Deposited Muddy Soil Reuse Technique Using Industrial Waste for Reconstruction of Small Earth fill Dams

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ABSTRACT

Some problems are encountered when old small earth fill dams are reconstructed in Japan. For example, tons of muddy soil is deposited on the bottom of a pond, and it is difficult to remove muddy soil because of the high water content. Furthermore expensive soil for the impermeable core zone has to be prepared because of a lack of suitable soil materials at the dam sites. In this paper, we proposed the creation of the soil for using muddy soil deposited on the bottom of a pond; old dam body’s material of fine-grain fraction lack, fly ash and quicklime, and it was found that improved soil was satisfied with standard value of strength and permeability. It was concluded that this method which using waste material could use as soil for impermeable core zone.

KEY WORDS: earth-fill dam; recycle; muddy soil; large soil-mixing machine; pressure curing.

INTRODUCTION

Small earth fill dam is artificial pond and the height is under 15m. Japan has 210,000 small earth-fill dams and many of them are located in Hyogo prefecture. The number exceeds 40,000. Many small earth fill dams were constructed over a long period of history, and have played essential role in agriculture as valuable water source, because steep and short Japanese rivers water is not a stable source of water for rice farming. However these old earth-fill dams have been faced with disasters by earthquakes and typhoons, because Japan is an earthquake-prone country. Therefore, prompt reconstructions on these aging dams are required. In the reconstruction, the soil materials for impermeable core zone are required. However expensive soil for the core zone has to be prepared because of a lack of suitable soil materials at the dam site. Additionally, these earth-fill dams that need repair have large deposit of muddy soil as shown in Fig. 1. Such muddy soil reduces the volume of water kept in the reservoir and declines the quality of water. Though the muddy soil has to be removed, it is not easy to dispose of it because of the high water content.

In this study, laboratory experiments and field experiments were conducted. In a laboratory, unconfined compression tests and permeability tests were conducted to investigate the best mixture fraction; muddy soil, old dam body’s material, fly ash and quicklime. On the other hand, in a field, a large soil-mixing machine shown in Fig. 2 was used to blend these materials, and it was tested for practical applicability since it had not been used before during restoration work on reservoirs and the improved soil for the impermeable core zone needs to be homogeneously-mixed.

MATERIALS

The samples used for blend design in a laboratory test were muddy soil, decomposed granite soil, fly ash, and quicklime. On the other hand, in a field test, the samples were muddy soil, decomposed granite soil, and soil stabilizing cement for soft soil.

Muddy Soil (in a laboratory test)

The properties of the muddy soil are shown in Table 1 and grain size accumulation curve is shown in Fig. 4. Because the properties of the muddy soil are greatly different according to the dredged places, the following processing was done to make a homogeneous sample. First, the muddy soil deposited on the earth-fill dam was put in the drying furnace of 110℃ and was made absolute dry. Next, the dry muddy soil was crushed with the crushing machine into the powder. The process is shown in Fig. 3.