

STRUCTURAL REINFORCEMENT FOR HANGERS AND MAIN CABLE OF BOSPHORUS BRIDGE

T. Idani¹, M. Sugimura¹

¹ IHI Infrastructure Systems Co., Ltd., Oversea Dept., Tokyo, Japan.

e-mail: idani9156@ihi-g.com

SUMMARY

The structural reinforcement of Bosphorus Bridge in Turkey was implemented from December 2013 to April 2019. This paper focuses on two highly remarkable work items. One is replacement of hangers and the other is reinforcement of main cable. Inspection and structural evaluation of existing inclined hangers were performed, and overstressed and corroded hangers were found. Bridge administrator decided to replace the inclined hanger system with the vertical hanger system. This was the first challenge to replace the inclined hanger system with vertical hanger system for a long span suspension bridge in the world. In conjunction with the hanger replacement, the existing wrapping wires were also replaced with new one. Then severe corrosions and broken wires of main cable were found near the tower. Therefore, additional strands were installed beside the main cable in order to compensate the loss of sectional area due to broken wires. There were lots of difficulties; however the above two works for Bosphorus Bridge were implemented successfully.

Keywords: *Suspension Bridge, Structural Reinforcement, Hangers, Inclined Hangers, Main Cable, Corrosion.*

1. INTRODUCTION

Bosphorus Bridge (now officially named “15 July Martyrs Bridge”) located in northwest Turkey, spanning the Bosphorus strait in Istanbul, was constructed in 1973. It has been more than 45 years since the traffic opening. The traffic volume is increasing according to the Turkey’s economic development, and now averaged daily traffic is about 200,000 vehicles. Bridge administrator (General directorate of highway, hereinafter called “KGM”) made an evaluation of existing structure in 2012, and decided to carry out the repair and life-span extension works. This project includes several kinds of work item, and this paper focuses on two highly remarkable work items, replacement of hangers and reinforcement of main cable. Fig. 1 shows the general layout of the bridge before and after the project.

2. REPLACEMENT OF HANGERS

Inclined hanger system was adopted in the original bridge design. However it has been reported that inclined hanger system was so weak due to fatigue that most would probably have to be replaced [1]. According to the structural analysis and field survey, there were lots of hangers which were overstressed at service limit state and/or ultimate limit state. Furthermore some corroded parts were observed in existing hangers. Considering these results, replacement of all hangers was recommended and two options were proposed. One is to maintain the original inclined hanger system, and the other is to change to a vertical hanger system. As a result, the vertical hanger concept is considered more economical and much shorter duration requested for replacement rather than the inclined hanger concept, because if the inclined hanger concept had been chosen, vertical hangers as temporary hanger system would have been necessary and it must have been dismantled after installation of new inclined hangers. Furthermore the vertical hanger system has such advantages in the structural system as less sensitive to live loads [2]. Considering these studies, KGM made the decision of