

<<现代堆石坝技术进展>>

图书基本信息

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内容概要

The development of modern rockfill dams started from late 1960s and early 1970s. Since then, rapid progress has been achieved in the construction of rockfill dams throughout the world. This is mainly due to its distinct advantages in economy and efficiency. At present, several super high CFRD and ECRD projects have been successfully constructed in the world, such as Shuibuya CFRD (233m) in China and Nurek ECRD (300 m) in Tajikistan. Zippingpu CFRD with height of 156m has demonstrated good performance in safety during the strong Wenchuan earthquake in 2008. Based on the previous progress achieved and the successful practices of the international milestone projects, great achievements will be made by further research works and engineering practices in the future. This volume presents the state-of-the-art of rockfill dam technologies by 2009 throughout the world. It could be a useful reference for engineers, professionals and students.

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The material for the first 10 layers of the embankment is processed with conventional earth-work construction machinery. The excavated material brought from the borrow areas is transported to the processing yard, then spread with a bulldozer in layers generally 150 mm thick and sprinkled with water. Most of the larger lumps break down to small size in this processing of spreading. Finally tamping - foot roller or bulldozer is employed to roll over the fill material by several passes till the percentage of lumps is reduced to 12% to 13%. Material coarser than 10mm in size is categorized as lumps. The number of passes for various layers varies between 15 and 22. Water is sprayed over the processed layer and the material is then pushed by dozer blade into a stockpile. While pushing, the dozer blade inevitably excavate some material from ground which is drier. Water is added to the piled-up material and the material worked with the loader bucket. The water content of the material is brought to within zero to +3% of the optimum water content.

3.2.2 Processing by agricultural rotavator
The material for the last 12 layers of the embankment is processed with agricultural rotavator. The object of using the rotavator is to reduce the material processing effort. The excavated material is spread in 150 mm thick layers by the bulldozer blade. The material is then loosened by the dozer rippers and water is sprinkled over the surface. The processing is then performed by the rotavator, with more water being sprinkled if required. In every pass, the rotavator penetrates 20 to 30 mm into the layer while cutting and pulverizing the lumps. Generally 6 passes of the rotavator is required to achieve full penetration of 150 mm into the layer. When full penetration is achieved, the proportion of lumps in the material is 15% to 25% and the maximum size of the lumps is about 100 mm. The processing of the material is continued with further passes of the rotavator. The proportion of lumps is reduced to about 12% after 8 to 18 passes. The maximum size of the lumps is about 50 mm. The processed material is stockpiled by a loader, water is added to the stockpile as required to increase the water content of the processed material. Mixing of water is achieved by working the material with the front-end loader.

3.3 Construction of trial embankment
The processed fill material stockpile in the processing area is transported to the trial embankment by dumps. Since the grader has broken down at the early stage, bulldozer is deployed for spreading and leveling. In this case, the spreading thickness is not uniform and the compaction thickness varied from 100 to 190 mm. A self-propelled single-drum tamping-foot vibratory roller with a static weight of 10.2 tons was used for compaction. As the fill material is silt, vibration is not used for compaction. The tamping-foot roller operates at a speed of 4 km/hour to achieve a compacted dry density of 97% of the maximum standard Proctor dry density. Generally the compacted surface is hard and homogeneous after 6 passes of the roller, expects for a few wet spots during Stage 1 where the moisture is much above the optimum due to lack of suitable water-mixing equipment. This problem does not occur during Stage 2 because of the uniform mixing of water by the rotavator. Sometimes the compacted surface is undulating due to the uneven spreading and poor leveling of material by the bulldozer. The proportion of lumps in the compacted fill is found to be about 8% to 9% compared with the range of 12% to 13% before placement and compaction. This reduction in the lumps content occurs during haulage of the material from the processing area to the embankment, spreading of the material by the bulldozer and compaction by the tamping-foot roller.

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