



Stress-Strain Behavior of Asphalt Concrete as a Sealing Core in Earth fill Dams under Cyclic Loading

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Abstract

Behavior of asphalt concrete samples as a sealing element in earthfill dams' core under cyclic loading was investigated in the present study. Asphalt concrete specimens were prepared and tested based on criteria of ICOLD¹ for asphalt concrete core and ASTM standards for bituminous mixtures. Samples with different aggregate size and bituminous content were tested by means of a cyclic triaxial system. Different levels of confining pressure and deviator stresses were exerted to each sample. Results obtained from more than 80 tests show that asphalt concrete behaves properly under cyclic loading and specimens stay intact after applying 200 cycles. Amount of shear modulus ranges between 100 to 300 MPa and damping scatters in the range of 0.05 to 0.30. Both are dependant to max aggregate size and bituminous content.

Keywords: asphalt concrete, earth fill dam, cyclic loading, dynamic properties

1. INTRODUCTION

In the past, most of the earth fill dams were constructed with clayey cores but because of some major problem that this kind of dam may arise, alternative materials like asphalt concrete has been extensively used as a water barrier for earth fill and rock fill dams. Executive problems like lack of natural resources of clay and difficulties of compacting clayey core in cold and rain storming regions are some examples that illustrate the disadvantages of clayey cores.

Asphalt concrete is a visco-elastoplastic material. This trait makes it more ductile and suitable to resist cracking especially in response to earthquake loads due to self-healing character of asphalt concrete. It also guaranty imperviousness of core. Another important character of asphalt concrete is its workability which makes the process of compaction more convenient. It also have the virtual ability to resist erosion and ageing.

In recent forty years more than sixty dams with asphaltic core have been constructed in different parts of the world which shows the growing tendency to use the asphalt concrete instead of other materials for sealing dams. As use of such dams become more prevalent, analytical and experimental studies on these dams are more required. Determination of characters and behavior of earth fill dams with asphalt concrete core in response to static and dynamic loads during their service period requires a wide studies of stress-strain behavior of various parts under dynamic and monotonic loading.

Although several numerical studies have been performed on behavior of earthfill dams with asphalt concrete core, very few laboratory studies are available about cyclic behavior and dynamic properties of asphalt concrete. The aim of present study is to investigate behavior of asphalt concrete in earth fill dams. More than eighty cyclic triaxial tests were conducted to attain dynamic behavior of asphalt concrete. Effects of maximum aggregate size, bituminous content, confining pressure, deviator stress and number of cycles on shear modulus G , and damping ratio D , are explained.

2. SPECIMENS' PROPERTIES AND PREPARATION PROCEDURE

In the present study, bitumen of type B60 was selected as binder. Softening point and penetration degree of bitumen were 52°C and 56.5; respectively. Aggregate used in this study was crushed limestone which is an

¹ International Congress for Large Dams