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Comfort Level Investigation of Chromite Composite Floor System under Human Walking Load

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ABSTRACT

This paper's main objective is to determine the comfortableness of a composite structural floor system known as Chromite. For this purpose, twenty-eight Chromite panels were developed via the Finite Element Method (FEM) to find their Fundamental Natural Frequency (FNF). Then, the studied panels are categorized as Low-Frequency Floor (LFF) or High-Frequency Floor (HFF) regarding to their FNFs. Peak accelerations of low and high-frequency panels and also static stiffness of high-frequency panels were determined and compared with the limit value affirmed by the American Institute of Steel and Construction (AISC). Effects of various parameters were determined on changing FNF and also peak acceleration and static stiffness of the studied panels, depend to kind of panel as LFF or HFF. The results demonstrated that although some factors decreased and increased peak acceleration and static stiffness of the Chromite system, respectively, the panels could reach high vibration levels resulting in lack of comfortableness for users. In addition, the results show that the Chromite floor system needs to improve to be comfortable for users.

Keywords: Chromite floor system, comfortableness, human walking load, static and dynamic response, low and high frequency floor.

1. INTRODUCTION

Human comfort is an important aspect that needs to be considered in the design of structural floor systems. Any local minor damages, weakness of structural or nonstructural components, or extreme movements of structures affect the human comfort level [1-2]. Floors of buildings will not be suitable for human occupancy since users feel uncomfortable. Therefore, the aspect of human comfort must be carefully addressed in the design of floor buildings. The vibration of structural flooring systems can be a critical criterion affecting human comfort, and this is normally generated by human activities (in residential buildings, offices, hotels, and so on) and also by machineries (in industrial buildings) placed on the floor. Alvis in 2001 [3] stated that Treadgold was the first person to study the vibration of floors under the human walking load in 1828. Also, Postlethwaite in 1944 determined the vibration perception threshold as 'feel'-'no feel' by only 0.03% of g for the floor with the FNF lower than 10 Hz, which is much lower than the