

Optimum Span Ratio of Cable Stayed-Suspension Bridges

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Summary

A development for the new structural system having a superior wind resistance performance may be the alternative way for ensuring wind stability. The cable stayed-suspension bridge is one of alternative structural types. In this study, a parametric analysis was performed to examine static and dynamic behaviour of the cable stayed-suspension bridge according to variation of girder length supported by stay cable. The analytical result shows that the reasonable span ratio of stayed span over main span (stayed + suspended span) is between the range of 0.25~0.30. Also, structural performance of the cable stayed-suspension bridge with the span ratio of 0.25~0.30 is improved by more than 50% in comparison with a conventional suspension bridge. This improvement can lead to the reduction for the steel quantity of cable and stiffening girder and the size of anchorage.

Keywords: cable stayed-suspension bridge; parameter analysis

1. Introduction

Since the stiffening girder of suspension bridge is the member suspended by main cable, such members can be easily oscillated due to lateral force, such as wind load. Therefore, the wind stability should be ensured in this kind of structure. Especially, the torsional and coupled flutter instability can lead to structural failure. An effective way for ensuring the flutter stability is to increase the torsional stiffness of stiffening girder. However, as the main span length increases, such countermeasure may be uneconomical because the weight of stiffening girder and cable becomes larger to increase the torsional stiffness.



Fig. 1: Concept of cable stayed-suspension bridge

A development for the new structural system having a superior wind resistance performance may be the way for ensuring wind stability. The cable stayed-suspension bridge is one of alternative structural types. Without increasing the weight of stiffening girder for the torsional stiffness, a reasonable span ratio, that is composed of optimized suspended section and maximum stayed section, lead to improve the oscillation property.

Since the research for this bridge type is in early stage, various studies should be carried out to verify its structural performance.

In this study, parametric analyses were conducted to evaluate static and dynamic behaviour of the cable stayed-suspension bridge considering the hybrid cable arrangement with a property of cable-stayed bridge and suspension bridge.