

DESIGN AND ANALYSIS WITH NUMERICAL METHOD OF GANTRY CRANE MAIN BEAM

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Keywords: Gantry crane, Main beam, Design and analysis, Finite element method.

Abstract. Nowadays, mostly in shipbuilding, gantry cranes are needed in many areas. With evolving technology, the sizes of the structures are growing too. Generally, in the construction of these structures gantry cranes are preferred for lifting heavy loads. In this study, a 2x400 ton gantry crane main beam is designed and analysis with numerical method is performed. The working load acting on the main beam is 800 tons. In the analysis of the main beam construction, the self-weight of the main beam, working load and dynamic loads arising due to the crane movements are considered. After analytical calculations, the main beam is modeled as a three dimensional design and the analysis of the construction is performed using finite element method with the help of an analyses program. The analysis is performed for three cases. In the first case, the analysis is performed by considering only self-weight of the main beam. In the second case, the analysis performed under the influence of working load (while two trolleys on the main beam are in various positions); and in the third case, both the working load and the dynamic loads arising due to the crane movements are considered in the analysis. In this study, the stress values obtained from the analysis are examined and it is identified that some regions in the design are needed to be revised and the results obtained from analytical calculations are compared with the results obtained with the finite element method. As a result, using finite element method in the analysis is appropriate and this method provides great convenience in the calculations.

Introduction

Shipping has a very high importance about travelling of people and transportation of commercial goods around the world. In the construction phase of the ships, many massive parts might be necessary for construction and need to be moved. Mostly in shipyards, and in many other places gantry cranes are preferred to transport massive parts.

In this paper, a 2x400 ton gantry crane main beam is designed. Analytical stress calculations and analysis with numerical method are made. Afterwards the results of analytical calculations and analysis are compared and discussed.

Design and Model

Cranes are designed in order to the requirements of the working conditions in the enterprise. The predetermined technical datas of the 2x400 ton gantry crane are shown in the Table 1.

Table 1. Technical data of the 2x400 ton gantry crane

Crane type	Gantry crane
Lifting capacity	2 x 400000 kg
Length of the trolley rail	100000 mm
Useful lifting height	60000 mm
Material	St 37-2, St 52-3

On the basis of the above data, it can be said that the usable length of the main beam is 100 meters. The full length of the main beam is 106 meters. The main dimensions and 3-D model of the gantry crane are shown in the Fig. 1.



Fig. 1 Main dimensions and 3-D model of the gantry crane

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