

Comparisons of Composite Girder Bridge Designs in the World by Benchmark

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Summery

The benchmark design project has been proposed in IABSE 2007 Symposium in Weimar, Germany for a simply-supported composite girder highway bridge, in which the design criteria are provided for engineers to follow. There are two types of designs in the project: Design A is a free design in which only three fundamental criteria are given, and Design B is a conditional design in which additional ten criteria are provided. Ten designs from the world have participated to the project and are compared in the present paper. Each design follows the same given criteria but different design standards, and thus reflects the design policy in each country. It is interesting that the design in each country shows quite different features in many means. From the comparisons engineers will learn different perspective views in bridge design.

Keywords: bridge design; Steel bridge; highway bridge; benchmark; composite girder; design comparison

1. Introduction

In IABSE 2007 Symposium in Weimar, Germany one of the authors has proposed the design comparison project for a highway girder bridge by the benchmark project [1] and consequently received ten sample designs from different countries in the world. By comparing these ten bridges designed under the same criteria for the benchmark bridge, the present paper will study the characteristics and thoughts of the designs of each country in order to investigate the rational bridge design. The design standards can also be compared because in the designs different design codes are applied. In order to make the comparative study easier, a simple type of bridge, i.e., simply supported composite girder bridge, is adopted in this study.

The countries (and the occupation) of ten participated engineers are; America (government officer), Belgium (professor), China (professor), Czech (professor), Egypt (professor), Ireland or UK (consultant), Italy (consultant), Japan (professor), Korea (professor) and Russia (government officer). Professor is an occupation of the most participants in this project, and the others are government office and consultant engineers. Name of the nations is shown only by the symbol A to J among which Japan is denoted by H.

2. Design criteria for benchmark bridge

The design criteria proposed for the benchmark are as follows [1]:

1. Span length = 30m, 2. Road width = 8.5m, 3. Support conditions - simply supported, 4. Number of girders = 4, 5. Thickness of concrete slab = 0.24m, 6. Concrete strength (28 day) = 25N/mm^2 , 7. Thickness of asphalt pavement = 0.08m, 8. Weight of curb (base for hand rail) = 4.85kN/m , 9. Weight of hand rail = 0.5kN/m , 10. Weight of steel girder (exterior and interior) = 3.3kN/m , 11. Weight of haunch (exterior and interior girders) = 1.5kN/m , 12. Weight of form work = 1.0kN/m^2 (per unit road area, to be removed for composite section after the concrete slab hardened), 13. Yield strength of steel = 315N/mm^2 or equivalent.

Two kinds of design conditions are proposed in the project: a free design (Design A) specifies only first three fundamental conditions 1 to 3 of the above criteria, and a conditional design (Design B) specifies all the conditions from 1 to 13. In the free design, except the fundamental conditions 1 to 3 engineers can take any criteria for the rest