THE STRESS DISTRIBUTION NEAR A LOADING POINT IN A UNIFORM FLANGED BEAM

Edward Walter Parkes, M.A.

St John's College, Cambridge

Abstract

The elementary theory of bending, which is the method by which the stresses in a uniform flanged beam subjected to transverse loading are usually determined, leads to certain incompatibilities of displacement and stress distribution near a section of the beam at which load is applied. The present dissertation attempts to remedy these deficiencies. Two main cases are considered-that in which the beam is loaded through a flange, and that in which it is loaded through the web. In both of these the analyses lead to stress concentrations in the outer fibres of the flanges, and it is found that the maximum stress concentrations, which occur at the loading section, may be expresses with an accuracy sufficient for most engineering purposes by means of simple formulae. For both cases, maximum concentration factors occur in short beams having large flanges and thin webs.

Results of strain-gauge tests carried out on mild steel beam specimens are presented which show very good agreement between the predicted and experimental stress distributions in the flanges, and photoelastic tests to determine the stresses in the web of a Catalin beam are also described. Comparisons are made with recent theoretical and experimental work in the same field by Biot, Hendry, Hildebrand, Reissener, Taylor and Winny, and the application of the analysis to certain problems in soil mechanics is discussed.