Efficient Finite Element Analysis of Composite Bridge Sections

The maintenance and safety problem of existing bridges is an important concern of all highway organizations. The subject of this diploma thesis was to develop a design tool which will enable the expedient identification of those regions particularly vulnerable to damage. The design tool that is developed is self-contained and runs in typical Intel based PC stations.



The Finite Strip Method is utilized as a tool for the efficient finite element analysis of composite bridge sections. This method reduces dramatically the computational effort and core requirements while, at the same time, it retains to a great extent the versatility of the classic Finite Element Analysis.

Three tailor made elements have been developed:

- a) a shell element for simulation of the bridge elements,
- b) a solid element for simulation of the wearing surface and,
- c) an interface element for simulation of the interaction between the bridge deck and the wearing surface,

Bridge spans with various end supports can be analyzed. Self weight, point loads and/or distributed loads representative of traffic loading conditions can be applied.

Deflections, strains and stresses at any point of the bridge cross-section can be computed along the transverse and/or longitudinal directions. A graphical user interface speeds-up the process of data input and post-processing. A demonstration of the developed SSGB (Single Span Girder Bridge)-program will be given.

Extensions of the methodology to more complicated analysis cases will be briefly presented.

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