# DYNAMIC SOIL STRUCTURE INTERACTION

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Open excavated trenches have for many years been used as barriers in an attempt to isolate structures from vibration energy. When a propagating wave in a geomaterial meets a barrier, it is either reflected or transmitted through it. Depending on the size of the barrier, the wave may also be diffracted beneath or around its edges. This causes vibration energy to be detected in the geometrical shadow. An alternative method is to isolate the structures by means of a row, or, rows of cylindrical piles. The piles diffract and scatter the plane incident waves, thus reducing the vibration energy behind the barrier. The success of the various methods employed depends on understanding the behaviour of the interaction between the incident waves and the barrier.

The basic theory of vibration and wave propagation in elastic medium are examined. The phenomena exhibited by acoustic and optical waves when they encounter an obstacle such as transmission, reflection, diffraction and interference are adapted for application in geomaterials and used in the analysis of the different methods of isolation. The results are compared with experimental data reported in the literature.

## CHAPTER 1

## INTRODUCTION AND BASIC PRINCIPLE

### 1.0 INTRODUCTION

Sensitive structures are usually located below the ground because of the protection provided by the surrounding geomaterials. Impulse or dynamic loading may act on these structures due to earthquake, explosive, impact loading resulting from construction operations, quarrying, moving traffic, and wind loading or load due to wave action of water. These loadings generate vibrations which propagate through the geomaterials. The nature of these dynamic loads are quite different from the live load or dead load prescribed for a structure as described in structural design codes. The effect of vibration on a structure includes the risk of damage to the structure or any installation within it, fatigue failure and also the nuisance caused to people as a result of human sensitivity to vibration.

Strengthening a structure may reduce the possibility of its damage from impulse loading, but the installation inside may still be susceptible to the vibration energy. In order to decrease the vibration of structures subject to body and surface waves propagating through soil, it is sometimes necessary to protect the structure from the influence of the energy in the waves. The following methods are sometimes used for this purpose: i) provision of open trenches, where trenches are excavated parallel to the wave front. They are either positioned near the structure for "passive" isolation, or near the source for "active" isolation.