Construction of Cable-Stayed Bridges Built on Temporary Supports

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Summary

One of the fastest and more economical ways of erecting cable-stayed bridges consists on building the bridge deck on a set of temporary and permanent supports. Then, the stays are successively placed and tensioned according to a predefined tensioning sequence and the static scheme of the structure is successively changed. Despite this technique has been used for erecting many cable-stayed bridges worldwide, no specific research referring to the modelling of the temporary supports erection method has been found in existing literature. In fact, most of the literature is based on the alternative erection technique, the cantilever erection method, and the temporary supports erection method is usually only described in general terms. This paper aims to fill this gap by providing an algorithm specifically designed to model the construction process of cable-stayed bridges built on temporary supports from a backward approach. This algorithm can be efficiently used to define the initial design of the tensioning sequence and, because of its simplicity; it can be easily implemented in any structural code that enables the modelling of the prestressing of the stays by means of imposed strains or imposed temperature increments.

Keywords: cable-stayed bridge, temporary support erection method, modelling.

1. Introduction

When environmental factors or the requirements of the foundations do not prevent the placement of temporary supports below the deck, the temporary supports erection method uses to be the most economical way of building cable-stayed bridges [1]. This technique has been used in the erection of many cable-stayed bridges, such as the Hungerford Bridge [2] or the Talavera de la Reina Bridge [3]. In the temporary support erection method, the bridge deck (with a self weight g_1) is first built over a set of temporary, T, and permanent supports by mean of conventional erection techniques (Figure 1a). Then, during the tensioning process, the stays are successively installed and tensioned by the jacks and the deck is successively raised from the temporary supports as presented in Figure 1b. For a *kth* construction stage, the axial force in the *nth* stay can be called $N_{Cn}{}^{k}$. Then, at *Kth* stage, once the tensioning sequence has been carried out, the Objective Completion Stage (*OCS*) (Figure 1c) is achieved. This stage is characterized by axial forces in the stays $N_{Cn}{}^{OCS}$, and can be easily calculated from the Objective Service Stage (*OSS*) [4] from which the structure was designed for a certain Target Load (*TL*).

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