



THE EFFECT OF CRACK FORMATION ON BODY BEHAVIOR IN SÜLEYMANLI EARTHFILL DAM

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Abstract

The cracks formed in the core in the earthfill dams lead to the formation of internal erosion and piping due to the pressure created by the water in the dam reservoir and can lead to the results until the failure of the dam. These cracks can consist of arching, hydraulic cracking, tectonic movement and different settlement events. In this paper, the behavior of the dam body has been investigated in the middle and side sections of the dam body. Numerical solutions made in the Süleymanli Dam show that a cracking can quickly cause the dam to failure due to piping.

Keywords: Dam failure, Earthfill dam, Hydraulic cracking, Süleymanlı Dam

1. INTRODUCTION

Generally, cracking in earthfill dams is common and may occur in all parts of the dam. Most of these cracks are not immediately visible on the body surface and therefore cannot be seen. In a study conducted in China, it was observed that 26% of 1000 incidents in the 241 earthfill dam are related to cracks. In the same report, it was determined that the breakdown of 40 small and medium size dam in the last 30 years was caused by cracks [1]. The International Committee on Large Dams (ICOLD) in 1984, the largest problems in world events indicate that the dam piping [2].

For example, in Idaho (USA) Sinker Creek dam is a homogeneous earthfill dam was built in 1910. When the reservoir was filled, wetness was observed at the downstream side of the fill and therefore the water level in the reservoir was kept as low as possible. In the spring of 1943, after the heavy rain, the reservoir was filled early, and the first investigations did not show anything unusual except for a wet area on the downstream side. However, the wet sector began to shift on June 19 and it grew gradually, causing the dam to collapse 8 hours after the first sliding movement [3].

The Hyttejuvet Dam was built in November 1965 and the reservoir was filled in May 1966 approximately 6 months after the completion of the dam. An initially negligible leak (1-2 l / s) was observed. However, when the water level elevation reached a height of 745 m, the measured leakage increased significantly. The water level in the reservoir has been reduced due to the increased leakage as the water level elevation reached 738 m [4].

2. CAUSES OF CRACK FORMATION

Cracks are one of the most important causes of landfill dam collapse. They can be formed along the width of the body in the direction of current in order to provide upstream/downstream relationship as well as in the direction of body length in the upright direction to the current. Transverse cracks are very dangerous as they can cause flow and thus piping. Cracks can be caused by various reasons such as arching, hydraulic cracking, tectonic movement and different settlements in the trunk.

Arching of the core with the shell is due to different deformation modulus. Because the clay core deformation module is less than the material used in the shell, the clay core is more seated due to the loads coming from the top. Therefore, some of the vertical loads are transferred to the shell. Thus, especially in the parts of the clay core close to the shell, there are decreases in vertical tension, resulting in transverse cracks (Figure 2a). In the dams built in the narrow valleys, the same problem between the dam and the valley slopes leads to longitudinal cracks (Figure 2b). In addition to the transverse and longitudinal arching event, local