

Marwa Sami Abdul Gabar. BEHAVIOR OF STEEL PLATE GIRDERS WITH WEB OPENINGS LOADED IN SHEAR. University of Technology. Building and Construction Engineering Department. M.Sc. . Supervisor: Dr. May J. Hamoodi. 2012. 106p.

ABSTRACT

Steel plate girders are used in various structures such as buildings and bridges. Plate girders are known by their strength to weight ratio and post buckling reserves of strength. Openings in steel plates may be required to provide access for ducts, cables and other services or just to reduce the weight. However, the presence of such openings in web plate leads to change in stress distribution at the web panel and decrease the ultimate shear load. Therefore, a reinforced strip around the circular opening is added to reduce the stress concentration around the opening and to increase the ultimate shear load.

The study consists of two parts. The first part presents the experimental tests that adopted to indicate the ultimate shear load and to investigate the behavior of steel plate girders with and without circular web opening.

In this research the structural behavior of three steel plate girders under shear is studied. The first one is the reference plate girder (G) which is prepared without web openings, and the second one (GO) is fabricated to contain circular opening at the center of each web panel, the diameter of the opening is 60% of the web depth, while the third plate girder (GOR) is with reinforced strip welded around the circular web openings. The aspect ratio of the panels is one and they all have the same dimensions.

The experimental results obtained from (GO) and (GOR) plate girders have been compared with those obtained from the reference plate girder (G). The comparison indicates that the reduction in the ultimate shear load for plate girder with web opening (GO) is 51% and for the plate girder with reinforced web opening (GOR) is 35%.

Also through the experimental results, new formulas are presented to predict the ultimate shear load of steel panels. These formulas take into account the effect of large opening, for girders with and without reinforced strip around circular web opening, on the ultimate shear load.

The second part presents a nonlinear finite element analysis using the package software program (ANSYS version 11.0). The analytical results contain the ultimate shear capacity and Von Mises stress distribution.

The 8-node shell elements (SHELL93) in (ANSYS V.11) are used to represent the three steel plate girders. The results of finite element models are compared with results of experimental tests. The difference in ultimate shear load was 10%, 9% and 1.5% for plate girders GO, GOR and G, respectively.

Also a parametric study with varying size of the reinforcement around the web openings is performed by using the ANSYS program, and the effect of this parameter on ultimate shear capacity of steel plate girders is found that the thickness of the reinforcement strip has higher effect than its width.

Keywords:Plate girders, Web opening, Reinforced web opening, ANSYS.