

Assessing the Impact of Air pollution on Masonry Walls of Muhammad Ali Palace in Cairo Using Spectrum Analysis

M. Azouz¹, M. Nessim¹, D. Salem¹, A. Hamed² and F Ashraf³

¹Architecture Department, Housing & Building National Research Center, 87 El-Tahrir St., Dokki, Giza, Egypt (Corresponding author: mariannessim7@gmail.com)

²Geological and Geophysical Department, Faculty of Petroleum and Mining Engineering-Suez university, Suez, Egypt

³Architecture Department, The British University in Egypt, Suez Desert Road El Sherouk City, Cairo, Egypt

Abstract. Built heritage has experienced significant degradation due to escalating air pollution, especially in urban centers, with high concentrations of pollutants. In Egypt, this environmental challenge has contributed to the degradation of valuable historical structures. Muhammed Ali Palace, situated in El-Manial district south of Cairo, exemplifies this issue due to its location in a traffic congested area, deterioration observed during field visits to the palace included surface recession, corrosion, and soiling. This study assesses the impact of air pollution on the masonry fence of the Muhammad Ali Palace using spectral analysis, a non-destructive technique for identifying the mineralogical alterations in the building material. A total of 158 points were tested at 14 locations on both the inner and outer sides of the fence. The study results indicates that the most severe alteration is on the outer side, where carbonates were replaced by sulfides, leading to gypsum formation. This alteration usually occurs due to the exposure to heavy traffic which forms a crust that accelerates erosion. Conversely, the inner side of the fence is protected by the presence of extensive vegetation. The research findings provide insights for stakeholders to develop effective conservation strategies to mitigate air pollution effects on heritage structures.

