Long Span Suspension Bridge Spanning up to 2800m with Longer Design Life

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Summary

This paper presents the prototype design results of a suspension bridge of which main span reaches up to 2800m. A new design code (draft) developed with supports of the Super Long Span Bridge R&D Center in Korea has been applied to the design. Influences on the design of the main cable, the steel pylon and the orthotropic deck plate are presented. Moreover, the result of optimization on the deck cross-section by wind-tunnel test is summarized.

In addition, a preliminary study on a bridge design life has been performed. Important infrastructures such as super long-span bridges may need a longer bridge design life than that of other structure. A bridge with a longer design life essentially requires higher construction cost. A proposal to raise economical efficiency is suggested.

Keywords: suspension bridge; super long-span bridge; design life; reliability index

1. Structural Change through Technical Improvement

A design on a suspension bridge, shown in Fig.1, was carried out previously based on Korean Bridge Design Code and Design Guidelines for Steel Cable-Supported Bridge with the design life of 100 years. For the same bridge, a new design has been performed based on the new design code which has been developed in the Super Long Span Bridge R&D Center with the design life of 200 years. The design results will be compared with the design results based on traditional design codes. Improved design aspects will be explained and applicability of the new code will be evaluated.

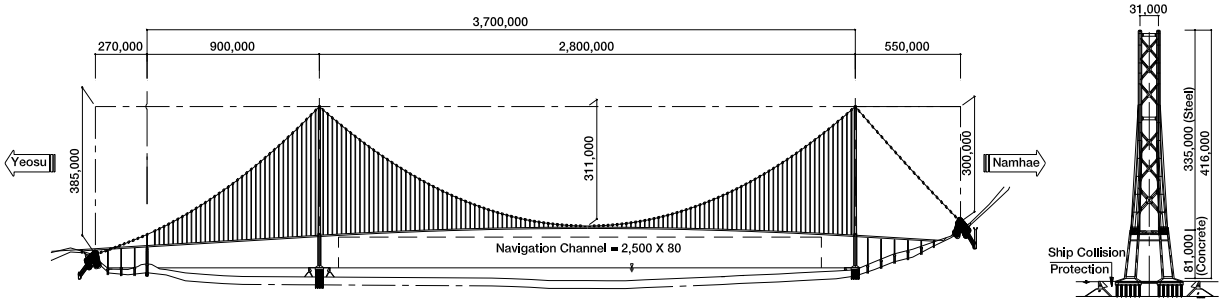

Fig.1: Outline of the Prototype Suspension Bridge

High-strength (2,100 MPa) wire has been used for the main cables of the bridge and importance factors for cables were used according to the live-to-dead load ratio and the target reliability.

The deck has been planned to be twin box girders. Through several steps, the cross-section of deck has been determined by wind tunnel tests.

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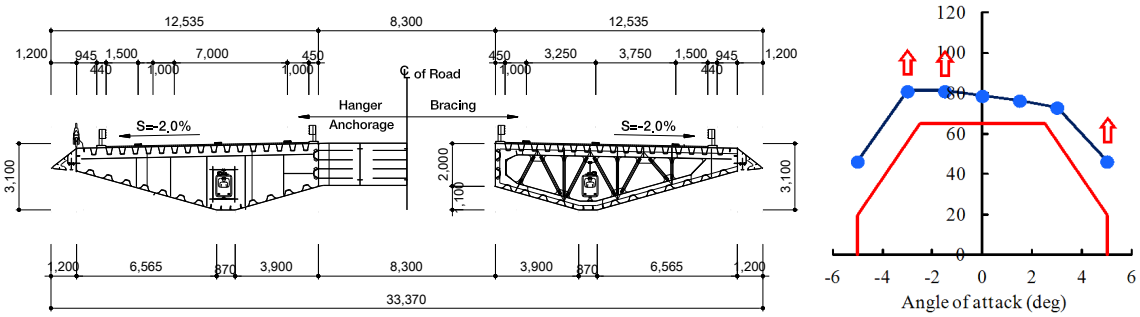

Fig2. Final Cross-section of Bridge Deck and Flutter Velocities

2. Study on Bridge Design Life

Existing bridge design codes are based on a bridge design life of 75 to 120 years. Some suspension bridges built in the 19th century, however, are still functioning over 120 years and require enormous maintenance costs. Accordingly, it might be economical to build bridges with longer design life, e.g. 200 years, if they are considered very important infrastructures. To get the reasonable bridge design life, the characteristics of bridge components shall be considered in terms of function recovery from damages. Since many components of suspension bridges can be replaced or repaired (or recovered) after damages, extending the bridge design life always involves cost increase and is not be economical. It is rather reasonable to set an appropriate design life for each component so as to cope with various situations during service life. Classification of components and corresponding design life are proposed in Fig.3.

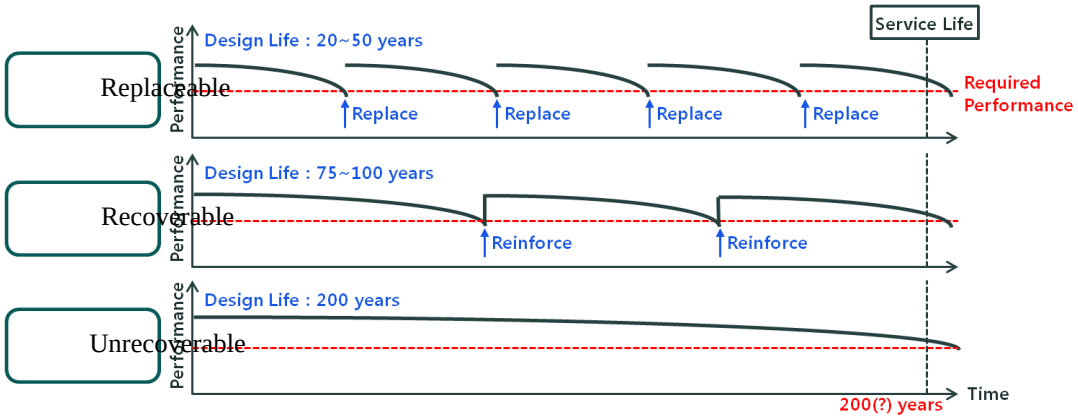

Fig.3: Design Life of Component

3. Conclusion

In order to design economical long-span suspension bridges, it is important to determine the reasonable safety margins of the bridge components by applying the design life oriented reliability-based limit state design method as well as to reduce the self-weights of the bridges through technical innovation on bridge technology.

It is expected that cost estimation according to the bridge design life and the consequent determination of the bridge design life with consideration of different design life or reliability index of each component in the preliminary design phase will increase economical efficiency in long span cable supported bridge projects.