

Abstract

Title: Dimensioning of concrete box girder bridges for tram-train traffic. Application to the French Island of La Reunion

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The tram-train is a new system of transportation that is gaining supporters thanks to its capacity of adaptation to local traffic difficulties. This innovator nature comes along with a lack of experience and, above all, standards. Through the dimensioning of concrete box girder bridges for tram-train traffic, this thesis sheds some light on the subject.

First of all, we analyze the tram-train concept: a railway system of transportation that is able to meet tramway features in the city and suburban train ones on the outskirts. The original concept was born in Karlsruhe in 1992 and the convoy was then adapted to the existing infrastructures. Nowadays, the concept is customized to fit to the different circumstances of every place. In the La Reunion Island, the lack of any kind of railroad has brought a construction project of a railway solely dedicated to the tram-train. The situation of collapse that lives the island's road network, as well as the impossibility of extending it due to geographical, environmental and sustainability issues, requires a real alternative for the growing population.

Then, we study the loads of the new system of transportation. In order to find the effects of the tram-train to the works it is necessary to model them. This is why we refer to the standards, but the eurocodes don't foresee this kind of railroad traffic. To overcome the absence of norms, a provisional study of the SNCF about the Alsatian tram-train allows us to identify which ideas of the eurocodes can be used and how we need to approach their adaptations.

After having modeled all the different loads associated to the tram train, we proceed to calculate, according to the eurocodes, the rest of the loads that are applied to the bridges of the La Reunion Island's project. The wind study is especially critical because the project is located at an area with a high risk of hurricanes. Thus, as a complement, we have checked the results given by the eurocodes with the current French standards.

Once we have the complete knowledge of the loads that our bridges will have to bear, we can calculate the prestressing needs. We focus our attention on the Lataniers viaduct, 588 meters long (48 – 6 x 82 – 48), which is a segmental bridge that we model with Pythagore, a software developed by Setec TPI. We calculate the internal tendons needs in both the top and the bottom slabs. Finally, we determine the external tendon arrangement and its necessary quantity. We can then verify the stresses in the box girder webs.

As a final point, we compare the characteristics of bridges under tram-train traffic and road traffic. We appreciate up to which extend the box needs to be more solid to resist the tram-train and has higher prestressing needs. We also recognize the influence of this new system of transportation to the external tendon arrangement.