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Development of Graphical Computer Software for the Design of Composite Steel I-Girder Bridges per the Canadian Highway Bridge Design Code

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Abstract **–** With increased prices of steel, bridge owners and design engineers may have become reluctant to using steel in bridge superstructure, as it may be cost prohibitive. During the preparation of bid documents, bridge design engineers select a bridge geometry which complies with functional requirements of the highway. While preliminary section sizes for precast concrete girders are available in the literature for use in the bidding process, no similar data is available for structural steel girders. So, the objective of this research is to establish ready-to-use design tables of steel I-girder bridges based on simplified analysis and design procedure specified in the Canadian Highway Bridge Design Code. The bridge analysis and design procedure were performed through a developed graphical computer software. The optimum steel girder section sizes were reached through iterative process to satisfy the ultimate, serviceability and fatigue limit state design procedure. The computer software discussed in this paper obtains input from the user, namely: (a) bridge dimensions, (b) truck type, and (c) design limit states required to be performed. The software is designed to generate accurate data for concrete slab-over-steel I-girder bridges ranging from 1 to 4 spans with span lengths ranging between 12 and 48 m. In terms of design trucks, the software considers (i) CL-625 – Canadian truck, (ii) CL625-ONT – Ontario truck, and (iii) CL-800 – Alberta truck. Results from the software for different bridge configurations were presented in the form of minimum required top and bottom flange areas and web thickness of the steel girders, and thus the structural steel content, to accelerate the process of bidding on bridge projects.

Keywords**:** Computer Programming, Finite-Element Modelling, Bridge Analysis, Load Calculation, Bridge Design, I-Girder Bridge, CHBDC, Project Bid Process, Steel Construction.