



New Accelerated Prefab Bridge Scheme – the NRW Bridge Modules

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Abstract

Arup had been commissioned with the design of a new modular bridge system by Straßen.NRW, the road authority of Germany's biggest state North Rhine-Westphalia. This article describes the background of this pilot project, the design concept, as well as the structural design and construction sequence of two new bridges, which can be erected within 8-10 weeks. The design is characterized by a high degree of prefabrication, modularity as well as the use of high performance concrete to ensure an excellent durability. The bridges are designed as integral frames – spanning about up to 30 m. The use of in-situ concrete had been kept to a minimum. The structures contain no bearings, no expansion joints and no separate parapets, which significantly reduces lifecycle costs. The use of high performance concrete made an additional waterproofing layer obsolete, which also saves construction time. The bridges are designed for replacement of deficient structures. To minimize demolition time, the foundations were designed so the existing foundations could remain in place.

Keywords: prefabricated bridges, replacement, modular, high performance concrete, integral bridges, post-tensioning, pilot project, SOFiSTiK model

1 Introduction and Background

The constantly increasing traffic intensity on road networks and the aging infrastructure pose significant future challenges for engineers. Figure 1 shows the distribution of “grades” i.e. condition indexes for all bridges of federal highway bridges in Germany.

The condition index is calculated after inspection of a bridge according to a specific key, defined in DIN 1076 [2]. The inspection criteria are structural integrity, traffic safety, and durability. The diagram shows that most of the German bridges are in a satisfying i.e. sufficient condition (grades between 2,0 and 2,9). However, it is expected that a lot of these bridges need to be strengthened or replaced in the upcoming decades to maintain a functional road and highway infrastructure. Official sources

expect that out of more than 150.000 bridges in Germany, 15 % need to be strengthened or replaced soon. Dealing with the aging infrastructure is a topic that has been insufficiently handled in the past but is now finally in the focus of federal and local political discourse in Germany. On one hand, the size of government investment in infrastructure has been growing substantially compared to past decades and currently reached ca. 10 billion € p.a. On the other hand, the increasing volume of construction work on federal roads is significantly limiting the availability of important sections of the road network. Developing and embracing new bridge erection methods using modular pre-fabricated bridge elements could significantly contribute to a more time efficient replacement scheme of small and mid-length bridges and reduce closure times on federal highways.