Creation of the Soil for Impermeable Core Zone for Earth-fill Dams

Toshinori Kawabata, Mariko Suzuki, Takeshi Suzuki, and Kazunori Uchida
Graduate School of Agricultural Science, Kobe University
Kobe, Hyogo, Japan

ABSTRACT

Many earth-fill dams are vulnerable to the disasters, such as earthquakes and typhoons, because they were constructed long time ago. 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 sites. In this paper, we proposed the creation of the soil for impermeable core zone that is made of muddy soil obtained from the bottom of pond, the granulated blast furnace slag, the old banking material, fly ash and quicklime. The zone has to be mechanically stable and low price. As a result, it was found that the specimen made with this method satisfied the standard of strength and permeability that were determined by previous research. It was concluded that this soil created from the waste material could be a replacement for the impermeable core zone.

KEY WORDS: earth-fill dam; recycle; muddy soil; granulated blast furnace slag.

INTRODUCTION

Japan has 210,000 earth-fill dams and many of them are located in the Hyogo prefecture. The number exceeded 40,000. They not only function as sources of water supply to the agriculture area, but also serve many multilateral functions. For instance, they have a function of flood adjustment, creating good landscape, and conserving biodiversity. However, it is difficult to keep them with aging population, and as a result, they are losing these functions. Moreover, old earth-fill dams are faced with disasters by earthquakes and typhoons. The case of the slip failure on the upstream slope is shown in Fig. 1. Therefore quickly reconstructions are required. However, expensive soil for core zone has to be prepared because of a lack of adequate soil materials for core zone in the dam site.

On the other hand, these earth-fill dams that need repair have large deposit of muddy soil (Fig. 2). Such muddy soil reduced the volume of water kept in the reservoir and declined the quality of water. Though the muddy soil has to be removed, it is not easy to dispose of it because of the high moisture content.

In this paper, we proposed the creation of the soil for impermeable core zone, using the muddy soil deposited at the bottom of the pond, and the industrial wastes, which are mechanically stable and low price.

MATERIALS

The samples used for blend design are the muddy soil deposit obtained from the bottom of pond, the granulated blast furnace slag, the decomposed granite soil, fly ash, and quicklime.

Muddy Soil

The properties of the muddy soil are shown in Table 1. 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.

Fig. 1 Slip failure on the upstream
Fig. 2 Muddy soil deposited on the bottom of pond