Means and Methods Analysis of a Cast-In-Place Balanced Cantilever Segmental Bridge: The Wilson Creek Bridge Case Study

by

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Abstract

Different means and methods exist in the construction industry to erect bridge superstructures. In planning and execution of the complex construction operations the effects of the chosen erection method need to be considered to achieve a safe and economical process. Failures of bridges under construction have underlined the importance of this issue.

Hence, constructability issues need to be considered from the very beginning of projects. Structural analysis mathematically models geometry, boundary conditions, and other structural details, material properties, and so-called actions and incorporates factors of safety. Aforementioned actions, i.e. loads or restraints of deformations may act only temporarily during construction, depending on the method and sequence of erection. However, these construction loads can create considerable stresses in the unfinished structure prior to completion when it still lacks additional redundancy against failure. Furthermore, time-dependent material properties such as creep, shrinkage, and relaxation play a major role, especially in segmental construction.

A case study is provided as an example of how constructability issues are dealt with in engineering practice. The Wilson Creek Bridge is a five-span cast-in-place concrete segmental bridge that was erected with Balanced Cantilever Construction. The bridge superstructure incorporated a camber to account for time-dependent deflections in final alignment.

Form travelers were used in an alternating manner about the bridge piers to construct cantilever arms that were finally connected at midspan. These travelers remained in place until the box girder segments had reached sufficient strength to be post-tensioned to their predecessors. Casting cycle duration on this project was one week.