking the bearing capacity of sloping sections and to dispense with the need for additional reinforcement works.

The carried out research allowed to find out that the constructed computer model of the bridge structure reflects only the qualitative work of the beams span structure of the bridge. However, the quantitative comparison of the calculation results and tests shows the existence of the significant stock of stiffness in the real construction compared with the computer idealized calculation model.

The found reserves of bearing capacity are partly based on the accurate approach in determining and taking into account the initial data for calculations of structures that have been used for a long time without proper technical support.

The existing calculation methods to the effect of transverse forces are based on the empirical method, developed for new structures and thus do not fully take into account the specificity of reinforced concrete beams that are strengthened after continuous operation. These methods require further development and improvement.

References

Bambura, A. N., Bachinsky, V. Ya. et al. (1987), Methodical recommendations for precise calculation of reinforced concrete elements, taking into account the complete diagram of concrete compression. CIIBC, USSR, Kyiv.

DSTU B V.2.6-154: 2010. Concrete and reinforced concrete constructions. Cast in place and precast constructions. Design rules (2011). Minregionbud of Ukraine, Kyiv.

DSTU-N B EN 1992-1-1: 2010. Eurocode 2. Design of reinforced concrete structures. Part 1-1. General rules and regulations for structures (EN 1992-1-1: 2004, IDT) (2012). Mininstry of Regional Development and Building of Ukraine (Minregionbud), Kyiv.

DSTU-N B EN 1992-2: 2012. Eurocode 2. Design of reinforced concrete structures. Part 2. Design of reinforced concrete bridges (EN 1992-2: 2005, IDT) (2013). Minregionbud of Ukraine, Kyiv.

National Standards of Ukraine (DSTU) B EN 13791: 2013 (EN 13791: 2007, IDT). Assessment of compression breaking strength of concrete in structures and prefabricated concrete elements (2013). Ministry of Regional Development of Ukraine, Kyiv.

Sobko, Yu.M. et al. (2017), Sika technologies for bridges' reconstruction. Reporter of the National University "Lvivska Polytechnika". Editorial series: Theory and practice of construction. Edition nr. 877. Ukraine, Lviv.

State Building Norms B.1.2-15: 2006. Bridges and pipes. Design Rules (2006). Ministry of Housing and Building of Ukraine, Kyiv.

Voitsehivskiy O.V., Baida D.M., Popov V.O. (2016), Results of the condition survey and assessment of the technical condition of the bridge construction across the river Pivdennyi Bug in Chornovil street in Vinnytsia. Special buildings and structures. Modern materials and constructions. KNUBA, Ukraine, Kyiv.