Economic Feasibility of Long Span Cable Bridges with Application of High Performance Steel and Wire

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Summary

To study an economic feasibility with respect to the application of high-performance steel and high strength wire for long span cable bridges, structural analyses and trial designs were performed.

In order to compare trial design with previous real design, the practical cable bridges, which type are suspension and cable stayed, were selected. Based upon design method and appropriate assumption, decrease of wire/steel weight and construction cost are evaluated.

The results showed that the steel weight and construction cost could be reduced certainly by using high performance steel and high strength wire, although the design stresses of some plates in box girder are not governed by material strength due to the stability of stiffened plates and the limitation of minimum plate thickness or specification for bridges.

Keywords: high-performance steel; high strength wire; economic feasibility; cable bridges.

1. Introduction

The development of technique for making steel have represented out progress of several industries. Especially, the utilization of high-performance steel and high strength wire could have dragged the significant evolution of bridge design and construction. For example, in concrete bridges, high strengthening of wire could have made lots of prestressed box bridges. And also, with regard to steel bridges, high performing of steel could have afforded to rationalize small and mid span girder or box bridges and make economical construction of longer cable bridges.

Actually, in bridge construction field, the reasons for utilizing high-performance steel come from economy, safety, and environment requirements. Among those, deducting environmental requirement (In fact, an increasingly concern is the environment), and only focusing on safety and economy, the necessity for application of high-performance steel/wire can be explained in the perspective of long span bridges. Because when the span length of bridge is longer, the self weight will become larger and the construction cost will increase. Therefore, in order to have longer span length of bridges, it is the key to bridge engineering to reduce self weight of the bridge.

Generally, huge tonnages of steel are required for cables, bridge decks and pylons in long span cable bridges. Therefore, using high-performance steel/wire could seem to save huge amounts of material and construction cost. From this fact, reversely it can be the basic requirement to apply high-performance steel/wire to super long span cable bridges.

In recent years, in Korea, high-performance steel for bridges with a minimum ultimate stress of 800MPa has been developed. And also, high strength wire for suspension bridges and cable stayed bridges with a minimum ultimate stress of 2,100 MPa, 1,900 MPa, has been developed, respectively. To confirm practical effect of developed steel/wire is important for the possibility of super long span cable bridges. In this paper, applying the properties of developed steel/wire to the real cable bridges (as shown in figure 1, 2), the effect of application of developed steel/wire is analyzed.

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