TMD Method of Construction for the Cable Stayed Bridge in the Environmentally Constrained Areas

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Summary

The TMD (Tuned Mass Damper) method of construction is proposed to the cable stayed bridge or the similar structure to suppress the wind-induced vibrations and ensure the aerodynamic stability. This stabilizing method of construction by TMD does not need any foundations. Thus it could solve the environmentally constrained problems by excavation or dredge of the ground and the risk of the traffic collisions. Moreover, it is more economical and workable in comparison with the temporary tied-down cables. It is shown that the vibration control by TMD is the most efficient solution to stabilize the bridge during construction regarding wind.

The three-pylon cable stayed bridge at the Busan~Geoje Fixed Link in the south-eastern part of Korea is introduced to show the example for the application of the TMD method of construction to solve the environmentally constrained problems.

Keywords: TMD (Tuned Mass Damper); construction; cable stayed bridge; environmentally constrained areas; free cantilever; erection method; temporary tied-down; strong wind.

1. Introduction

When we construct a cable stayed bridge or the similar structure, the stabilizing measures by temporary tied-down cables are generally used to resist strong wind, specifically, typhoon because these type of the structures are more vulnerable to wind under construction rather than in service.

However, the temporary tied-down cables could not apply to the structures in the environmentally constrained areas: on the sea, traffic congestion or green areas. Thus the alternative was considered to substitute for the temporary tied-down cables. The method using TMD is proposed and expected to be the most efficient solution to stabilizing the structures under construction regarding wind.

2. TMD method of construction

So far TMD has been successfully applied to lots of high rise buildings and long span bridges in the world. However, most of the cases have been used to reduce the amplitude of the wind-induced vibration within the service criteria under construction or in service condition. In other words, TMD has been introduced to solve the serviceability, not the safety of the structure. The main reason is that the method using TMD needs high technical engineering regarding wind and vibration controls.

The highest accuracy and reliability of the result from wind tunnel test and dynamic analysis of the structure and sufficient experience regarding vibration controls are required to apply TMD to the safety problem. Thus special techniques such as large scale aeroelastic model test, extraction of flutter derivatives and aerodynamic admittance are introduced to design TMD under construction.

The procedures for the TMD method of construction are as follows: 1) find the response of the structure during construction, 2) extract aerodynamic admittance or coefficients to ensure the higher accuracy and reliability for the analysis, 3) determination of the control target, 4) calculation of the

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