

Sensitivity Analysis of Prestressed Post-Tensioned I-Girder and Deck System

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Abstract : Sensitivity analysis of design parameters of the optimization procedure can become a significant factor while designing any structural system. The objectives of the study are to analyze the sensitivity of deck slab thickness parameter obtained from both the conventional and optimum design methodology of pre-stressed post-tensioned I-girder and deck system and to compare the relative significance of slab thickness. For analysis on conventional method, the values of 14 design parameters obtained by the conventional iterative method of design of a real-life I-girder bridge project have been considered. On the other side for analysis on optimization method, cost optimization of this system has been done using global optimization methodology 'Evolutionary Operation (EVOP)'. The problem, by which optimum values of 14 design parameters have been obtained, contains 14 explicit constraints and 46 implicit constraints. For both types of design parameters, sensitivity analysis has been conducted on deck slab thickness parameter which can become too sensitive for the obtained optimum solution. Deviations of slab thickness on both the upper and lower side of its optimum value have been considered reflecting its realistic possible ranges of variations during construction. In this procedure, the remaining parameters have been kept unchanged. For small deviations from the optimum value, compliance with the explicit and implicit constraints has been examined. Variations in the cost have also been estimated. It is obtained that without violating any constraint deck slab thickness obtained by the conventional method can be increased up to 25 mm whereas slab thickness obtained by cost optimization can be increased only up to 0.3 mm. The obtained result suggests that slab thickness becomes less sensitive in case of conventional method of design. Therefore, for realistic design purpose sensitivity should be conducted for any of the design procedure of girder and deck system.

Keywords : sensitivity analysis, optimum design, evolutionary operations, PC I-girder, deck system

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