

**STUDY OF TUNNEL RESPONSE TO DYNAMIC LOADINGS**

by

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B.Sc. in Civil Engineering

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in Civil Engineering

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nderground facilities are an integral part of the infrastructure of modern society and are used for a wide range of applications, including subways and railways, highways, material storage, sewage and water transport .Underground facilities might be built in areas subjected to seismic activity, therefore, they must withstand both seismic and static loading. Historically, underground facilities have experienced a lower rate of damage than surface structures. Nevertheless, some underground structures have experienced significant damage in recent large earthquakes, e.g. the 1995 Kobe earthquake, Japan, the1999 Chi-Chi earthquake, Taiwan, and the 1999 Kocaeli earthquake, Turkey.

This thesis presents a parametric study on the effects of seismic waves on the tunnel structures through numerous simulations employing the finite – element analysis software PLAXIS®. The objectives of the research were achieved through three steps. In the first step, a finite element model was performed using PLAXIS® to simulate free field response under seismic analysis in comparison with EERA code (Bardet et al. 2000) which stands for Equivalent-linear Earthquake site Response Analysis. In the second step, the results deduced from these correlations were used to create the parametric study of the seismic effects on tunnel body internal forces and on ground surface response. In the third step, the response of Cairo Metro – Line III tunnel when subjected to seismic wave incidence and train dynamic loads is studied. These analyses show the influence of the various parameters which must be determined for a seismic design. It is shown that the stratification and the soil parameters, together with the earthquake magnitude, significantly influence the tunnel response.

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