

A comparison of the resource-efficiency of different reinforcement concepts motivated by tunnel segments

Marion Decker, Clemens Proksch-Weilguni, Johann Kollegger

Institute of Structural Engineering, TU Wien, Vienna, Austria

Contact: marion.decker@tuwien.ac.at

Abstract

In view of ongoing climate change and the limited availability of resources and energy, efforts in optimizing newly built structures are crucial to improve the resource-efficiency of the construction sector. Tunnels with a segmental lining offer great potential for such efforts. Therefore, the Institute of Structural Engineering at TU Wien developed a reinforcement concept to increase the ultimate load of a tunnel segment by adding butt-jointed reinforcement bars in the longitudinal joint.

To evaluate the beneficial effect of the new concept, cylindrical specimens with varying reinforcement concepts and materials, respectively, were tested at TU Wien. By putting the results on the ultimate load in context with the global warming potential (GWP), the performance of concepts with butt-jointed reinforcement bars and confining reinforcement compared to plain concrete or concrete with steel-fibers is quantified.

Keywords: reinforcement concepts; material input, ultimate load, global warming potential (GWP), resource-efficiency

1 Introduction

The construction sector accounts for a significant share of the world's resource and energy consumption, which has a major impact on the environment. To improve the resource-efficiency and thus reduce the sector's impact on global warming, attempts to optimize the use of materials in new constructions play an important role in planning and designing. Nevertheless, in infrastructure projects, the optimization of individual structural elements is rather uncommon, as the structures are characterized by a high degree of individuality. This is due to the strong influence of local conditions in these projects. Tunnel structures constructed with a segmental lining consisting of a huge number of identical elements, however, offer great potential in improving the overall resource-efficiency by optimizing the

prefabricated tunnel segments. Accordingly, the design of tunnel segments and the longitudinal joint, especially, are subject to ongoing research.

1.1 Reinforcement concept developed at TU Wien

A reinforcement concept has been developed at the Institute of Structural Engineering at TU Wien that allows the load-bearing capacity of a segment to be increased by installing butt-jointed reinforcing bars in the longitudinal joint. Thereby, parts of the compressive force can be transferred from one segment to another through the additional butt-jointed bars. For further technical details on the concept and its application, the reader is referred to [1, 2 and 3].