Effect of Pitting Corrosion on the Load-carrying Capacity of Steel-box Sections subjected to Axial Compression

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Abstract

Due to the increasing numbers and expenses of steel structures in different countries, the study of their corrosion during the time that causes some problems in their members' load-carrying ability, had been of fundamental importance. Considering the slight weight of eroded members and the depth of pits, the existence of pitting corrosion is a fundamental issue in the buildings. Firstly, in this study, the load-carrying capacity of thin-walled box-sections (four specimens with different dimensions) is examined. Then, assuming width-thickness ratio and section side ratio of each specimen to be variable, the effect of each parameter on the ultimate load-carrying capacity of system is observed. all models using modeling software ABAQUS. Finally, the aim of this paper is to examine the effect of corrosion on the ultimate load-carrying capacity of the above box-sections.

Keywords: Steel-box section, Pitting corrosion, load-carrying capacity, Ultimate strength.

1. INTRODUCTION

High strength thin-walled box-section steel columns have been widely used in steel structures [1-3] to decrease the weight, such as long-span steel bridges [4]. Steel high-strength capability leads to designing of slender and thin sections. Principally, slender and thin sections are sensitive to buckling phenomenon. Therefore, in designing steel structures, this phenomenon should be precisely focused. The overall and local buckling phenomenon is of the most importance in steel structure designing, and most of the studies in this field are assigned to the quantitative and qualitative knowledge of it. It is likely that the stability of thin-walled steel members is influenced due to lack of strain hardening. Many researchers have studied the stability of the high strength steel members. Usami and Fukumoto [5] gave some experimental results of local and overall buckling of welded box columns fabricated by steel HT80 with nominal yield of 690 Mpa. Lei Gao and et al [4], in their study, have considered the load carrying capacity and ultimate strength of thin-walled box-section steel columns. Fereydoun Irani and Arash Bahrami [6] have also considered the effect of radius curvature on the elastic local buckling capacity of the cold form sections including box and channel. Chou and et al [7] have investigated post buckling behavior of the thin-walled sections fabricated by cold form sections and moreover, they have examined the stub columns generated under axial compression. Ulrike Kuhlmann and et al [8] have studied the slender thin-walled box-section columns which are undergone some instabilities including, overall Euler buckling and local buckling in component plates. Rasusumussen and Hancock [9-10] studied plate slenderness limits for high strength steel sections and the buckling of high strength columns fabricated by steel BISALLOY80 with the nominal yield strength of 690 Mpa. Young and et al [11] studied the compressive characteristics of stub and long columns fabricated by G550 with the nominal yield strength of 550 Mpa.

The traditional designing method in box-sections steel members, does not allow the local buckling to happen before that overall failure happens. Thus, the width-thickness ratio is strictly limited. In fact, the component plate buckling does not mean failure of the members. The post buckling strength of components, therefore, can be used in designing the thin-walled structures. There are many methods considering the effects of local buckling including, the effective method, the numerical integral method, the finite strip method, and the finite element method. The finite element method, amongst all, is the most widely used.