

Analysis of Electromagnetic Fields in Urban Environments

J. Crompton¹, L. Gritter¹, S. Yushanov¹, K. Koppenhoefer¹

¹AltaSim Technologies, Columbus, OH, USA

Abstract

Electromagnetic fields are pervasive in today's urban environment and under certain circumstances exposure has led to safety hazards that have been reported to cause personal injury. The United States Department of Labor has reported multiple cases of electrical shock on construction sites, but the full number of non-fatal electric shocks is unclear due to underreporting. Previous work has suggested that amplitude modulated (AM) radio emissions can induce currents in nearby structures that were of sufficient magnitude to cause reporting of electrical shocks to workers. To reduce the likelihood of future shock events, simulations of the electromagnetic fields produced by sources such as radio towers and transmission lines can quantify the induced current and floating potential of surrounding structures to identify when conditions exist that could pose a hazard to workers.

In this work, computational simulations were performed using the COMSOL Multiphysics® software to identify conditions under which harmful or fatal electric shocks are developed around a fixed urban infrastructure. The analyses conducted are representative of those that should be performed when electromagnetic sources are in the vicinity of urban infrastructure where work is being performed by humans. Workers in Illinois reported non-fatal electric shocks while repairing a bridge structure, COMSOL Multiphysics® was used to assess the interaction between electromagnetic fields due to nearby electric transmission lines the bridge structure and nearby equipment. The analyses identified conditions under which potentially harmful induced currents and floating potentials are developed and the likely effect on worker safety. In addition, proposed mitigation techniques were investigated to demonstrate elimination of the conditions leading to the hazard and procedures that must be followed to ensure a safe working environment.

Figures used in the abstract

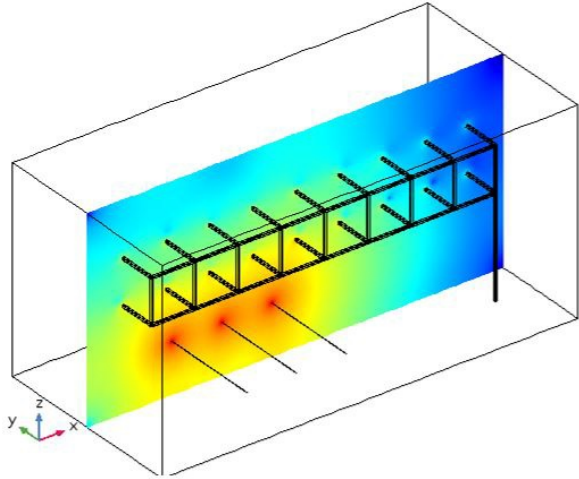


Figure 1: Electromagnetic field associated with electricity transmission lines.