

## Sustainability by Integration of Existing Structures into new Infrastructures

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### Abstract

One of the solutions for sustainable development of transport infrastructure is upgrading the old transport system or – in case a substantial enlargement of capacity is needed – by integrating existing transportation structures into new transportation structures with higher capacity. However, the upgrading and/or integration of existing structures goes along with demanding engineering tasks, such as considering design changes in the final structure, changes in geometry or loading and dealing with structural deficiencies. This makes it necessary to reassess and strengthen the existing structures and to design the new structure and its connections to the existing structure while paying attention to all these aspects. Also, in many cases unavoidable deviations from the valid regulations become necessary. For these design tasks, it is necessary evaluate and develop new solutions and to gain broader knowledge base to draw from. The present paper reports on the experiences from an infrastructure project in Germany.

**Keywords:** Sustainability in structural engineering, underground structures, existing structures, fire protection

### 1 Introduction

Cement production is one major contributor to worldwide CO<sub>2</sub> emissions. Therefore, those infrastructure structures, for which at present reinforced concrete cannot be dispensed with, must be built using as little newly produced concrete as possible.

One of the solutions for sustainable development of transport infrastructure is upgrading the old transport system or – in case a substantial enlargement of capacity is needed – by integrating existing transportation structures into new transportation structures with higher capacity. However, the upgrading and/or integration of

existing structures goes along with demanding engineering tasks, such as considering design changes in the final structure, changes in geometry or loading and dealing with structural deficiencies. This makes it necessary to reassess and (if necessary) strengthen the existing structures and to design its connections to the new structure while paying attention to all these aspects. Also, in many cases deviations from codes and regulations become necessary – either because of an outdated design basis of the existing structures or – which can be even more critical – because of newly detected deficiencies. Therefore, project-related approvals as well as the development of a fundamental knowledge base and new, generally