



Effect of transverse bending moments on the shear resistance of concrete bridges

Dimosthenis Karagiannis, Walter Kaufmann

Institute of Structural Engineering (IBK), ETH Zurich, Switzerland

Contact: kaufmann@ibk.baug.ethz.ch

Abstract

Transverse bending moments may strongly affect the shear strength of hollow-box bridge girder webs. Hence, the interaction of longitudinal shear and transverse bending should be considered, particularly in the safety evaluation of existing bridges with low stirrup reinforcement ratios susceptible to brittle web-crushing failures. However, existing models for combined loading were developed over 30 years ago, based on very limited experimental evidence and with the aim of ensuring ductile failures. If these potentially conservative models are applied in the safety evaluation of existing bridges, many of them would have to be strengthened. For these reasons, a research project including theoretical modelling and large-scale experiments is currently being carried out by the authors. In the present paper, an overview of the experimental campaign, including testing facility and instrumentation is given along with some preliminary results of the theoretical investigations.

Keywords: concrete bridges, shear, transverse bending, ultimate load, deformation capacity, large scale experiments, safety assessment of bridges.

1. Introduction

Developed countries today are facing the challenge of ageing infrastructure. With traffic intensity as well as traffic loads having increased since their construction, many infrastructure objects need to be re-assessed in order to ensure their structural safety. Current design codes and guidelines are based on past research and models conceived with the purpose of safely designing new structures. They are therefore typically characterised by a certain conservatism. While this is certainly appropriate when designing new structures, as it corresponds to an increase of robustness and redundancy at little extra cost, this does not apply to the safety evaluation of existing structures. In the latter case, the actual resistance of the structure should be exploited in order to

avoid unnecessary strengthening measures that are often expensive and cause traffic disruptions.

In order to face these challenges, assessment codes of practice have recently been developed. However, while allowing actualizing material strength parameters used in the calculations, these codes still do not provide solutions for the most critical cases as they use the same underlying models as the design codes. There is therefore a need for more detailed and accurate models that make maximum use of the existing load carrying capacity of the structures being assessed.

The main population of bridges that needs to be assessed at present in many European countries is characterised by webs with very low stirrup