CHAPTER II

LITERATURE REVIEWS

The dynamic interaction between a circular plate and a soil medium has been considered by a lot of researchers over the last 30 years. Several studies (Awojobi & Grootenhuis, 1965; Robertson, 1966; Veletsos & Wei, 1971; Luco & Westman, 1971,1972) investigated the dynamic response of a rigid circular plate resting on an elastic half-space. The interaction of a loaded rigid annular plate with an elastic half-space was also studied by Dhawan (1981), Tassoulas & Kausel (1984), and Veletsos & Tang (1987a, b). Annular plates can be found in the foundations used for cooling towers, radar stations and liquid-storage tanks. However, the above studies considered only the case of rigid circular and annular plates.

Results from the experimental studies conducted by Whitman et al. (1973) and Hudson (1977) on dynamic response of actual buildings indicated the necessity to take into consideration the foundation flexibility in the analysis. The dynamic response of an elastic plate resting on either an elastic or a viscoelastic half-space have been considered in the past for both circular (Lin, 1978; Krenk & Schmidt, 1981; Iguchi & Luco, 1982) and annular (Rajapakse, 1989) plates. The case of layered soil can be found in the studies by Kausel et al. (1975) and Wong & Luco (1986). However, both studies considered only the case of a rigid plate.

All studies mentioned above considered the half-space as being either an elastic or a viscoelastic material. The analysis of interaction of a rigid plate resting on a homogeneous poroelastic half-space can be found in the work of Halpern & Christiano (1986). In that paper, they considered the time-harmonic response of a rigid plate resting on a homogeneous poroelastic half-space under surface loading. Thereafter, various methods have been employed to study the dynamic interaction between a rigid plate and a poroelastic medium by using Biot 's poroelastodynamic theory (Biot, 1962).

Kassir & Xu (1988) solved a mixed boundary value problem related to time-harmonic response of a rigid strip on a homogeneous poroelastic half-space by establishing the Fredholm integral equations. Later, Kassir et al.

(1996), extended the same approach to study the case of a rigid circular plate resting on a homogeneous poroelastic half-space. Philippacopoulos (1989) investigated the dynamic interaction between a rigid circular plate and a partially saturated poroelastic half-space. Bougacha et al. (1993a) obtained dynamic stiffness of strip and circular foundations on a poroelastic stratum by employing a Finite Element approach based on the use of spatially semidiscrete modes of vibration. A Boundary Element method (BEM) is also employed for the analysis of rigid circular foundations (Dargush & Chopra, 1996) and rigid strip foundations (Japon et al., 1997) on a poroelastic half-space.

Recently, Bo & Hua (1999) studied vertical vibrations of a rigid circular plate resting on a poroelastic half-space by using Hankel integral transform and Abel transform. Zeng & Rajapakse (1999) considered the response of a rigid circular plate buried in a poroelastic half-space by using Hankel integral transform and a discretization technique. By using the similar approach given in the first paper (Bo & Hua,1999), Bo and his co-researchers (Bo & Xu, 1999; Bo, 1999; Bo & Hua, 2000) included the flexural behavior of the plate in the study of the vertical vibrations of a circular plate resting on a homogeneous poroelastic half-space.

All existing studies mentioned above are concerned with the response of a plate and a homogeneous poroelastic medium. However, natural soil profiles are normally layered in character with different properties. There is only one paper considering the interaction between a rigid strip resting on a multi-layered poroelastic medium (Senjuntichai & Rajapakse, 1996). A review of literature indicates that the dynamic interaction between an elastic circular plate and a multi-layered poroelastic half-space has never been considered in the past.