Hydrodynamic Isolation for Concrete Arch Dams

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Abstract

Earthquake is one of the important forces in arch dams design. The hydrodynamic forces resulting from earthquake or shock blast especially in high arc design of concrete dams that their sites are located in high seismic risk , is considerable . For this reason, it seems to use hydrodynamic pressure reducing methods in these types of dams can be more useful. The investigation also indicated to reduce the hydrodynamic pressure due to use the air cushion technique this type of dams, Sometimes even up to 92 percent. Clever use of liquid damper in the vertical seams of concrete arch dams and energy dissipation caused by severe earth movement is another effective method for achieving this goal. Because of the strong ground shaking movements the vertical seams with grout injected torn between the seams, seams opened and are not able to tolerance tensile force and damper mounted between the seams will cause absorption and energy dissipation. There are many other ways that have not been applied practically in any dams yet which is presented in this research text.

Keywords: Hydro-seismic Isolator, High arch dams, Seismic energy dissipation, Fluid damper, Air cushion.

1. Introduction

Earthquake force is one of the important forces designing arch dams which must be applied synchronously in three components of river direction, perpendicular to river direction, and perpendicular to the system of dam- foundation- fountain. It's quite natural that as the height of the dam increases so does hydrostatic and hydrodynamic forces on top of the dam. Sometimes hydrodynamic pressure exceeds hydrostatic one. Earthquake forces can lead to cracks which in turn are more dangerous compared to those on buildings. A arch dam was designed and performed in one case in form of 2- dimensional arming but this method isn't economical one due to high expenses. This method has been applied in arch dam of Inguri (USSR) with a height of 271 m. as the role of hydro- seismic force are highlighted in design, the method becomes justified economically and technically to dissipation and separate induction force derived from earthquake and shock. Hall et.al, through a research, have described quake separation of gravity dams as insufficient in regions more susceptible to earthquake and recommended this method for arch dams from which considerable hydrodynamic force derived. Some of earthquake- induced force reduction methods are applicable with performed samples and some others are under analytical and experimental studies and they will provide applied observations and results in case of success. Since dam structure plays a major role in different aspects of human civilization, its destruction will result to demolish civilization. For this the issue of investigation and recognition of quake behavior of high concrete dams particularly the effect of water reservoir on quake response of dam have been considered by researchers. This system contains dam structure and lake behind it. This research aims to introduce different technique of hydro- seismic separations and energy deprivation resulting from earthquake and shock and followed by expressing each advantageous and drawbacks.

2. Interaction of water reservoir and dam body

One of the most intricate issues of structural dynamic is prediction of concrete dams' behavior at time of earthquake. On the most important cases affecting dams' response to quake is interaction of water reservoir and dam.