

## **ABSTRACT**

During the last decade, cable-stayed bridges have been extensively used for medium and long-span crossings in North America, Europe and Japan. However, very few, if any, of these bridges have been subjected to strong earthquakes. Thus, the experience with the seismic behaviour of such flexible bridges is limited.

The research work outlined in this thesis presents the results of a comprehensive study investigating the modal and seismic response characteristics of different configurations of cable-stayed bridges. The effects of variation of the basic parameters: stiffness, mass and damping on the structural seismic response are assessed. The effects of the geometric nonlinear behaviour of these bridges are also examined. The structural seismic response is obtained by the different available seismic analyses : Response Spectrum, linear and nonlinear Time-Step Integration and finally applying the AASHTO (1992) specifications for the seismic design of bridges. The seismic responses, obtained by these analyses, are compared and the accuracy and limitations of each analysis are highlighted. Moreover, the structural seismic response, for the different characteristics of the ground motion excitation is investigated.

Special problems relevant to long-span bridges are also studied; these include the variation in the seismic ground motion from one support of the bridge to another. These variations are mainly caused by the travel of the seismic waves and by the variation of the soil conditions at the supports.

The study proposes a simplified model that can account, with sufficient accuracy, for the effects of the local soil condition and the soil-structure interaction. The results of the study show that the effects of the above parameters are significant and should not be ignored in the seismic analysis of cable-stayed bridges.