Internal Deterioration in Concrete Lined Open Channels Due to Frost Damage

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ABSTRACT

The occurrence of frost damage is different in the open channel made of concrete by construction and environmental condition, and it can be confirmed by the cracks by the surface deformation on the stage at deterioration progresses. However, the occurrence process is not clarified concerning the internal deformation. In this research, the occurrence process of the crack in the side wall was clarified by the analysis of the core sampled from the side wall of the open channel where the frost damage occurred. In addition, the frost damage deterioration in internal side wall of the open channel was clarified.

KEY WORDS: Open channel; wall structure; frost damage; surface deformation; internal deformation; layered cracks; fine cracks.

INTRODUCTION

Frost damage is a characteristic form of deterioration in open channels. The diagnosis of concrete structures which have deteriorated due to frost damage requires the precise evaluation of the damage. Moreover, during repair, it is necessary to completely remove the damaged section before applying the repair layer. In addition, the factor causing the frost damage needs to be controlled. Frost damage is a characteristic form of deterioration in open channels.

The open channel made by concrete (the following, the open channel) holds many ratios of the water supply facilities of agriculture. The concrete lining in such channels consists of thin and wide surfaces. Moreover, the environment in which the structure is used is different in the irrigation period and the non-irrigation period. The inside of the open channels of the irrigation period has characteristics that the part lower than water level is underwater, and the part upper than water level is exposed in the air. The back condition of the open channels generally fall into two types that covering with soils and exposing in the air. The states of the open channels covering with soils are different by groundwater level. The frost damage of the open channels is characteristic as above. The outbreak of the frost damage is confirmed by cracks as surface deformations after the deterioration went such as Fig.1 and Fig.2. However, there are cases the surface deformations cannot be confirmed by covering mosses and fine particles depending on environment conditions and internal deformations only occur although surface deformation cannot be confirmed depending on deterioration processes. The frost damage diagnosis in open channels must be based on both the surface and internal deformation. Therefore, it is necessary to clarify the internal deformation process, because this is not clarified now.

EXPERIMENTAL PROGRAM

A site survey was carried out to confirm surface deformations. This was followed by laboratory experiments to establish internal deformations.